Microsoft® Office 365 & 2019 Series

Microsoft®

Excel

Expert Certification Guide

Exam MO-201
February 2020

CCI Learning™

Microsoft® Office 365 & 2019 Expert Certification Guides

This courseware is one in a series prepared by CCI Learning Solutions Inc. for use by students and instructors in courses on computer software applications. CCI designed these materials to assist students and instructors in making the learning process both effective and enjoyable.

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What is the Microsoft Office Specialist Certification?

Microsoft Office Specialist (MOS) certification is the leading IT certification in the world. More than 1 million MOS exams are taken every year in over 140 countries.

The Microsoft Office Specialist Program enables students to demonstrate the knowledge, skills, and abilities to productively use Microsoft Office. The MOS Program enables students to tap into the full functionality of the Microsoft Office programs, resulting in higher levels of individual performance and confidence, which can help those with MOS certifications distinguish themselves in the workplace from those who are not certified. To learn more about these and other certifications, please visit www.certiport.com.

Microsoft
Office Specialist

The Microsoft Office Specialist (MOS) certification exams validate skills within the applicable Microsoft Office programs. The Office 365 & Office 2019 exams are powerful tools for assessing student skills and preparing students for real-world application. Skill assessments include performance-based formats, revised instructions, multiple projects, and questions integrated with objective domains.

The available Microsoft Office Specialist Program 2019 exams include:

- Microsoft Office 365 & Office 2019 Word
- Microsoft Office 365 & Office 2019 Excel
- Microsoft Office 365 & Office 2019 PowerPoint
- Microsoft Office 365 & Office 2019 Outlook
- Microsoft Office 365 & Office 2019 Access Expert
- Microsoft Office 365 & Office 2019 Word Expert
- Microsoft Office 365 & Office 2019 Excel Expert

The Microsoft Office Specialist Program consists of two levels: Associate and Expert.

Students earn a certification for each exam they pass; however, if students earn any three of the four available associate certifications, they will become Microsoft Office Specialist - Associates and earn an additional credential for this accomplishment. If students want to advance even further and earn Associate certifications and any two of the three available Expert certifications, they will become Microsoft Office Specialist - Experts and achieve the highest credential within the Microsoft Office Specialist Program.*

*This certification replaces the Microsoft Office Master credential.

For more information:

Visit www.ccilearning.com/store-ca/product-category/microsoft/ to learn more about the Microsoft Office 365 & 2019 books.

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Course Description

This *Microsoft® Office 365 & 2019 Excel Expert Certification Guide* teaches the skills necessary to create and edit professional-looking spreadsheets for a variety of purposes and situations.

Students who complete this course will have reviewed all the exam objectives and be prepared to take the Microsoft Office Specialist Excel Expert Exam #MO-201. Successful completion of the certification exam validates the knowledge and skill sets for individuals seeking employment or advancement in their careers.

Suggested Course Length: 25-35 Hours

Course Series

This guide is one of seven courses in CCI's Microsoft Office 365 & 2019 series. The courses available in the series include:

- Word Associate
- Excel Associate
- PowerPoint Associate
- Outlook Associate
- Access Expert
- Word Expert
- Excel Expert

Course Prerequisites

This course is designed for students who are familiar with the Microsoft Windows operating system, personal computers, using a keyboard, and using a mouse. The course assumes that students have completed the *Microsoft Excel Associate* course or have equivalent knowledge and experience. Students should be able to:

- ☐ Start and run Windows.
- ☐ Use the taskbar.
- ☐ Use the Start button.
- ☐ Use the Help feature.
- ☐ Use Minimize, Restore Down/Maximize, or Close.
- ☐ Use the left and right mouse buttons.
- ☐ Understand file management techniques.
- ☐ Navigate between files, folders, or drives.
- ☐ Create workbooks and navigate within Excel.
- ☐ Manipulate cell data.
- ☐ Use formulas.
- ☐ Format worksheets.
- ☐ View and print workbooks.
- ☐ Work with charts.
- ☐ Organize data.
- ☐ Use data tools to search for, find, and replace data.

System Requirements

This courseware was developed using specific software and hardware configurations. To complete this courseware, you should have the following for each student:

- A desktop or laptop system running Microsoft® Windows 10 and Microsoft® Office 365 or 2019
- Mouse or comparable pointing device
- 101-key enhanced keyboard

In the materials contained in this courseware, we assume that you have met these criteria, and that you have successfully installed both Windows and Office on your computer.

Note: This course was written using Microsoft Office 365 Version 1902; if you subscribe to Office 365, features may be added or updated without notice.

Classroom Setup

The features and exercises shown in this courseware were developed using the standard installation of the Microsoft Office 365 Version 1902 Desktop applications on a system with Windows 10. If your computers have another version of Windows or Office 365 installed, you will need to adjust accordingly to accommodate for the differences in dialog boxes or command sequences.

It is likely your teacher set up the classroom computers based on the system requirements to run the software for this course. Most software configurations on your computer are identical to those on your teacher's computer. However, your teacher may use additional software to demonstrate network interaction or related technologies.

Teacher Resources are available and are produced specifically to assist an educator in preparing to deliver the course using the CCI materials. Contact your coordinator or administrator or call your CCI Account Manager for information on how to access these resources.

Downloading the Exercise Files

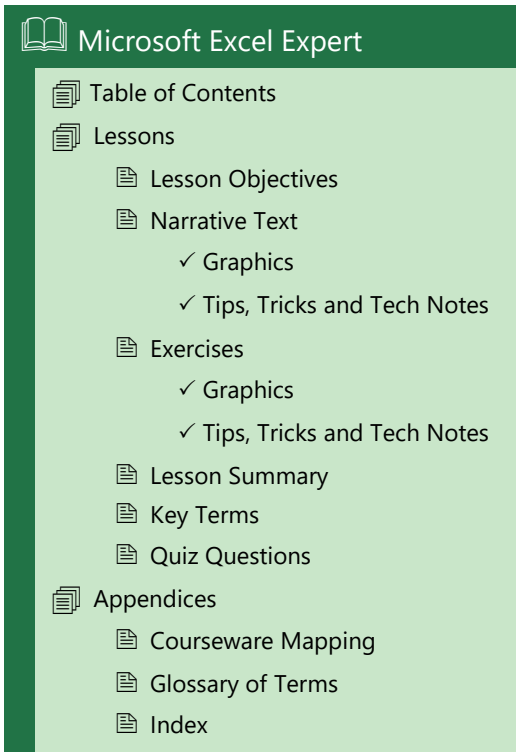
The exercises in this courseware require you to use the exercise files provided for the course. To download the exercise files for this course, perform the following steps.

1. Launch your browser and navigate to the Student Data Files page on CCI Learning's website, located at http://www.ccilearning.com/data.
2. Type: **3274** in the *Courseware #* field, then click **Find Data**.
3. Depending on the browser you are using, the ZIP file may be automatically saved in your Downloads folder, or you may be prompted to open or save the file. Save (or move) the downloaded ZIP file to your Desktop.
4. Right-click the **ZIP file** on your Desktop, then click **Extract All** to display the Extract Compressed (Zipped) Folders dialog box.
5. Click the **Browse** button, navigate to the Desktop, click the **Select Folder** button to confirm the Desktop as the location for extracting the files, then click the **Extract** button. A folder named *3274 Exercise Files* should now reside on your Desktop.

   Within the 3274 Exercise Files folder, you will find a *StarterFiles*, *ResourceFiles*, and *MyProjects* folder. The StarterFiles folder contains data file(s) you are directed to open at the beginning of an exercise. The ResourceFiles folder contains supplemental files that you will be directed to access during an exercise. The MyProjects folder will be empty. As you perform the exercises for a lesson, you will be directed to save your work in the MyProjects folder.

Course Design

This course book was developed for instructor-led training and will assist you during class. Together with comprehensive instructional text and objectives checklists, this course book provides easy-to-follow hands-on exercises and a glossary of course-specific terms. This course book is organized in the following manner:



When you return to your home or office, you will find this course book to be a valuable resource for reviewing exercises and applying the skills you have learned. Each lesson concludes with questions that review the material. Lesson quiz questions are provided as a study resource only and in no way guarantee a passing score on a certification exam. Appendices in the back of this course book provide additional information.

Course Objectives

This course book teaches the skills you will need to successfully complete the Microsoft Excel Expert Exam MO-201. These skill sets are introduced using multiple types of business and personal workbooks.

After completing this course, you will be able to:

- Apply conditional formatting.
- Apply custom and international cell formats.
- Use functions in formulas.
- Use lookup, date, and time functions.
- Check for formula errors.
- Validate data.
- Create, format, customize, and group pivot table data.
- Create and customize pivot charts.

- Link external workbooks.
- Create, reply to, and delete comments.
- Protect workbooks.
- Use financial, conditional logic, and conditional summary functions.
- Perform what-if analysis.
- Fill cells using the Fill Series Tool and Flash Fill.
- Outline data.
- Create, edit, and share macros.
- Create advanced charts.

Conventions and Graphics

The following conventions are used in CCI learning materials.

Folder Names – Names of folders and specific locations are indicated in *italic* font style.

File Names – Names of files are indicated in **bold** font style.

Exercise Text Entry – Content to be entered by the student during an exercise appears in **Times New Roman, 10pt, bold** font.

Key Terms – Vocabulary terms that are presented in the narrative appear in ***bold, italic*** font style.

Procedures – Procedures and commands you are instructed to activate are indicated in **bold** font style.

Objective 1.1.1, 1.1.2 – This indicates the numbered objective from the Microsoft Office exam being covered in the topic. Refer to the Appendix for a complete listing of exam objectives.

Technical Notes point out exceptions or special circumstances that you may find when working through a particular process, or may indicate there is another method to complete the task.

Learn to Exercise

Learn to headings signal the start of step-by-step, hands-on exercises or other activities.

Microsoft®

Excel

Expert Certification Guide

Lesson 1: Advanced Formatting

Lesson Objectives

In this lesson, you will apply conditional formats, custom cell formats, and international formats, as well as use the +Body and +Heading fonts. Upon completion of this lesson, you will be able to:

- ☐ Use advanced conditional formatting.
- ☐ Manage conditional formatting rules.
- ☐ Create custom conditional formatting rules using formulas.
- ☐ Apply custom number, accounting, date, and time formats.
- ☐ Apply international formats to numeric and date/time data.
- ☐ Use international currency symbols.
- ☐ Configure the editing and display language.
- ☐ Understand +Body and +Heading fonts.

Using Conditional Formatting

Applying Advanced Conditional Formatting

Objective 2.3.1

You can use ***conditional formatting*** to change the appearance of a cell, depending on that cell's value. The cell ***format*** will change automatically when the cell value changes, triggering a different conditional formatting rule (Figure 1-1). This saves time for you and eliminates errors in having to make the format changes manually.

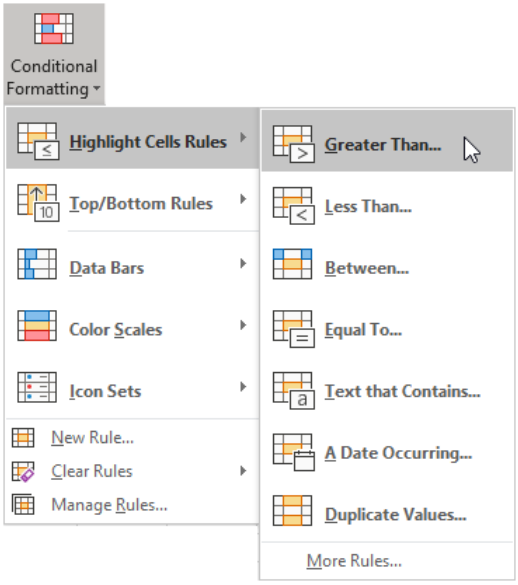


Figure 1-1: Conditional Formatting rules

The Excel courseware covered the topic of using the Ribbon to create conditional formats. The Ribbon method is easy to use and enables you to create the most frequently used conditional formats. Behind the scenes, the Ribbon method creates conditional formatting rules. You can also create these rules directly by using the New Formatting Rule dialog box (Figure 1-2). Click New Rule or More Rules in one of the Conditional Formatting drop-down menus to open the New Formatting Rule dialog box.

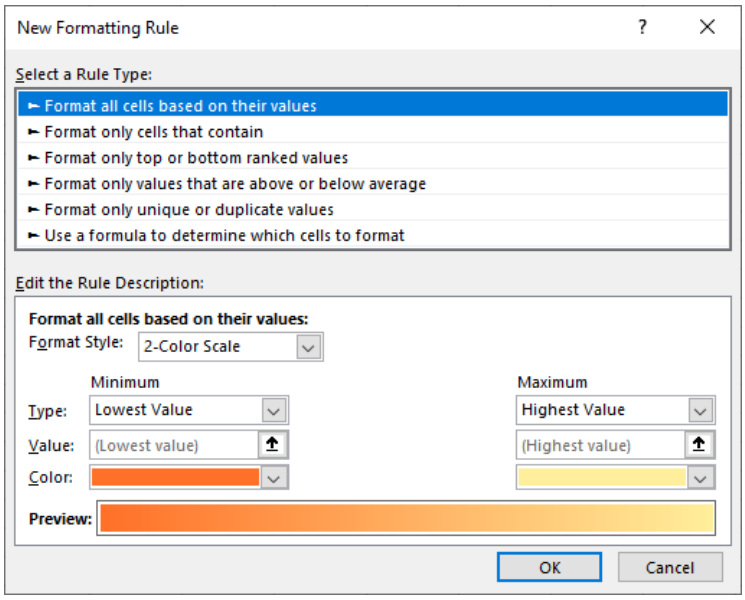


Figure 1-2: New Formatting Rule dialog box

The New Formatting Rule dialog box includes the following rule types in the *Select a Rule Type* list.

- **Format all cells based on their values** – The main application of this rule is to display indicators that show how the values in a range of cells relate to each other. For example, you may want cells with the highest values to show in red, while the cells with the lowest values show in blue. Excel will choose gradient colors between the red and blue for all other cells with the data values in between the two extremes. You can choose one of four main types of indicators: a 2-color scale, a 3-color scale, a data bar, or an icon set. In addition, you can choose from several different types of icons for the icon set.

- **Format only cells that contain** – The most commonly-used rule, offering a wide variety of operators to select the cells to highlight, such as between, greater than, and equal to. All cells that meet that rule will be highlighted with the same formatting.
- **Format only top or bottom ranked values** – Apply a specific format to the cells with the highest or lowest values or percentile in a range of cells. For example, you can use this rule to identify the 10% of students with the highest-ranking scores in a course.
- **Format only values that are above or below average** – Apply a specific format to cells that are above or below the average of a range of cells. Excel allows you to choose from the mean average or various degrees of standard deviation from the mean average.
- **Format only unique or duplicate values** – Identify and apply a specific format to all cells within a range with duplicate or unique values.
- **Use a formula to determine which cells to format** – Enter a formula that evaluates as TRUE or FALSE to enable the conditional formatting for the cells within the range. This formula may reference another cell in the same worksheet, but not another worksheet or workbook.

A cell may have both a manual format as well as a conditional format applied to it. If a cell is not affected by a conditional format, the cell will use the manual format.

Formatting options include only the font styles (regular, bold, italics, or bold and italics), font colors, borders, and background fill patterns. You may not choose different font names or font sizes in a conditional format.

Managing Conditional Formatting Rules

Objective 2.3.3

All conditional formatting rules for a worksheet are displayed in the Rules Manager window. To get to the Rules Manager window, click Manage Rules in one of the drop-down menus. You can use the ***Rules Manager*** to create new rules, modify existing ones, and delete rules that are no longer needed.

You may apply multiple conditional formats to a range of cells at the same time. For example, one rule may be to display a certain color if the value is less than 3,000; another rule to display a different color if the value is between 3,000 and 10,000; and a third rule if the value is greater than 10,000. In this situation, the rules do not conflict with each other and one of them will be in effect at any given time.

Suppose instead that one rule is in effect when the value is less than 10,000 and another rule is in effect when the value is greater than 3,000. In this case, the two rules overlap. Generally, the rule listed higher than the other in the Rules Manager will override the other. This is known as *rule precedence*. However, both will take effect if they do not conflict; for example, when one rule specifies to display an icon set and the other specifies to display a background fill color.

In Figure 1-3, the top two rules conflict with each other because both are setting background fill formats. Because the rule at the top takes precedence, all cells with a value greater than 3,000 have an orange background. The remaining cells have a green background because they meet the second condition of less than 10,000.

The third rule applies to all cells because an icon set format does not conflict with the background fill.

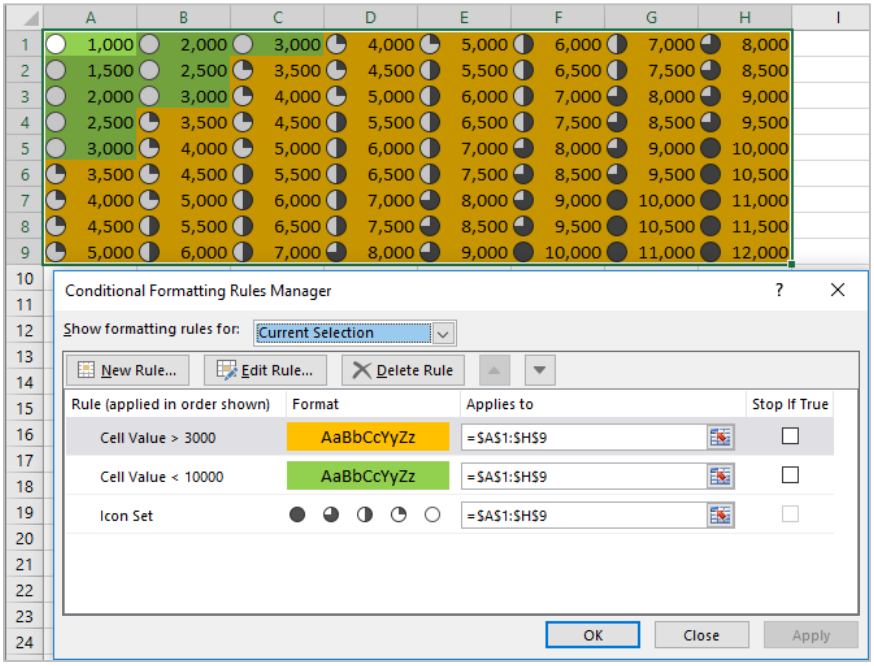


Figure 1-3: Rules Manager window – Rule precedence

The rules in the Rules Manager window apply in reverse sequence to when they were added; that is, the latest rule added is always placed at the top of the list and takes precedence over any rules below it. The sequence of these rules can be changed – simply select a rule and click Move Up or Move Down.

Note: You can also apply manual formatting to a cell using the Format Cells dialog box or by changing the formatting settings directly from the Ribbon. If the cell also has a conditional format, then the conditional format will always take precedence over the manual formatting.

Learn to apply conditional formats to cells

In this exercise, you will review how to apply basic conditional cell formatting.

1. Open **New York Temperatures Basic Formatting.xlsx** located in the *3274 Exercise Files\StarterFiles* folder.

The New York Temperatures Basic Formatting worksheet shows the average monthly temperature for New York City from 2005 to 2020. You will create a conditional format using the Ribbon to set the fill color to blue for any cell that contains a temperature value of less than 32 degrees Fahrenheit (0 degrees Centigrade).

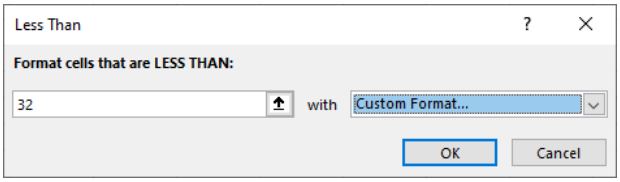
2. Select the cell range **B2:M17**.
3. On the Home tab, in the Styles group, click **Conditional Formatting**, then click **Highlight Cells Rules**, **Less Than**.

   The Less Than dialog box opens with default values entered for you.

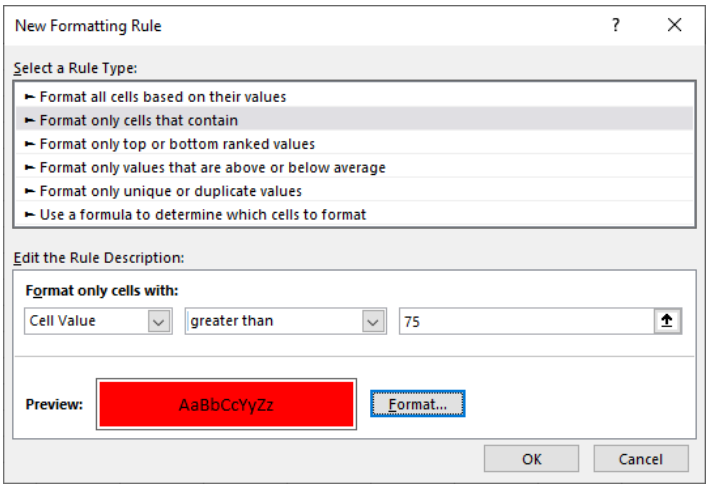
4. In the Less Than dialog box, enter: **32** in the *Format cells that are LESS THAN* field, then click the drop-down arrow in the *with* list box and click **Custom Format**.

   Because the Custom Format option was selected, the Format Cells dialog box opens.

5. In the Format Cells dialog box, click the **Fill** tab, then click the **blue** standard color (bottom line, third from the right) and click **OK**.



6. In the Less Than dialog box, click **OK**.
7. On the Home tab, in the Styles group, click **Conditional Formatting**, then click **New Rule**.
8. In the New Formatting Rule dialog box, click **Format only cells that contain** in the *Select a Rule Type* list.
9. In the *Edit the Rule Description* section, click the drop-down arrow in the second list box and click **greater than**. In the right-most field, enter: **75**.
10. Click the **Format** button.
11. In the Format Cells dialog box, click the **red** standard color (bottom row, second from the left), and click **OK**.



12. In the New Formatting Rule dialog box, click **OK** to complete the creation of the conditional formatting rule.
13. On the Home tab, in the Styles group, click **Conditional Formatting**, then click **Manage Rules**.
14. Click the bottom rule (Cell Value < 32), then click **Edit Rule**.

    You can change the formatting criteria rule in this window.
15. In the Edit Formatting Rule dialog box, click **Format**.
16. In the Format Cells dialog box, click the **light blue** standard color (bottom row, fourth from the right), then click **OK**.
17. In the Edit Formatting Rule dialog box, click **OK**. In the Conditional Formatting Rules Manager dialog box, click **OK**.
18. Click in a blank cell of the worksheet.

The screen should look similar to the following:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2005	31.3	37.3	47.2	51.0	63.5	71.3	72.3	72.7	66.0	57.0	45.3	31.1
3	2006	33.6	35.9	39.6	54.2	63.8	72.9	73.2	78.7	67.7	58.5	52.7	44.1
4	2007	39.9	40.6	44.1	56.1	60.7	71.4	78.8	77.7	70.2	55.2	46.0	36.0
5	2008	27.5	30.1	43.1	49.8	58.7	68.3	75.8	76.7	67.9	55.1	50.0	37.6
6	2009	24.7	35.0	43.5	53.6	65.2	71.2	74.5	74.2	69.3	56.0	48.2	38.4
7	2010	31.3	36.5	39.4	55.1	58.9	74.0	77.5	79.7	73.3	57.9	49.6	35.3
8	2011	40.9	35.7	43.1	55.7	63.1	71.0	77.9	75.8	66.6	56.2	51.9	43.6
9	2012	37.5	28.2	42.2	50.3	65.2	71.4	75.0	74.0	70.3	63.6	45.4	37.0
10	2013	36.5	35.8	42.6	54.9	60.1	74.0	78.4	73.8	68.8	55.1	45.8	38.1
11	2014	27.9	36.7	42.4	54.5	62.5	67.5	72.7	75.7	66.3	55.0	51.2	35.9
12	2015	32.5	33.1	48.2	57.9	65.3	74.7	81.3	77.4	71.1	58.1	47.9	32.8
13	2016	29.7	36.0	42.3	54.3	64.5	72.3	80.2	75.3	70.0	57.1	51.9	43.3
14	2017	37.3	40.9	50.9	54.8	65.1	71.0	78.8	76.7	68.8	58.0	43.9	41.5
15	2018	35.1	33.9	40.1	53.0	62.8	72.7	79.8	74.6	67.9	60.2	45.3	38.6
16	2019	28.7	31.7	37.7	52.3	64.0	72.5	76.1	74.5	69.7	59.6	45.3	40.5
17	2020	29.9	24.1	38.1	54.3	68.5	71.2	78.8	79.0	74.4	58.0	52.8	50.8

19. Click cell **B6**, then click the **Fill Color** drop-down arrow in the Ribbon. In the *Theme Colors* section of the drop-down menu, click the **Gold, Accent 4, Lighter 40%** color.

Now test the conditional formatting rules in some of the cells.

20. Click cell **F5**, and enter: **31**
21. Click cell **C5**, and enter: **75.1**
22. Click cell **B6**, and enter: **40**
23. Click the **Undo** button in the Quick Access Toolbar once to undo the change to cell B6.

    Cell B6 is now back to the light blue background color, and the gold background color that you manually set is no longer visible. You can remove the conditional formatting from a selected range of cells or from the entire worksheet.

24. On the Home tab, in the Styles group, click **Conditional Formatting**, click **Clear Rules**, and then click **Clear Rules from Entire Sheet**.

    Notice that the manual formatting in cell B6 is now in effect because the conditional formatting has been removed.

25. With cell **B6** still selected, click the **Fill Color** drop-down arrow in the Ribbon, then click **No Fill** in the drop-down menu.
26. Close the workbook without saving.

Applying Custom Conditional Formatting Using a Formula

Objective 2.3.2

If the predefined conditional formatting rules cannot provide what you are looking for, you can also create a customized one using a ***formula***.

In Figure 1-4a, the formula *=A$1=$B$19* is used for a new conditional format on the cell range A1:M17, as shown in Figure 1-4b.

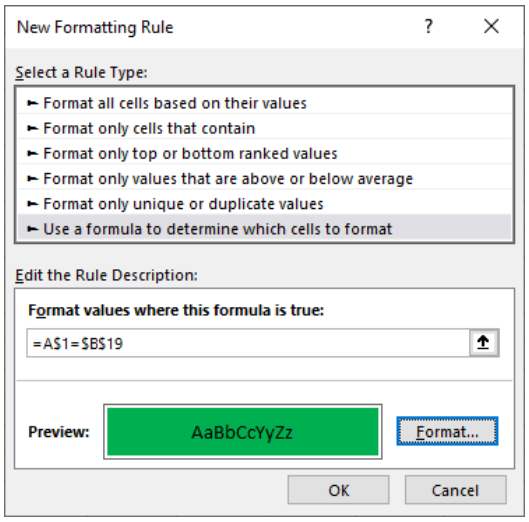


Figure 1-4a: New Formatting Rule – Using a formula

	A	B	C	D	E	F	G
1	Year	Jan	Feb	Mar	Apr	May	Jun
2	2005	31.3	37.3	47.2	51.0	63.5	71.3
3	2006	33.6	35.9	39.6	54.2	63.8	72.9
4	2007	39.9	40.6	44.1	56.1	60.7	71.4
5	2008	27.5	30.1	43.1	49.8	58.7	68.3
6	2009	24.7	35.0	43.5	53.6	65.2	71.2
7	2010	31.3	36.5	39.4	55.1	58.9	74.0
8	2011	40.9	35.7	43.1	55.7	63.1	71.0
9	2012	37.5	28.2	42.2	50.3	65.2	71.4
10	2013	36.5	35.8	42.6	54.9	60.1	74.0
11	2014	27.9	36.7	42.4	54.5	62.5	67.5
12	2015	32.5	33.1	48.2	57.9	65.3	74.7
13	2016	29.7	36.0	42.3	54.3	64.5	72.3
14	2017	37.3	40.9	50.9	54.8	65.1	71.0
15	2018	35.1	33.9	40.1	53.0	62.8	72.7
16	2019	28.7	31.7	37.7	52.3	64.0	72.5
17	2020	29.9	24.1	38.1	54.3	68.5	71.2
18							
19		Feb					

Figure 1-4b: Result of formatting rule on selected cell range

There are two important rules to remember about this formula:

- The formula must result in a TRUE or FALSE value.
- If the formula contains any cell references, the formula must be entered as if it was being entered into the upper left corner cell of the selected range. In the example above, the upper left corner cell for this range of cells receiving the conditional formatting is cell A1. Therefore, the cell formula *=A$1=$B$19* is evaluated for that cell. However, if the cell range selected for the conditional format is B2:M14, the equivalent formula must be *=B$2=$B$19*.

Notice that if the formula contains cell references, these references may be relative, absolute, or mixed. For all other cells in the cell range in which the conditional format rules apply, Excel will automatically adjust the relative and mixed cell references. Absolute cell references and the absolute part of mixed cell references will not change from cell to cell. Using the above example again, in cell C1 the formula will adjust to *=C$1=$B$19*, but for cell C2 the formula will also be *=C$1=$B$19*. For both cells C1 and C2, the formula evaluates to TRUE and therefore the conditional format will activate for these cells.

Learn to customize conditional formatting using a formula

In this exercise, you will use a formula to apply conditional formatting.

1. Open **New York Temperatures Formatting Formulas.xlsx** located in the *3274 Exercise Files\StarterFiles* folder, and save it as **My New York Temperatures Formatting Formulas.xlsx** in the *3274 Exercise Files\MyProjects* folder.

2. Enter the following values into the worksheet:

Cell	Value
B19	**Feb**
C19	**2006**

   Excel automatically formatted cell C19 using the same settings as the cells above containing numbers. You need to clear this formatting so that it shows as a year value without the decimal digits.

3. Select cell **C19** again, then on the Home tab, in the Editing group, click **Clear**, and click **Clear Formats**.
4. Select the cell range **A1:M17**.
5. On the Home tab, in the Styles group, click **Conditional Formatting**, then click **New Rule**.
6. In the New Formatting Rule dialog box, click **Use a formula to determine which cells to format** in the *Select a Rule Type* list.
7. In the Format values where this formula is true field, type: =**A1=$B$19**.
8. Click the **Format** button.
9. In the Format Cells dialog box, on the Fill tab, click the **green** standard color (bottom row, fifth from the right), and click **OK**.
10. In the New Formatting Rule dialog box, click **OK** to complete the creation of the conditional formatting rule.

    In the worksheet, only cell C1 is highlighted in green because it is the only cell in which the formula entered in step 6 evaluates to the value of TRUE (for this cell, the formula is adjusted to **=C1=$B$19**). The conditional format can be modified so that the entire column is highlighted in green.
11. Click **Conditional Formatting** in the Ribbon, then click **Manage Rules**.
12. With the sole rule already selected, click **Edit Rule**.
13. In the *Format values where this formula is true* field, change the formula to: =**A$1=$B$19** and click **OK**.
14. In the Conditional Formatting Rules Manager dialog box, click **OK**.

    The entire column is now highlighted. Every cell (not just C1) in the cell range C1:C17 will now have the formula in the conditional format adjusted to =C1=$B$19.
15. Ensure that the range **A1:M17** is still selected, click **Conditional Formatting**, then click **New Rule**.
16. In the New Formatting Rule dialog box, click **Use a formula to determine which cells to format** in the *Select a Rule Type* list.
17. In the Format values where this formula is true field, type: =**$A1=$C$19**
18. Click the **Format** button, click the **orange** standard color (bottom row, third from the left), and click **OK**.
19. In the New Formatting Rule dialog box, click **OK** to complete creating the conditional formatting rule.
20. Click in any blank cell outside of the range A1:M17 to view the results of the conditional formatting.

The screen should look similar to the following:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2005	31.3	37.3	47.2	51.0	63.5	71.3	72.3	72.7	66.0	57.0	45.3	31.1
3	2006	33.6	35.9	39.6	54.2	63.8	72.9	73.2	78.7	67.7	58.5	52.7	44.1
4	2007	39.9	40.6	44.1	56.1	60.7	71.4	78.8	77.7	70.2	55.2	46.0	36.0
5	2008	27.5	30.1	43.1	49.8	58.7	68.3	75.8	76.7	67.9	55.1	50.0	37.6
6	2009	24.7	35.0	43.5	53.6	65.2	71.2	74.5	74.2	69.3	56.0	48.2	38.4
7	2010	31.3	36.5	39.4	55.1	58.9	74.0	77.5	79.7	73.3	57.9	49.6	35.3
8	2011	40.9	35.7	43.1	55.7	63.1	71.0	77.9	75.8	66.6	56.2	51.9	43.6
9	2012	37.5	28.2	42.2	50.3	65.2	71.4	75.0	74.0	70.3	63.6	45.4	37.0
10	2013	36.5	35.8	42.6	54.9	60.1	74.0	78.4	73.8	68.8	55.1	45.8	38.1
11	2014	27.9	36.7	42.4	54.5	62.5	67.5	72.7	75.7	66.3	55.0	51.2	35.9
12	2015	32.5	33.1	48.2	57.9	65.3	74.7	81.3	77.4	71.1	58.1	47.9	32.8
13	2016	29.7	36.0	42.3	54.3	64.5	72.3	80.2	75.3	70.0	57.1	51.9	43.3
14	2017	37.3	40.9	50.9	54.8	65.1	71.0	78.8	76.7	68.8	58.0	43.9	41.5
15	2018	35.1	33.9	40.1	53.0	62.8	72.7	79.8	74.6	67.9	60.2	45.3	38.6
16	2019	28.7	31.7	37.7	52.3	64.0	72.5	76.1	74.5	69.7	59.6	45.3	40.5
17	2020	29.9	24.1	38.1	54.3	68.5	71.2	78.8	79.0	74.4	58.0	52.8	50.8
18													
19		Feb	2006										

21. Click cell **B19**, and type: **Sep**
22. Click cell **C19**, and type: **2018**

    With these changes, every cell in column J is green, except cell J15. Every cell in row 15 is orange, including cell J15.

23. Click **Conditional Formatting** in the Ribbon, then click **Manage Rules**.
24. In the *Show formatting rules for* list box, click the arrow and select **This Worksheet**.
25. With the top-most rule already selected, click the **Move Down** button, then click **OK**.

    By switching the sequence of the conditional formatting rules, the one that highlights in green now takes precedence. The entire column is now green, including cell J15.

26. Save and close the workbook.

Using Custom Cell Formats

Formatting cells is a crucial activity because spreadsheets often contain large volumes of numeric information. Users can absorb the information much more quickly when the spreadsheet is visually readable by using a variety of fonts, colors, and sizes. The relevance and accuracy of the contents is an absolute necessity for spreadsheets, but poor presentation discourages users from paying attention.

Excel provides a good variety of standard display formats for numbers, dates, times, and text characters. The most commonly used options are easily accessible from the Ribbon.

In some cases, you may need to use special formats that are not one of these frequently-used cell formatting categories. For example, you may need special formatting for data such as dates, part numbers, phone numbers, and currencies (as you would in many European and Asian countries).

Applying Custom Number Formats

Objective 2.2.1

The Format Cells dialog box (Figure 1-5) includes several predefined custom formats in the Custom category.

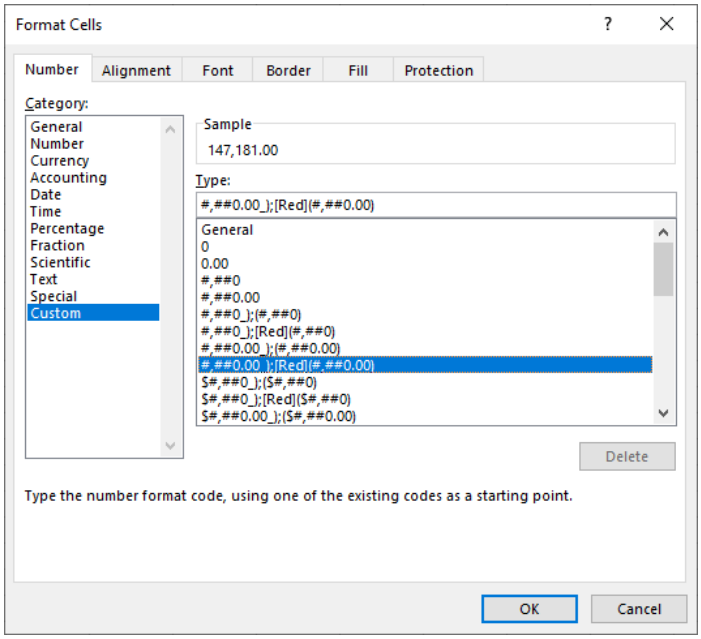


Figure 1-5: Format Cells dialog box – Custom category

You can also create your own custom number format, using the following specification:

positive number format; negative number format; zero format; text format

Notice that this format has four sections separated by semicolons. A custom format does not require all four sections; it can have as few as one section. If you specify only the first section, Excel will use this same format for all numbers (positive, negative, and zero). If you specify only the first two sections, Excel will use the positive number format for zero values as well as positive values and the format in the second section for negative numbers.

You can specify each numeric format by using a sequence of symbols to indicate the position and type of each of the numeric digits to be displayed. Some symbols that can be used in a custom format are:

#	Display a digit, but do not display anything for leading and trailing zeros.
0	Display a digit, even if it is a leading or trailing zero.
?	Display a digit and replace trailing zeros with a blank space so that multiple cells with this format are aligned by the decimal point.
, (comma)	Separate a number into thousands and scale a number by a multiple of one thousand. In some countries, the period (.) is used as the thousands separator.
. (period)	Normally used as a decimal point. In some countries, the comma (,) is used as the decimal point.

_ (underscore)	Add a blank space that is the width of the character following the underscore in the custom format. For example, the format **#,##0.00_-** has **_-** at the end, which means leave a space that is the width of the minus sign. This format is used for the positive number component of the Currency Style format to ensure numbers are aligned by the decimal point yet allows for the brackets for negative numbers.
color	Apply black, blue, cyan, green, magenta, red, white, or yellow.
conditional expression	Specify a simple condition when this format applies. For example, the format **[Green][>1000]#,##0** displays the number in a cell in green only if it is greater than 1,000. However, as the conditional formatting feature in the Ribbon is more flexible and powerful than this feature, you should use the Ribbon feature most often.
"text"	The double quotation marks tell Excel to insert the specified text in the displayed value. For example, the format "$"#,##0.00" DR" places the $ character at the left side and a DR at the right side of the displayed number.
*** "character"**	The "*" symbol tells Excel to fill the remainder of the cell with the specified character.

Examples

Value	Format	Displayed Value	
98765.4	#.###	98765.4	
98765.4	0.000	98765.400	
98765.4	?.???	98765.4	(with two blank spaces at the end)
98765.4	[Blue]#,##0.00_);[Red](#,##0.00)	98,765.40	(blue color)
-98765.4	[Blue]#,##0.00_);[Red](#,##0.00)	(98,765.40)	(red color)
36000	#,##0	36,000	
36000	#,	36	
36000000	#,,	36	
36000000	#,###,	36,000	
36	0000	0036	
123456.78	"Cdn" $#,##0.00	Cdn $123,456.78	
123456789	"Part #" 000-00-0000	Part # 123-45-6789	
456.78	0.00 "cm"	456.78 cm	
456.78	*$0.00	$$$$$456.78	($ repeats as necessary to fill the space at left)

The fourth section (text format) of the custom formatting specification applies only if the cell contains a text string instead of a number. You can also display text strings inside cells containing numeric values.

You can delete custom cell formats that you no longer need or have created by mistake. However, you cannot delete any of the built-in cell formats.

Learn to create and use custom number formats

In this exercise, you will create and use custom number formats.

1. Open **Destination Profiles Numeric.xlsx** located in the *StarterFiles* folder, and save it as **My Destination Profiles Numeric.xlsx** in the *MyProjects* folder.
2. Select cells **B7:E8** and, on the Home tab, in the Number group, click the **Number Format** dialog box launcher. If necessary, select the **Number** tab.

3. In the *Category* section, click **Number**.
4. Reduce the *Decimal places* value to **0**, select **Use 1000 Separator (,)** to turn it on, and click **OK**.
5. Select cells **B13**:**E13**, then click the **Number Format** dialog box launcher in the Number group.
6. In the *Category* section, click **Custom**, and in the *Type* section, click **#,##0** (fourth from the top).

   Notice how the preview of the data changes in the Sample section of the dialog box when you select the custom format.
7. Click **OK**.
8. Select cells **B15:E15**, then click the **Number Format** dialog box launcher in the Number group.
9. In the *Category* section, click **Custom**, and in the *Type* section, click **#,##0_);[Red](#,##0)** (seventh from the top), and click **OK**.
10. With cells **B15:E15** still highlighted, click the **Number Format** dialog box launcher in the Number group.
11. Click the **Custom** category, and change the formatting instructions in the *Type* field to: **[Blue]#,##0;[Red]-#,##0**. Click **OK**, then click in a blank area of the worksheet to deselect these cells.

    Notice that the positive values are blue and the negative values are red. You can select from a number of different colors to highlight positive and/or negative numbers.
12. Select cell **D15** and click the **Number Format** dialog box launcher in the Number group.

    Notice that the new format created earlier has been added at the bottom of the list of custom formats. Now you want to add the text "m" or "ft" to the numbers in row 15. Because these cell formats have both a positive and negative section, you must add the text to both.
13. In the *Type* field, change the format code to: **[Blue]#,##0 "ft";[Red]-#,##0 "ft"** and click **OK**.
14. Select cells **B15:C15**, and click the **Number Format** dialog box launcher in the Number group.
15. Click the **Type** field, change the format code to: **[Blue]#,##0 "m";[Red]-#,##0 "m"** and click **OK**.
16. Select cell **E15**, click the **Number Format** dialog box launcher in the Number group, select the **[Blue]#,##0 "m";[Red]-#,##0 "m"** custom format code at the bottom of the list, and click **OK**.
17. Change several other cells containing numeric values to the following custom formats:

Cell Range	Custom Format
B7:C7	#,##0 "sq km"
D7	#,##0 "sq mi"
E7	#,##0 "sq km"
B13:C13	#,##0 "m"
D13	#,##0 "ft"
E13	#,##0 "m"

The worksheet should appear similar to the following:

	A	B	C	D	E
1	Tolano Adventures				
2	Destination Profiles				
3					
4	Region:	Nepal	Mexico	California	British Columbia
5	Capital:	Kathmandu	Mexico City	Sacramento	Victoria
6	Primary Language:	Nepali	Spanish	English	English
7	Size:	147,181 sq km	1,972,550 sq km	163,696 sq mi	944,735 sq km
8	Population:	26,494,504	118,395,054	38,332,521	4,400,057
9	Gross Domestic Product (GDP):	19921000000	1.327E+12	2.0035E+12	2.17749E+11
10	Currency:	Nepalese rupee	Mexican Peso	US Dollar	Canadian Dollar
11	Exchange Rate (to US$1):	0.01007	0.07541	1	0.89997
12	Highest Point:	Mount Everest	Pico de Orizaba	Mount Whitney	Mount Fairweather
13	Height of Highest Point:	8,848 m	5,700 m	14,505 ft	4,663 m
14	Lowest Point:	Musaharniya	Laguna Salada	Death Valley	Pacific Ocean
15	Height of Lowest Point:	59 m	-10 m	-282 ft	0 m

18. Save and close the workbook.

Applying Custom Accounting Formats

Objective 2.2.1

The Accounting format is intended for use with numbers that represent money or currencies. The Symbol list in the Format Cells dialog box (Figure 1-6) allows you to select from the many different currency symbols used around the world.

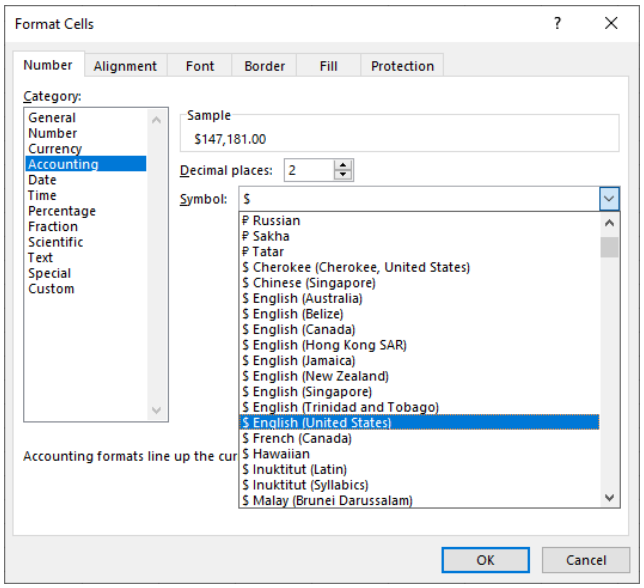


Figure 1-6: Format Cells dialog box – Accounting category, Symbol list

You can create custom accounting formats by combining the currency symbol with the custom number formatting described previously.

Learn to create and use custom accounting formats

In this exercise, you will create and use custom accounting formats.

1. Open **Destination Profiles Accounting.xlsx** located in the *StarterFiles* folder, and save it as **My Destination Profiles Accounting.xlsx** in the *MyProjects* folder.

2. Select cells **B11:E11**, then on the Home tab, in the Number group, click the **Number Format** dialog box launcher.
3. In the *Category* section, select **Accounting**.
4. Click the **Symbol** drop-down arrow, then click **$ English (United States)**.
5. In the *Category* section, select **Custom**.

   The formatting code is much more complex because a specific currency symbol was selected in step 4.
6. Click **OK**.

   Notice that the numbers in this row are indented to the left by one space. This space is reserved for the right bracket; if the number is less than zero, brackets are displayed on both the left and right side. Because these number are all greater than zero, a blank space appears on the right side.

   One of the differences between the Accounting and Currency formats is that the currency symbol in the Accounting format is at the far left of the cell, whereas it is immediately to the left of the number when the Currency format is used.
7. With cells **B11:E11** still highlighted, click the **Number Format** dialog box launcher in the Number group.
8. Click the **Custom** category, delete the contents of the *Type* field, and type: **$0.00000;-$0.00000**. Click **OK**.
9. Select cells **B9:E9**. On the Home tab, in the Number group, click the **Number Format** dialog box launcher.
10. In the *Custom* category, change the custom format to: **$#,##0,,, "billion"** and click **OK**.

	A	B	C	D	E
1	Tolano Adventures				
2	Destination Profiles				
3					
4	Region:	Nepal	Mexico	California	British Columbia
5	Capital:	Kathmandu	Mexico City	Sacramento	Victoria
6	Primary Language:	Nepali	Spanish	English	English
7	Size:	147,181 sq km	1,972,550 sq km	163,696 sq mi	944,735 sq km
8	Population:	26,494,504	118,395,054	38,332,521	4,400,057
9	Gross Domestic Product (GDP):	$20 billion	$1,327 billion	$2,004 billion	$218 billion
10	Currency:	Nepalese rupee	Mexican Peso	US Dollar	Canadian Dollar
11	Exchange Rate (to US$1):	$0.01007	$0.07541	$1.00000	$0.89997
12	Highest Point:	Mount Everest	Pico de Orizaba	Mount Whitney	Mount Fairweather
13	Height of Highest Point:	8,848 m	5,700 m	14,505 ft	4,663 m
14	Lowest Point:	Musaharniya	Laguna Salada	Death Valley	Pacific Ocean
15	Height of Lowest Point:	59 m	-10 m	-282 ft	0 m

11. Save and close the workbook.

Applying Custom Date and Time Formats

Objective 2.2.1

There are many more ways to format date and time values than you might expect. Excel provides the flexibility to accommodate almost all circumstances, as shown in Figure 1-7.

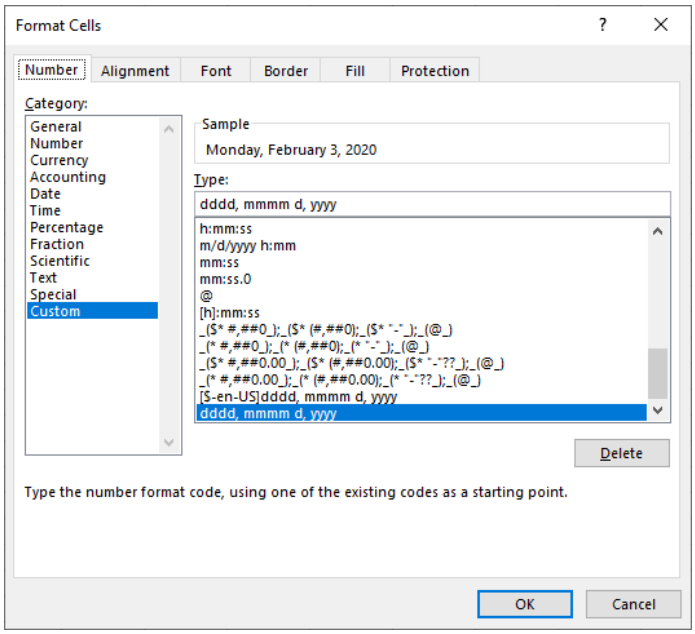


Figure 1-7: Format Cells dialog box – Custom category

The various codes that can be used in a custom date and time format are:

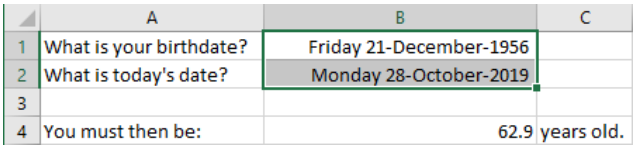
d, dd, ddd, dddd	Display the day of the month. The "d" version displays the days as 1 to 31; "dd" displays 01 to 31 (always two digits); "ddd" displays "Sun" to "Sat"; and "dddd" displays "Sunday" to "Saturday."
m, mm, mmm, mmmm, mmmmm	Display the month of the year. The "m" displays 1 to 12; "mm" displays 01 to 12; "mmm" displays "Jan" to "Dec"; "mmmm" displays "January" to "December"; and "mmmmm" displays "J" to "D" (first letter of the month name).
yy, yyyy	Display the year value. The "yy" displays 00 to 99; "yyyy" displays the full combined century and year value.
h, hh	Display the hour value. The "h" displays 0 to 23; "hh" displays 00 to 23.
m, mm	Display the minutes value within the context of a time value. The "m" displays 0 to 59; "mm" displays 00 to 59.
s, ss	Display the seconds value. The "s" displays 0 to 59; "ss" displays 00 to 59.
AM/PM, am/pm, a/p	Display the time using the 12-hour clock format (hour value is 0 to 11). The "AM/PM" displays "AM" or "PM" in upper case; "am/pm" displays them in lower case; "a/p" displays only the first character of "am" and "pm." If this symbol is absent, the time is displayed using the 24-hour clock format (hour value is 0 to 23).

Learn to create and use custom date formats

In this exercise, you will create and use custom date formats.

1. Open **Age Calculator.xlsx** located in the *StarterFiles* folder, and save it as **My Age Calculator.xlsx** in the *MyProjects* folder.
2. In cell **B1**, enter your date of birth.
3. Select cells **B1:B2**. On the Home tab, in the Number group, click the **Number Format** dialog box launcher.

4. Select the **Number** tab. In the *Category* section, select **Custom**.
5. Click in the **Type** field. Move to the year section at the far right side of the field and type: **yy** to expand the year format to four digits. Click **OK**.
6. With cells **B1:B2** still selected, on the Home tab, in the Number group, click the **Number Format** dialog box launcher.
7. Delete the current contents of the *Type* field, and then type (do this slowly, and observe what is displayed in the *Sample* field as you enter each character): **dddd dd-mmmm-yyyy** and click **OK**.



	A	B	C
1	What is your birthdate?	Friday 21-December-1956	
2	What is today's date?	Monday 28-October-2019	
3			
4	You must then be:	62.9	years old.

8. Save and close the workbook.

Using International Formats

Objective 1.3.1

Some types of data are displayed differently depending on which country is being represented. Examples include currency (or money), dates, and measurements such as temperature and weight. Some of this country-dependent data can be identified using ordinary text such as kg for kilograms or C for Celsius. Excel has special capabilities to handle the unique formatting requirements for currency and date values.

Applying International Currency and Number Formats

Objective 1.3.1

Most European countries in the European Union (EU) use the € symbol to identify the Euro as their recognized currency. Australia, Canada, USA, Mexico, and several other countries use the $ symbol to identify the dollar or peso as their currency.

The currency format is set for all software on your computer through the Regional Settings of the Control Panel. Windows then determines the correct currency symbol to use with the selected region of the world. In addition, you can choose from a long list of currency symbols for other countries for your spreadsheet. The Symbol list in the Currency category of the Format Cells dialog box provides this list. Excel also ensures that the symbol position is correct when displaying the currency values.

Most English-speaking countries use the period (".") as the decimal point for numbers, and the comma (",") to separate groups of thousands. Most European countries – for example, France and Italy – use the comma as the decimal point and the period or space as the thousands separator.

Country	**Example**
United States	1,234,567.89
Canada	1,234,567.89
United Kingdom	1,234,567.89
France	1 234 567,89
Germany	1.234.567,89 or 1 234 567,89

With the Control Panel Regional Settings configured to any country, Excel will use the correct currency format for that country.

You can also override the default currency format settings by using the Symbol option list in the Format Cells dialog box (Figure 1-8).

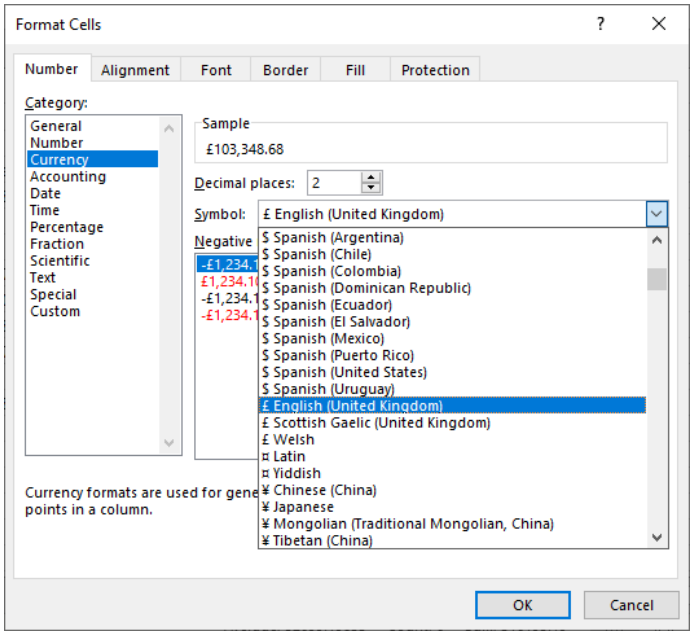


Figure 1-8: Format Cells dialog box – Currency category, Symbol option list

Learn to select different regional currency formats

In this exercise, you will select different regional currency formats.

1. Open **Consolidated Income Numeric.xlsx** located in the *StarterFiles* folder, and save it as **My Consolidated Income Numeric.xlsx** in the *MyProjects* folder.
2. Select cells **D5:D13**. On the Home tab, in the Number group, click the **Number Format** dialog box launcher.
3. If necessary, click the **Number** tab. In the *Category* section, select **Currency**.
4. Click the **Symbol** drop-down arrow, and then select **£ English (United Kingdom)**.
5. In the *Negative numbers* list box, select the option at the bottom (displays both negative sign and red font), then click **OK**.

   Your sheet should look similar to the following:

	A	B	C	D	E	F	G	H
1	**Tolano Adventures**							
2	**Consolidated Income Statement**							
3								
4		**Total**	**Cape Town**	**London**	**New York**	**Sydney**	**Toronto**	**Tokyo**
5	Revenues	880448.92	74723.83	£103,348.68	222334.83	143989.75	88026.79	248025.04
6								
7	Expenses:							
8	Sales Expenses	572335.13	44242.67	£84,991.71	140985.84	126279.59	54095.58	121739.74
9	Administrative Expenses	235797.86	13953.11	£22,484.38	57485.64	29409.24	16209.02	96256.47
10	Financing Expenses	14063.05	1245.95	£2,021.74	3812.18	2583.49	2399.86	1999.83
11	Total Expenses	822196.04	59441.73	£109,497.83	202283.66	158272.32	72704.46	219996.04
12								
13	Net Income	58252.88	15282.1	-£6,149.15	20051.17	-14282.57	15322.33	28029

6. For cells **C5:C13**, display the Format Cells dialog box, and with Currency selected, select the **R English (South Africa)** currency option (about one-half of the way down the long list of currencies).

7. For cells **H5:H13**, repeat the previous step but use the **¥ Japanese** currency option for this range.

   The numbers in columns E, F, and G all use the same $ currency symbol, even though they are for different countries. To help differentiate these columns, you can customize the currency symbol as US$, C$, and A$.

8. Select cells **E5:E13**. Open the Format Cells dialog box and, in the *Custom* category, change the custom format in the *Type* field to: **"US"$#,##0.00;[Red]-"US"$#,##0.00** and then click **OK**.

9. For cells **F5:F13**, change the custom format in the *Type* field to: **"A"$#,##0.00;[Red]-"A"$#,##0.00** and click **OK**.

10. Repeat step 8 for cells **G5:G13**, using the custom format **"C"$#,##0.00;[Red]-"C"$#,##0.00**

11. Select cells **B5:B13**. On the Home tab, in the Number group, click the **Number Format** drop-down arrow, and select **Currency**.

    Your sheet should look like the following:

	A	B	C	D	E	F	G	H
1	Tolano Adventures							
2	Consolidated Income Statement							
3								
4		Total	Cape Town	London	New York	Sydney	Toronto	Tokyo
5	Revenues	$880,448.92	R74,723.83	£103,348.68	US$222,334.83	A$143,989.75	C$88,026.79	¥248,025.04
6								
7	Expenses:							
8	Sales Expenses	$572,335.13	R44,242.67	£84,991.71	US$140,985.84	A$126,279.59	C$54,095.58	¥121,739.74
9	Administrative Expenses	$235,797.86	R13,953.11	£22,484.38	US$57,485.64	A$29,409.24	C$16,209.02	¥96,256.47
10	Financing Expenses	$14,063.05	R1,245.95	£2,021.74	US$3,812.18	A$2,583.49	C$2,399.86	¥1,999.83
11	Total Expenses	$822,196.04	R59,441.73	£109,497.83	US$202,283.66	A$158,272.32	C$72,704.46	¥219,996.04
12								
13	Net Income	$58,252.88	R15,282.10	-£6,149.15	US$20,051.17	-A$14,282.57	C$15,322.33	¥28,029.00

12. Save and close the workbook.

Inserting International Currency Symbols

Objective 1.3.1

You can also manually insert the symbol for many of the most common international currencies as an individual text character. You may be able to find these symbols on the Insert tab, in the Symbols group, under Symbol. The currency symbols are listed under the Latin-1 Supplement subset (Figure 1-9a) or the Currency Symbols subset (Figure 1-9b).

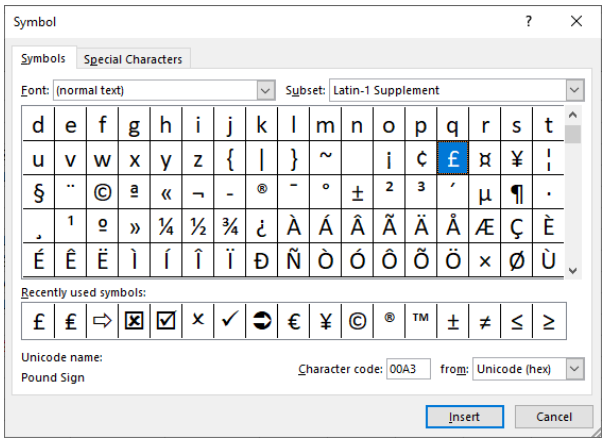


Figure 1-9a: Symbol dialog box – Latin-1 Supplement subset

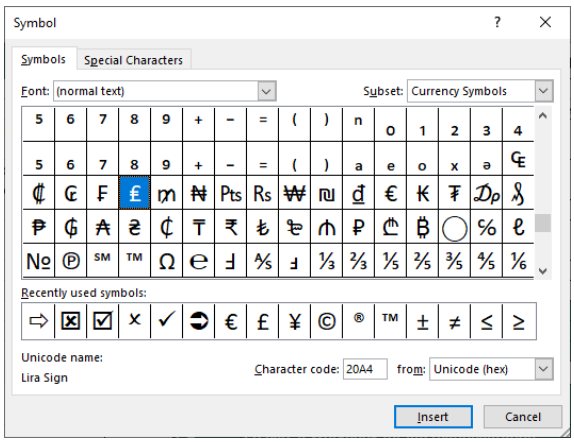


Figure 1-9b: Symbol dialog box – Currency Symbols subset

Learn to insert a currency symbol as a text character

In this exercise, you will insert a currency symbol as a text character.

1. Open Consolidated Income Currency Symbols.xlsx located in the *StarterFiles* folder, and save it as My Consolidated Income Currency Symbols.xlsx in the *MyProjects* folder.
2. Select cell **A15** and type: **British Pound** (with a blank space at the end), but do not press **ENTER** yet.
3. On the Insert tab, in the Symbols group, click **Symbol**.
4. If necessary, click the **Font** drop-down arrow and select **(normal text)**.
5. Click the **Subset** drop-down arrow and select **Latin-1 Supplement**.
6. If necessary, scroll up or down to find the £ symbol, then click the **£** (Pound Sign) symbol and click **Insert**.

   Note: When you click the Insert button, you will be tempted to click it again because it may appear as if nothing had been inserted. This is caused by the Symbol dialog box staying open and blocking your view of the cell. After clicking the Insert button, the Symbol dialog box will display the Close button. If it still shows the Cancel button, then you have not yet clicked the Insert button.

7. Close the Symbol dialog box and then press **ENTER** to finish the cell entry.
8. Select cell **A16** and type: **Japanese Yen** (with a blank space at the end), but do not press **ENTER** yet.
9. Repeat steps 3 to 7 to insert the Japanese Yen ¥ (Yen Sign) symbol.
10. Save and close the workbook.

Applying Custom and International Date and Time Formats

Objective 1.3.1

Like the currency formats, you can also select from among different date formats. To override the current Regional Settings date format, you can change the Locale (location) setting in the Format Cells dialog box (Figure 1-10) for a range of cells.

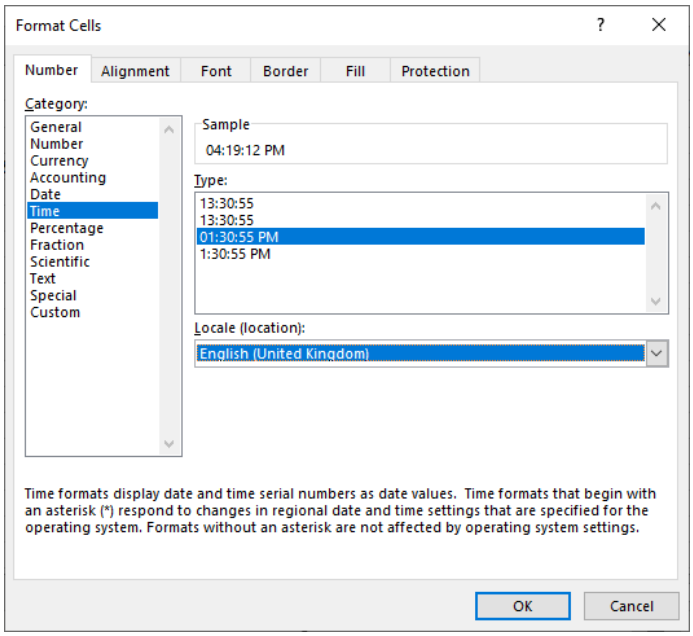


Figure 1-10: Format Cells dialog box – Time category

Furthermore, you can customize a date value to any format of your choosing (Figure 1-11).

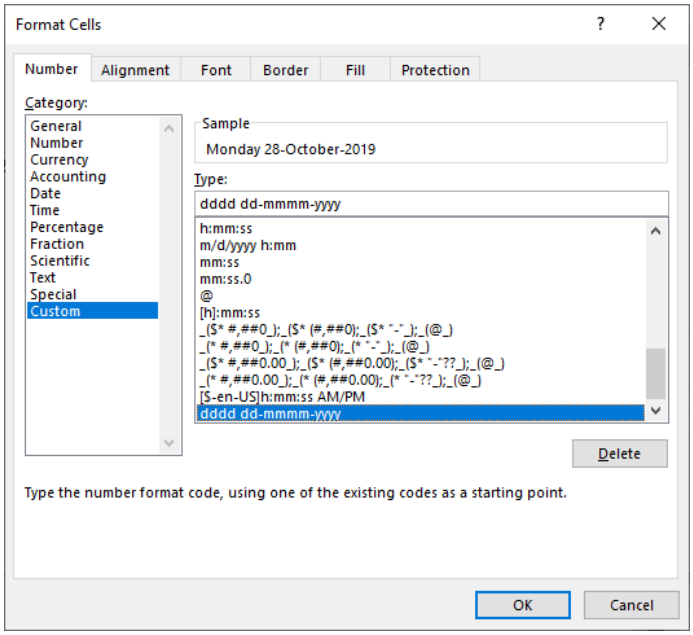


Figure 1-11: Format Cells dialog box – Custom category, customizing a date value

The various codes that can be used in a custom date and time format are the same as those described in the *Applying Custom Date and Time Formats* section.

Learn to change the formatting of date and time values

In this exercise, you will change the formatting of date and time values.

Note: The dates and times shown on your computer will be current according to your computer's clock and will differ from those shown here. Date and time formatting will also reflect the Regional settings of your computer.

1. Open **Date and Time Demo.xlsx** located in the *StarterFiles* folder, and save it as **My Date and Time Demo.xlsx** in the *MyProjects* folder.
2. Select cell **B2**, then on the Home tab, in the Number group, click the **Number Format** dialog box launcher.
3. If necessary, click the **Number** tab. In the *Category* section, select **Custom**.
4. Delete the current contents of the *Type* field and then type (do this slowly, and observe what is displayed in the *Sample* field as you enter each character): **dddd dd-mmmm-yyyy** and click **OK**.
5. Select cell **B3**, then on the Home tab, in the Number group, click the **Number Format** dialog box launcher.
6. Click the **Custom** category, and replace the contents of the *Type* field with: **hh:mm:ss** and click **OK**.
7. Select cell **C2**, and click the **Number Format** dialog box launcher in the Number group.
8. Click the **Locale (location)** drop-down arrow, select **English (Canada)**, and click **OK**.
9. Select cell **C3**, and click the **Number Format** dialog box launcher in the Number group.
10. Ensure the **Locale (location)** drop-down displays **English (Canada)**, and click **OK**.
11. Select cell **D2**, and open the Format Cells dialog box.
12. With the *Date* category selected, change the *Locale (location)* to **French (France)**.
13. In the *Type* list box, select the **14-mars-12** entry (sixth from the top), and click **OK**.
14. Select cell **D3**, and open the Format Cells dialog box.
15. With the *Time* category selected, ensure the *Locale (location)* is **French (France)**.
16. If necessary, in the *Type* list box, select the **13:30:55** entry (third from the top), and click **OK**.
17. Save and close the workbook.

Configuring the Editing and Display Language

Objective 1.3.1

You can change the editing language and the display language in Excel. The ***editing language*** consists of the keyboard layout and proofing tools (these include language-specific features such as dictionaries for spelling and grammar checking, and paragraph direction buttons). The ***display language*** affects the language used in the menus, tool tips, and Help system.

To access the language options, click File, click Options to open the Excel Options dialog box, and then click the Language tab (Figure 1-12).

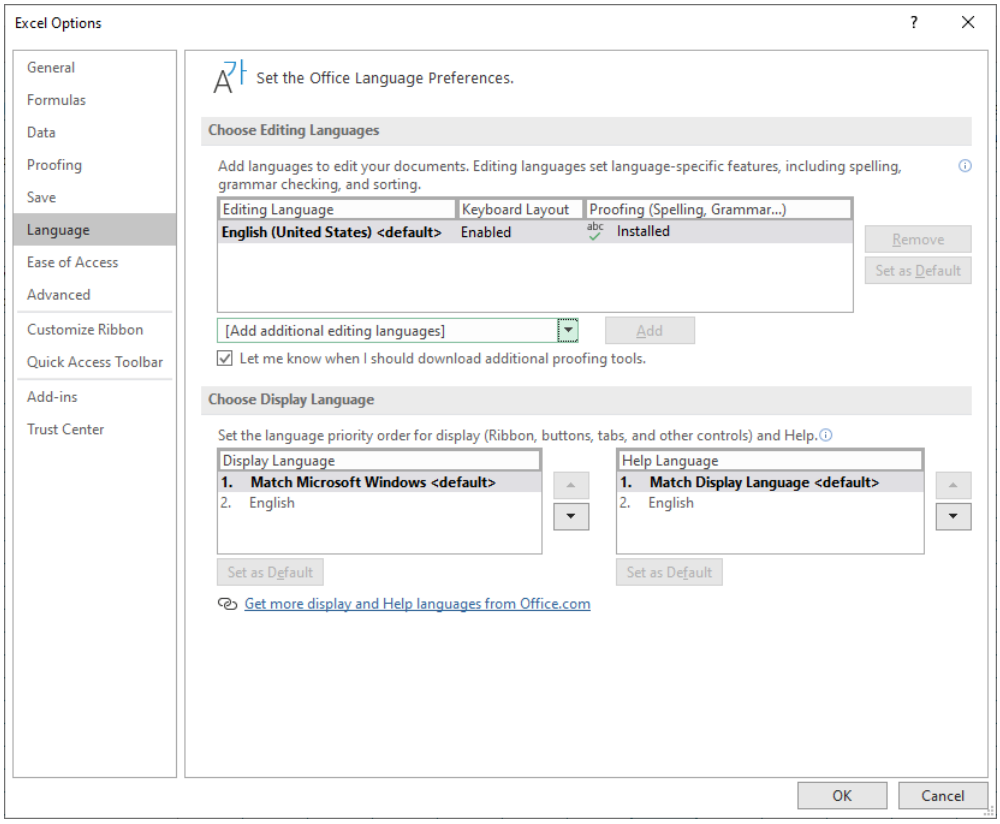


Figure 1-12: Excel Options dialog box – Language tab

The currently available editing languages appear in the Editing Language list box in the Choose Editing Languages section (Figure 1-13). Select a language and click OK to set it as the editing language. To add an editing language, click the [Add additional editing languages] arrow, select a language, and then click Add.

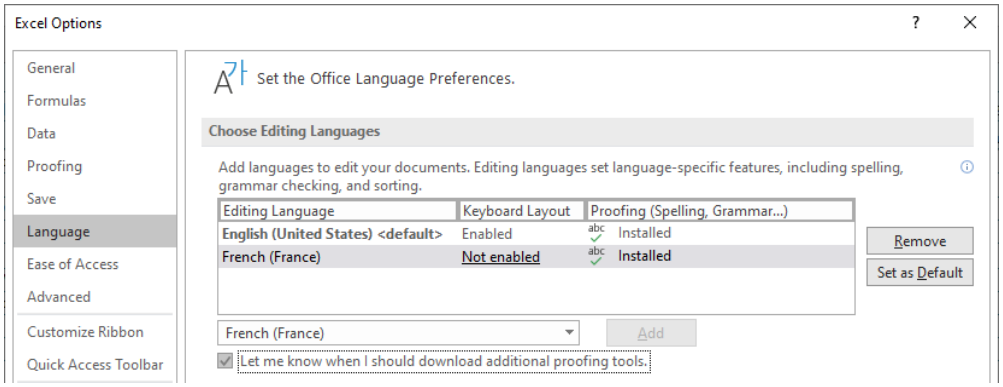


Figure 1-13: Excel Options dialog box – Language tab, Choose Editing Languages section

Once you add a language to the Editing Language list box, you may need to enable the keyboard and/or install the proofing tools for the language.

Notice that you also have the option to remove the selected language or set it as the default editing language. The display and help languages can be set independently. To add display or help languages, click the *Get more display and Help languages from Office.com* link in the dialog box to open a web page in your browser. Select a language from the drop-down list, then click the download link for the correct software version (32-bit or 64-bit). Open the downloaded file and install it. Restart Excel and open the Language tab in the Excel Options dialog box.

In the Choose Display Language section, select the language you want to use in the Display Language list box, then click Set as Default. Select the language you want to use in the Help Language list box, then click Set as Default. Click OK and then restart Excel.

Learn to change the editing language

In this exercise, you will change the editing language.

1. Open **Climate Data.xlsx** located in the *StarterFiles* folder, click **File**, and then click **Options** to open the Excel Options dialog box.
2. In the Excel Options dialog box, click the **Language** tab in the left panel.
3. In the *Choose Editing Languages* section, click the **[Add additional editing languages]** drop-down arrow, then in the list, click **Spanish (Spain)**.
4. Click the **Add** button to add the selected language to the Editing Languages list.

   At this point, you could click OK and you would be prompted to restart Office. For this exercise, however, you will remove the language instead.
5. With **Spanish (Spain)** selected in the *Editing Language* list box, click **Remove**, then click **OK**.

   Note: If you are prompted to restart Office, click **OK**, but do not restart Excel.
6. Close the workbook without saving.

Understanding +Body and +Heading Fonts

Objective 1.3.2

In the Microsoft Office Suite, the +Body and +Heading fonts are the ones that automatically adjust themselves whenever a different theme is selected. In Excel, the Font list in the Home tab and the Mini toolbar identifies these two fonts in the Theme Fonts section with the font name followed by (Body) or (Headings) (Figure 1-14a). This is also true of the font list that displays in the Font tab of the Format Cells dialog box (Figure 1-14b). Notice that the Font tab of the Format Cells dialog box offers effects such as Strikethrough, Superscript, and Subscript, which are not available on the Ribbon.

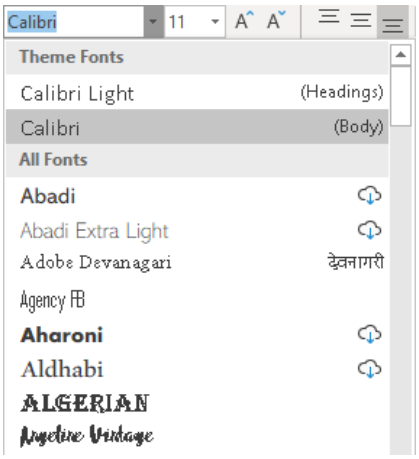


Figure 1-14a: Font list – Headings and Body fonts

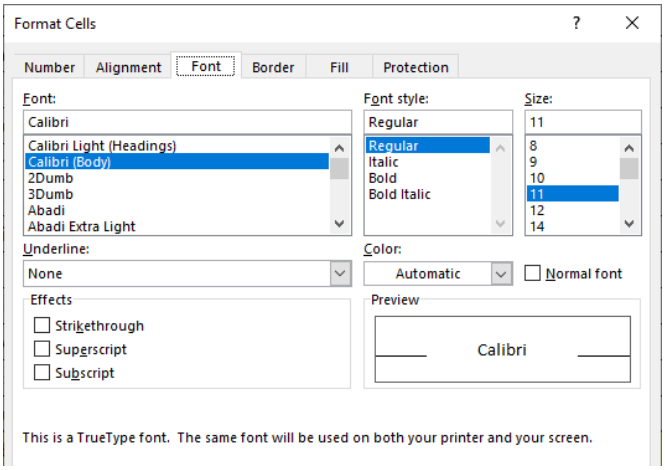


Figure 1-14b: Format Cells dialog box – Font tab

However, if you insert a graphic text box or WordArt and right-click the text within the graphic object, the Font dialog box (Figure 1-15) shows these fonts as +Body and +Heading.

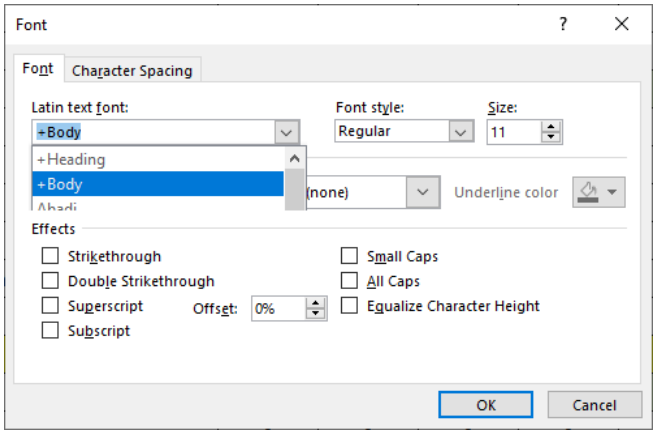


Figure 1-15: Font dialog box – +Body and +Heading

You can apply formatting (style, size, color settings, effects, and so on) to one of these generic fonts just as you can to a named font. Notice there are additional effects options (including Small Caps and All Caps) available for text in graphic objects.

If you manually apply a font other than the current body or heading font to a cell or to the text in a graphic object, the font and size will remain unchanged if you select a different theme for your workbook.

Learn to experiment with manually applied font settings

In this exercise, you will manually apply font settings so they will remain constant when you change the workbook theme.

1. Open Travel Insurance Premiums Body Heading Fonts.xlsx located in the *StarterFiles* folder, and save it as My Travel Insurance Premiums Body Heading Fonts.xlsx in the *MyProjects* folder.
2. On the Insert tab, in the Text group, click **Text Box**.
3. Click in any blank area of the worksheet, and type: **Not valid for more than 365 days**.

4. Click and drag this text box to cell **H12**.

   Now you will manually apply a different font to one of the new worksheet cell values.

5. Select cell **K2**, then on the Home tab, in the Font group, click the **Font** drop-down arrow and select a script-like font such as **Freestyle Script**. Be sure to memorize the name of the font that you selected – you will need it for a later step.

6. Select cell **A2**, then on the Home tab, in the Font group, click the **Font** drop-down arrow, and view the list of fonts available.

   You will leave cell A2 with the default (Body) font.

7. Click anywhere outside the drop-down menu to close it.

8. Select the cell range **B2:J2**, then on the Home tab, in the Font group, click the **Font** drop-down arrow and select **Calibri Light (Headings)**.

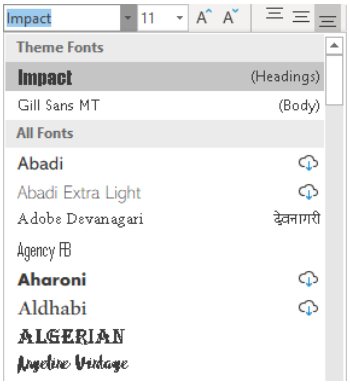
9. On the Page Layout tab, in the Themes group, click **Themes** to display the list of themes available.

10. Point the cursor at some of the different themes to see how the font and size of all cells except K2 (which was set to a script-like font in a previous step) will appear if a different theme is applied.

    Notice that all cells and the graphic text reformatted to match the theme specifications, except for cell K2.

11. Click the **Badge** theme to apply it.

12. Select cell **B2**, then on the Home tab, in the Font group, click the **Font** drop-down arrow, and view the list of fonts available.



    The Font drop-down list shows that the Badge theme has changed the default Body and Headings fonts for this workbook.

13. Select all of the text inside the text box in cell **H12**, then right-click and click **Font**.

14. Click the **Latin text font** drop-down arrow to display the list of fonts available.

15. Search for and click the same font that you had selected for cell K2, then in the *Effects* section, select the **Small Caps** check box, and click **OK** to close the Font dialog box.

16. Preview a few more themes. Notice that the font and size and effects of the text box now remains unchanged as different themes are previewed in the worksheet.

17. Click away from the drop-down menu to close it.

18. Save and close the workbook.

Lesson Summary

Now that you have completed this lesson, you should be able to:

- ☑ Use advanced conditional formatting.
- ☑ Manage conditional formatting rules.
- ☑ Create custom conditional formatting rules using formulas.
- ☑ Apply custom number, accounting, date, and time formats.
- ☑ Apply international formats to numeric and date/time data.
- ☑ Use international currency symbols.
- ☑ Configure the editing and display language.
- ☑ Understand +Body and +Heading fonts.

Key Terms

Term	Definition
Conditional Formatting	A feature that enables you to change the appearance of a cell, depending on that cell's value.
Display Language	Refers to the language-specific text used in menus, tool tips, and the Help system.
Editing Language	Refers to the language-specific keyboard layout and proofing tools such as dictionaries for spelling and grammar checking, and paragraph direction buttons.
Format	Instructions that tell Excel how it should display styles, fonts, colors, numbers, bullets, and so on.
Formula	A calculation that displays a new result based on the values in other cells. Composed of values, cell references, arithmetic operators, and special functions. These results may be used in other formulas located in other cells.
Rules Manager	A feature you can use to create new conditional formatting rules, modify existing ones, and delete rules that are no longer needed. See Conditional Formatting.

Quiz Questions

For each question, select the best answer.

1. Which of the following is NOT a valid conditional format?

    a. Display a dark gray background color if the cell contains a text string with the text string "con" in it.
    b. Display cell text in a different font if the cell value is greater than 10,000.
    c. Display a color that could range from dark green to dark red, with lighter shades between these two extremes, depending on the numeric value in the cell.
    d. All of the options listed are valid conditional formats.

2. Suppose you create the following two conditional format rules on a range of cells: Rule 1 – display an orange background color if the cell has a value > 7.5; and Rule 2 – display a green background color if the cell has a value >= 7.4. What background color will display if every value has a minimum value of 8?

    a. It depends which rule is listed above the other in the Rules Manager dialog box.
    b. Orange
    c. Green
    d. Brown – both colors are applied and combined

3. Which of the following formulas is NOT a valid formula to use in a conditional formatting rule?

    a. =$F$5>TODAY()
    b. =A$16<>SUM(A$1:A$15)
    c. =$C2
    d. =ISNUMBER(A1)

4. You can create your own custom number format using which of the following specifications?

    a. general number format; accounting format; scientific format; conditional format
    b. general number format; percentage format; fraction format; zero format
    c. positive number format; negative number format; zero format; text format
    d. positive number format; negative number format; zero format; red format

5. The Symbol list in the Format Cells dialog box allows you to select many different _____.

    a. time formats used around the world
    b. date formats used around the world
    c. fraction formats used around the world
    d. currency symbols used around the world

6. Which of the following date formats is NOT valid?

    a. mm-d-yyy
    b. mm-d-yyyy
    c. d-m-yy
    d. All of these date formats are valid.

7. How can you override the default currency format settings in Excel and apply a currency format for a foreign country to a range of cells?

    a. Enter the foreign country currency as a text value, thus allowing you to enter any characters necessary.
    b. Select the appropriate option in the Symbol list in the Format Cells dialog box.
    c. Install a language pack for the foreign country and then set that language as the editing language.
    d. You cannot override the default settings; you must adjust them through the Control Panel.

8. When you manually insert an international currency symbol using the Symbol dialog box, which of the following subset options would you likely NOT select when looking for currency symbols?

    a. The Latin-1 Supplement subset
    b. The Currency Symbols subset
    c. The Wingdings subset
    d. All of these subsets are good options for finding the desired currency symbol.

9. How can you override the current Regional Settings date format and apply a date format for a foreign country to a range of cells?

    a. Change the Locale (location) setting in the Format Cells dialog box.
    b. Enter the foreign country date as a text value, thus allowing you to enter any characters necessary.
    c. Install a language pack for the foreign country and then set that language as the editing language.
    d. You cannot override the default settings; you must adjust them through the Control Panel.

10. Dan would like to check the spelling and grammar of his worksheet using Parisian French. Which of the following steps should he take?

    a. He should use the Insert Tools command in the Language group on the Insert tab of the Ribbon.
    b. He should use the Import Dictionary command in the Proofing group on the Review tab of the Ribbon.
    c. He should ensure that French (France) is selected in the Editing Language list in the Language tab of the Excel Options dialog box.
    d. You cannot change the editing language in Excel; you must change the editing language using the Regional settings in Windows.

11. What is special about the +Body and +Heading fonts?

    a. They automatically increase in point size each time you select them.
    b. They are designed for use in HTML representations of your workbook.
    c. They automatically configure themselves to be one point larger in size than text in surrounding cells.
    d. They automatically adjust themselves when a new theme is applied.

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Expert Certification Guide

Lesson 2: Advanced Functions and Formulas

Lesson Objectives

In this lesson, you will learn how to use some of the more advanced functions in Excel, check for errors in your formulas, and use the data validation feature to improve the quality of the data in your workbooks. Upon completion of this lesson, you will be able to:

- ☐ Describe what a function is.
- ☐ Use the correct syntax for functions.
- ☐ Insert a function.
- ☐ Use the lookup functions CHOOSE, INDEX, MATCH, HLOOKUP, and VLOOKUP.
- ☐ Use date and time functions.
- ☐ Use the Error Checking Tool to mark possible incorrect formulas.
- ☐ Trace formula errors.
- ☐ Check the worksheet manually for formula errors.
- ☐ Configure Data Validation.

Understanding Functions

The power of a spreadsheet program comes from the ability to perform calculations based on entered values. For simple calculations such as 'A – B =', the use of common mathematical operators works well. For more complex calculations, such as computing a monthly loan payment amount, Excel offers a tool called a function. Excel has a large selection of ***built-in functions*** to help you perform calculations in a spreadsheet.

Built-in functions are grouped into the following categories:

Compatibility	Statistical functions available in Excel 2007 and earlier versions have since been replaced with newer versions. Functions in this category are still available for workbooks that still require them. All the compatibility functions can also be found in the Statistical category.
Cube	Work with the Microsoft SQL Server Analysis Services tool to perform data mining.
Database	Extract and manipulate data within an Excel database.
Date & Time	Perform calculations on dates and times.
Engineering	Perform calculations that are typically used in engineering applications. These functions must be loaded as part of the Analysis Toolpak add-in.
Financial	Perform financial calculations, such as those typically used with loans, annuities, and cash flows.
Information	Display information about the cells in the worksheet.
Logical	Control the actions taken by Excel based on evaluations of data in the spreadsheet.
Lookup & Reference	Locate information within tables or on the Internet.
Math & Trig	Perform mathematical and trigonometric calculations, such as logarithms, cosine, and rounding.
Statistical	Perform statistical evaluations, such as average, mean, and standard deviation.
Text	Manipulate text strings and convert numbers and text.
Web	Exchange data with other systems located on the Internet or in the local network using web functionality.

For complete details on the available functions, refer to the Microsoft Excel Help feature or get online help from the Microsoft website.

Using the Correct Syntax for Functions

When using functions in Excel, you must follow a standard syntax. The basic components of a function consist of the "=" (equals sign) symbol, a function name, and its arguments. The purpose of each of these parts is as follows:

The "=" Symbol	Identifies the start of a formula or function. Only one = symbol is required for each cell.
Function Name	Identifies the particular function to be used.
(Arguments)	Identifies any variable portions of the argument or required parts of the formula.

You put these three components together in the following order:

=FUNCTION(Arguments)

The argument portion of a function is enclosed in parentheses and can include one or more values or references. Commas separate multiple arguments in a function. Some functions do not require any arguments; these functions do, however, still require parentheses.

If you do not include the "=" symbol, Excel treats the function as a text label. If the function name is invalid, Excel will display *#NAME?* in the cell. If you do not include the proper number of arguments, Excel displays a message box and suggests using the Insert Function feature to help you enter the function correctly.

A function can also be used as part of a larger formula. For example:

=(SUM(A1:A5) + SUM(B1:B7)) / SUM(C1:C3)

In this example, the SUM function is used three times in the same formula. Note the use of parentheses to ensure that the calculations are performed in the sequence that you had intended. Excel follows the standard mathematical precedence of operators:

1. Parentheses: ()
2. Exponents and roots
3. Multiplication and division
4. Addition and subtraction

You can also nest functions together; that is, you can embed one function within another function. An example of a nested function is shown here:

=ROUND(SUM(C1:C5),-2)

You can accomplish the same result by putting the intermediate results into separate cells. That is, you could put the SUM function in cell C6 so the results are displayed there. You could then use =ROUND(C6,-2) to calculate your final result in a different cell.

You are permitted to nest up to 64 layers of functions, which is more than sufficient for any worksheet. Prior to Excel 2007, you could nest up to only seven layers.

Inserting Functions

Excel has a very large number of functions available; memorizing the syntax of every function is an impossible task. To make it easier to use functions, Excel provides a special tool called ***Insert Function***.

To access the Insert Function dialog box (Figure 2-1), use one of the following methods:

- Click Insert Function (fx) to the left of the Formula bar; or
- on the Home tab, in the Editing group, click the arrow beside AutoSum, then click More Functions; or
- on the Formulas tab, in the Function Library group, click Insert Function.

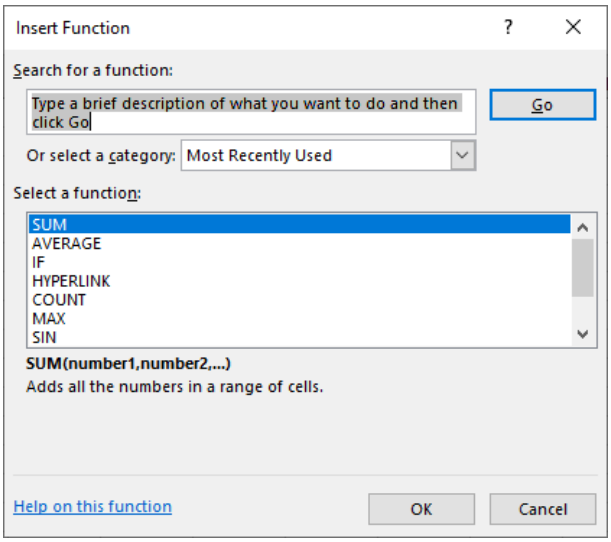


Figure 2-1: Insert Function dialog box

You can also access a list of functions by typing "=" (to indicate to Excel that you are entering a formula), and then typing the first few characters of the function that you want to enter. Excel displays a drop-down list of all functions that begin with these characters (Figure 2-2).

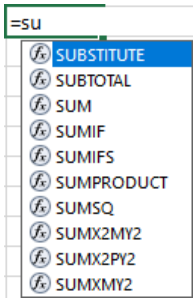


Figure 2-2: Function drop-down list

The Insert Function dialog box displays all functions grouped by most recently used or by categories previously discussed. If you do not know the name of the function you want to use, but you do know what you want to accomplish, you can type a brief description of what you want to do and the Insert Function feature will recommend a function for you.

After you select a function, Excel displays the Function Arguments dialog box (Figure 2-3) to help you enter all the required function arguments. Helpful features of this dialog box include the following:

- Each argument is listed and the required arguments are highlighted in bold. If the function you're using allows a variable number of arguments, the dialog box displays additional argument boxes as necessary.
- When the cursor is in one of the argument text boxes, the relevant help information displays in the lower part of the dialog box.
- If you select or enter data values or cell references into the argument boxes, Excel previews the data to the right of that argument box. In the following example screen, the data values being considered are {45;24;57;49;36}.
- If enough arguments have been entered, Excel also displays the results in the lower part of the dialog box. In this example screen, the calculated sum for the selected cell range is 211.

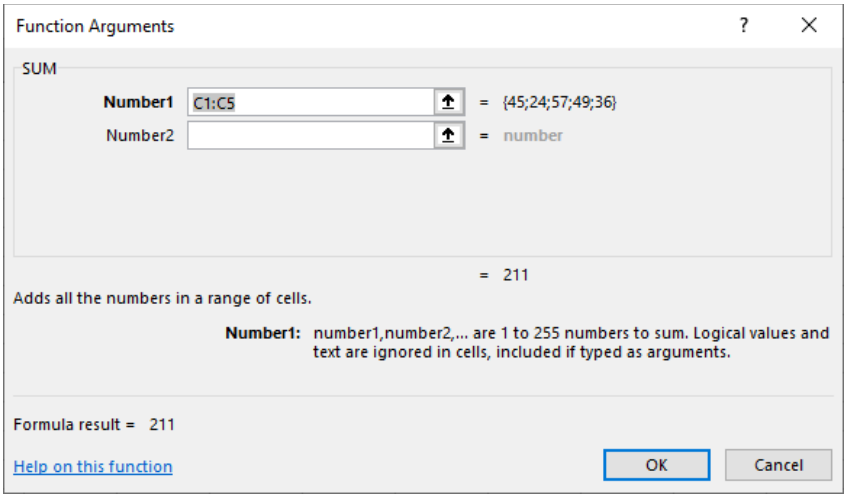


Figure 2-3: Function Arguments dialog box

Many of the arguments in a function permit you to select a cell or range of cells containing the values to be used. For example, consider the following three functions:

=SUM(45,24,57,49,36)
=SUM(C1,C2,C3,C4,C5)
=SUM(C1:C5)

Assuming that cell C1 contains the value 45, C2 contains 24, and so on, all three of these functions will result in the displayed value of 211.

You can type a value or cell range into the appropriate boxes within the Function Arguments dialog box, or you can select a cell or cell range directly in the worksheet. In some situations, such as if you are using a device with a very small screen, the Function Arguments dialog box may block your view of the cell range. If you click the Collapse button ( ) located to the right of the argument text box, the Function Arguments dialog box shrinks temporarily, as shown in Figure 2-4.

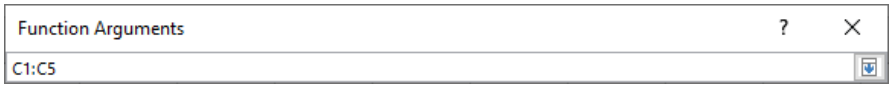


Figure 2-4: Function Arguments dialog box - collapsed

Once you have selected your cell range, press ENTER or click the Restore ( ) button located at the right side of the text box. The Function Arguments dialog box restores to its full size.

Learn to use the Insert Function feature

In this exercise, you will use the Insert Function feature.

1. Create a new blank workbook.
2. Enter the following values into the worksheet:

	A	B	C
1	Sum:		45
2	Standard Deviation:		24
3			57
4			49
5			36

3. Select cell **B1**.
4. Click **Insert Function** to the left of the Formula bar.
5. If necessary, in the **Or select a category** box, click the drop-down arrow and click **Math & Trig** (or **Most Recently Used**).

   Because the SUM function is by far the most commonly used, it is usually in the *Most Recently Used* list. If it's not, you can find it in the *Math & Trig* category.
6. In the *Select a function* list, scroll down and click **SUM**, and then click **OK**.

   For this exercise, you will use the Collapse and Restore buttons to enter argument values into the Function Arguments dialog box. Alternatively, you can enter the cell range values directly into the argument text boxes or select the cell range without collapsing the dialog box.

7. With the cursor in the *Number1* box, click **Collapse** to temporarily shrink the Function Arguments dialog box and then drag the box to an empty part of the worksheet so that it does not obstruct the cell range to be selected.
8. Select cells **C1:C5** in the worksheet and click **Restore** to return the Function Arguments dialog box to its default size.
9. Click **OK** to complete the function.
10. Select cell **B2** and then click **Insert Function**.
11. In the *Search for a function* box, type: **standard deviation** and click **Go**.

    Excel displays a list of functions that involve the use of standard deviation.
12. Click the **STDEV.S** function and then click **OK** to display the Function Arguments dialog box.
13. If necessary, drag the Function Arguments dialog box out of the way so that it is not blocking the cell range **C1:C5**.
14. With the cursor in the *Number1* box, select the cell range **C1:C5** and click **OK**.

    Your completed worksheet should appear similar to the following:

	A	B	C
1	Sum:	211	45
2	Standard Deviation:	12.67675	24
3			57
4			49
5			36

15. Close the workbook without saving.

Understanding Lookup Functions

Lookup functions are used to find information in lists or arrays based on a known value. This capability is very useful in situations such as locating product information in a table containing product IDs, with the description and price next to each ID. You can scan down the list until you find the Product ID, then look at the adjacent columns to find the description and price for that product. Thus, the basic principle of lookup functions is to look for a value in a table and select the corresponding values in adjacent cells.

Some of the most common lookup functions are described here.

Using the CHOOSE Function

The CHOOSE function (Figure 2-5) is the simplest form of lookup. Select from a one-dimensional list of values (called a vector) by using an index number. The first argument is the index number, which selects which of the remaining arguments in the list to use. The vector list does not require the cells to be in any sequence or structure. Suppose you have the following formula:

=CHOOSE(A1,C1,C3,D1,D4)

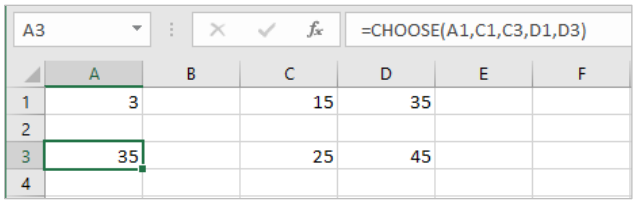


Figure 2-5: Example of CHOOSE function

If cell A1 contained the value 3, then this cell will display the value that is entered in cell D1, which is the third argument in the list after the index number.

Learn to use the CHOOSE function

In this exercise, you will use the CHOOSE function.

1. Open the **Tour Price List.xlsx** workbook located in the *StarterFiles* folder, and save it as **My Tour Price List.xlsx** in the *MyProjects* folder.

2. Ensure that the **CHOOSE** worksheet tab is active.

	A	B	C	D	E	F
1	Tour Price List					
2	Tour #	Date	Price			
3	LP-001	12-Mar	$2,325			
4	LP-002	2-Apr	$2,348		Row:	
5	LP-003	21-May	$2,997		Tour #:	
6	LP-004	11-Jun	$2,681		Date:	
7	LP-005	9-Jul	$2,681		Price:	
8	LP-006	30-Jul	$2,463			
9	LP-007	13-Aug	$2,463			
10	LP-008	27-Aug	$2,515			
11	LP-009	17-Sep	$2,839			
12	LP-010	15-Oct	$2,499			

   This worksheet is the tour price list for one of Tolano's travel suppliers. Each specific tour has a unique identification number, departure date, and price per person. In this worksheet, you will create a simple lookup to display information about the tour.

3. In cell **F4**, enter: **1**.

4. Enter the following formulas:

Cell	Formula
F5	**=CHOOSE(F4,A3,A4,A5,A6,A7,A8,A9,A10,A11,A12)**
F6	**=CHOOSE(F4,B3,B4,B5,B6,B7,B8,B9,B10,B11,B12)**
F7	**=CHOOSE(F4,C3,C4,C5,C6,C7,C8,C9,C10,C11,C12**

   Unfortunately, the CHOOSE function does not allow you to enter a cell range. It also does not apply the formatting for the data.

5. Select cell **B3** and, on the Home tab, in the Clipboard group, click **Format Painter**. Click cell **F6** to copy the formatting to this cell.

6. Use the Format Painter again to copy the formatting from cell **C3** to cell **F7**.

Once the CHOOSE functions have been set up, you can easily display the data for any tour by entering the row number.

7. Select cell **F4** and enter different numbers of your choice between 1 and 10 to see how the values in cells F5 to F7 change to match which row you selected.

   The completed worksheet should appear similar to the following:

	A	B	C	D	E	F
1	Tour Price List					
2	Tour #	Date	Price			
3	LP-001	12-Mar	$2,325			
4	LP-002	2-Apr	$2,348		Row:	4
5	LP-003	21-May	$2,997		Tour #:	LP-004
6	LP-004	11-Jun	$2,681		Date:	11-Jun
7	LP-005	9-Jul	$2,681		Price:	$2,681
8	LP-006	30-Jul	$2,463			
9	LP-007	13-Aug	$2,463			
10	LP-008	27-Aug	$2,515			
11	LP-009	17-Sep	$2,839			
12	LP-010	15-Oct	$2,499			
13						

CHOOSE | INDEX | MATCH

8. Save and close the workbook.

Using the INDEX Function

Objective 3.2.1

The INDEX function is similar to the CHOOSE function, but will select a value from a two-dimensional table or range of cells using both a row number and column number as indices. Unlike the CHOOSE function, this function has two different versions: array and reference. The most commonly-used version is the reference version:

=INDEX(reference, row num, [column num], [area num])

Where:

reference	Refers to one or more ranges of cells.
row num	Identifies the row in the range to find the value.
column num	Optional: Identifies the column in the range to find the value. If not specified, the entire row of data is used.
area num	Optional: Identifies which reference range to use. If not specified, area 1 is used.

Following are examples of the INDEX function using the reference version (Figure 2-6).

Formula	**Result**
=INDEX(A2:D4,2,3)	liter
=INDEX(A2:D4,1,2)	millimeter

A6 =INDEX(A2:D4,2,3)

	A	B	C	D	E
1	Factor	Length	Volume	Weight	
2	-3	millimeter	milliliter	milligram	
3	1	meter	liter	gram	
4	3	kilometer	cubic meter	kilogram	
5					
6	liter				

Figure 2-6: Example of INDEX function using reference version

You can also specify more than one range of cells in this version.

Formula	Result
=INDEX((A2:D2,A3:D3,A4:D4),1,3,2)	liter
=INDEX((A2:D2,A3:D3,A4:D4),1,2,1)	millimeter

In this form of the reference version, the first example specifies that area 2 (A3:D3) be used for the index. In the second example, area 1 (A2:D2) is to be used.

The second version of the INDEX function is the array version, which uses an array constant instead of a range of cell references:

=INDEX(array, row num, [column num])

Where:

array	Identifies a range of cells, or an array constant. An array constant is a set of values listed within a set of curly braces.
row num	Identifies the row in the range to find the value.
column num	Optional: Identifies the column in the range to find the value.

Note that if the array is a range of cells, then the INDEX function will behave exactly like the reference version.

Following are examples of the array version using array constants (Figure 2-7).

Formula	Result
=INDEX({10,20,30;40,50,60},2,3)	60
=INDEX({10,20,30;40,50,60},1,2)	20

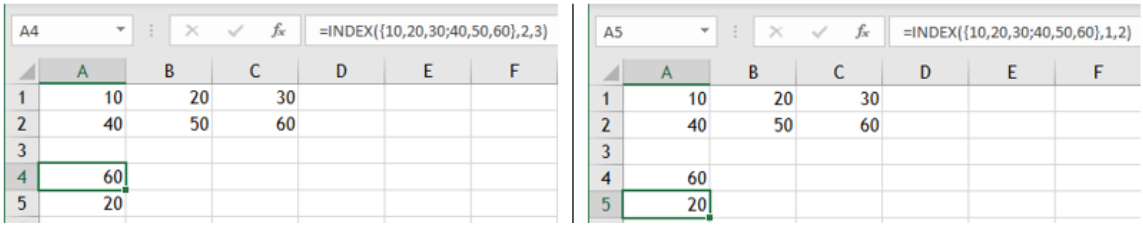


Figure 2-7: Examples of INDEX function using array constants

In this example, each set of numbers separated by the semicolon represents a separate row within the array. Therefore, the first example specifies to find a value in the second row of the array (consisting of the numbers 40, 50, and 60) and within that row, to select the value in the third column (60). The second example specifies to find a value in the first row of the array (consisting of the numbers 10, 20, and 30) and within that row, to select the value in the second column (20).

Learn to use the INDEX function

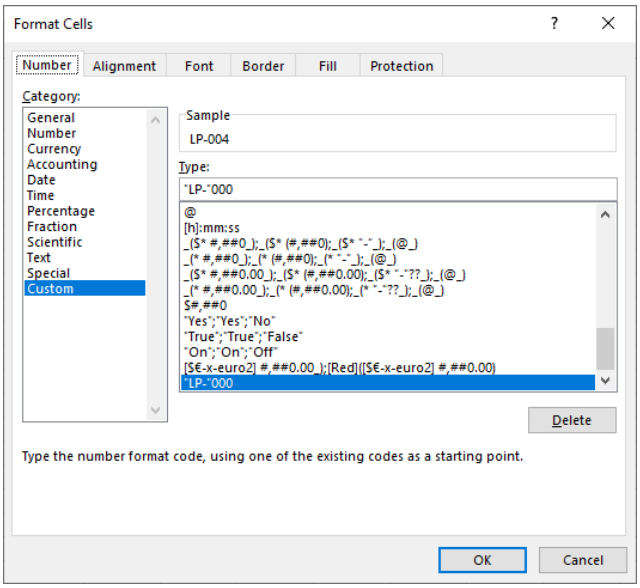
In this exercise, you will use the INDEX function.

1. Open **Tour Price List – Index.xlsx** located in the *StarterFiles* folder, and save it as **My Tour Price List – Index.xlsx** in the *MyProjects* folder.
2. Click the **INDEX** worksheet tab if necessary, select cell **F4**, and enter: **1**.
3. In cell **F5**, enter: **=INDEX($A$3:$C$12,$F$4,2)**.

Note: Remember you can use the F4 key to convert a cell reference to an absolute reference.

By using absolute references, you can copy this formula to other cells while pointing at the same lookup range of cells. Even though using absolute references makes this formula more complex, the ability to copy makes the process easier than using the CHOOSE function.

4. Copy the formula in cell **F5**, and paste it into cell **F6**.
5. Select cell **F6** again, press the **F2** key to modify the cell contents, and change the last argument in the formula from *2* to **3**. The formula in this cell should now be: **=INDEX($A$3:$C$12,$F$4,3)**.
6. Use the Format Painter to copy the formatting from cell **B3** to cell **F5**, and from cell **C3** to cell **F6**.
7. Select cell **F4** and enter different numbers of your choice between 1 and 10 to see how the values in cells F5 and F6 change to match which row you selected.
8. Select cell **F4** and, on the Home tab, in the Number group, click the **Number Format** dialog box launcher.
9. Click the **Number** tab if necessary, then click **Custom** as the Category.
10. Delete the current contents in the *Type* field, and replace it with: **"LP-"000** and click **OK**.



You can now use the row # cell to show the tour # value. As a reminder, you should add some instructions that only the numeric value should be entered.

11. Select cell **E4**, type: **Tour #:**, and then select cell **G4** and type: **(enter number only)**.

    The completed worksheet should appear similar to the following:

	A	B	C	D	E	F	G	H
1	Tour Price List							
2	Tour #	Date	Price					
3	LP-001	12-Mar	$2,325					
4	LP-002	2-Apr	$2,348		Tour #:	LP-008	(enter number only)	
5	LP-003	21-May	$2,997		Date:	27-Aug		
6	LP-004	11-Jun	$2,681		Price:	$2,515		
7	LP-005	9-Jul	$2,681					
8	LP-006	30-Jul	$2,463					
9	LP-007	13-Aug	$2,463					
10	LP-008	27-Aug	$2,515					
11	LP-009	17-Sep	$2,839					
12	LP-010	15-Oct	$2,499					
13								

CHOOSE INDEX MATCH

12. Save and close the workbook.

Using the MATCH Function

Objective 3.2.1

The MATCH function is similar to the CHOOSE and INDEX functions in that it will look for a value in a list or range of cells. However, it is very different because it returns the position of the value in the list, instead of the actual value itself.

The MATCH function works by searching through the lookup array for the lookup value. When it is found, its position in the lookup array is displayed.

The format of this function is as follows:

=MATCH(lookup value, lookup array, [match type])

Where:

lookup value	Identifies the value to be found in the lookup array.
lookup array	Identifies the list of values or range of cells to be searched. This range must be a single row or column.
match type	Optional: 1 is less than, 0 is exact match, -1 is greater than. If 1 or -1 is specified, then the values in the lookup array must be sorted in ascending order.

Following are examples of the MATCH function (Figure 2-8).

Formula	Result
=MATCH(A6,D2:D4,0)	3
=MATCH(A6,B2:B4,0)	2

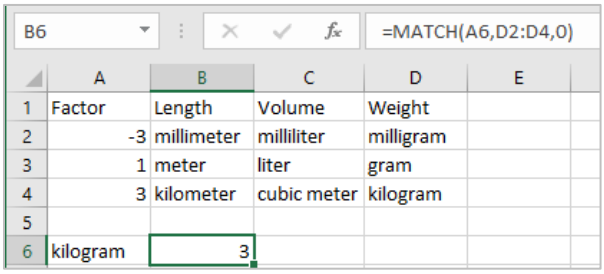


Figure 2-8: Example of MATCH function

In this example, the MATCH function looks up the value in cell A6 (kilogram) and finds it in cell D4. Cell D4 is in the third position (column) in the cell range D2:D4, so the MATCH function returns the value 3.

Learn to use the MATCH function

In this exercise, you will use the MATCH function.

1. Open **Tour Price List – Match.xlsx** located in the *StarterFiles* folder, and save it as **My Tour Price List – Match.xlsx** in the *MyProjects* folder.
2. Click the **MATCH** worksheet tab if necessary, select cell **F4**, and enter: **LP-001**.
3. In cell **F5**, enter: **=MATCH(F4,A3:A12,0)**.
4. Select cell **F4** and enter different tour numbers to see how the row number value in cell F5 changes to match the tour number you selected.

At first, it appears that the MATCH function does not provide anything useful, until you extend it with the INDEX function.

5. In cell **F6**, enter: **=INDEX($B$3:$C$12,$F$5,1)**.

   With the tour # cell being used as the lookup value, you need only include the date and price column in the lookup range. However, you can also include the tour # column in the lookup range if you prefer.

6. Copy the formula in cell **F6**, and paste it into cell **F7**.

7. In cell **F7**, press the **F2** key to modify the cell contents, and change the last argument in the formula from *1* to **2**. The formula in this cell should now be: **=INDEX($B$3:$C$12,$F$5,2)**.

8. Use the Format Painter to copy the formatting from cell **B3** to cell **F6**, and from cell **C3** to cell **F7**.

9. Select cell **F4**, and enter different tour numbers again.

   The completed worksheet should appear similar to the following:

	A	B	C	D	E	F
1	Tour Price List					
2	Tour #	Date	Price			
3	LP-001	12-Mar	$2,325			
4	LP-002	2-Apr	$2,348		Tour #:	LP-005
5	LP-003	21-May	$2,997		Row:	5
6	LP-004	11-Jun	$2,681		Date:	9-Jul
7	LP-005	9-Jul	$2,681		Price:	$2,681
8	LP-006	30-Jul	$2,463			
9	LP-007	13-Aug	$2,463			
10	LP-008	27-Aug	$2,515			
11	LP-009	17-Sep	$2,839			
12	LP-010	15-Oct	$2,499			
13						

CHOOSE | INDEX | MATCH

10. Save and close the workbook.

Using the HLOOKUP Function

Objective 3.2.1

You can use the HLOOKUP function to search for a lookup value in the first row of a two-dimensional array and return the value in the same position in the result vector. The HLOOKUP function is specifically designed to use the top row as the lookup vector.

The format for the horizontal lookup function is:

=HLOOKUP(lookup value,table array,row index number,range lookup)

lookup value	The value to be found in the table array.
table array	A range of cells containing the values to be searched and the data to be returned.
row index number	The row number in the array containing the value to be returned; rows are numbered sequentially from the top row of the table.
range lookup	Optional: You can enter "0" or "false" if you wish the function to find an exact match in a sorted or unsorted list; enter "true" or omit the argument if you want the function to find an approximate match in a sorted list.

Even though the range lookup parameter is optional, it has an important switch setting that deserves a closer look. Consider an example of a scoring sheet for a school examination paper:

Mark Achieved on Exam	0%	50%	60%	70%	85%
Grade Assigned	F	D	C	B	A

All students will have a result ranging from 0% to 100%. By using a range lookup value of TRUE, you tell Excel to search the table for the highest mark value that does not exceed the lookup value. For example, a student achieving a mark of 65% will get a grade value of C because 60% is the highest table value found that does not exceed the lookup value.

If a range lookup value of FALSE is used, the HLOOKUP formula will not find the correct grade for most students. This is because the mark achieved must exactly match one of the values in the table in order to be found. Therefore, a range lookup value of FALSE is not the right choice to use here.

Learn to use the HLOOKUP function

In this exercise, you will use the HLOOKUP function.

1. Open **GradeBook.xlsx** located in the *StarterFiles* folder, and save it as **My GradeBook.xlsx** in the *MyProjects* folder.

2. Select cell **I5**.

   This worksheet shows the History class grades for four students as well as a table in cells L3:P4 that shows the correlation between numeric scores and letter grades.

   Notice that the scores in the table are sorted in ascending order from left to right. This is required for the lookup function to work properly.

You will enter a formula that will look up and display the final letter grade for the term in Column I.

3. In cell **I5**, enter: **=HLOOKUP(H5,$L$3:$P$4,2)**.

   With the final numeric grade being used as the lookup value, it is important to omit the range lookup argument so that the function will find an approximate match in the letter grade table.

4. Copy the formula in cell **I5** to cells **I6:I8**.

   The worksheet should appear similar to the following:

	A	B	C	D	E	F	G	H	I
1	**Student Grades**								
2	**History Final**							**Final**	**Final**
3			Final Exam					**Numeric**	**Letter**
4	**Last Name**	**First Name**	Score	Q1	Q2	Q3	Q4	**Grade**	**Grade**
5	Andrews	Archie	74	85	80	90	90	83.8	B
6	Cooper	Betty	89	95	92	89	93	91.6	A
7	Jones	Jughead	92	75	85	95	90	87.4	A
8	Lodge	Veronica	83	84	80	82	80	81.8	B

5. Save and close the workbook.

Using the VLOOKUP Function

Objective 3.2.1

You can use the VLOOKUP function to search for a lookup value in the first column of a two-dimensional array and return the value in the same position in the result vector. The VLOOKUP function always uses the left-most column as the lookup vector.

The format for the vertical lookup function is:

=VLOOKUP(lookup value,table array,column index number,range lookup)

lookup value	The value to be found in the table array.
table array	A range of cells containing the values to be searched and the data to be returned.
column index number	The column number in the array containing the value to be returned; columns are numbered sequentially from the left-most column.
range lookup	Optional: You can enter "0" or "false" if you wish the function to find an exact match in a sorted or unsorted list; enter "true" or omit the argument if you want the function to find an approximate match in a sorted list.

You would use the VLOOKUP function if your table is arranged vertically. For example, here is the scoring sheet table shown in a vertical layout.

Mark Achieved on Exam	Grade Assigned
0%	F
50%	D
60%	C
70%	B
85%	A

The same range lookup value of TRUE can be used to find the correct grade to assign, even though the student's mark can be any value between 0% and 100%. The range lookup value of FALSE is also inappropriate for this VLOOKUP formula because most students will not have a mark that matches the table values exactly.

Learn to use the VLOOKUP function

In this exercise, you will use the VLOOKUP function.

1. Open **Pricing Sheet – Vertical.xlsx** located in the *StarterFiles* folder, and save it as **My Pricing Sheet – Vertical.xlsx** in the *MyProjects* folder.
2. Examine the **VLOOKUP** worksheet tab.

	A	B	C	D	E
1	Tolano Adventures				
2	Pricing Sheet				
3					
4		**Tour #**	**Description**	**Cost**	
5		A0289	Rocky Mountains train tour	1,400.00	
6		A4353	Tokyo Ginza district shopping tour	485.00	
7		B3454	Costa Rica eco tour	1,800.00	
8		C6386	Egypt pyramid tour	2,335.00	
9					
10	**Invoice**				
11	**Qty**	**Tour #**	**Description**	**Cost**	**Total**
12					
13					
14					
15			**Total**		

This worksheet shows a partial tour pricing list on the top and a sample invoice below it. The requirement is to enter a product number in column B of the invoice and have the description and cost appear on the invoice automatically. In this case, Excel will look up the product number and retrieve the corresponding description and cost.

Notice that the tour numbers are sorted in ascending order. This is required for the lookup function to work properly.

Note: In a real-world example, the inventory list would be on a different worksheet or, more often, in a different workbook. This exercise has been simplified for instructional purposes.

3. In cell **E12**, enter: =**A12*D12**.
4. Copy this formula to the range **E13:E14**.
5. Select cell **E15** then, on the Home tab, in the Editing group, click **AutoSum**, verify the formula is: **=SUM(E12:E14)** and press **ENTER**.
6. In cell **C12**, type: =**VLOOKUP(B12,$B$5:$D$8,2,TRUE)** and press **ENTER**.

   The characters #N/A appear in cell C12.
7. Copy this formula to the range **C13:C14**.
8. In cell **D12**, type: =**VLOOKUP(B12,$B$5:$D$8,3,TRUE)** and press **ENTER**.
9. Copy this formula to the range **D13:D14**.

	A	B	C	D	E
1	Tolano Adventures				
2	Pricing Sheet				
3					
4		**Tour #**	**Description**	**Cost**	
5		A0289	Rocky Mountains train tour	1,400.00	
6		A4353	Tokyo Ginza district shopping tour	485.00	
7		B3454	Costa Rica eco tour	1,800.00	
8		C6386	Egypt pyramid tour	2,335.00	
9					
10	**Invoice**				
11	**Qty**	**Tour #**	**Description**	**Cost**	**Total**
12			#N/A	#N/A	#N/A
13			#N/A	#N/A	#N/A
14			#N/A	#N/A	#N/A
15			**Total**		#N/A

Notice the #N/A filling the cells; this is displayed by the lookup functions when there is no lookup value. The IF function could be used to clean up its appearance, but this exercise focuses on the VLOOKUP function.

10. Enter the following quantities and part numbers:

Row	Qty	Tour#
12	**3**	**A0289**
13	**4**	**B3454**
14	**2**	**A4350**

The worksheet should appear similar to the following:

	A	B	C	D	E
1	Tolano Adventures				
2	Pricing Sheet				
3					
4		**Tour #**	**Description**	**Cost**	
5		A0289	Rocky Mountains train tour	1,400.00	
6		A4353	Tokyo Ginza district shopping tour	485.00	
7		B3454	Costa Rica eco tour	1,800.00	
8		C6386	Egypt pyramid tour	2,335.00	
9					
10	**Invoice**				
11	**Qty**	**Tour #**	**Description**	**Cost**	**Total**
12	3	A0289	Rocky Mountains train tour	1,400.00	4,200.00
13	4	B3454	Costa Rica eco tour	1,800.00	7,200.00
14	2	A4350	Rocky Mountains train tour	1,400.00	2,800.00
15			**Total**		14,200.00

The last item entered had the wrong tour number. As a result, the wrong description and cost were displayed. For this kind of worksheet, you should use the FALSE value for the range lookup option so that Excel will identify incorrect tour numbers immediately.

11. Select cell **C12**, press **F2**, and change the *TRUE* to **FALSE** in the VLOOKUP formula.

12. Repeat the previous step for cell **D12**.

13. Copy the formulas in cells **C12:D12** to cells **C13:D14**.

    The Description (C14) and Cost (D14) for row 14 now show *#N/A* because this tour number was not found in the lookup list.

14. Select cell **B14** and enter the correct tour # value: **A4353**.

    The worksheet should appear similar to the following:

	A	B	C	D	E
1	Tolano Adventures				
2	Pricing Sheet				
3					
4		**Tour #**	**Description**	**Cost**	
5		A0289	Rocky Mountains train tour	1,400.00	
6		A4353	Tokyo Ginza district shopping tour	485.00	
7		B3454	Costa Rica eco tour	1,800.00	
8		C6386	Egypt pyramid tour	2,335.00	
9					
10	**Invoice**				
11	**Qty**	**Tour #**	**Description**	**Cost**	**Total**
12	3	A0289	Rocky Mountains train tour	1,400.00	4,200.00
13	4	B3454	Costa Rica eco tour	1,800.00	7,200.00
14	2	A4353	Tokyo Ginza district shopping tour	485.00	970.00
15			**Total**		12,370.00

15. Save and close the workbook.

Using Date and Time Functions

Objective 3.3.1, 3.3.2

Excel's date and time functions help you create worksheets that perform calculations based on dates and times. It is possible to use dates to calculate things such as age or length of service or the number of days between two dates. The use of time functions enables calculations based on time, with Excel converting seconds to minutes and minutes to hours.

To perform these calculations, Excel stores the date and time values as serial numbers with the integer part representing the number of days since January 1, 1900 and the fractional part as a portion of a 24-hour period. A *serialized date value* is simply a number that Excel uses to represent a specific point in time (which consists of the month, day, year, and time components), which could be the current date and time or a manually entered date and time. Special functions are provided to determine the date and time serial numbers, and to extract the month, day, year, hours, minutes, and second values from serial numbers.

Some of the most useful date and time functions include:

NOW	Returns the serial number of the current date and time. This date and time value is continuously updated. The format of this function is **NOW()**. The function does not take any arguments because it simply gets the current date and time from your local computer.
TODAY	Returns the serial number of today's date with the time portion set to 0. The date value is continuously updated. The format of this function is **TODAY()**. Like the NOW function, it does not take any arguments.
DATE	Calculates the serial number for a specified date. The format of this function is **DATE(year, month, day)**. Each of the year, month, and day values must be individual whole numbers, and must be valid for that component. For example, month must be between 1 and 12, and day must be valid for the specified month.
DATEVALUE	Like the DATE function, this function calculates the serial number for a specified date. The format of this function is **DATEVALUE(date in text form)**. Unlike DATE, DATEVALUE uses a text description of the date (for example, March 15, 2020) as the argument.
DAY	Displays the day value for the specified date serial number. This function is useful for extracting only the day value for a date. The format of this function is **DAY(date value)**.
MONTH	Displays the numeric month value for the date serial number. This function is useful for extracting only the month value for a date. The format of this function is **MONTH(date value)**.
YEAR	Displays the year value for the specified year serial number. This function is useful for extracting only the year value for a date. The format of this function is **YEAR(date value)**.
DAYS	Calculates the number of days between two dates as a whole number. The format of this function is **DAYS(end date, start date)**.

WEEKDAY	Displays a numeric weekday value for the date serial number. For example, a date that falls on a Sunday will return a 1 (first day of the week), and a date that falls on a Saturday will return a 7. You can also specify a different numbering pattern; for example, you can specify Monday as the first day of the week, which will then return a 1. The format of this function is **WEEKDAY(date value, return type)**.
WORKDAY	Calculates the nearest working day in the future or the past. This function is useful in business situations, such as developing project plans, that can't include weekends in date calculations. The format of this function is **WORKDAY(start date, # of days, holiday date range)**.
TIME	Calculates the serial number for a specified time entered as hours, minutes, and seconds. The format of this function is **TIME(hour, minute, second)**.
HOUR	Displays the hour value for the specified time serial number. This function is useful for extracting only the hour value for a date/time value. The format of this function is **HOUR(date/time value)**.
MINUTE	Displays the minute value for the specified time serial number. This function is useful for extracting only the minute value for a date/time value. The format of this function is **MINUTE(date/time value)**.
SECOND	Displays the second value for the time serial number. This function is useful for extracting only the seconds value for a date/time value. The format of this function is **SECOND(date/time value)**.

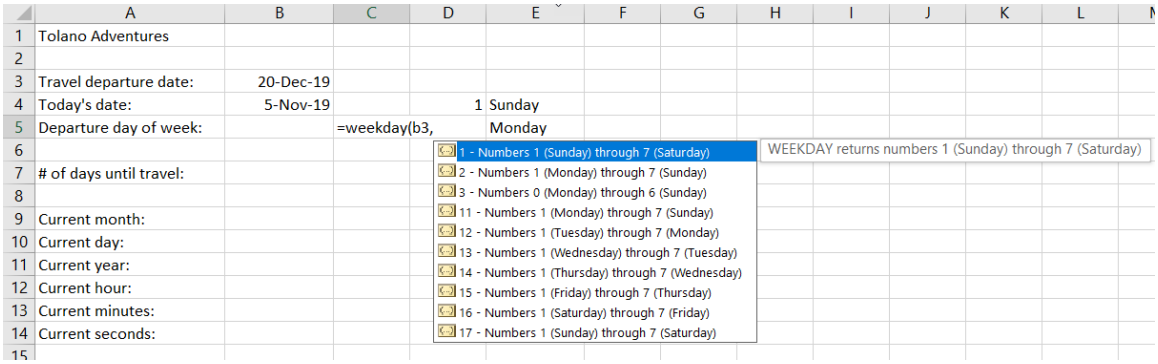
Note: Another way to obtain the current date is by pressing CTRL+; (semicolon), and the current time by pressing CTRL+SHIFT+; (semicolon). However, these date and time values are not continuously updated; they are inserted into the worksheet as fixed points in time.

Learn to use date and time functions

In this exercise, you will use time and date functions.

1. Open **Departure Date Calculator.xlsx** located in the *StarterFiles* folder, and save it as **My Departure Date Calculator.xlsx** in the *MyProjects* folder.
2. Select cell **B3** and enter a date in the future of your choice.
3. Select cell **B4** and enter: **=NOW()**.
4. Select cell **C5** and type the first part of the formula (do not press ENTER yet): **=WEEKDAY(B3,**

   The WEEKDAY function returns a single number that identifies the day of the week on which a date falls. It has a second argument that allows you to choose which numbering pattern to use, with Sunday being 1 as the default if the second argument is not specified.



5. Finish the rest of the formula by entering: **1)**

6. Select cell **B5** and enter: **=INDEX(D4:E10,C5,2)**

7. Select cell **B7** and enter: **=B3-B4**

You can also calculate the number of days difference between two dates using a built-in function. However, it calculates in whole days.

8. Select cell **C7** and enter: **=DAYS(B3,B4)**

9. Enter the following functions:

Cell	Formula
B9	**=MONTH(B4)**
B10	**=DAY(B4)**
B11	**=YEAR(B4)**
B12	**=HOUR(B4)**
B13	**=MINUTE(B4)**
B14	**=SECOND(B4)**

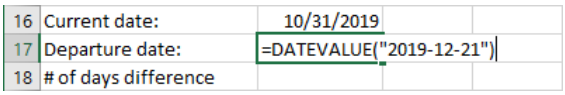
10. Press the **F9** key to recalculate the current date and time. Wait at least one minute and press it again and note the changes in cells B13 and B14 as the current time changes.

11. Select cell **B16** and enter: **=DATE(B11,B9,B10)**

Create the same result using a different function.

12. Select cell **B16** and enter: **=TODAY()**

13. Select cell **B17** and enter: **=DATEVALUE("yyyy-mm-dd")** where yyyy-mm-dd is the date you entered in cell B3 at the beginning of the exercise.



The result is a number, which is the serialized date value. You can change the format to a date.

14. Select cell **B17** again, then on the Home tab, in the Number group, click the **Number Format** drop-down arrow and click **Short Date**.

15. Select cell **B18** and enter: **=DAYS(B17,B16)**

16. Select cell **B20** and enter the number of days currently displayed in cell B18. Do not enter a formula that references cell B18.

17. Select cell **B21** and enter: =**WORKDAY(B16,B20,B22:B23)**

18. Select cell **B17** and, on the Home tab, in the Clipboard group, click the **Format Painter** button once, then click cell **B21** to copy the formatting for that cell.

    At this point, cell B21 shows a date that is much later than the travel departure date showing in cell B17 (and B3). This is caused by the # of days value in cell B20, which should count only the number of working days difference from today to the departure date. Cell B18 shows the total # of days, including weekends.

    Note: If your weekend days are not Saturdays and Sundays, use the WORKDAY.INTL function to specify other days of the week as weekends.

19. Change the number in cell **B20** so that the date in cell B21 is the same as the date showing in cell B17. You can estimate this number by multiplying the number in cell B18 by 0.714 (5 working days divided by 7 days in a week).

    The WORKDAY function skips only over weekends by default. You can also have it skip over holiday dates.

20. Enter a date into cell **B22**. This date should be a date between today and the travel departure date displayed in cell B17 and B3. It also must be a weekday between Monday and Friday.

21. Enter another weekday date into cell **B23**.

    By specifying two holiday dates (you can include as many holidays as needed in the cell range), the WORKDAY function will automatically adjust its calculations.

You will calculate the day of the week on which the nearest working day date you calculated previously falls.

22. Select cell **C21** and enter: =**WEEKDAY(B21,1)**

    Cell C21 displays a number corresponding to the day of the week. The worksheet should appear similar to the following:

	A	B	C	D	E
1	Tolano Adventures				
2					
3	Travel departure date:	25-Dec-19			
4	Today's date:	31-Oct-19		1	Sunday
5	Departure day of week:	Wednesday	4	2	Monday
6				3	Tuesday
7	# of days until travel:	54.32323009	55	4	Wednesday
8				5	Thursday
9	Current month:	10		6	Friday
10	Current day:	31		7	Saturday
11	Current year:	2019			
12	Current hour:	16			
13	Current minutes:	14			
14	Current seconds:	33			
15					
16	Current date:	10/31/2019			
17	Departure date:	12/25/2019			
18	# of days difference	55			
19					
20	# of days	39			
21	Nearest working day	12/27/2019	6		
22	Holiday day 1	11/28/2019			
23	Holiday day 2	11/29/2019			

23. Save and close the workbook.

Checking for Formula Errors

Users automatically assume that spreadsheets are correct and base decisions on the information provided. Spreadsheet usage is pervasive in business and personal applications, ranging in size from major corporate investments to individual life insurance policies and everything in between. Accordingly, the impact from errors in spreadsheets can range from minor inconveniences to major implications on the livelihoods of thousands of employees. Formulas should be checked on any worksheet before it is printed or saved.

Using the Error Checking Tool

Objective 3.5.3

Excel includes an ***error checking*** feature that greatly reduces the time spent auditing formulas for accuracy. If background error checking is enabled, Excel displays a dark green triangle in the upper left corner of a cell to indicate that it contains an inappropriate formula. Possible errors that Excel will highlight include:

- formulas that are inconsistent with others in the same row or column.
- formulas that refer to a range but omit a cell that is within or adjacent to the range.
- formulas that evaluate to an error.
- numbers stored as text.

When you select a cell with a green triangle, a box with an exclamation mark (the Trace Error icon) appears beside it. Click the button to display a drop-down menu that describes the problem and offers to fix it (Figure 2-9).

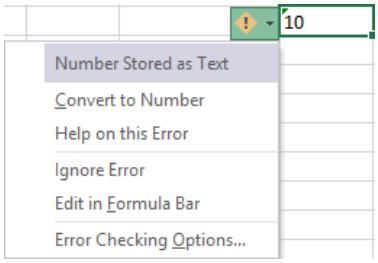


Figure 2-9: Trace Error drop-down menu

Alternatively, on the Formulas tab, in the Formula Auditing group, click Error Checking.

Selecting Error Checking Rules

You can also specify which error checking rules are enforced by selecting options in the Formulas page of the Excel Options dialog box (Figure 2-10).

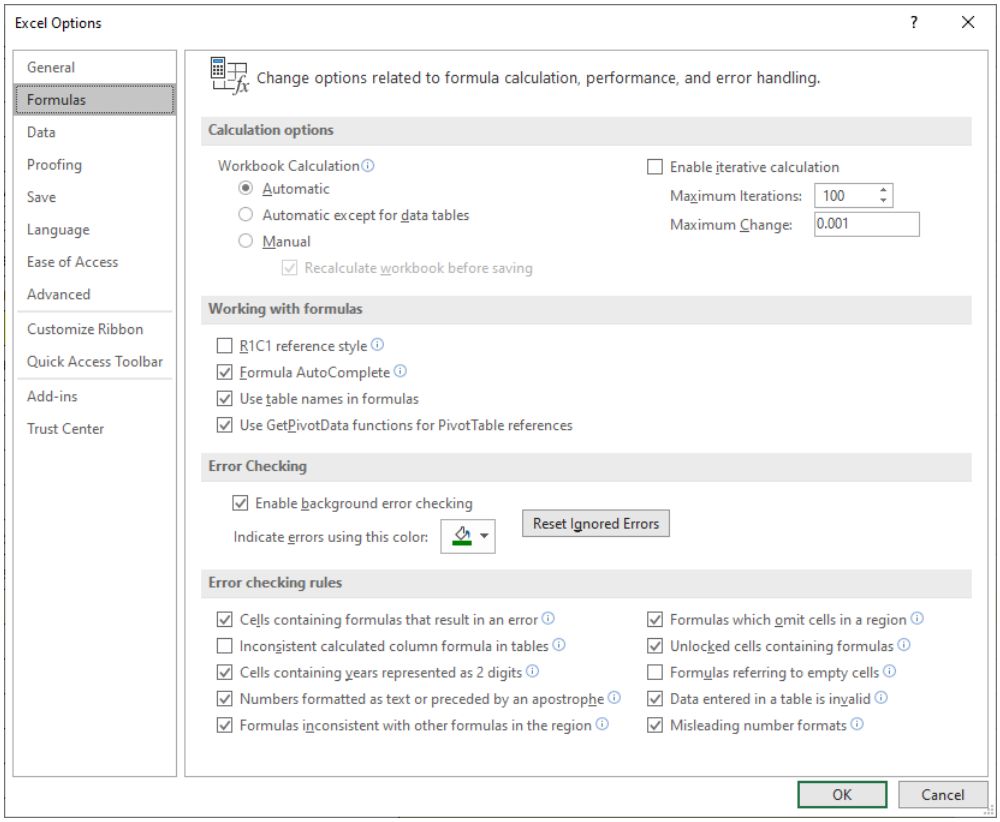


Figure 2-10: Excel Options dialog box – Formulas page

Select or deselect the appropriate check boxes in the *Error checking rules* section to validate formulas using specific error checking rules.

Learn to use the Error Checking tool

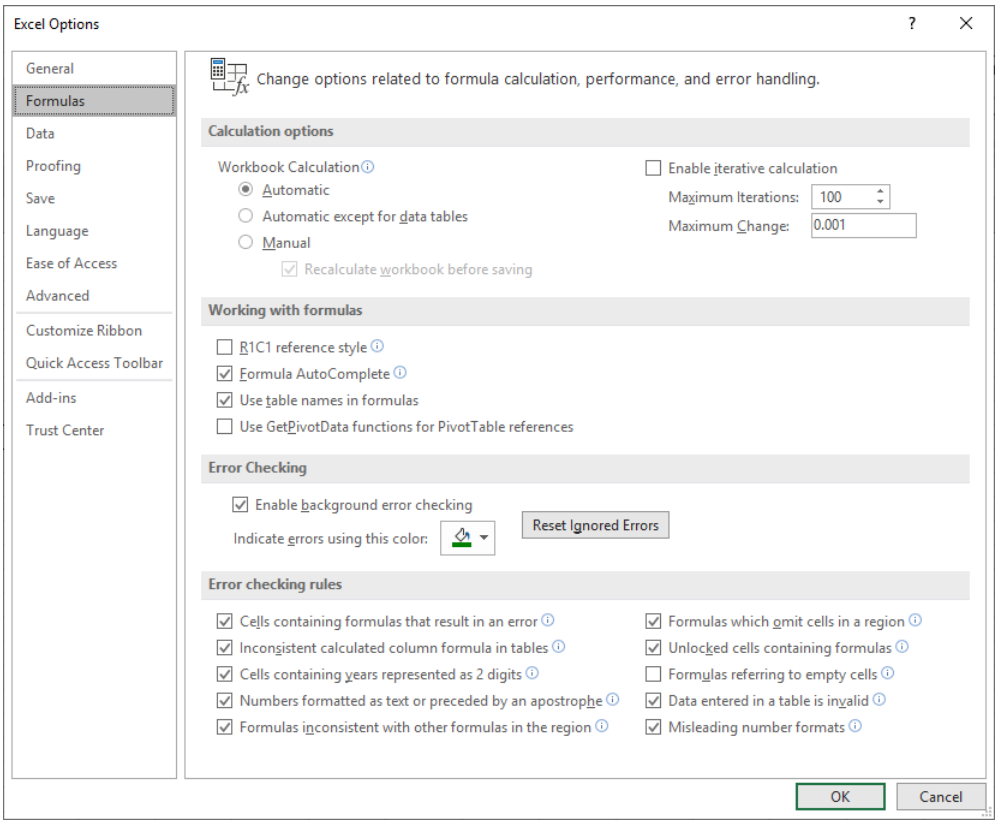
In this exercise, you will use Excel's Error Checking tool to find errors in formulas.

1. Open **Rocky Mountains Tour Error Checking.xlsx** located in the *StarterFiles* folder, and it save as **My Rocky Mountains Tour Error Checking.xlsx** in the *MyProjects* folder.

   Tolano Adventures is using this spreadsheet to compare the revenues to the expenses for a planned tour. The numbers appear to indicate that a healthy profit will be made.

   However, this worksheet has formulas with errors in them. Wherever Excel believes that a formula is incorrect, it displays an Error Indicator (green triangle at the upper left corner) in the cell. By default, this background error checking is turned on. You can verify this by looking in the Options dialog box.

2. Click **File** and then click **Options**. In the Excel Options dialog box, click the **Formulas** tab.



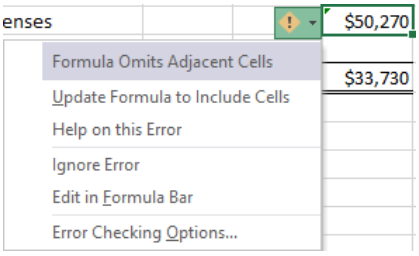
3. Ensure that the **Enable background error checking** check box is selected.

   Notice that you can also change the color of the Error Indicator triangle or toggle various error checking rules on or off.

4. Click the **Reset Ignored Errors** button, and then click **OK** to close the dialog box.

   An error indicator (the small green triangle) is now visible in the upper left corner of cell D21, indicating that it contains a possible formula error.

5. Select cell **D21** and click the **Trace Error** icon to the left of this cell.



   At the top row of the Trace Error menu, Excel describes the problem it has identified: the formula in this cell does not include adjacent cells containing data that you may have wanted to include. At this point, you should check the contents of the formula bar to determine whether to change this formula.

6. Look at the Formula Bar for this cell.

   The formula in this cell is =SUM(D13:D19). However, cells D12 to D20 contain expense numbers.

7. In the Trace Error menu, click **Update Formula to Include Cells**.

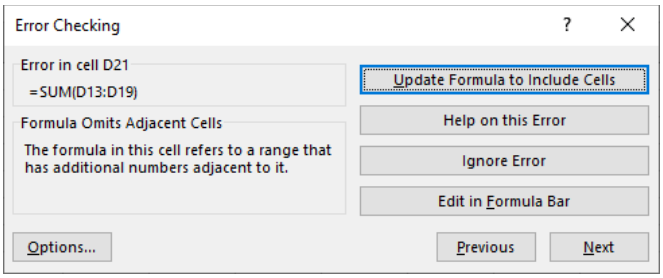
If you select Ignore Error, the green triangle disappears and the error is not identified in future error checks (unless you click Reset Ignored Errors in the Excel Options dialog box).

8. Click **Undo** in the Quick Access Toolbar to revert the formula back to its previous value.
9. Select cell **A1** or any cell at the top of the worksheet.

The next step demonstrates how Excel behaves when you use the error checking tool. In fact, it doesn't matter where the cell pointer is when you carry out this step.

10. On the Formulas tab, in the Formula Auditing group, click **Error Checking**.

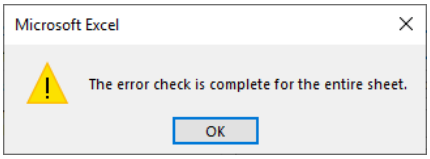
    The cursor jumps to the first cell that Excel finds with a potential error in it.



    Excel has found the formula error again in cell D21.

11. Click **Update Formula to Include Cells**.

    When Excel can no longer find any problems with formulas, it displays the following:



12. Click **OK**.

    Your worksheet should look similar to the following:

	A	B	C	D
1	Tolano Adventures			
2	Rocky Mountains Tour Revenue and Expenses Analysis			
3				
4	Revenues			
5	Rate Group	Fare	Qty	Total
6	Adults	1,400	40	$56,000
7	Children	850	8	11,200
8	Seniors	1,250	12	16,800
9	Total Revenues		60	$84,000
10				
11	Expenses			
12	Hotels			31,500
13	Food & meals			34,000
14	Train fares			15,000
15	Bus rental			500
16	Bus driver			250
17	Tour guide			250
18	Canoe rentals			120
19	Bicycle rentals			150
20	Climbing equip rentals			250
21	Total Expenses			$82,020
22				
23	Net			$1,980

This updated worksheet shows that the profit has been substantially reduced, but there is still a small profit being made. The worksheet actually has more formula errors, but the Error Checking tool has found as many errors as it could.

13. Save and close the workbook.

Tracing Formula Errors

Objective 3.5.1

Another method of finding formula errors is to use ***tracing tools*** (Figure 2-11). These tools (which can be found in the Formula Auditing group on the Formulas tab of the Ribbon) draw arrows to help you trace cells that are precedents or dependents of the current cell. By following the lines and dots in the arrows, you can determine which cells are referenced in formulas.

When you select a cell and trace its precedents, Excel draws lines from other cells leading to the current active cell. Excel also draws box outlines around these cells. This is a visual way of examining a worksheet to see which cells are being referenced by formulas. In a complex worksheet with many formulas, this is a very useful tool to ensure they are all correct.

When you select a cell and trace its dependents, Excel draws lines to any cells that use the data in the current active cell, directly and indirectly. Dependent cells contain formulas that reference the current active cell.

	A	B	C	D	E
1	Tolano Adventures				
2	Rocky Mountains Tour Revenue and Expenses Analysis				
3					
4	Revenues				
5	Rate Group	Fare	Qty	Total	
6	Adults	1,400	40	$56,000	
7	Children	850	8	11,200	
8	Seniors	1,250	12	16,800	
9	Total Revenues		60	$84,000	
10					
11	Expenses				
12	Hotels			31,500	
13	Food & meals			34,000	
14	Train fares			15,000	
15	Bus rental			500	
16	Bus driver			250	
17	Tour guide			250	
18	Canoe rentals			120	
19	Bicycle rentals			150	
20	Climbing equip rentals			250	
21	Total Expenses			$82,020	
22					
23	Net			$1,980	
24					

Figure 2-11: Formula Auditing tracing tools

You can extend the tracing of precedent or dependent cells by selecting Trace Precedents or Trace Dependents again in the Ribbon.

Learn to use auditing tools

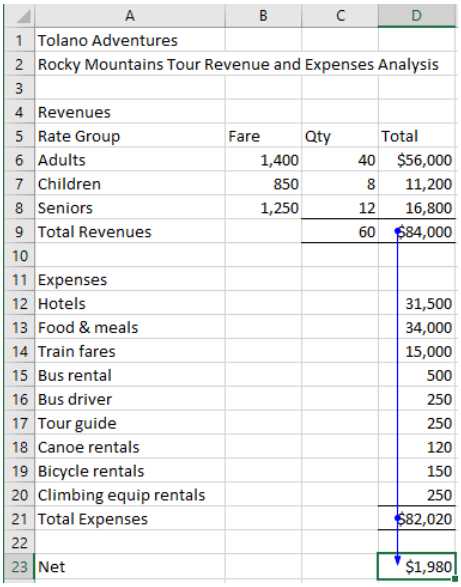
In this exercise, you will use auditing tools to check for formula errors.

1. Open **Rocky Mountains Tour Tracing Errors.xlsx** located in the *StarterFiles* folder, and save it as **My Rocky Mountains Tour Tracing Errors.xlsx** in the *MyProjects* folder.

Start by selecting the most important cell in the entire workbook—the one that calculates the profit of Total Revenues less Total Expenses.

2. Select cell **D23** and then, on the Formulas tab, in the Formula Auditing group, click **Trace Precedents**.

   Notice the thin line and the dots drawn from cell D9 to D23. The dots in cells D9 and D21 indicate that these cells are referenced in the formula in cell D23. These appear to be correct.



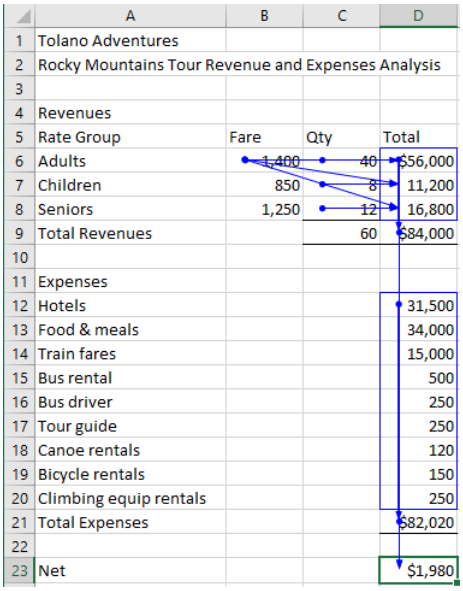
	A	B	C	D
1	Tolano Adventures			
2	Rocky Mountains Tour Revenue and Expenses Analysis			
3				
4	Revenues			
5	Rate Group	Fare	Qty	Total
6	Adults	1,400	40	$56,000
7	Children	850	8	11,200
8	Seniors	1,250	12	16,800
9	Total Revenues		60	$84,000
10				
11	Expenses			
12	Hotels			31,500
13	Food & meals			34,000
14	Train fares			15,000
15	Bus rental			500
16	Bus driver			250
17	Tour guide			250
18	Canoe rentals			120
19	Bicycle rentals			150
20	Climbing equip rentals			250
21	Total Expenses			$82,020
22				
23	Net			$1,980

3. With cell **D23** still selected, click **Trace Precedents** again.

   As the Trace Precedents tool drills down through the next layer of detail, Excel draws boxes above cells D9 and D21. The boxes indicate that these cell ranges are referenced in the formulas in the two cells. These also appear to be correct.

4. Click **Trace Precedents** one more time.

   Another set of lines and dots is drawn as the Trace Precedents tool drills down through another layer of detail. These indicate the cells referenced in the formulas entered into the cell range D6:D8.



	A	B	C	D
1	Tolano Adventures			
2	Rocky Mountains Tour Revenue and Expenses Analysis			
3				
4	Revenues			
5	Rate Group	Fare	Qty	Total
6	Adults	1,400	40	$56,000
7	Children	850	8	11,200
8	Seniors	1,250	12	16,800
9	Total Revenues		60	$84,000
10				
11	Expenses			
12	Hotels			31,500
13	Food & meals			34,000
14	Train fares			15,000
15	Bus rental			500
16	Bus driver			250
17	Tour guide			250
18	Canoe rentals			120
19	Bicycle rentals			150
20	Climbing equip rentals			250
21	Total Expenses			$82,020
22				
23	Net			$1,980

   Looking at the last set of lines and dots drawn, you should see that they do not appear to be correct. The Fare value in cell B6 is used to calculate the total in cells D6:D8, but the fares in cells B7 and B8 are not used at all.

5. Select cell **D7**.

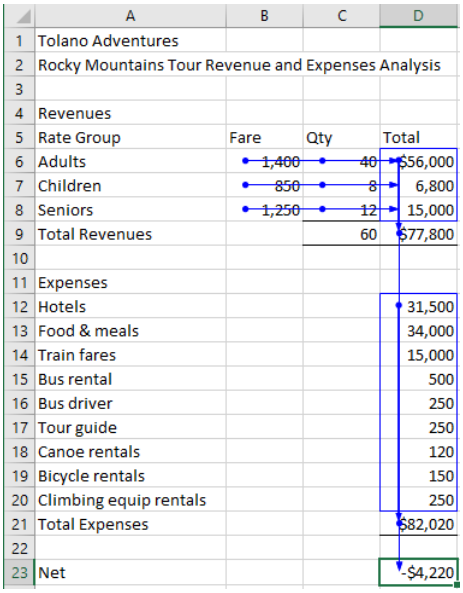
   By selecting cell D7, you can see that the formula is incorrect.

6. Change the formula in cell **D7** to: **=B7*C7**

7. Select cell **D8** and change the formula to: **=B8*C8**

8. Select cell **D23** and click **Trace Precedents** again.

   The lines and dots now appear in the correct cells. It also now appears that this tour will incur a loss instead of a profit.



	A	B	C	D
1	Tolano Adventures			
2	Rocky Mountains Tour Revenue and Expenses Analysis			
3				
4	Revenues			
5	Rate Group	Fare	Qty	Total
6	Adults	1,400	40	$56,000
7	Children	850	8	6,800
8	Seniors	1,250	12	15,000
9	Total Revenues		60	$77,800
10				
11	Expenses			
12	Hotels			31,500
13	Food & meals			34,000
14	Train fares			15,000
15	Bus rental			500
16	Bus driver			250
17	Tour guide			250
18	Canoe rentals			120
19	Bicycle rentals			150
20	Climbing equip rentals			250
21	Total Expenses			$82,020
22				
23	Net			-$4,220

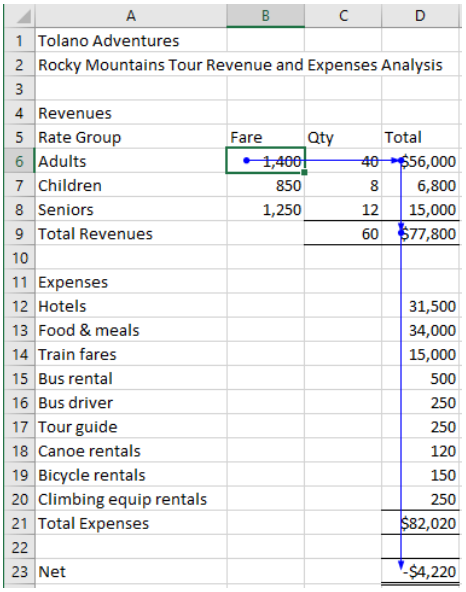
9. On the Formulas tab, in the Formula Auditing group, click **Remove Arrows**.

   Instead of finding the precedent cells, you can find cells containing formulas that depend on the value in a selected cell, either directly or indirectly. This is the reverse method—tracing dependent cells.

10. Select cell **B6** and, on the Formulas tab, in the Formula Auditing group, click **Trace Dependents**.

11. Click **Trace Dependents** two more times.

    The worksheet should appear similar to the following:



	A	B	C	D
1	Tolano Adventures			
2	Rocky Mountains Tour Revenue and Expenses Analysis			
3				
4	Revenues			
5	Rate Group	Fare	Qty	Total
6	Adults	1,400	40	$56,000
7	Children	850	8	6,800
8	Seniors	1,250	12	15,000
9	Total Revenues		60	$77,800
10				
11	Expenses			
12	Hotels			31,500
13	Food & meals			34,000
14	Train fares			15,000
15	Bus rental			500
16	Bus driver			250
17	Tour guide			250
18	Canoe rentals			120
19	Bicycle rentals			150
20	Climbing equip rentals			250
21	Total Expenses			$82,020
22				
23	Net			-$4,220

12. Verify that cell **D6** contains the correct formula: **=B6*C6**.

13. Save and close the workbook.

Manually Checking and Displaying Formulas

While the Error Checking tool is very helpful, you should never skip the step of manually checking your formulas to ensure they reference the correct cells. For example, if all the formulas in a row refer to values in the same incorrect row, Excel will not detect an error. Also, Excel ignores inconsistencies if formulas reference other formulas rather than values. Therefore, you should still manually check formulas for accuracy.

Manually checking a worksheet means selecting every cell in the worksheet to determine if it contains the right value or formula. If a cell contains a formula that references other cells, you should look and verify that the correct cells are being referenced. Excel displays cell range references visually by highlighting them with a colored border when you press F2 to help you verify that these formulas are correct (Figure 2-12).

	A	B	C	D
1	Tolano Adventures			
2	Rocky Mountains Tour Re			
3				
4	Revenues			
5	Rate Group	Fare	Qty	Total
6	Adults	1400	40	=B6*C6
7	Children	850	8	=B6*C7
8	Seniors	1250	12	=B6*C8
9	Total Revenues		=SUM(C6:C8)	=SUM(D6:D8)

Figure 2-12: Cell range references highlighted with colored border

A useful feature to help you review all the formulas in a worksheet at the same time is the Show Formulas option, which you can access from the Formula Auditing group on the Formulas tab. This feature forces every cell to display its underlying formula instead of the calculated value.

Learn to check worksheets for formula errors

In this exercise, you will check worksheets to ensure there are no formula errors.

1. Open **Rocky Mountains Tour Manual Checking.xlsx** located in the *StarterFiles* folder, and save it as **My Rocky Mountains Tour Manual Checking.xlsx** in the *MyProjects* folder.
2. Select cell **C9** and then press the **F2** key to switch to edit mode for this cell.

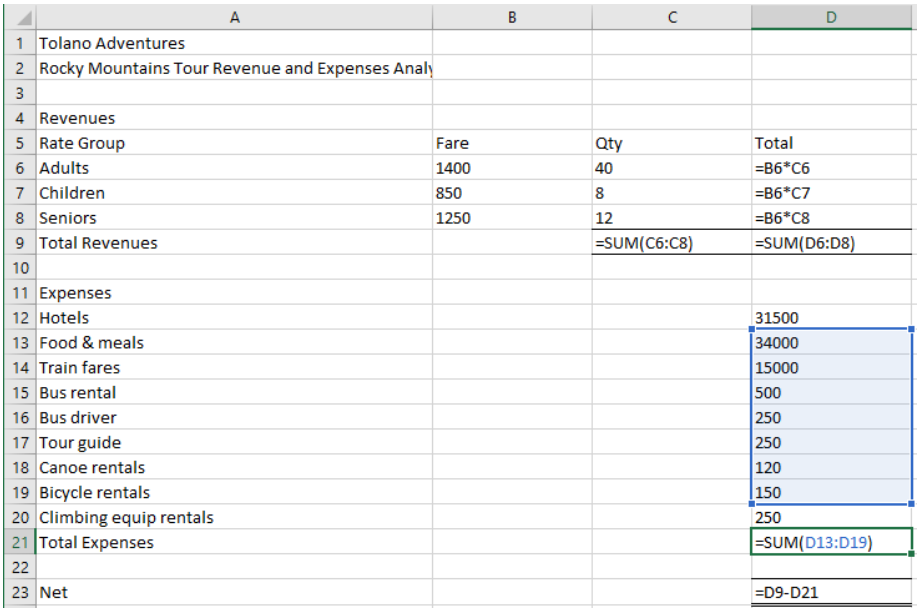
   While in edit mode, you can see the formula in this cell, and the referenced range of cells that is highlighted in the worksheet. This formula appears to be correct.
3. Press the **ESC** key to exit from edit mode.
4. Repeat steps 2 and 3 for cells **D9** and **D21**.

   The formula in cell D9 appears to be correct. However, cell D21 appears to be suspicious. Repeating these steps for each cell is tedious work.
5. On the Formulas tab, in the Formula Auditing group, click **Show Formulas**.
6. If necessary, adjust the size of the Excel workbook window so that you can see the cell range **A1**:**D23**.

   With the worksheet now in Show Formula mode, you can easily see which cells to check. First, select the cells containing SUM formulas to verify that they are correct.
7. Select cell **C9**, then cell **D9**, and then cell **D21**.

As you select each of these cells, note the range of cells that are highlighted and ask yourself if the selection appears to be correct.

The worksheet should appear as follows:



	A	B	C	D
1	Tolano Adventures			
2	Rocky Mountains Tour Revenue and Expenses Analy			
3				
4	Revenues			
5	Rate Group	Fare	Qty	Total
6	Adults	1400	40	=B6*C6
7	Children	850	8	=B6*C7
8	Seniors	1250	12	=B6*C8
9	Total Revenues		=SUM(C6:C8)	=SUM(D6:D8)
10				
11	Expenses			
12	Hotels			31500
13	Food & meals			34000
14	Train fares			15000
15	Bus rental			500
16	Bus driver			250
17	Tour guide			250
18	Canoe rentals			120
19	Bicycle rentals			150
20	Climbing equip rentals			250
21	Total Expenses			=SUM(D13:D19)
22				
23	Net			=D9-D21

8. With cell **D21** still selected, correct the formula by dragging the upper right (or upper left) handle around the blue highlighted cell range up by one row. Then drag the bottom left (or bottom right) handle down by one row.

   The formula in cell D21 should now be: **=SUM(D12:D20)**.

9. Press **ENTER**.

10. Click each of the cells **D6**, **D7** and **D8**. Correct any of the formulas in these cells, as necessary.

Then check the last remaining formula on this worksheet.

11. Click cell **D23**, and correct the formula in it, if necessary.

12. On the Formulas tab, in the Formula Auditing group, click **Show Formulas** again to turn the formula display off.

13. Save and close the workbook.

Configuring Data Validation

Objective 2.2.2

Electronic spreadsheets first appeared as very crude blank sheets. You could enter any type of value in any cell and the spreadsheet would attempt to cope with it. For example, even if it seemed as if there should be a numeric value in a cell, Excel would accept a text string if you entered it. If that cell were subsequently used in a calculation, Excel treated that cell as if it contained the value 0 (zero). This flexibility (or, described another way, this willingness of the spreadsheet to accept anything anywhere without many complaints) made spreadsheets very popular with novice computer users.

However, this flexibility often resulted in undesirable side effects when wrong values were entered in certain cells. For example, the uppercase letter "O" can be mistakenly entered instead of the number "0" and the lower case "l" can be mistaken for the number "1" in some character fonts.

Excel can prevent these types of errors with the ***Data Validation*** feature, which displays a helpful message when the user selects a cell or displays an error message if an incorrect value is entered. You use the Data Validation dialog box to specify the message and error alert (Figure 2-13).

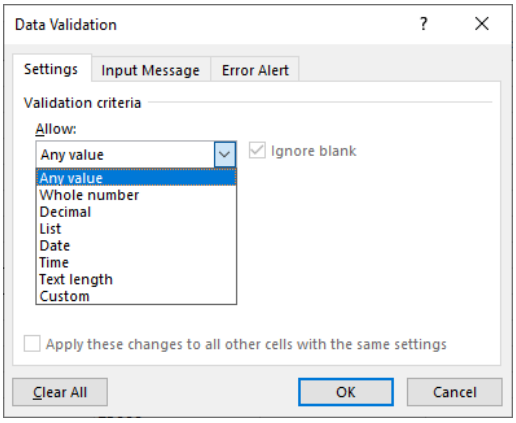


Figure 2-13: Data Validation dialog box

You can choose from different data types as validation checks as described below.

Any value	Deactivate any data validation. This is the default setting for all cells. However, you can also use it to display an input message without validating any data entry.
Whole number	Allow only numeric values without any decimal digits.
Decimal	Allow any numeric value.
List	Allow selections from a defined list of values in a cell range. This is also known as a pick list. By using this type of list, you can ensure the cell will contain only one of these values.
Date	Allow only date values. The lowest date value is January 1, 1900.
Time	Allow only valid time values.
Text length	Allow only the specified number of text characters. This validation does not permit any numbers, dates, or time values to be entered.
Custom	Enter a formula to validate the data being entered in the cell. The result of the formula must be a true or false value.

You can use the Input Message tab of the Data Validation dialog box (Figure 2-14a) to enter a message that will appear when a cell is selected. You can use the Error Alert tab (Figure 2-14b) to enter an error message that will appear when invalid data is entered in a cell.

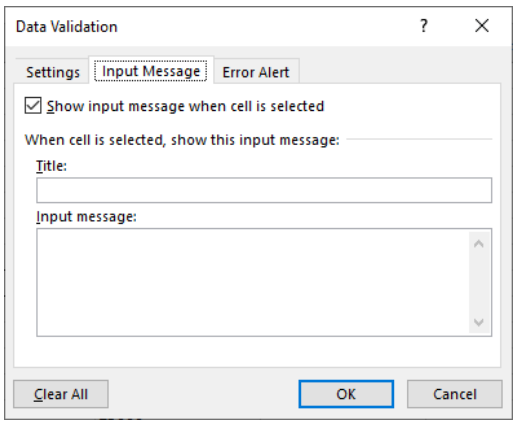


Figure 2-14a: Data Validation dialog box – Input Message tab

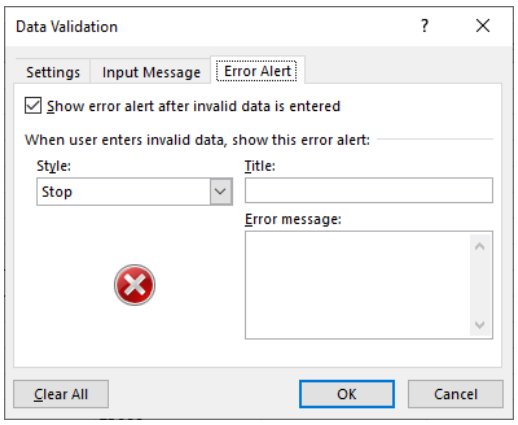


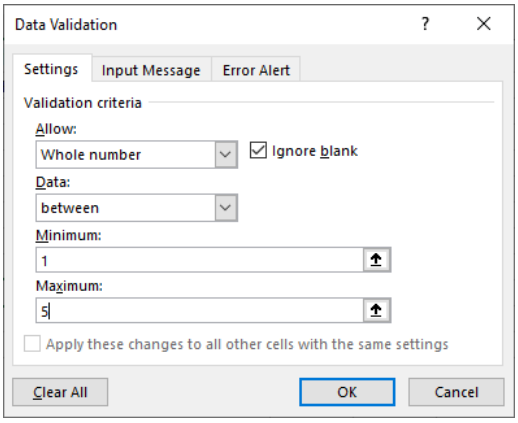
Figure 2-14b: Data Validation dialog box – Error Alert tab

Learn to configure Data Validation

In this exercise, you will use the Data Validation feature.

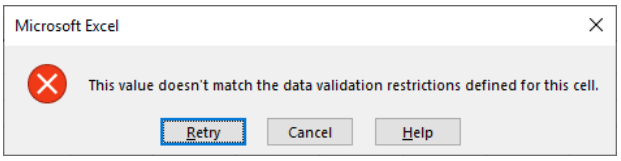
1. Open **Feedback Form.xlsx** located in the *StarterFiles* folder, and save it as **My Feedback Form.xlsx** in the *MyProjects* folder.
2. Select cell **B10**.
3. On the Data tab, in the Data Tools group, click **Data Validation**. If you clicked the drop-down arrow below the Data Validation button, click **Data Validation**.
4. Enter or select the following options for the Settings tab and click **OK**.

Criteria	**Select**
Allow:	Whole number
Data:	between
Minimum:	**1**
Maximum:	**5**



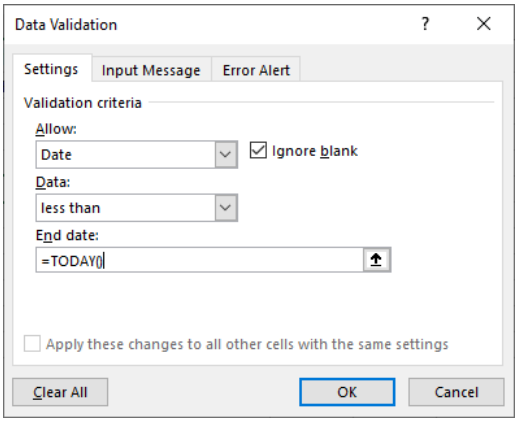
5. Select cell **B10**. Type: **0** and press **ENTER**.

   Excel displays the default error message.



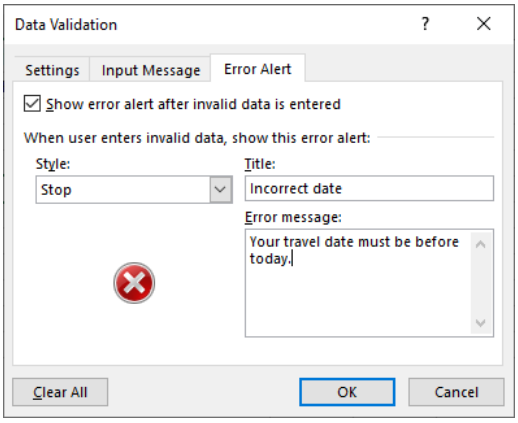
6. Click **Cancel**.
7. Select cell **B6**. On the Data tab, in the Data Tools group, click **Data Validation**.
8. Enter or select the following options for the Settings tab, but do not click OK yet:

Criteria	**Select**
Allow:	Date
Data:	less than
End date:	**=TODAY()**



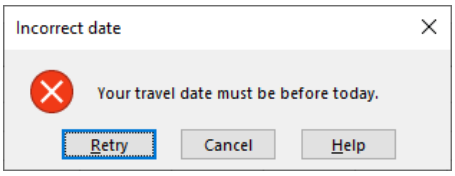
9. Click the **Error Alert** tab, enter the following settings, and click **OK**:

Criteria	**Enter**
Style:	Stop
Title:	**Incorrect date**
Error message:	**Your travel date must be before today.**



10. Select cell **B6** and enter a future date.

    Your customized error message is now displayed.



11. Click **Cancel**.

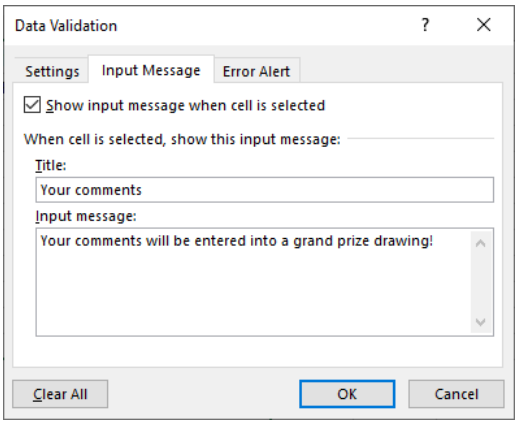
12. Select cell **B13**. On the Data tab, in the Data Tools group, click **Data Validation**.

13. Click the **Settings** tab and enter or select the following, but do not click OK yet:

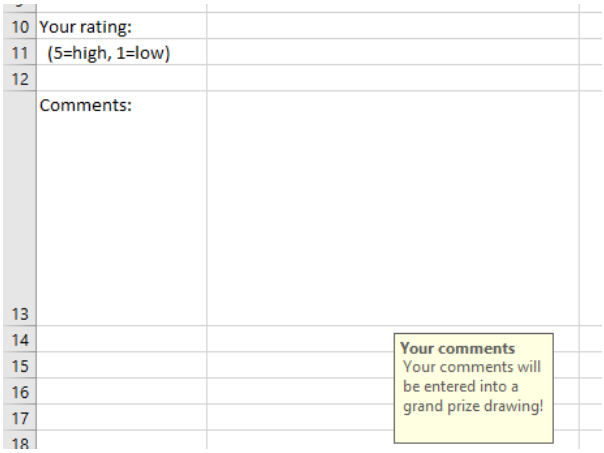
Criteria	**Select**
Allow:	Text length
Data:	less than
Maximum:	**150**

14. Click the **Input Message** tab, enter the following settings, and click **OK**:

Criteria	Enter
Title:	**Your comments**
Input message:	**Your comments will be entered into a grand prize drawing!**



Your customized input message is now displayed.



15. Click another cell and then click cell **B13** again to see the input message display again.
16. Test the worksheet by entering values of your own choosing into the various cells.
17. Save and close the workbook.

Lesson Summary

Now that you have completed this lesson, you should be able to:

- ☑ Describe what a function is.
- ☑ Use the correct syntax for functions.
- ☑ Insert a function.
- ☑ Use the lookup functions CHOOSE, INDEX, MATCH, HLOOKUP, and VLOOKUP.
- ☑ Use date and time functions.
- ☑ Use the Error Checking Tool to mark possible incorrect formulas.
- ☑ Trace formula errors.
- ☑ Check the worksheet manually for formula errors.
- ☑ Configure Data Validation.

Key Terms

Term	Definition
Built-in Functions	Pre-programmed formulas used to perform specific calculations. You can either type these functions in or use the Insert Function wizard to assist in creating the function. See Insert Function.
Data Validation	A feature that helps you set up validation checks in cells; for example, numbers only, list of inventory items available only, and so on.
Error Checking	An auditing tool used to assist in checking any errors that may exist in the formulas. Any errors are marked with a dark green triangle in the upper left corner of a cell.
Insert Function	The feature that Excel provides to help you select the desired function to perform calculations.
Tracing Tool	An audit tool that draws arrows to help you find or trace formula errors in cells that are precedents or dependents of the current cell.

Quiz Questions

For each question, select the best answer.

1. Which method can you use the access the Insert Function dialog box?

    a. Click Insert Function to the left of the Formula bar.
    b. On the Home tab, in the Editing group, click the arrow beside AutoSum, then click More Functions.
    c. On the Formulas tab, in the Function Library group, click Insert Function.
    d. You can use any of these methods to access the Insert Function dialog box.

2. The CHOOSE function _____.

    a. selects from a two-dimensional range of cells using both a row number and a column number as the indices
    b. returns the position of the value in the list, instead of the actual value itself
    c. selects from a one-dimensional list of values by using an index number
    d. selects from a two-dimensional range of cells using a row number as the index number

3. Which of the following shows the correct syntax for the INDEX function?

    a. =INDEX(A2:D4,2,3)
    b. =INDEX(A2,D4,2,3)
    c. =INDEX(A2-D4,2,3)
    d. =INDEX((A2:D4),2,3)

4. Which of the following functions returns the position of a value in a list, instead of the actual value itself?

    a. INDEX
    b. MATCH
    c. VLOOKUP
    d. HLOOKUP

5. Which of the following functions will look up a value in the third row of the cell range O11:R14?

    a. =VLOOKUP(L4,O11:R14,2,0)
    b. =HLOOKUP(L4,O11:R14,2,0)
    c. =HLOOKUP(L4,O11:R14,3)
    d. =VLOOKUP(L4,E12:LI14,3,0)

6. Which VLOOKUP switch setting will find an exact match for a lookup value?

    a. EXACT
    b. TRUE
    c. 1
    d. 0 or FALSE

7. Which function will show the current date and time?

    a. =NOW()
    b. =TODAY
    c. =TODAY()
    d. =NOW(Time)

8. Which function will show the day of the week for the date stored in cell A2, assuming that Monday is the first day of the week?

    a. =WEEKDAY(A2,2)
    b. =DAY(A2)
    c. =DAY(A2,1)
    d. =WEEKDAY(A2,0)

9. When the Error Checking tool detects a possible error in a worksheet cell, it _____.

    a. automatically corrects the error
    b. opens the debug window
    c. opens the Evaluate Formula dialog box
    d. displays a dark green triangle in the upper left corner of the cell

10. Where can you find tools to trace precedents and dependents of the current cell in a worksheet?

    a. On the Data tab, in the Data Tools group
    b. On the Insert tab, in the Tracing Tools group
    c. On the Formulas tab, in the Formula Auditing group
    d. On the Review tab, in the Review Formulas group

11. You can force every cell in a worksheet to display its underlying formulas instead of the calculated result by using which option?

    a. Watch Window
    b. Show Formulas
    c. Evaluate Formula
    d. Calculation Off

12. You can impose restrictions on data input except for:

    a. restricting input to one of 10 values in a list.
    b. restricting input to whole numbers only.
    c. restricting input to a maximum of 50 characters.
    d. It is possible to impose all the restrictions listed here using the data validation feature.

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Lesson 3: Data Analysis Using Pivot Tables and Pivot Charts

Lesson Objectives

In this lesson, you will learn how to use pivot tables and pivot charts. Upon completion of this lesson, you will be able to:

- ☐ Create, format, and customize pivot tables.
- ☐ Use data slicers.
- ☐ Group pivot table data.
- ☐ Create calculated fields and items for pivot tables.
- ☐ Create a pivot chart.
- ☐ Change pivot chart options.
- ☐ Drill down into a pivot table and pivot chart.
- ☐ Change pivot chart styles.

Creating and Managing Pivot Tables

The pivot table is one of the most powerful features in Excel. A ***pivot table*** lets you summarize or cross-tabulate large amounts of data by selecting fields for rows and columns and performing a summary function on the intersections of the row and column fields.

Pivot tables are frequently used to analyze large volumes of data, which are usually found in corporate databases. When performing this kind of analysis, you almost always find values that repeat in many data records or rows. The repeating values can be paired in various combinations to reveal underlying trends.

Creating a Pivot Table

Objective 4.2.1

To create a pivot table, on the Insert tab, in the Tables group, click PivotTable. The Create PivotTable dialog box (Figure 3-1) will appear in which you select the data you want to analyze and specify whether to put the pivot table on the current worksheet or on a new one. You can create pivot tables from data in a single range, multiple ranges, external data sources, or even other pivot tables. If you select an external data source, Excel starts Microsoft Query to create a query that will retrieve the data for the pivot table.

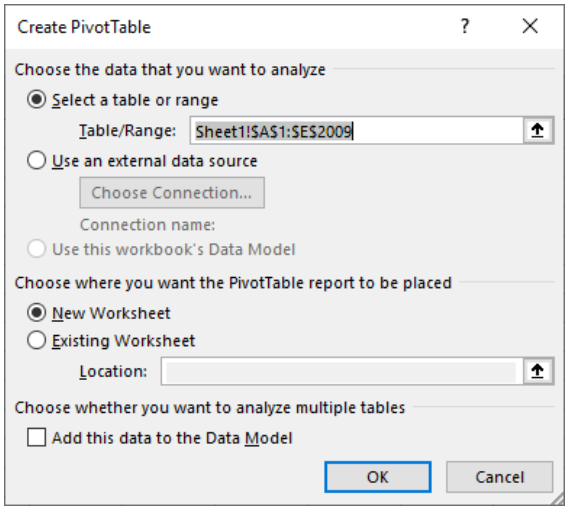


Figure 3-1: Create PivotTable dialog box

Once you specify the pivot table data and location and click OK, the PivotTable Fields task pane opens, which controls the structure of the pivot table (Figure 3-2). You use this task pane to decide which columns of data (correctly referred to as *fields*) from your source data table to use as the columns, rows, values, or filters for the pivot table.

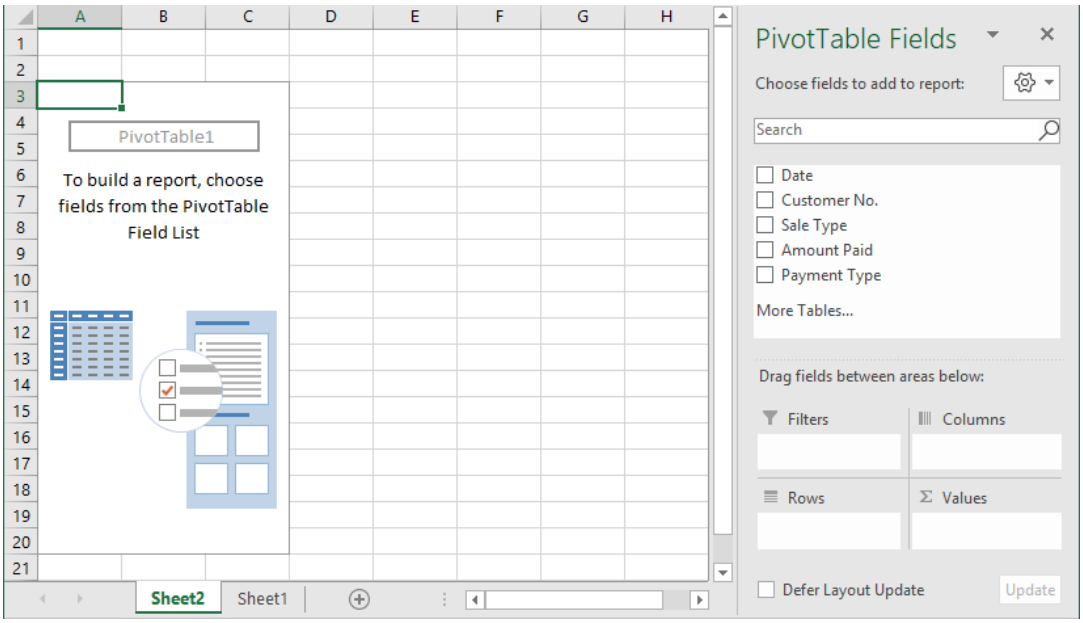


Figure 3-2: PivotTable Fields task pane

Filters	Select (or filter) rows of data from the source data that appear in the pivot table.
Columns	Display fields in this area as columns across the top of the pivot table.
Rows	Display fields in this area as rows down the left side of the pivot table.
Values	Summarize fields in this area in the main body of the pivot table. The default summary function is SUM, although it can be changed to other functions, such as AVERAGE, MIN, or MAX.

Excel allows you to put more than one column from the source data into each area in the PivotTable Fields task pane. You can specify the fields you want to display in the pivot table by selecting check boxes for each field or by dragging the fields directly from the field list in the top half of the PivotTable Fields task pane to the areas located in the bottom half.

Once you select fields to display in the pivot table, the table will appear in the worksheet (Figure 3-3).

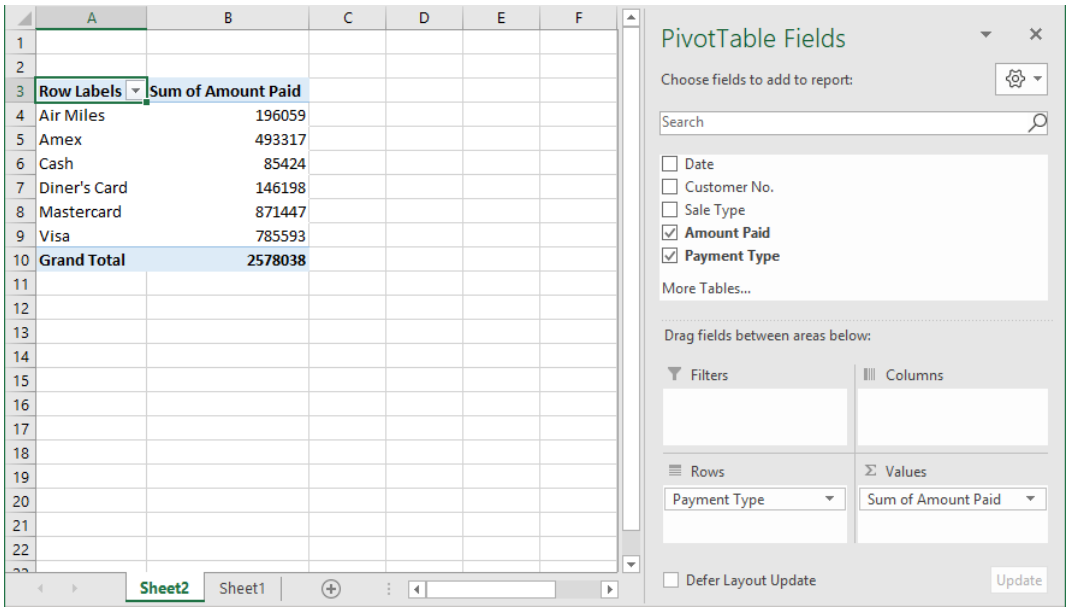


Figure 3-3: Creating a pivot table

By default, Excel places columns containing text data into the Rows area and those containing numeric data into the Values area. Also, by default, it applies the SUM function to the columns in the Values area.

You can ***filter*** which rows and/or columns to display in a pivot table by using ***AutoFilter*** buttons. For example, clicking the Row Labels AutoFilter button will display a drop-down menu from which you can specify how to sort and which rows to display in the pivot table (Figure 3-4).

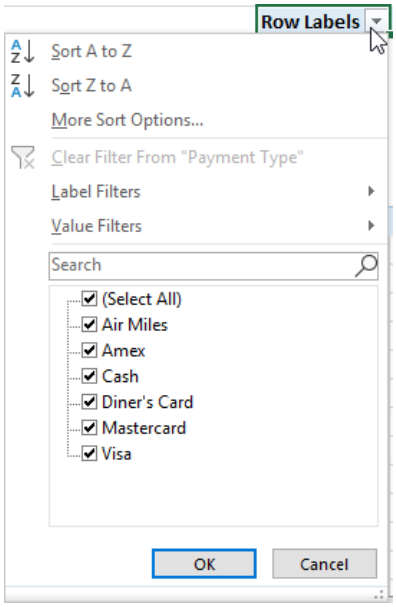


Figure 3-4: Row Labels AutoFilter drop-down menu

In this example, if you deselect the Air Miles and Cash check boxes and click OK, the pivot table will appear as shown in Figure 3-5.

2		
3	**Row Labels**	**Sum of Amount Paid**
4	Amex	493317
5	Diner's Card	146198
6	Mastercard	871447
7	Visa	785593
8	**Grand Total**	**2296555**
9		

Figure 3-5: PivotTable excluding Air Miles and Cash fields

Notice that the Grand Total amount changes to reflect the data displayed in the pivot table.

The PivotTable Fields task pane automatically turns itself on and off when you select a cell inside or outside the pivot table. Click any cell outside the pivot table to hide the PivotTable Fields task pane. Click any cell inside the pivot table to re-display the PivotTable Fields task pane.

Note: The PivotTable Fields task pane can also be turned on or off using the Ribbon. On the PivotTable Tools Analyze tab, in the Show group, click Field List to toggle it on or off.

Learn to create a pivot table

In this exercise, you will create a pivot table.

1. Open **Sales Pivot Table.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Pivot Table.xlsx** in the *MyProjects* folder. Take a moment to review the contents of the worksheet.

   There is a lot of data – over 2,000 rows. It will be difficult to examine the data in its current condition and identify patterns or trends. Note that the same data values are repeated down each column, but in different combinations and with different amount paid values. This kind of data is ideal for pivot tables.

   The Date, Customer No., Sale Type, and Payment Type columns contain data values that appear multiple times and are excellent candidates for row or column labels.

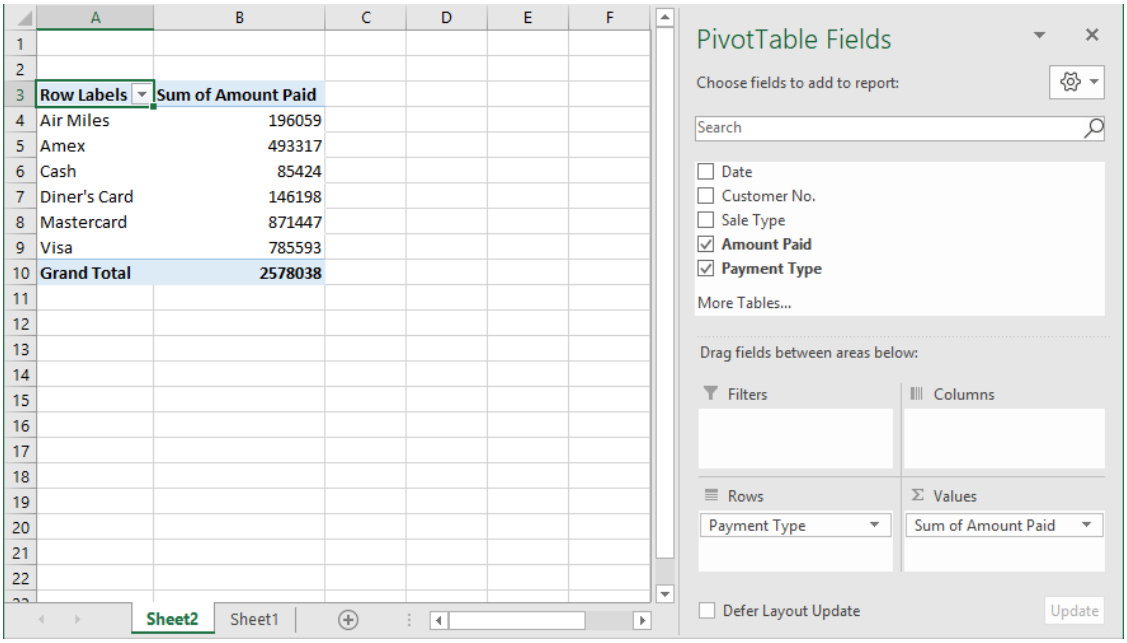
2. Select a cell within the cell range **A1:E2009**. On the Insert tab, in the Tables group, click **PivotTable**.

   Notice that the table range is already specified in the Create PivotTable dialog box because you clicked a cell within the range before executing the PivotTable command.

3. Click **OK**.

   The skeleton pivot table is now ready. Notice that Excel has created it in a new worksheet; you can put the pivot table into the same worksheet but you need to ensure that as the pivot table changes shape, it does not overwrite other cells containing data.

4. Select the check boxes for the **Amount Paid** and **Payment Type** fields in the PivotTable Fields task pane to turn them on and indicate that they are to be used in the pivot table. Excel does not know exactly where you will want to place these fields, so for now it makes a guess.



5. Select the check box for the **Sale Type** field to turn it on.

   With the addition of the Sale Type column, the pivot table is now much bigger. However, you will notice that the same sale type (for example, bike tour, car rental) labels are repeated under each of the payment types (for example, Air Miles, Amex, Cash).

Row Labels	Sum of Amount Paid
Air Miles	**196059**
Bike tour	461
Car rental	4120
Cruise	44686
Flight	26949
Flight+Car rental	20223
Flight+Cruise	59595
Flight+Hotel	19719
Hotel	12549
Hotel+Car rental	4880
Nature tour	1871
Rock climbing	1006
Amex	**493317**
Bike tour	1417
Car rental	7241
Cruise	110010
Flight	45842
Flight+Car rental	49897
Flight+Cruise	160902
Flight+Hotel	61468
Hotel	27434

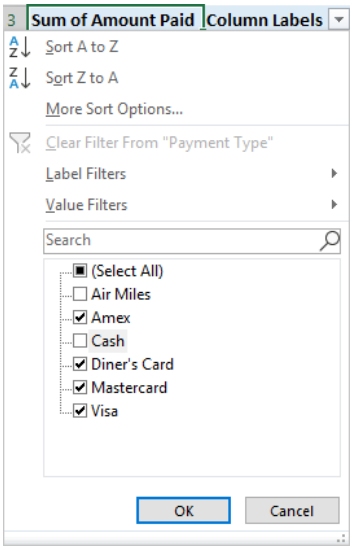
This table would make more sense if the payment type labels and values were pulled across the columns.

6. In the PivotTable Fields task pane, drag the **Payment Type** field from the *Rows* area to the *Columns* area.

Sum of Amount Paid	Column Labels						
Row Labels	**Air Miles**	**Amex**	**Cash**	**Diner's Card**	**Mastercard**	**Visa**	**Grand Total**
Bike tour	461	1417		380	2129	2699	7086
Car rental	4120	7241	1579	3383	13221	12862	42406
Cruise	44686	110010	20989	16915	221052	166480	580132
Flight	26949	45842	10427	28750	99741	87117	298826
Flight+Car rental	20223	49897	9119	15013	74842	76498	245592
Flight+Cruise	59595	160902	20637	29753	268184	235494	774565
Flight+Hotel	19719	61468	7869	19757	86179	83441	278433
Hotel	12549	27434	5717	11146	41962	53963	152771
Hotel+Car rental	4880	24081	8372	19554	54944	57998	169829
Nature tour	1871	2754	295	1096	6182	5899	18097
Rock climbing	1006	2271	420	451	3011	3142	10301
Grand Total	**196059**	**493317**	**85424**	**146198**	**871447**	**785593**	**2578038**

7. Click the **Column Labels** AutoFilter button in the PivotTable.

8. Deselect the **Air Miles** and **Cash** check boxes to turn them off, and click **OK**.



These two columns no longer appear in the pivot table. Notice that the grand total amounts appearing in the far right have also been adjusted to include only the columns appearing on the screen. To re-display all of the columns, select the Select All check box.

9. Click the **Column Labels** AutoFilter button in the PivotTable.
10. Select the **(Select All)** check box to turn it on, and click **OK**.
11. Click the **Column Labels** AutoFilter button in the PivotTable.
12. Select the **(Select All)** check box to turn it off, then select the **Amex**, **Mastercard** and **Visa** check boxes to turn them on, and click **OK**.
13. Save and close the workbook.

Formatting Pivot Table Data

Objective 4.2.6

Almost all pivot table values are numeric, and occasionally they will include date values. Therefore, the Format Cells dialog box is primarily used to format numeric and date data. You cannot apply shading or borders or change cell alignment using this dialog box.

To ensure that the formatting remains applied even as the pivot table changes, you should apply the formatting directly to the field (as opposed to applying it to the values that display in the pivot table). To apply formatting to the field, click the drop-down arrow on the far right of the field in the Values area of the PivotTable Fields pane, and then click Value Field Settings (Figure 3-6a). The Value Field Settings dialog box will open (Figure 3-6b).

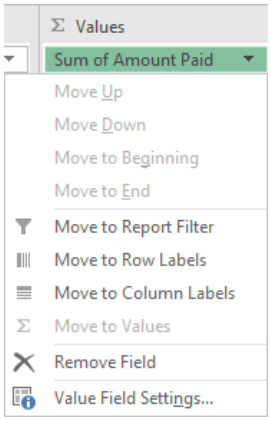


Figure 3-6a: Value Field Settings

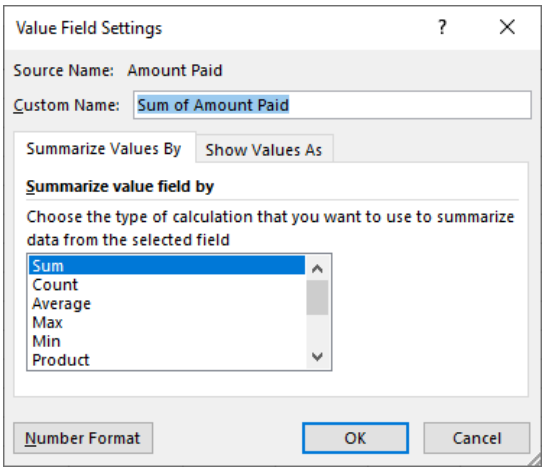


Figure 3-6b: Value Field Settings dialog box

In the Value Field Settings dialog box, click the Number Format button to open the Format Cells dialog box (Figure 3-7) and specify the formatting attributes as desired.

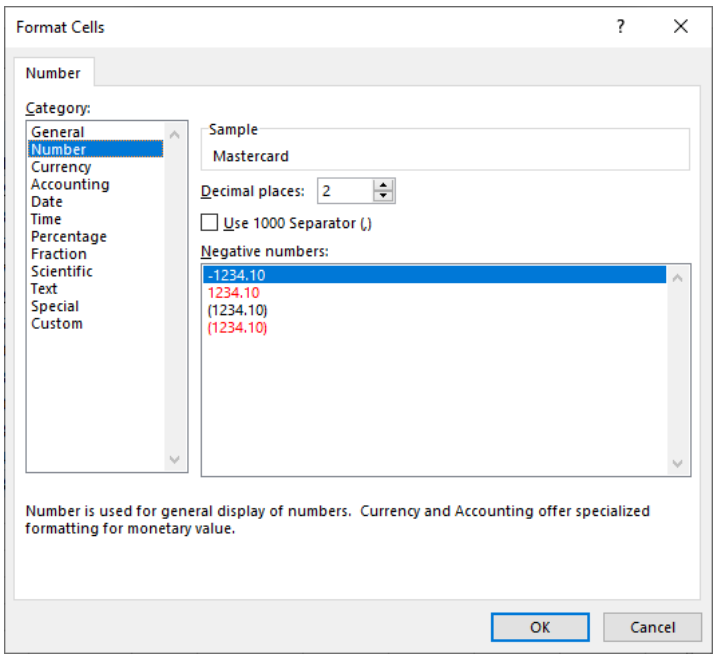


Figure 3-7: Format Cells dialog box

Learn to format the data in a pivot table

In this exercise, you will format the data in a pivot table.

1. Open **Sales Pivot Table Formatting.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Pivot Table Formatting.xlsx** in the *MyProjects* folder.
2. In the PivotTable Fields task pane, click the drop-down arrow on the far right of **Sum of Amount Paid** in the *Values* area, and then click **Value Field Settings**.
3. Click **Number Format** to open the Format Cells dialog box.
4. In the Format Cells dialog box, select **Number** in the *Category* list.

5. Reduce the *Decimal places* to **0** and select **Use 1000 Separator (,)** to turn it on. Click **OK**.
6. Click **OK** to close the Value Field Settings dialog box.

   The worksheet should now reflect the formatting changes, as shown in the following image.

Sum of Amount Paid	Column Labels			
Row Labels	Amex	Mastercard	Visa	Grand Total
Bike tour	1,417	2,129	2,699	6,245
Car rental	7,241	13,221	12,862	33,324
Cruise	110,010	221,052	166,480	497,542
Flight	45,842	99,741	87,117	232,700
Flight+Car rental	49,897	74,842	76,498	201,237
Flight+Cruise	160,902	268,184	235,494	664,580
Flight+Hotel	61,468	86,179	83,441	231,088
Hotel	27,434	41,962	53,963	123,359
Hotel+Car rental	24,081	54,944	57,998	137,023
Nature tour	2,754	6,182	5,899	14,835
Rock climbing	2,271	3,011	3,142	8,424
Grand Total	**493,317**	**871,447**	**785,593**	**2,150,357**

7. Save and close the workbook.

Customizing Pivot Tables

Objective 4.2.2

According to the *Merriam-Webster Dictionary*, a *pivot* is "a shaft or pin on which something turns" or "a person, thing, or factor having a major or central role, function, or effect." An Excel pivot table is both because it allows you to rotate and filter data in different ways so that you can gain a better understanding of it.

For example, you can change the fields that are displayed in the pivot table simply by selecting or deselecting their check boxes in the PivotTable Fields task pane, or you can drag a field from the Rows area to the Columns area (or vice versa) in the task pane to change your view of the data.

The following three figures illustrate how you can customize the display of a pivot table.

- In Figure 3-8, three of five possible fields (Sale Type, Amount Paid, and Payment Type) display in the pivot table with sale types in the rows and payment types in the columns.

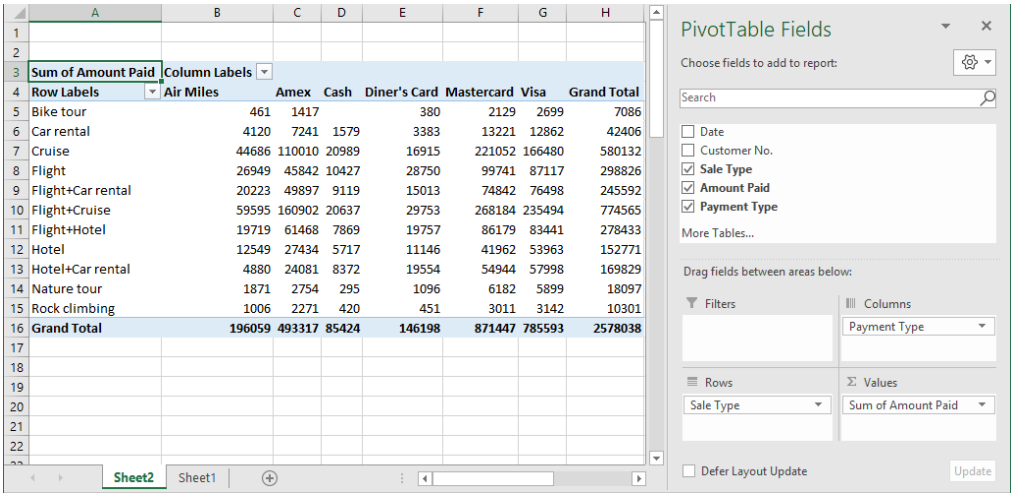
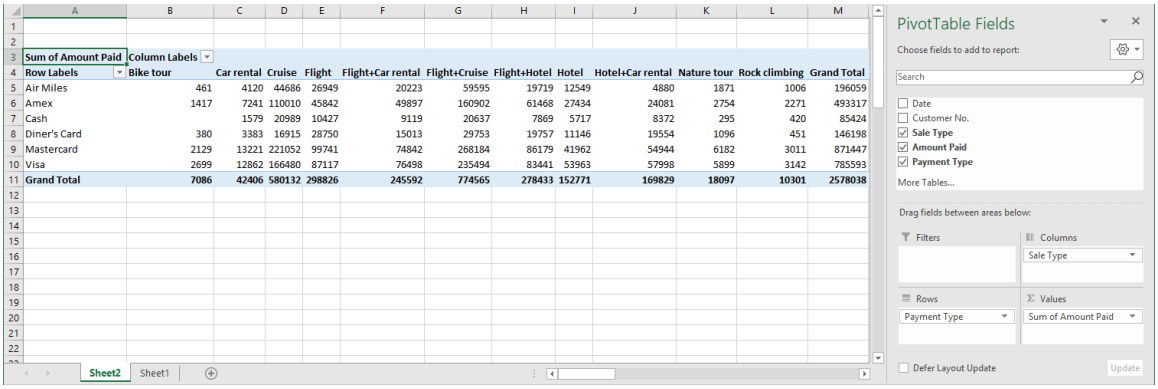


Figure 3-8: Three of five possible fields display in the pivot table

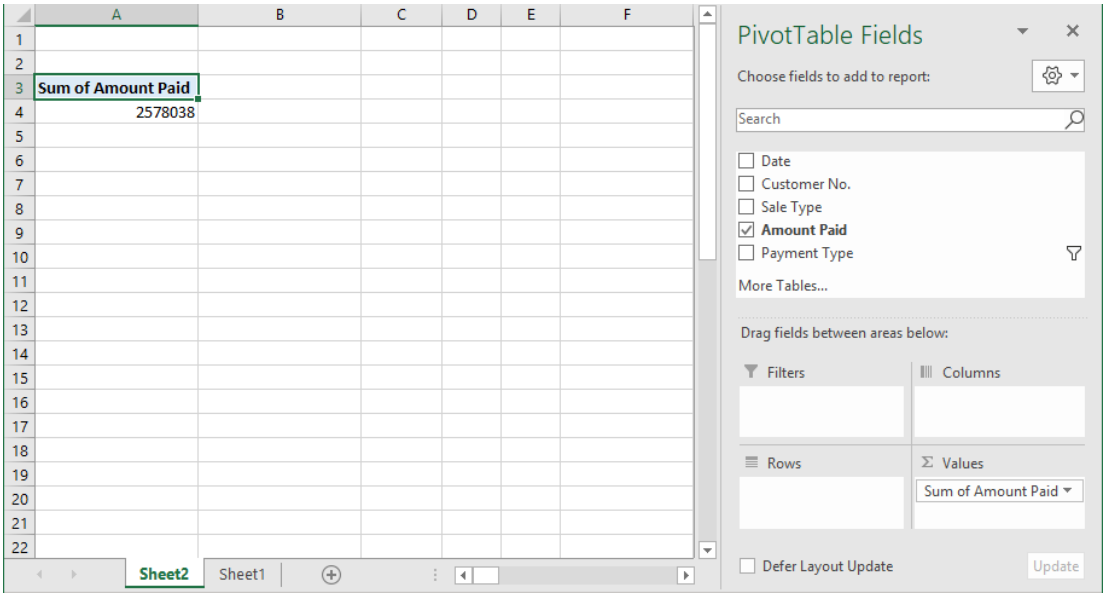
- In Figure 3-9, the same three fields display in the pivot table, but the row and column fields are reversed.



Sum of Amount Paid	Column Labels											
Row Labels	Bike tour	Car rental	Cruise	Flight	Flight+Car rental	Flight+Cruise	Flight+Hotel	Hotel	Hotel+Car rental	Nature tour	Rock climbing	Grand Total
Air Miles	461	4120	44686	26949	20223	59595	19719	12549	4880	1871	1006	196059
Amex	1417	7241	110010	45842	49897	160902	61468	27434	24081	2754	2271	493317
Cash		1579	20989	10427	9119	20637	7869	5717	8372	295	420	85424
Diner's Card	380	3383	16915	28750	15013	29753	19757	11146	19554	1096	451	146198
Mastercard	2129	13221	221052	99741	74842	268184	86179	41962	54944	6182	3011	871447
Visa	2699	12862	166480	87117	76498	235494	83441	53963	57998	5899	3142	785593
Grand Total	7086	42406	580132	298826	245592	774565	278433	152771	169829	18097	10301	2578038

Figure 3-9: Row and column fields are reversed

- In Figure 3-10, only one field displays (Amount Paid).



Sum of Amount Paid
2578038

Figure 3-10: One field displays in the pivot table

Filtering Pivot Table Data

You can specify a field by which to filter data in a pivot table by simply dragging the field into the Filters area in the bottom part of the PivotTable Fields task pane. For example, if you dragged Customer No. into the Filters area, the pivot table would look like Figure 3-11.

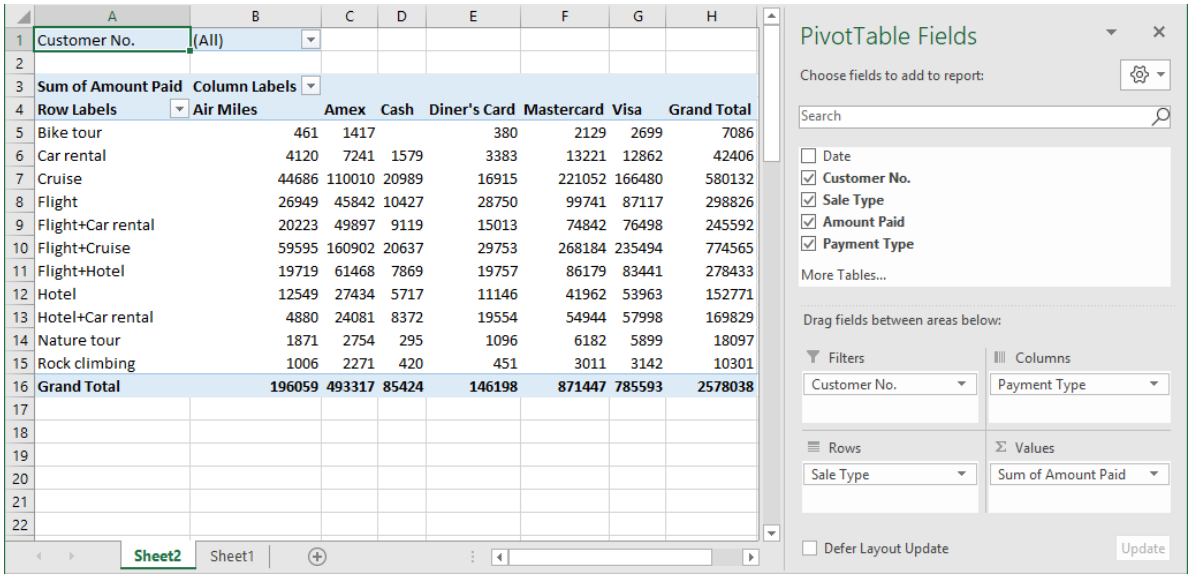


Figure 3-11: Filtering pivot table data

Notice that the Customer No. check box is now selected in the top part of the PivotTable Fields task pane, and a Custom No. drop-down field appears above the pivot table. You can click the drop-down arrow at the right of the Customer No. field and select a customer to display pivot table data for only that customer (Figure 3-12).

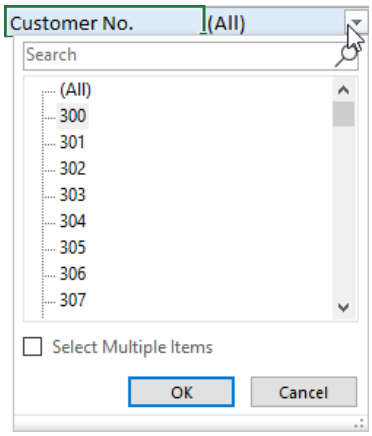


Figure 3-12: Customer No. field drop-down list

For example, selecting 300 in the Customer No. list and clicking OK would display only the data for customer #300 (Figure 3-13).

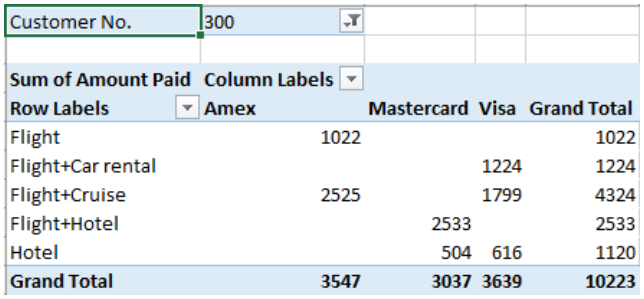


Figure 3-13: Filtered pivot table showing only customer #300

To remove the filter field, click the drop-down arrow for the field in the Filters area of the PivotTable Fields task pane, and then click Remove Field (Figure 3-14).

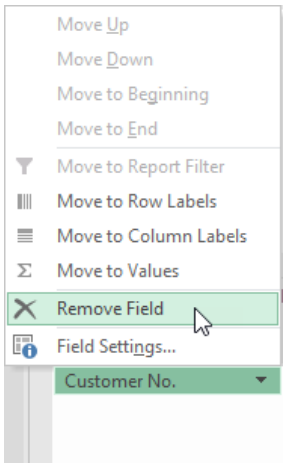


Figure 3-14: Remove Field option

The field will be removed from the Filters area and will be deselected in the field list at the top of the PivotTable Fields task pane.

As you can see, pivot tables completely change the way you analyze data—almost to the point of making it fun! You can change the way data is filtered, grouped, and/or summed in a matter of seconds, even though the volume of data may be very large.

Learn to manipulate a pivot table

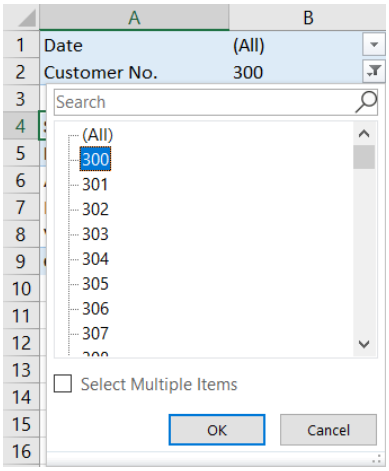
In this exercise, you will manipulate a pivot table by moving fields around and apply the PivotTable AutoFilter.

1. Open **Sales Pivot Table Customizing.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Pivot Table Customizing.xlsx** in the *MyProjects* folder.
2. In the pivot table, click the **Column Labels** AutoFilter button, and click **Clear Filter From "Payment Type"**.
3. In the PivotTable Fields task pane, click and drag the **Payment Type** field from the *Columns* area to the *Rows* area.
4. Drag the **Sale Type** field from the *Rows* area to the *Columns* area.
5. In the PivotTable Fields task pane, select the check boxes for the **Date** and **Customer No.** fields to turn them on.
6. Drag the **Date** and the **Customer No.** fields to the *Filters* area.

   When you activated these two fields in the pivot table, Excel made a guess at how you wanted them added: the Customer No. field contains numeric data so it was put into the Values area, and the Date field was put into the Rows area. Because the Date field contains date data, Excel also created a new Month field and added it to the Rows area as well. You will remove both of these fields.
7. Click the down arrow button to the right of the **Months** item in the *Rows* area and click **Remove Field**.
8. If the **Sum of Customer No.** item appears in the *Values* area, click the down arrow button and click **Remove Field**.

Hint: You could have avoided the need to remove these fields if you had dragged them directly into the Filters area at step 6, instead of simply activating them.

9. In the pivot table, click the drop-down arrow at the far right of the **Customer No.** field, and then select customer **300**.



10. Click **OK**.

    The pivot table shows only the data for customer 300:

	A	B	C	D	E	F	G
1	Date	(All)					
2	Customer No.	300					
3							
4	**Sum of Amount Paid**	**Column Labels**					
5	**Row Labels**	**Flight**	**Flight+Car rental**	**Flight+Cruise**	**Flight+Hotel**	**Hotel**	**Grand Total**
6	Amex	1,022		2,525			3,547
7	Mastercard				2,533	504	3,037
8	Visa		1,224	1,799		616	3,639
9	**Grand Total**	**1,022**	**1,224**	**4,324**	**2,533**	**1,120**	**10,223**

11. In the pivot table, click the drop-down arrow at the far right of the **Customer No.** field, select **(All)**, and click **OK**.

12. Click the drop-down arrow at the far right of the **Date** field, scroll down and select **1-Apr**, and then click **OK**.

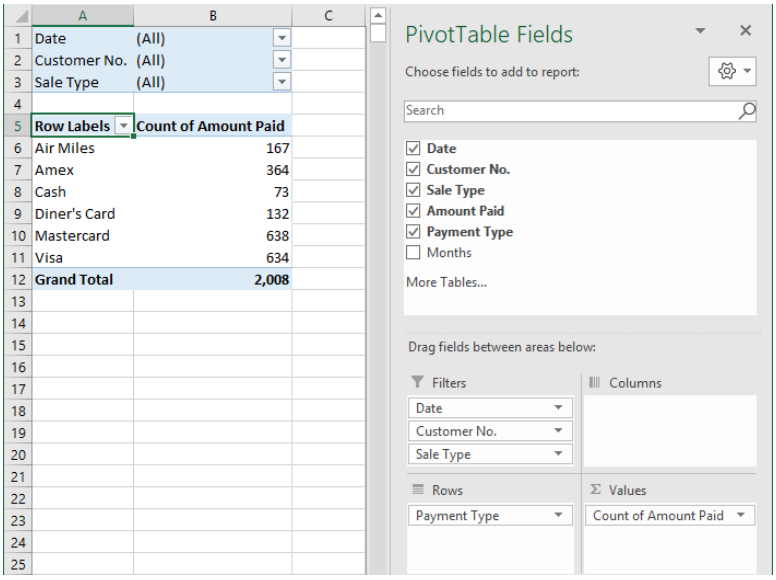
13. In the pivot table, click the drop-down arrow at the far right of the **Date** field, select **(All)**, and click **OK**.

14. In the PivotTable Fields task pane, drag the **Sale Type** field from the *Columns* area to the *Filters* area.

15. In the PivotTable Fields task pane, click the **Sum of Amount Paid** drop-down arrow in the *Values* area and click **Value Field Settings**.

16. Select **Count** in the *Summarize value field by* list and click **OK**.

The completed PivotTable should look similar to the following:



17. Save and close the workbook.

Using Data Slicers with a Pivot Table

Objective 4.2.3

Filters are an integral part of pivot tables. However, it is not always apparent what the active filter criteria are. You can use ***data slicers*** (or simply, "slicers") on pivot tables to help you easily determine which filter conditions are currently active.

To insert slicers, on the PivotTable Tools Design tab, in the Filter group, click Insert Slicer to open the Insert Slicers dialog box (Figure 3-15).

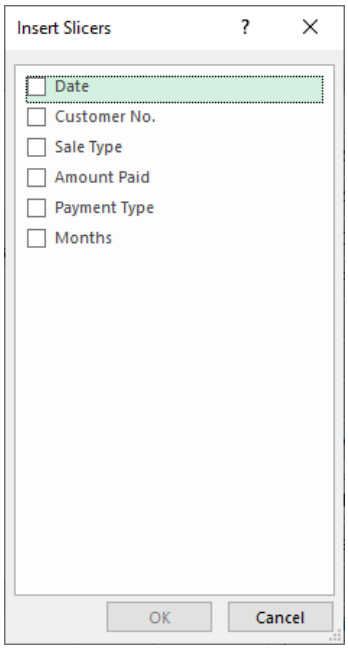
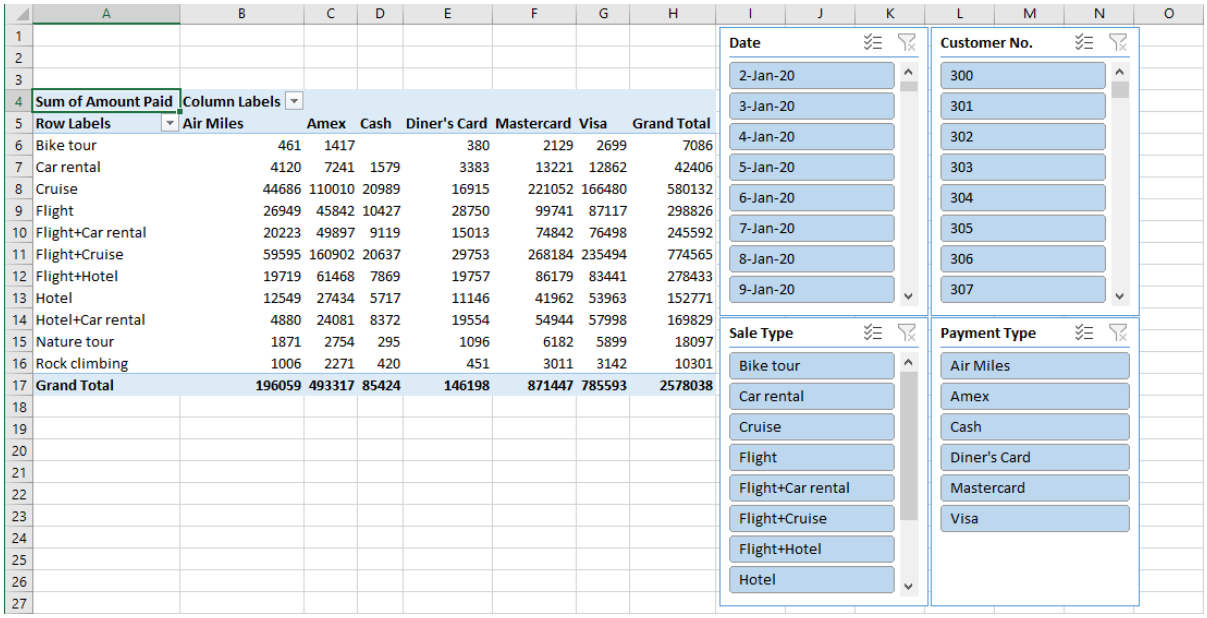


Figure 3-15: Insert Slicers dialog box

In the Insert Slicers dialog box, you can select check boxes to indicate the slicers you want to create. After you click OK, the slicers will appear on the worksheet but overlap each other. You can move the slicers to different areas of the worksheet to see them in their entirety. For example, if you select Date, Customer No., Sale Type, and Payment Type, and then move the slicers so they no longer overlap, your worksheet would look similar to Figure 3-16.



Sum of Amount Paid	Column Labels						
Row Labels	Air Miles	Amex	Cash	Diner's Card	Mastercard	Visa	Grand Total
Bike tour	461	1417		380	2129	2699	7086
Car rental	4120	7241	1579	3383	13221	12862	42406
Cruise	44686	110010	20989	16915	221052	166480	580132
Flight	26949	45842	10427	28750	99741	87117	298826
Flight+Car rental	20223	49897	9119	15013	74842	76498	245592
Flight+Cruise	59595	160902	20637	29753	268184	235494	774565
Flight+Hotel	19719	61468	7869	19757	86179	83441	278433
Hotel	12549	27434	5717	11146	41962	53963	152771
Hotel+Car rental	4880	24081	8372	19554	54944	57998	169829
Nature tour	1871	2754	295	1096	6182	5899	18097
Rock climbing	1006	2271	420	451	3011	3142	10301
Grand Total	196059	493317	85424	146198	871447	785593	2578038

Figure 3-16: Slicers rearranged to display entire worksheet

You can click individual items within the slicers to filter the data that will display in the pivot table according to your selections. You can press and hold the CTRL key to select (or deselect) multiple items.

To clear the filter (that is, to re-select all the values in a slicer), simply click the Clear Filter button in the upper-right corner of the slicer.

To remove a slicer, simply select it and press DELETE.

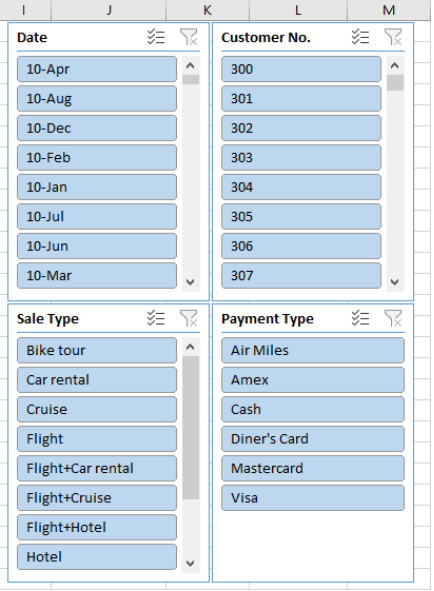
Learn to activate slicers for a pivot table

In this exercise, you will activate slicers for a pivot table and use them to apply filters.

1. Open **Sales Pivot Table Slicers.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Pivot Table Slicers.xlsx** in the *MyProjects* folder.
2. Select any cell inside the pivot table to activate the PivotTable Tools tabs in the Ribbon.
3. In the PivotTable Fields task pane, drag the **Payment Type** field from the *Rows* area to the *Columns* area.
4. Drag the **Sale Type** field from the *Filters* area to the *Rows* area.
5. Click the **Count of Amount Paid** drop-down arrow in the *Values* area, and click **Value Field Settings**.
6. Select **Sum** in the *Summarize value field by* list and click **OK**.
7. On the PivotTable Tools Analyze tab, in the Filter group, click **Insert Slicer**.
8. Select the check boxes for **Date**, **Customer No.**, **Sale Type**, and **Payment Type** to turn these on, and click **OK**.

9. Move the slicers to an empty area to the right of the pivot table.

	A	B	C	D	E	F	G	H
2	Date	(All)						
3	Customer No.	(All)						
5	Sum of Amount Paid	Column Labels						
6	Row Labels	Air Miles	Amex	Cash	Diner's Card	Mastercard	Visa	Grand Total
7	Bike tour	461	1,417		380	2,129	2,699	7,086
8	Car rental	4,120	7,241	1,579	3,383	13,221	12,862	42,406
9	Cruise	44,686	110,010	20,989	16,915	221,052	166,480	580,132
10	Flight	26,949	45,842	10,427	28,750	99,741	87,117	298,826
11	Flight+Car rental	20,223	49,897	9,119	15,013	74,842	76,498	245,592
12	Flight+Cruise	59,595	160,902	20,637	29,753	268,184	235,494	774,565
13	Flight+Hotel	19,719	61,468	7,869	19,757	86,179	83,441	278,433
14	Hotel	12,549	27,434	5,717	11,146	41,962	53,963	152,771
15	Hotel+Car rental	4,880	24,081	8,372	19,554	54,944	57,998	169,829
16	Nature tour	1,871	2,754	295	1,096	6,182	5,899	18,097
17	Rock climbing	1,006	2,271	420	451	3,011	3,142	10,301
18	Grand Total	196,059	493,317	85,424	146,198	871,447	785,593	2,578,038



10. Click individual buttons of your choice in any of the slicers and observe the effects on the pivot table.
11. Press and hold the **CTRL** key to select (or deselect) more than one button in a slicer.
12. Click the **Clear Filter** button in the upper-right corner of any slicer to select all the values in that slicer.
13. Save and close the workbook.

Grouping Pivot Table Data

Objective 4.2.4

A large pivot table with many rows or columns (or both) can be simplified by using the ***grouping*** feature. Date values are good candidates for grouping; they can be automatically grouped by month, quarter, or year. Right-click a date in the pivot table and click Group to open the Grouping dialog box (Figure 3-17).

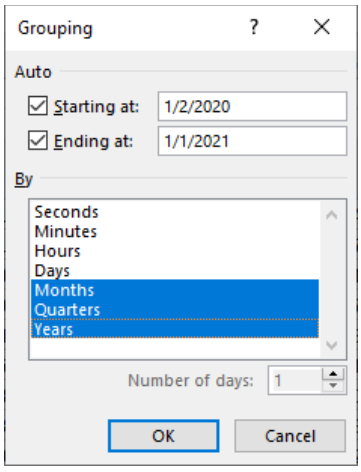


Figure 3-17: Grouping dialog box

You can use the Grouping dialog box to specify a starting and ending date, and the fields by which to group the pivot table data. The pivot table in Figure 3-18 shows rows of date values grouped by month, quarter, and year.

Sum of Amount Paid	Column Labels						
Row Labels	Air Miles	Amex	Cash	Diner's Card	Mastercard	Visa	Grand Total
2020	196059	493317	85424	146198	871447	785593	2578038
Qtr1	35756	135492	23763	37217	210027	193311	635566
Jan	8304	62621	5828	9653	73743	68400	228549
Feb	14628	39881	11086	15813	55310	67737	204455
Mar	12824	32990	6849	11751	80974	57174	202562
Qtr2	55868	118979	22422	30526	203817	200500	632112
Apr	23334	16369	11430	6772	65879	60782	184566
May	10808	49884	2912	9016	81105	74580	228305
Jun	21726	52726	8080	14738	56833	65138	219241
Qtr3	79352	112630	23694	51567	247475	180805	695523
Jul	21573	38248	5657	16529	120166	59034	261207
Aug	43878	36363	4876	17129	90950	59534	252730
Sep	13901	38019	13161	17909	36359	62237	181586
Qtr4	25083	126216	15545	26888	210128	210977	614837
Oct	16150	38768	5283	13196	48929	79714	202040
Nov	3651	52755	4324	4864	78077	67402	211073
Dec	5282	34693	5938	8828	83122	63861	201724
Grand Total	196059	493317	85424	146198	871447	785593	2578038

Figure 3-18: Pivot table showing grouped date values

You can click the Collapse (-) button if you want to see only the summary values for a group. Conversely, if a group or groups are collapsed, you can click the Expand (+) button to display the detail for that group.

You can also right-click any date and click Expand/Collapse for additional expand and collapse options (Figure 3-19).

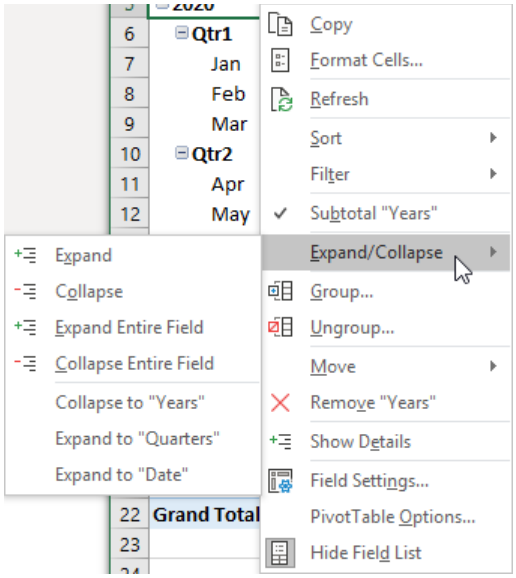


Figure 3-19: Expand/Collapse options

Expand	Click to display the details for the current item; analogous to clicking the Expand (+) button.
Collapse	Click to hide the details for the current item; analogous to clicking the Collapse (-) button.

Expand Entire Field	Click to display the details for all items in a field.
Collapse Entire Field	Click to hide the details for all items in a field.
Expand to "<field name>"	Click to display a level of detail beyond the next level.
Collapse to "<field name>"	Click to hide a level of detail beyond the next level.

To remove the grouping from the pivot table, right-click any date value, and click Ungroup.

To ensure that summary totals will appear automatically, you can right-click any of the row labels that should contain totals (for example, quarter or year), and then click Field Setting to open the Field Settings dialog box (Figure 3-20). Click Automatic in the Subtotals section and click OK.

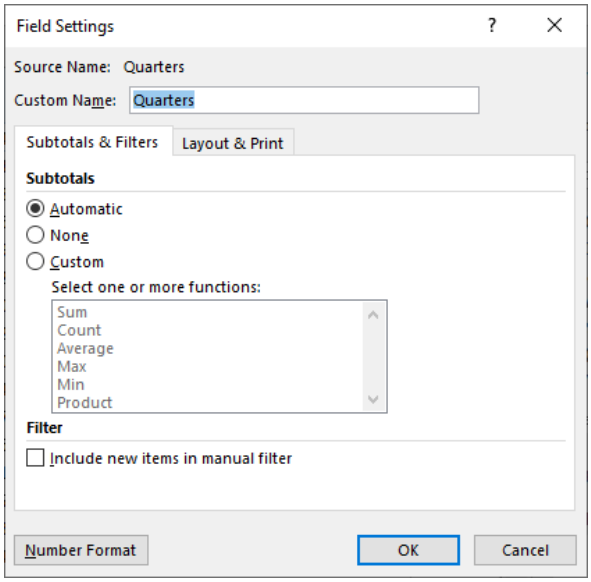


Figure 3-20: Field Settings dialog box

Manually Grouping Pivot Table Data

You can also manually create groups by selecting the rows or columns to include in each group. Suppose you have the pivot table shown in Figure 3-21 in your worksheet.

	A	B	C	D	E	F	G	H
1								
2	Date	(All)						
3	Customer No.	(All)						
4								
5	**Sum of Amount Paid**	**Column Labels**						
6	**Row Labels**	**Air Miles**	**Amex**	**Cash**	**Diner's Card**	**Mastercard**	**Visa**	**Grand Total**
7	Bike tour	461	1,417		380	2,129	2,699	7,086
8	Car rental	4,120	7,241	1,579	3,383	13,221	12,862	42,406
9	Cruise	44,686	110,010	20,989	16,915	221,052	166,480	580,132
10	Flight	26,949	45,842	10,427	28,750	99,741	87,117	298,826
11	Flight+Car rental	20,223	49,897	9,119	15,013	74,842	76,498	245,592
12	Flight+Cruise	59,595	160,902	20,637	29,753	268,184	235,494	774,565
13	Flight+Hotel	19,719	61,468	7,869	19,757	86,179	83,441	278,433
14	Hotel	12,549	27,434	5,717	11,146	41,962	53,963	152,771
15	Hotel+Car rental	4,880	24,081	8,372	19,554	54,944	57,998	169,829
16	Nature tour	1,871	2,754	295	1,096	6,182	5,899	18,097
17	Rock climbing	1,006	2,271	420	451	3,011	3,142	10,301
18	**Grand Total**	**196,059**	**493,317**	**85,424**	**146,198**	**871,447**	**785,593**	**2,578,038**

Figure 3-21: Sample pivot table

You can create two groups called Single Booking and Multiple Booking that contain row data appropriate for each booking type.

For example, to create the Single Booking group, press and hold CTRL, select Bike tour, Car rental, Cruise, Flight, Hotel, Nature tour, and Rock climbing, release CTRL, right-click any of the selected row values, and click Group. A group called Group1 will be created containing the rows you selected. In the Formula Bar, change the name of Group1 to a meaningful name, such as Single Booking.

If you perform the same steps using the remaining row values to create the Multiple Booking group, the pivot table should appear similar to Figure 3-22.

	A	B	C	D	E	F	G	H
1								
2	Date	(All)						
3	Customer No.	(All)						
4								
5	**Sum of Amount Paid**	**Column Labels**						
6	**Row Labels**	**Air Miles**	**Amex**	**Cash**	**Diner's Card**	**Mastercard**	**Visa**	**Grand Total**
7	**Single Booking**	**91,642**	**196,969**	**39,427**	**62,121**	**387,298**	**332,162**	**1,109,619**
8	Bike tour	461	1,417		380	2,129	2,699	7,086
9	Car rental	4,120	7,241	1,579	3,383	13,221	12,862	42,406
10	Cruise	44,686	110,010	20,989	16,915	221,052	166,480	580,132
11	Flight	26,949	45,842	10,427	28,750	99,741	87,117	298,826
12	Hotel	12,549	27,434	5,717	11,146	41,962	53,963	152,771
13	Nature tour	1,871	2,754	295	1,096	6,182	5,899	18,097
14	Rock climbing	1,006	2,271	420	451	3,011	3,142	10,301
15	**Multiple Booking**	**104,417**	**296,348**	**45,997**	**84,077**	**484,149**	**453,431**	**1,468,419**
16	Flight+Car rental	20,223	49,897	9,119	15,013	74,842	76,498	245,592
17	Flight+Cruise	59,595	160,902	20,637	29,753	268,184	235,494	774,565
18	Flight+Hotel	19,719	61,468	7,869	19,757	86,179	83,441	278,433
19	Hotel+Car rental	4,880	24,081	8,372	19,554	54,944	57,998	169,829
20	**Grand Total**	**196,059**	**493,317**	**85,424**	**146,198**	**871,447**	**785,593**	**2,578,038**

Figure 3-22: Sample pivot table – Single Booking group and Multiple Booking group

Learn to group data in a pivot table

In this exercise, you will group data in a pivot table.

1. Open **Sales Pivot Table Grouping.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Pivot Table Grouping.xlsx** in the *MyProjects* folder.
2. Select a cell within the cell range **A1:E2009**. On the Insert tab, in the Tables group, click **PivotTable** and click **OK** to create a pivot table in a new worksheet.
3. Select the **Date**, **Amount Paid**, and **Payment Type** check boxes.
4. In the PivotTable Fields task pane, drag the **Payment Type** field from the *Rows* area to the *Columns* area.

   Notice that the date rows are already grouped by month.

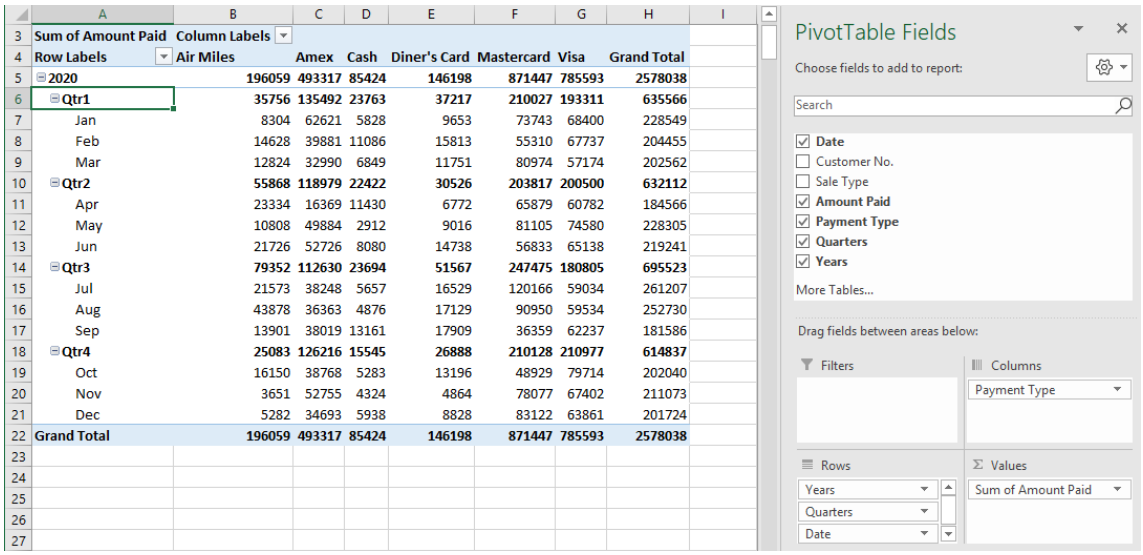
Sum of Amount Paid	Column Labels						
Row Labels	Air Miles	Amex	Cash	Diner's Card	Mastercard	Visa	Grand Total
Jan	8304	62621	5828	9653	73743	68400	228549
Feb	14628	39881	11086	15813	55310	67737	204455
Mar	12824	32990	6849	11751	80974	57174	202562
Apr	23334	16369	11430	6772	65879	60782	184566
May	10808	49884	2912	9016	81105	74580	228305
Jun	21726	52726	8080	14738	56833	65138	219241
Jul	21573	38248	5657	16529	120166	59034	261207
Aug	43878	36363	4876	17129	90950	59534	252730
Sep	13901	38019	13161	17909	36359	62237	181586
Oct	16150	38768	5283	13196	48929	79714	202040
Nov	3651	52755	4324	4864	78077	67402	211073
Dec	5282	34693	5938	8828	83122	63861	201724
Grand Total	196059	493317	85424	146198	871447	785593	2578038

The Months option is already selected for you. You will add the Years selection as well.

5. Right-click any date value in the pivot table, and click **Group**.
6. Click the **Years** option, then click **OK**.

   The date rows are now grouped by both year and month. You can expand and collapse the groups to see the rows at different levels of detail.

7. Click the **Collapse** (-) button for the months of **Jan** and **Feb**.
8. Click the **Expand** (+) button for the month of **Feb**.
9. Right-click any month in column A, click **Expand/Collapse**, then click **Collapse Entire Field**.
10. Right-click any date value in the pivot table, and click **Ungroup**.
11. Right-click any date value in the pivot table, and click **Group**. With the **Months** option selected, click the **Quarters** and **Years** options so that all three are selected. Click **OK**.



Notice that the lowest level of data is now at the month level, even though the Task Pane shows Date in the Rows area. Also notice two new items in the Rows area: Years and Quarters.

12. Select the **Sheet2** tab.

13. Press and hold the **CTRL** key, then click each of the following row labels:
    Bike tour
    Car rental
    Cruise
    Flight
    Hotel
    Nature tour
    Rock climbing
14. Release the **CTRL** key, right-click any of the selected row values, and then click **Group**.
15. Select the **Flight+Car** rental label, press and hold the **CTRL** key, then click on each of the following row labels:
    Flight+Cruise
    Flight+Hotel
    Hotel+Car rental
16. Release the **CTRL** key, right-click any of the selected row values, and then click **Group**.
17. Select cell **A7** (containing the label Group1), select the text **Group1** in the Formula Bar and enter: **Single Booking**.
18. Select cell **A15** (containing the label Group2), select the text **Group2** in the Formula Bar and enter: **Multiple Booking**.

    The screen should look similar to the following:

	A	B	C	D	E	F	G	H
1								
2	Date	(All)						
3	Customer No.	(All)						
4								
5	Sum of Amount Paid	Column Labels						
6	Row Labels	Air Miles	Amex	Cash	Diner's Card	Mastercard	Visa	Grand Total
7	**Single Booking**	**91,642**	**196,969**	**39,427**	**62,121**	**387,298**	**332,162**	**1,109,619**
8	Bike tour	461	1,417		380	2,129	2,699	7,086
9	Car rental	4,120	7,241	1,579	3,383	13,221	12,862	42,406
10	Cruise	44,686	110,010	20,989	16,915	221,052	166,480	580,132
11	Flight	26,949	45,842	10,427	28,750	99,741	87,117	298,826
12	Hotel	12,549	27,434	5,717	11,146	41,962	53,963	152,771
13	Nature tour	1,871	2,754	295	1,096	6,182	5,899	18,097
14	Rock climbing	1,006	2,271	420	451	3,011	3,142	10,301
15	**Multiple Booking**	**104,417**	**296,348**	**45,997**	**84,077**	**484,149**	**453,431**	**1,468,419**
16	Flight+Car rental	20,223	49,897	9,119	15,013	74,842	76,498	245,592
17	Flight+Cruise	59,595	160,902	20,637	29,753	268,184	235,494	774,565
18	Flight+Hotel	19,719	61,468	7,869	19,757	86,179	83,441	278,433
19	Hotel+Car rental	4,880	24,081	8,372	19,554	54,944	57,998	169,829
20	**Grand Total**	**196,059**	**493,317**	**85,424**	**146,198**	**871,447**	**785,593**	**2,578,038**

19. Save and close the workbook.

Adding Calculated Fields and Items

Objective 4.2.5

You can use formulas to create ***calculated fields*** for your pivot table. These calculated fields are very useful for creating new data that is meaningful, such as percent failure rate or sales rep commissions. However, there are several limitations to these fields:

- You cannot refer to worksheet cells outside of the pivot table by address or by name. For example, =J3 will not be accepted as a valid formula because it refers to a cell in the worksheet.
- You cannot use functions that use cell references outside of the pivot table. For example, =SUM(M3:M10) will not be accepted as a valid formula.
- Pivot table labels used in formulas must use single quotes if the labels contain a blank space. For example, ='Amount Paid' * 0.05
- You cannot refer to the pivot table totals or subtotals.
- Calculated fields are not available in an Online Analytical Processing or OLAP-based pivot table.

Because of these limitations, calculated fields are usually simple formulas that use math operators such as add (+), subtract (-), multiply (*), and divide (/). You can also use any function that allows references to pivot table labels, such as =SUM(Item1,Item2,Item3) or =IF(Amount>20,Amount*0.05,0).

To insert a calculated field, on the PivotTable Tools Analyze tab, in the Calculations group, click Fields, Items, & Sets, and then click Calculated Field. The Insert Calculated Field dialog box (Figure 3-23) will open, in which you can specify the name and formula of a field for which you want to calculate values based on the current fields in the pivot table.

For example, a new calculated field called Commissions can be calculated by multiplying the existing field Amount Paid by 12%, as shown in Figure 3-23.

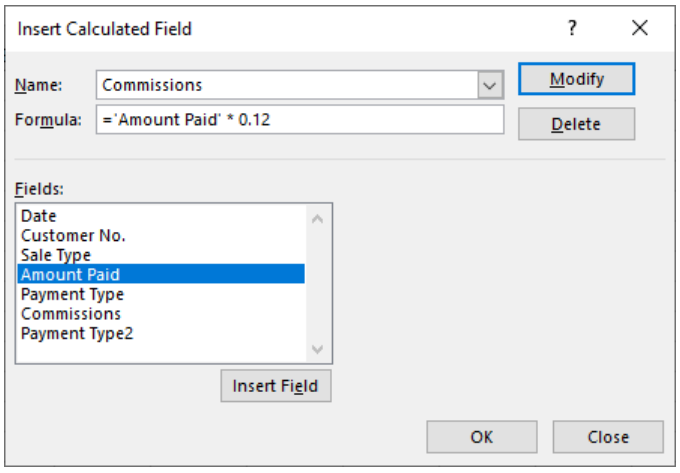


Figure 3-23: Insert Calculated Field dialog box – Commissions calculated field

Calculated items are similar to calculated fields in pivot tables, but are used for distinctly different purposes, which will be explained shortly. To insert a calculated item, on the PivotTable Tools Analyze tab, in the Calculations group, click Fields, Items, & Sets, and then click Calculated Item. The Insert Calculated Item dialog box will open, in which you can specify the name and formula of an item for which you want to calculate values based on the current items in the pivot table.

For example, a new calculated item called Regular Card can be calculated by multiplying the sum of three items (Air Miles, Mastercard, and Visa) by 2.5%, as shown in Figure 3-24.

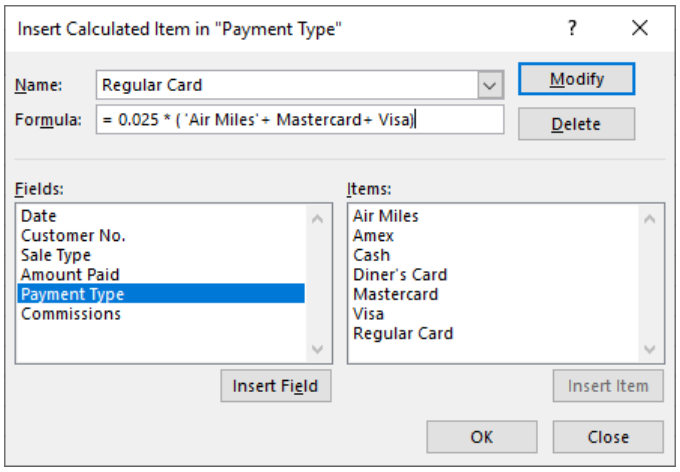


Figure 3-24: Insert Calculated Item in "Payment Type" dialog box – Regular Card new calculated item

A second new calculated item called Premium Card can be calculated by multiplying the sum of two items (Amex and Diner's Card) by 3.0%, as shown in Figure 3-25.

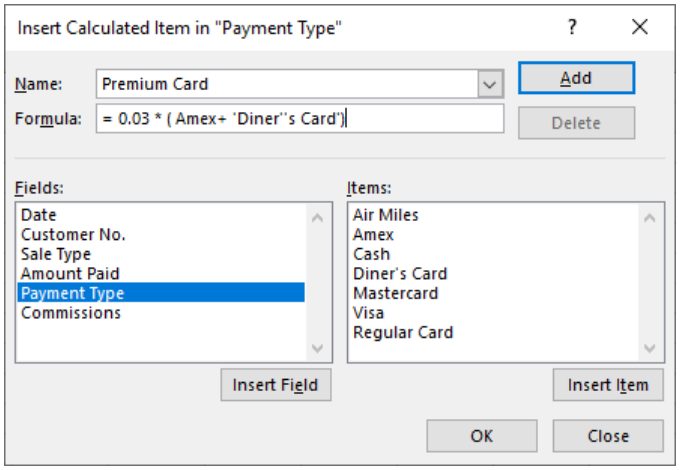


Figure 3-25: Insert Calculated Item in "Payment Type" dialog box – Premium Card new calculated item

Figure 3-26 shows how the new calculated field and the two new calculated items will appear in the pivot table.

	A	B	C
1			
2			
3	**Row Labels**	**Sum of Amount Paid**	**Sum of Commissions**
4	**Group1**	**2578038**	**309,364.56**
5	Air Miles	196059	23,527.08
6	Amex	493317	59,198.04
7	Cash	85424	10,250.88
8	Diner's Card	146198	17,543.76
9	Mastercard	871447	104,573.64
10	Visa	785593	94,271.16
11	**Group2**	**65512.925**	**7,861.55**
12	Regular Card	46327.475	5,559.30
13	Premium Card	19185.45	2,302.25
14	**Grand Total**	**2643550.925**	**317,226.11**

Figure 3-26: Calculated field and two new calculated items in pivot table

One way of describing the differences between calculated fields and calculated items is illustrated by the pivot table example in the previous figure. The Sum of Commissions column is a calculated field based on each row (credit card type). This pivot table also has two calculated items added: Regular Card and Premium Card. Each of these new rows is calculated as a formula based on rows 5 to 10. Therefore, a calculated field appears as a new column, but a calculated item shows as a new row, or vice versa.

This example also demonstrates that a calculated field appears as a separate column from the original data, and therefore does not affect the original data. A calculated item appears as another row, together with the original data rows. A calculated item can be described as a virtual item (row or column). Because it now behaves like one of the original data items, its value is added to summary totals, can be filtered, and can be included in a group. In the previous example, the two calculated items are grouped separately from the original data to help users distinguish between the two.

Keep in mind that you must remove any groups from all pivot tables that were created from the same data before you can create calculated items. After you have created the calculated items, you can group the data again.

Learn to create a calculated field and items in a pivot table

In this exercise, you will create a calculated field and calculated items in a pivot table.

1. Open **Sales Pivot Table Calculated Fields.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Pivot Table Calculated Fields.xlsx** in the *MyProjects* folder.
2. Select a cell within the cell range **A1:E2009**. On the Insert tab, in the Tables group, click **PivotTable** and click **OK** to create a pivot table in a new worksheet.
3. Select the **Amount Paid** and **Payment Type** check boxes.
4. On the PivotTable Tools Analyze tab, in the Calculations group, click **Fields, Items, & Sets**, then click **Calculated Field**.
5. With the default name in the *Name* field highlighted, type: **Commissions**.
6. In the Fields list box, click **Amount Paid**, and then click **Insert Field**.
7. With the cursor now in the *Formula* field, type: *** 0.12** and click **OK**.

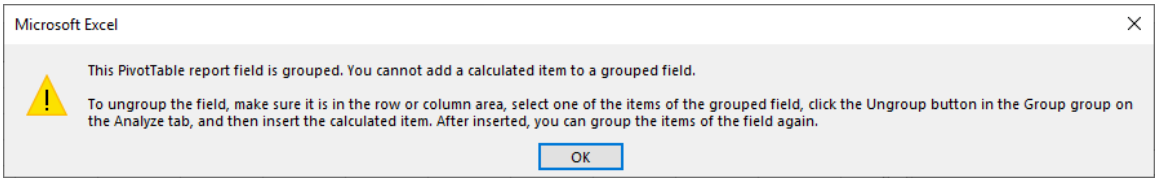
   The pivot table should appear similar to the following:

	A	B	C
1			
2			
3	**Row Labels**	**Sum of Amount Paid**	**Sum of Commissions**
4	Air Miles	196059	23,527.08
5	Amex	493317	59,198.04
6	Cash	85424	10,250.88
7	Diner's Card	146198	17,543.76
8	Mastercard	871447	104,573.64
9	Visa	785593	94,271.16
10	**Grand Total**	**2578038**	**309,364.56**

8. Select **Sheet1** and insert a new pivot table that includes the **Amount Paid** and **Payment Type** fields.
9. Select any cell in the range **A4:A9**.

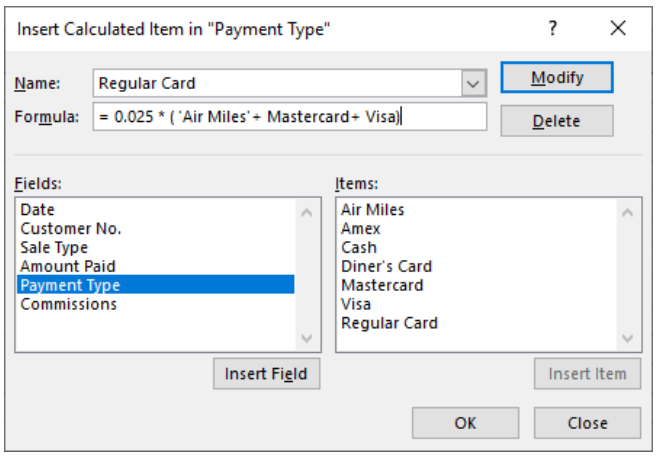
10. On the PivotTable Tools Analyze tab, in the Calculations group, click **Fields, Items, & Sets**, and then click **Calculated Item**.

    A warning message displays:



Note: Notice also that the PivotTable Fields task pane has additional fields that were not present originally, such as Quarters and Sale Type2.

11. Click **OK** to close the message.
12. Click the **Sheet2** worksheet tab.
13. Right-click the group label in cell **A15**, then click **Ungroup**.
14. Right-click the group label in cell **A7**, then click **Ungroup**.
15. Click the **Sheet3** worksheet tab. Right-click the group label in cell **A5**, then click **Ungroup**.
16. Select the **Sheet5** worksheet tab, then on the PivotTable Tools Analyze tab, in the Calculations group, click **Fields, Items, & Sets** and click **Calculated Item**.
17. In the *Name* field, type: **Regular Card** and press **TAB**.
18. In the *Formula* field, type: = **0.025 * (**
19. Click **Air Miles** in the *Items* list box and click **Insert Item**.
20. With the cursor in the *Formula* field, type: +
21. Click **Mastercard** in the *Items* list box and click **Insert Item**.
22. With the cursor in the *Formula* field, type: +
23. Click **Visa** in the *Items* list box and click **Insert Item**.
24. With the cursor in the *Formula* field, type: **)**



25. Click **OK**.
26. On the Analyze tab, in the Calculations group, click **Fields, Items, & Sets** then click **Calculated Item**.

27. In the *Name* field, type: **Premium Card** and press **TAB**.
28. In the *Formula* field, type: = **0.03 * (**
29. Click **Amex** in the *Items* list box and click **Insert Item**.
30. With the cursor in the *Formula* field, type: +
31. Click **Diner's Card** in the *Items* list box and click **Insert Item**.
32. With the cursor in the *Formula* field, type: **)** and click **OK**.

    The new calculated items display in the pivot table.

	A	B
1		
2		
3	**Row Labels**	**Sum of Amount Paid**
4	Air Miles	196059
5	Amex	493317
6	Cash	85424
7	Diner's Card	146198
8	Mastercard	871447
9	Visa	785593
10	Regular Card	46327.475
11	Premium Card	19185.45
12	**Grand Total**	**2643550.925**

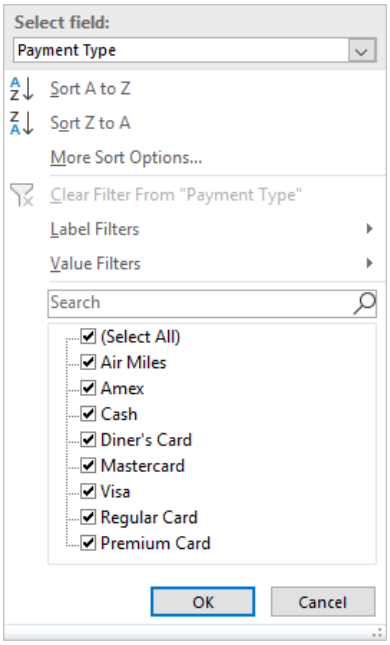
33. Click cell **A4** (Air Miles), press and hold the **SHIFT** key, and then click cell **A9** (Visa). Release the **SHIFT** key.
34. Right-click any of the selected row values, and click **Group**.
35. Select the **Regular Card** label, press and hold the **CTRL** key, then click the **Premium Card** label.
36. Release the **CTRL** key, right-click any of the selected row values, and then click **Group**.
37. Select cell **A4** (containing the label Group1) and enter: **Sales**
38. Select cell **A11** (containing the label Group2) and enter: **Credit Card Fees**

    The worksheet should look similar to the following:

	A	B
1		
2		
3	**Row Labels**	**Sum of Amount Paid**
4	**Sales**	**2578038**
5	Air Miles	196059
6	Amex	493317
7	Cash	85424
8	Diner's Card	146198
9	Mastercard	871447
10	Visa	785593
11	**Credit Card Fees**	**65512.925**
12	Regular Card	46327.475
13	Premium Card	19185.45
14	**Grand Total**	**2643550.925**

39. In the *Row Labels* field (click the **Row Labels** drop-down arrow), ensure that **Payment Type** is selected.

    Notice that each of the original credit card types and the two calculated items appear in the filter list at the bottom.



40. Click **Cancel**, then click the **Sheet4** worksheet tab.

    Notice that this pivot table created earlier with a calculated field now also has the calculated items. All rows are also grouped in this pivot table, but the group names have not changed from their defaults.

41. Save and close the workbook.

Working with Pivot Charts

Creating a Pivot Chart

Objective 4.3.1

The data displayed in a pivot table can be represented in a chart, which is referred to as a ***pivot chart***. Despite its special name, it is really nothing more than a regular chart that is tied to a pivot table.

To insert a pivot chart, on the Insert tab, in the Charts group, click PivotChart. The Create PivotChart dialog box opens in which you select the data you want to chart and specify whether to put the pivot chart on the current worksheet or on a new one (Figure 3-27).

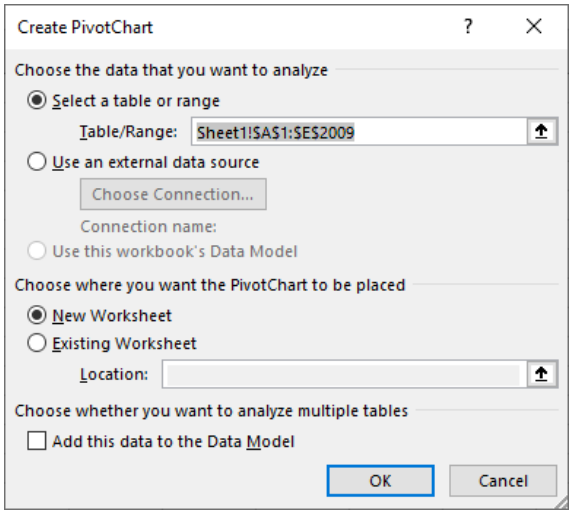


Figure 3-27: Create PivotChart dialog box

Once you specify the pivot chart data and location and click OK, the PivotChart Fields task pane (Figure 3-28) opens, which controls the structure of the pivot chart—it works in the same manner as the PivotTable Fields task pane.

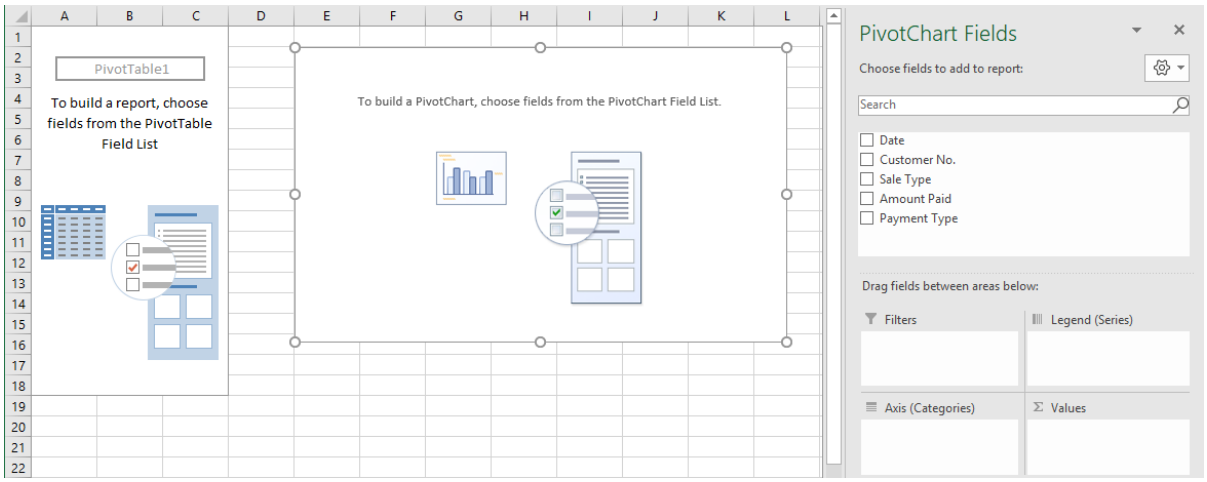


Figure 3-28: PivotChart Fields task pane

Filters	Select (or filter) rows of data from the source data that appear in the pivot chart.
Legend (Series)	Display fields in this area as chart legend labels.
Axis (Categories)	Display fields in this area as labels along the x-axis (horizontal axis) of the chart.
Values	Display data points for these fields along the y-axis (vertical axis) of the chart.

Once you select fields to display in the pivot chart, the chart will appear in the worksheet. Because Excel links a pivot chart to a pivot table, the pivot table is created on the worksheet at the same time as the pivot chart, as shown in Figure 3-29.

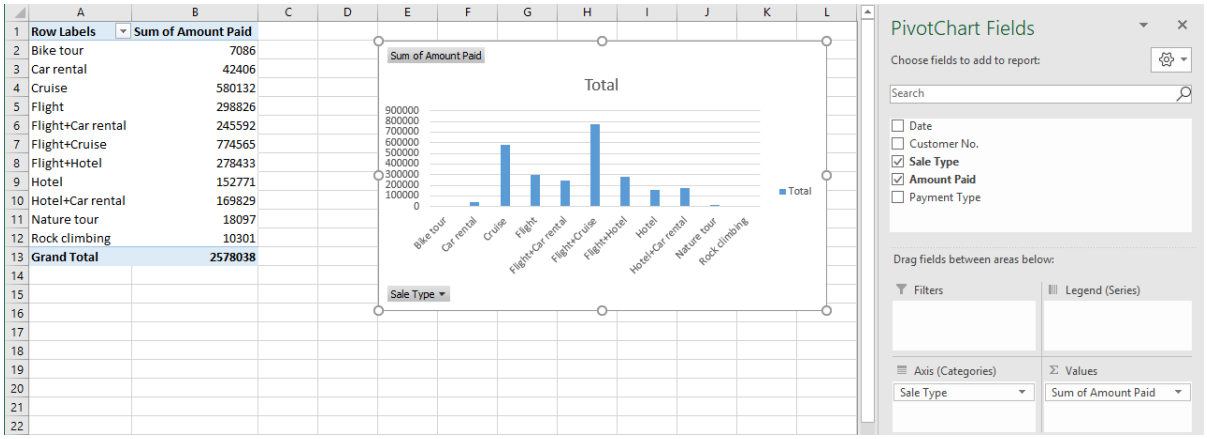


Figure 3-29: Pivot table and pivot chart

You can also create a pivot chart directly from a pivot table by selecting a cell in the pivot table, and then in the PivotTable Tools Analyze tab, in the Tools group, clicking PivotChart. Select the type of chart you want to create and click OK.

You can also use the PivotChart button in the Charts group of the Insert tab to create a standalone pivot chart or a pivot chart with an associated pivot table (Figure 3-30).

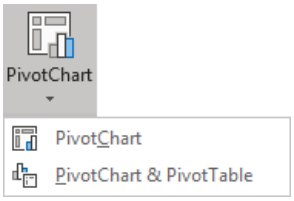


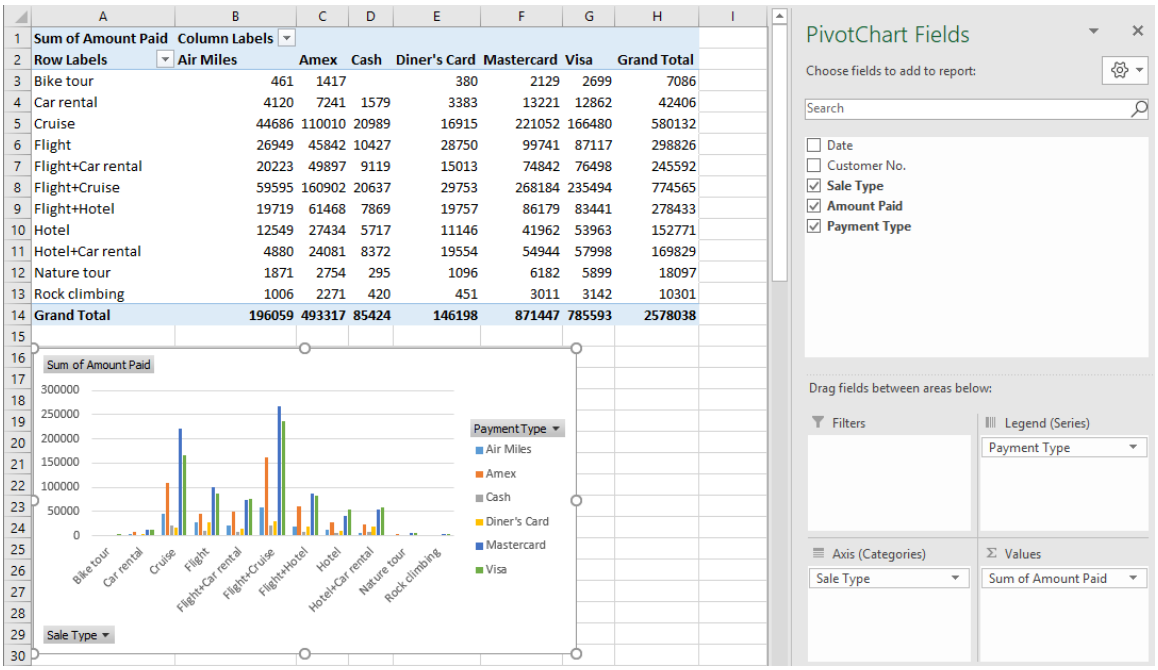
Figure 3-30: PivotChart button

Learn to create three pivot charts

In this exercise, you will create three pivot charts; one from an existing pivot table, and two more from the source data.

1. Open **Sales Pivot Chart.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Pivot Chart.xlsx** in the *MyProjects* folder.
2. Select any cell in the cell range **A1:E2009**.
3. On the Insert tab, in the Charts group, click **PivotChart**.
4. Verify that the correct cell range (A1:E2009) has been selected and that the pivot chart will be placed in a new worksheet, then click **OK**.
5. In the PivotChart Fields pane, select the **Sale Type** and **Amount Paid** check boxes to turn them on.

   Notice that Excel links a pivot chart to a pivot table; therefore, as you define your pivot chart, the pivot table is created on the worksheet at the same time.
6. Select the **Payment Type** check box to turn it on, then drag the **Payment Type** field from the *Axis (Categories)* area to the *Legend (Series)* area.
7. Drag the pivot chart to the blank area below the pivot table.



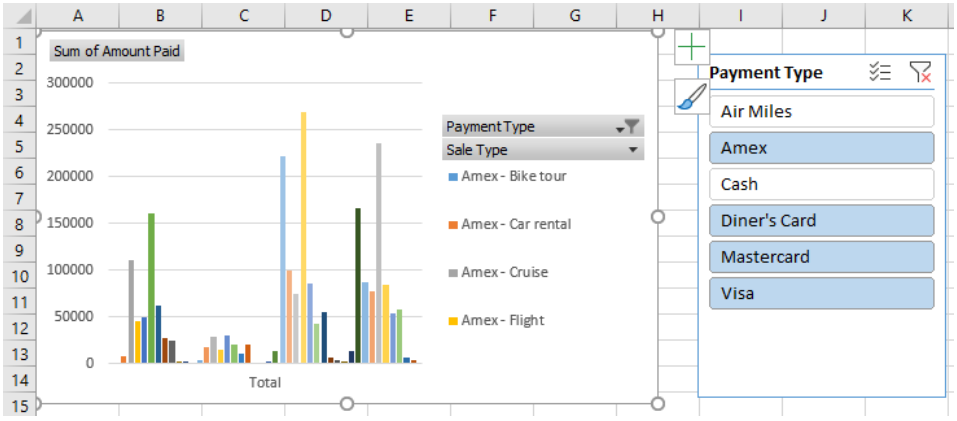
Sum of Amount Paid	Column Labels						
Row Labels	Air Miles	Amex	Cash	Diner's Card	Mastercard	Visa	Grand Total
Bike tour	461	1417		380	2129	2699	7086
Car rental	4120	7241	1579	3383	13221	12862	42406
Cruise	44686	110010	20989	16915	221052	166480	580132
Flight	26949	45842	10427	28750	99741	87117	298826
Flight+Car rental	20223	49897	9119	15013	74842	76498	245592
Flight+Cruise	59595	160902	20637	29753	268184	235494	774565
Flight+Hotel	19719	61468	7869	19757	86179	83441	278433
Hotel	12549	27434	5717	11146	41962	53963	152771
Hotel+Car rental	4880	24081	8372	19554	54944	57998	169829
Nature tour	1871	2754	295	1096	6182	5899	18097
Rock climbing	1006	2271	420	451	3011	3142	10301
Grand Total	196059	493317	85424	146198	871447	785593	2578038

8. Click the **Sheet2** tab to go to that worksheet.

9. If necessary, click any cell in the pivot table to activate the PivotTable Fields Task Pane.
10. On the PivotTable Tools Analyze tab, in the Tools group, click **PivotChart**.
11. With the **Clustered Column** chart (far left in the Column category) selected, click **OK**.
12. Move the pivot chart to a new position below the pivot table.

    This pivot chart is identical to the one in Sheet3 but was created using the PivotChart command in the PivotTable Tools Ribbon. If you make any changes to the pivot table, the pivot chart will automatically change as well.
13. Click the **Column Labels** AutoFilter button in the pivot table.
14. Select the **Air Miles** and **Cash** check boxes to turn them off, and then click **OK**.
15. Select the **Sheet1** worksheet, then on the Insert tab, in the Charts group, click **PivotChart**.
16. In the Create PivotChart dialog box, select the **Add this data to the Data Model** check box to turn it on.
17. Verify that the correct cell range has been selected and that the pivot chart will be placed in a new worksheet, then click **OK**.
18. In the PivotChart Fields pane, select the **Sale Type**, **Amount Paid**, and **Payment Type** check boxes to turn them on.
19. Drag the **Payment Type** field from the *Axis (Categories)* area to the *Legend (Series)* area.

    Notice that the pivot chart appears on its own without any pivot table being visible.
20. Drag the pivot chart to the upper left area of the worksheet.
21. On the PivotChart Tools Analyze tab, in the Filter group, click **Insert Slicer**.
22. In the Insert Slicers dialog box, select the **Payment Type** check box to turn it on, and then click **OK**.
23. In the *Payment Type* slicer box, click the **Amex** button, press and hold the **CTRL** key, and then click the **Diner's Card**, **MasterCard**, and **Visa** buttons to select them as well. Release the **CTRL** key.
24. In the PivotChart Fields pane, drag the **Sale Type** field to the *Legend (Series)* area.



25. In the PivotChart Fields pane, drag the **Sale Type** field back to the *Axis (Categories)* area.
26. Save and close the workbook.

Changing Pivot Chart Options

Objective 4.3.2

You can change the format and design of a pivot chart by using the options in the PivotChart Tools contextual Ribbons. The PivotChart Tools Format and PivotChart Tools Design ribbons are shown in Figure 3-31 and Figure 3-32, respectively.

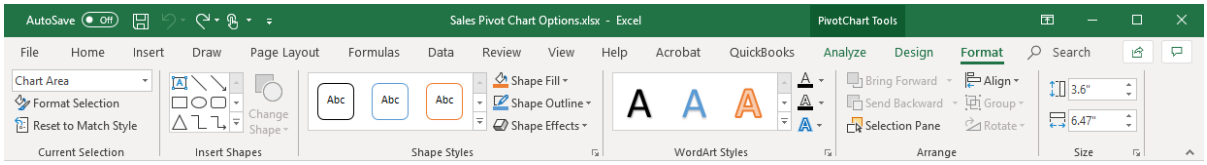


Figure 3-31: PivotChart Tools Format ribbon

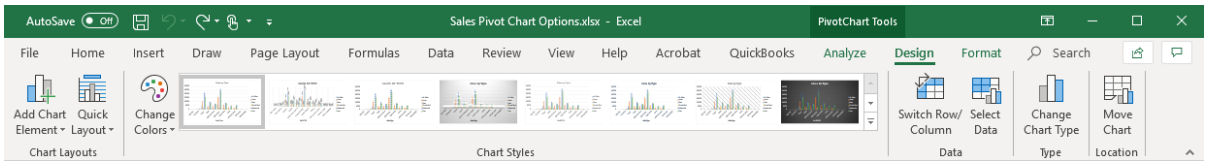


Figure 3-32: PivotChart Tools Design ribbon

The most commonly used chart elements can be switched on or off by using the Chart Elements button (Figure 3-33) that appears to the right of the pivot chart.

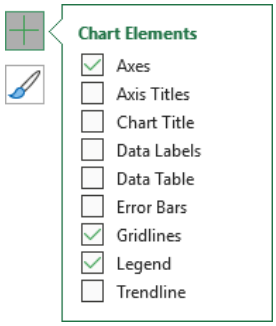


Figure 3-33: Chart Elements button

Figure 3-34 shows a pivot chart with the Axis Titles and Chart Title elements turned on (in addition to the three default elements: Axes, Gridlines, and Legend). You can replace the default title text with any text of your choice.

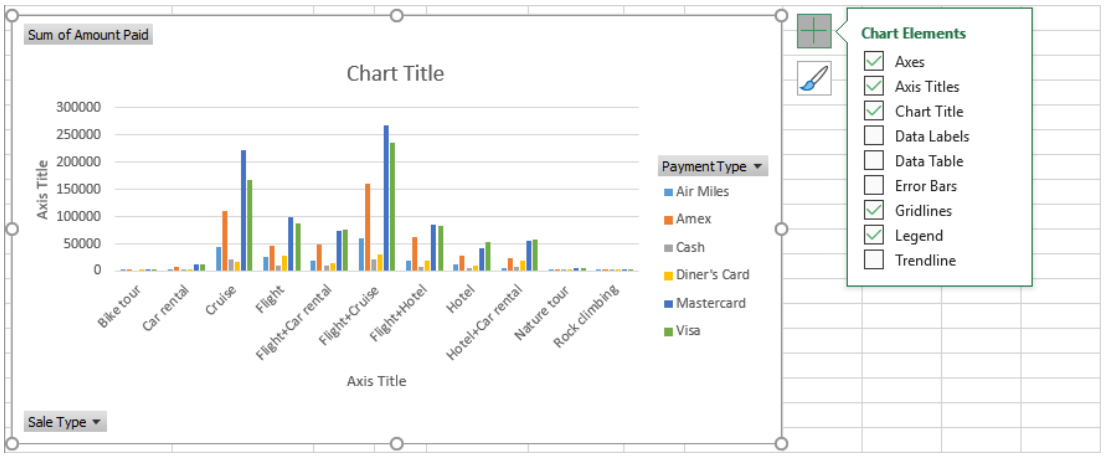
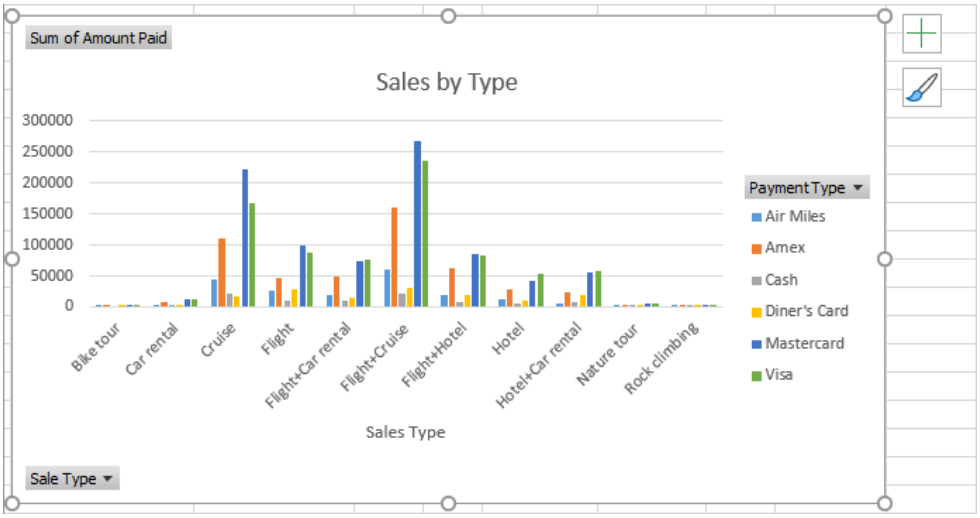


Figure 3-34: Pivot chart with Axis Titles and Chart Title elements turned on

Learn to make formatting changes to a pivot chart

In this exercise, you will make formatting changes to a pivot chart.

1. Open **Sales Pivot Chart Options.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Pivot Chart Options.xlsx** in the *MyProjects* folder.
2. Select the **Sheet3** tab, click in the pivot chart to select it, then widen it to the same width as the pivot table. Also make the chart taller by at least two rows.
3. Click the **Chart Elements** icon that appears to the right of the pivot chart.
4. Point the cursor at each of the following check boxes that are turned off, and observe the effect on the pivot chart: **Data Labels**, **Data Table**, and **Error Bars**.
5. Select the **Chart Title** check box to turn it on.
6. Select the **Axis Titles** check box to turn it on, then click the arrow button to the right. Deselect the **Primary Vertical** check box to turn it off.
7. Click twice in the **Axis Title** text box below the horizontal axis, delete the default text, and then type: **Sales Type**
8. Click twice in the **Chart Title** text box at the top of the chart, and replace the default text with: **Sales by Type**



9. On the PivotChart Tools Format tab, examine the various Ribbon commands available to format the pivot chart.
10. On the PivotChart Tools Analyze tab, in the PivotChart group, click in the **Chart Name** text box and change the name to: **Sales by Type**
11. Click in any blank area of the chart background, then on the PivotChart Tools Format tab, in the Shape Styles group, click the **Shape Fill** arrow, and then hover the cursor over the different colors displayed. Observe the changes to the chart background colors.
12. Click in an empty area of the worksheet to close the *Shape Fill* drop-down list.
13. Save and close the workbook.

Drilling Down into a Pivot Table and Pivot Chart

Objective 4.3.4

Pivot tables and pivot charts are very useful tools for sorting, grouping, and flipping data around in many different ways. This feature allows you to see trends, patterns, and anomalies (something that doesn't look right) if you are looking at hundreds or thousands of rows of data.

However, the pivot tools always perform an aggregation of the values; for example, they will calculate a sum total, an average, or find the maximum value. Quite often when you look at an aggregate value, you will want to see the detailed data rows behind that value.

Drilling Down into a Pivot Table

You can drill down into a pivot table very easily by double-clicking the cell in the table for which you want to see the detailed data rows that make up that value.

For example, suppose you have the pivot table shown in Figure 3-35.

	A	B	C	D	E	F	G	H
1	**Sum of Amount Paid**	**Column Labels**						
2	**Row Labels**	**Air Miles**	**Amex**	**Cash**	**Diner's Card**	**Mastercard**	**Visa**	**Grand Total**
3	Bike tour	461	1417		380	2129	2699	7086
4	Car rental	4120	7241	1579	3383	13221	12862	42406
5	Cruise	44686	110010	20989	16915	221052	166480	580132
6	Flight	26949	45842	10427	28750	99741	87117	298826
7	Flight+Car rental	20223	49897	9119	15013	74842	76498	245592
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11	Hotel+Car rental	4880	24081	8372	19554	54944	57998	169829
12	Nature tour	1871	2754	295	1096	6182	5899	18097
13	Rock climbing	1006	2271	420	451	3011	3142	10301
14	**Grand Total**	**196059**	**493317**	**85424**	**146198**	**871447**	**785593**	**2578038**

Figure 3-35: Sample pivot table

If you double-click cell B5 in the pivot table (whose value is 44686), a separate worksheet will be created that contains the detail row data that make up the aggregate value that appears in cell B5, as shown in Figure 3-36. The new worksheet shows a breakdown of the amount paid for cruises using air miles.

	A	B	C	D	E
1	**Date**	**Customer No.**	**Sale Type**	**Amount Paid**	**Payment Type**
2	10/30/2020	325	Cruise	2027	Air Miles
3	9/10/2020	305	Cruise	2784	Air Miles
4	8/28/2020	337	Cruise	3740	Air Miles
5	8/10/2020	306	Cruise	1826	Air Miles
6	8/3/2020	352	Cruise	3610	Air Miles
7	7/10/2020	319	Cruise	1316	Air Miles
8	6/30/2020	369	Cruise	3807	Air Miles
9	6/13/2020	304	Cruise	5613	Air Miles
10	5/21/2020	383	Cruise	1868	Air Miles
11	5/17/2020	386	Cruise	3934	Air Miles
12	4/15/2020	380	Cruise	3560	Air Miles
13	3/19/2020	322	Cruise	947	Air Miles
14	3/13/2020	397	Cruise	5432	Air Miles
15	2/7/2020	353	Cruise	1852	Air Miles
16	1/8/2020	331	Cruise	2370	Air Miles

Figure 3-36: Pivot table detail row data – breakdown of amount paid for cruises using air miles

Drilling Down into a Pivot Chart

When you include multiple fields in the Axis (Categories) area of a pivot chart, the + − (Excel pivot chart drill down) buttons appear. These buttons are named Expand Entire Field and Collapse Entire Field, respectively, and they enable you to drill up or down in the chart with a click.

Use the Expand Entire Field button to drill down into the details and reflect them in the chart. Use the Collapse Entire Field button to gain a more summary view of the data.

Figure 3-37 shows the same pivot chart with varying degrees of detail displayed. Each successive display is achieved by clicking the Expand Entire Field drill down button.

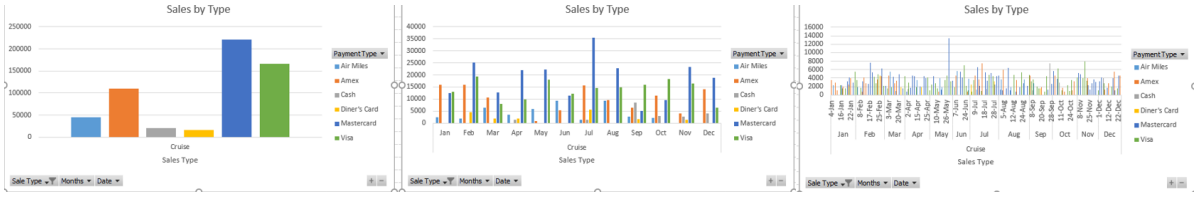

Figure 3-37: Three images of pivot chart with varying degrees of detail

Learn to drill down into a pivot table

In this exercise, you will drill down into a pivot table and a pivot chart.

1. Open **Sales Pivot Chart Drilling.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Pivot Chart Drilling.xlsx** in the *MyProjects* folder.

Suppose you want to know what the detailed transactions were that added up to the total value you see for cruises that were paid for using air miles.

2. Select the **Sheet3** tab if necessary, then double-click cell **B5**.

   A new worksheet is created with the detailed transactions that comprise this value in the pivot table.

3. Double-click the right edge of the column **A** header to auto-fit the column width to the largest value.

	A	B	C	D	E
1	Date	Customer No.	Sale Type	Amount Paid	Payment Type
2	10/30/2020	325	Cruise	2027	Air Miles
3	9/10/2020	305	Cruise	2784	Air Miles
4	8/28/2020	337	Cruise	3740	Air Miles
5	8/10/2020	306	Cruise	1826	Air Miles
6	8/3/2020	352	Cruise	3610	Air Miles
7	7/10/2020	319	Cruise	1316	Air Miles
8	6/30/2020	369	Cruise	3807	Air Miles
9	6/13/2020	304	Cruise	5613	Air Miles
10	5/21/2020	383	Cruise	1868	Air Miles
11	5/17/2020	386	Cruise	3934	Air Miles
12	4/15/2020	380	Cruise	3560	Air Miles

Suppose you want to see the transactions for cruises that were paid for using air miles represented in the pivot chart.

4. Select the **Sheet3** tab.
5. Drag the pivot chart to cell **J1**.
6. In the pivot chart, display the **Sale Type** list, deselect the **(Select All)** check box, select the **Cruise** check box, and then click **OK**.

   Now the chart shows data only for cruises.

7. In the PivotChart Fields pane, select the **Date** field check box.

   The Months and Date fields are added to the Axis (Categories) area in the PivotChart Fields pane and a bar for each payment type displays for each month.

   Notice that the Excel pivot chart drill down buttons now display in the lower right corner of the pivot chart.

8. In the pivot chart, click the **Expand Entire Field** button.

   The chart now shows the detail transactions for each cruise.

   Notice also that the pivot table expands to show more detailed data.

9. In the pivot chart, display the *Payment Type* list, deselect the **(Select All)** check box, select the **Air Miles** check box, and then click **OK**.

   The chart now shows the detail transactions for each cruise that was paid for using air miles.

10. In the pivot chart, click the **Collapse Entire Field** button to view more summarized data.

    The chart now shows the monthly totals for each cruise that was paid for using air miles.

11. In the pivot chart, click the **Collapse Entire Field** button once more.

    The pivot chart now shows only one bar, representing the total dollar amount for cruises that were paid for using air miles.

12. Save and close the workbook.

Working with Pivot Chart Styles

Objective 4.3.3

Like the Chart Elements button, the Chart Styles button that appears to the right of the pivot chart allows you to easily format the chart by selecting options from the list of available chart styles and colors.

Select a pivot chart and click the Chart Styles button to display the Style tab, from which you can select a built-in chart style (Figure 3-38a). Clicking the Color tab will display a list of the color schemes you can apply to the chart (Figure 3-38b).

Figure 3-38a: Chart Styles button – Style tab

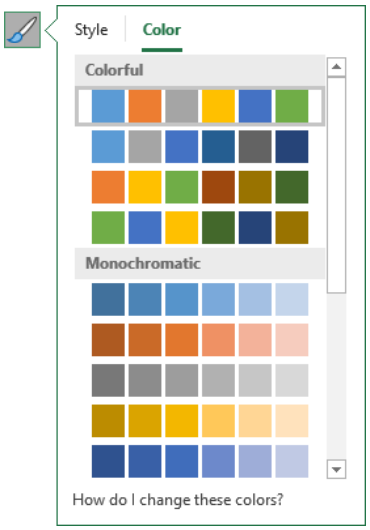

Figure 3-38b: Chart Styles button – Color tab

Figure 3-39 shows a pivot chart with the Style 7 style and the Colorful Palette 4 color scheme applied.

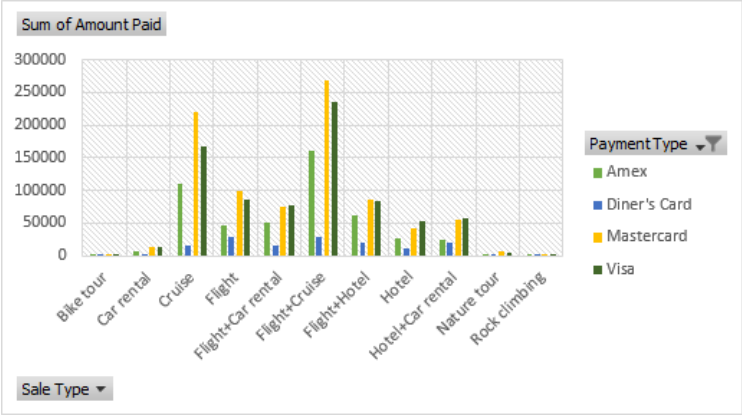

Figure 3-39: Pivot chart with Style 7 and Colorful Palette 4 applied

The full set of chart styles, colors, and elements are accessible from the PivotChart Tools Design tab in the Ribbon (Figure 3-40).

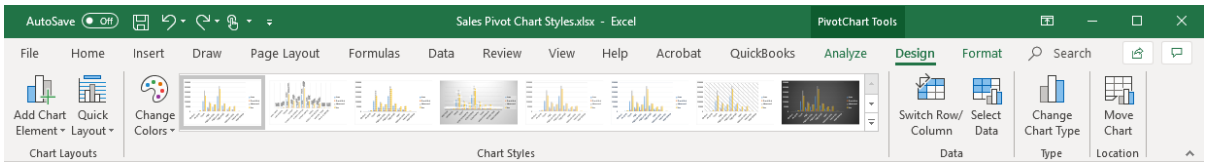

Figure 3-40: PivotChart Tools Design ribbon

Learn to select a different chart style for a pivot chart

In this exercise, you will select different chart styles and colors for a pivot chart.

1. Open **Sales Pivot Chart Styles.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Pivot Chart Styles.xlsx** in the *MyProjects* folder.
2. Click the **Sheet2** tab, and then click a blank area of the pivot chart to select it.
3. Click the **Chart Styles** icon that appears to the right of the pivot chart.
4. Point the cursor at some of the chart styles icons and observe the live preview effect on the pivot chart.
5. Click **Style 7** to select it.
6. Click the **Color** tab in the Chart Styles window.
7. Point the cursor over some of the color options and observe the effect on the pivot chart.
8. Click the **Chart Styles** icon again to close the Chart Styles window.
9. On the PivotChart Tools Design tab, in the Chart Styles group, click **Change Colors**.

   Notice the options you see here are the same as those you accessed on the Color tab in the Chart Styles window.
10. On the PivotChart Tools Design tab, in the Chart Styles group, click the **More** button to view the various chart styles available.

    Notice these options are the same as the ones you accessed on the Style tab in the Chart Styles window.
11. Click in a blank area of the worksheet to close the Chart Styles gallery.
12. Save and close the workbook.

Lesson Summary

Now that you have completed this lesson, you should be able to:

- ☑ Create, format, and customize pivot tables.
- ☑ Use data slicers.
- ☑ Group pivot table data.
- ☑ Create calculated fields and items for pivot tables.
- ☑ Create a pivot chart.
- ☑ Change pivot chart options.
- ☑ Drill down into a pivot table and pivot chart.
- ☑ Change pivot chart styles.

Key Terms

Term	Definition
AutoFilter	A feature that allows you to filter records in a worksheet by specifying filter criteria. See Filter.
Calculated Fields	Simple formulas that use math operators such as add (+), subtract (-), multiply (*), and divide (/) that you can insert into a pivot table to create new data based on existing data. See Pivot Table.
Data Slicers	Buttons you can click to filter the data in a table or pivot table.
Filter	The process of temporarily hiding data rows and/or columns that do not meet the filter criteria.
Grouping	A feature you can use to simplify a large table or pivot table by condensing data into logical groups (for example, grouping date values by month, quarter, or year).
Pivot Chart	A chart that displays the data in a pivot table. See Pivot Table.
Pivot Table	A table that summarizes or cross-tabulates large amounts of data by selecting fields for rows and columns and performing a summary function on the intersections of the row and column fields.

Quiz Questions

For each question, select the best answer.

1. Which tool do you use to specify which columns of data from your source data table to use as the columns, rows, values, or filters of a pivot table?

    a. The PivotTable Transform dialog box
    b. The PivotTable Elements button
    c. The PivotTable Slicer dialog box
    d. The PivotTable Fields task pane

2. Dean applied numeric formatting via the Format Cells dialog box to the values displayed in his pivot table, but discovered that when he changes the pivot table, the formatting disappears. What can he do to remedy the situation?

    a. Apply the formatting using the buttons on the PivotTable Tools Analyze contextual ribbon tab.
    b. Apply the formatting to the pivot table fields, instead of to the displayed values.
    c. Apply the formatting using the Tools button in the PivotTable Fields task pane.
    d. There is no remedy for this situation; it is the nature of pivot tables.

3. Which tool would you use to customize a pivot table – for example, to switch the fields used for rows with the fields used for columns?

    a. The PivotTable Fields task pane
    b. The PivotTable Transform dialog box
    c. The PivotTable Elements button
    d. The PivotTable Slicer dialog box

4. How do you remove a filter field from a pivot table?

    a. Remove the column that contains the filter field from the pivot table.
    b. Remove the column that contains the filter field from the source data.
    c. Click the drop-down arrow for the field in the Filters area of the PivotTable Fields task pane, and then click Remove Field.
    d. Hide the column that contains the filter field in the pivot table.

5. Which pivot table feature can you use to easily determine which filter conditions are currently active?

    a. Slicers
    b. FilterTrackers
    c. Timelines
    d. Calculated items

6. Elsie created a pivot table from 5,000 records of source data that groups employees by the following departments: Engineering, Fulfillment, Support, Sales, and Marketing. For budgeting purposes, she wants to group these five departments into two groups – Group 1 (which includes Engineering and Support) and Group 2 (which includes Fulfillment, Sales, and Marketing); however, these groups do not appear in the source data. What can she do?

    a. Recreate the source data range and arrange the data into the desired Group 1 and Group 2 groups.
    b. Create the Group 1 and Group 2 groups manually.
    c. Add a calculated field to the pivot table for grouping purposes.
    d. Add a calculated item to each group, and then group by the item.

7. If a calculated field named Sum of Commissions appears as a new column, how will a calculated item named Zone 2 appear in the pivot table?

    a. As a filter
    b. As a new column
    c. As a new row
    d. It is impossible to predict from the given information.

8. Which tool do you use to configure the structure of a pivot chart?

    a. The PivotTable Fields task pane
    b. The PivotChart Fields task pane
    c. Commands in the Structure group on the PivotChart Tools Format tab
    d. Options in the Color tab of the Chart Styles button

9. What is an easy way to add or remove chart elements in a pivot chart?

    a. Click the buttons for the elements on the PivotChart Tools Analyze contextual ribbon tab.
    b. Select the desired elements from a gallery on the PivotChart Tools Format contextual ribbon tab.
    c. Switch them on or off using the Chart Elements button.
    d. You must re-create the pivot chart in order to include the elements you want.

10. When do the Excel pivot chart drill down buttons appear in a pivot chart?

    a. When you include multiple fields in the Axis (Categories) area of the pivot chart
    b. When all pivot chart filters are turned off
    c. When all pivot chart summary calculations are set to Sum
    d. When you activate at least one data slicer

11. In order to apply styles to a pivot chart, which tab in the PivotChart Tools contextual ribbon would you use?

    a. Analyze
    b. Design
    c. Format
    d. Style

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Lesson 4: Workbook Management Features

Lesson Objectives

In this lesson, you will link to external workbooks, consolidate data, use comments, protect workbooks, and set global and workbook-specific options. Upon completion of this lesson, you will be able to:

- ☐ Insert, modify, and remove links to external workbooks.
- ☐ Consolidate data from multiple workbooks.
- ☐ Create, navigate among, reply to, and delete comments.
- ☐ Create secure passwords.
- ☐ Protect a worksheet from unwanted changes.
- ☐ Allow users to edit specific ranges only.
- ☐ Protect a workbook structure from unwanted changes.
- ☐ Set global and workbook-specific options.

Linking External Workbooks

Referencing Other Worksheets in Formulas

Excel formulas can reference cells in other worksheets in the same workbook. The general format of this kind of reference is:

'<worksheet name>'!<cell reference>

The ! (exclamation) symbol – also known as the bang symbol – is used by Excel to indicate that this cell reference is found in a different worksheet. The single quotes are required if the worksheet name includes blank spaces in it.

Linking Other Workbooks

Objective 1.1.2

In addition to referencing any cell within the same workbook — whether in the same or different worksheet — formulas can also reference worksheets in a different workbook. These formulas are set up with a link to these other workbook files even if they are not open.

Using workbook links in your worksheet formulas creates a very powerful tool for consolidating information. Other users can input data into source workbooks independently, and when the dependent workbook is opened, the links will be automatically updated.

Links between worksheets have a source portion and a dependent portion. The worksheet in which you create the linking formula is called the dependent worksheet because it depends on the data from the other worksheet. The referenced worksheet is called the source; it supplies data to the dependent worksheet.

When the source worksheet is in a different workbook, moving the source workbook to another folder or changing its file name can cause linking errors. Having both the source and dependent workbooks open and using Save As to change the name or location of the source workbook will ensure that the links are properly updated.

You can also ***link*** worksheets by entering the full workbook location and cell reference directly. This method enables you to link to source worksheets that are not open in the current session. However, you must ensure that you accurately enter the path, file name, worksheet, and cell reference correctly.

The correct form for the reference is: ='path\[workbook name.xlsx]Sheet name'!cell reference. For example, a reference to cell B4 on Sheet 1 of a workbook named Land Tour Group 1 would be as follows:

='C:\Users\Instructor\Documents\[Land Tour Group 1.xlsx]Sheet1'!B4

The link address is often long, and every character is required or else the link will not work.

Learn to use the linking feature

In this exercise, you will link workbooks.

1. Open **Land Tour Group Totals Create Links.xlsx**, **Land Tour Group 2.xlsx**, and **Land Tour Group 1.xlsx** located in the *StarterFiles* folder.
2. Make the *Land Tour Group Totals Create Links* workbook the active workbook and maximize it.

You will enter links into this (dependent) workbook from several source workbooks.

3. On the View tab, in the Window group, click **Arrange All**. In the Arrange Windows dialog box, select the **Tiled** option and click **OK** to make it easier to view and copy data from one workbook to another.
4. Select cell **B5** in the *Land Tour Group Totals Create Links* workbook, and type: = to start your formula.
5. Click anywhere in the *Land Tour Group 1* workbook and select cell **B4**. Press **ENTER**.
6. Select cell **B5** in the *Land Tour Group Totals Create Links* workbook again and note the cell reference in the Name Box. Within this worksheet, the cell is named B5.

7. With cell **B5** in the *Land Tour Group Totals Create Links* workbook still selected, note the cell reference in the Formula Bar.

   The cell reference contains the file name (and full drive and folder name, after the workbook has been saved the first time) reference of the source workbook, the worksheet name, and the cell address.

   Notice that the workbook link uses an absolute cell reference; you will need to modify it if you want to copy and paste the formula to other cells.

8. With cell **B5** in the *Land Tour Group Totals Create Links* workbook still selected, press **F2** and change the cell reference from $B$4 to **$B4**.

9. Copy the formula in cell **B5** to the cell range **B6:B12**.

10. Select the cell range **B4**:**B11** in the *Land Tour Group 2* workbook, then copy these cells.

11. Select cell **C5** in the *Land Tour Group Totals Create Links* workbook, then on the Home tab, in the Clipboard group, click the **Paste** drop-down arrow. In the *Paste* menu, click **Paste Link (N)**. (This item can be found in the *Other Paste Options* section, second from left).

    This technique inserts the correct links for all the cells selected in the source workbook.

12. Close the **Land Tour Group 1** workbook and the **Land Tour Group 2** workbook.

13. Open the **Land Tour Group 4** workbook and the **Land Tour Group 3** workbook located the *StarterFiles* folder.

14. Make the *Land Tour Group Totals Create Links* workbook the active workbook and tile the windows once more.

15. Select cell **D5** in the *Land Tour Group Totals Create Links* workbook, and type: =

16. Select cell **B4** in the *Land Tour Group 3* workbook, and press **ENTER**.

17. Select cell **D5** in the *Totals* workbook again, press **F2** and change the cell reference from $B$4 to **$B4**.

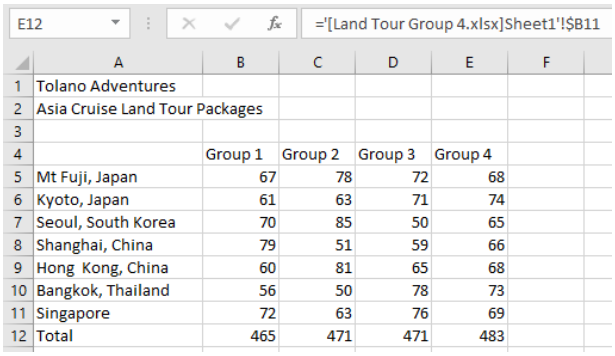
18. Copy this formula in cell **D5** to cell **E5**.

19. Select cell **E5**, press **F2** and change the worksheet reference to: **Land Tour Group 4.xlsx**.

    With the two workbook links now referencing two different workbooks, you can correctly copy and paste these formulas to the remaining cells.

20. Select the cell range **D5:E5**, and copy down to the cell range **D6:E12**.

    The screen now appears similar to the following (note the formula for **E12** in the Formula Bar):



E12 ='[Land Tour Group 4.xlsx]Sheet1'!$B11

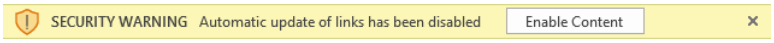
	A	B	C	D	E	F
1	Tolano Adventures					
2	Asia Cruise Land Tour Packages					
3						
4		Group 1	Group 2	Group 3	Group 4	
5	Mt Fuji, Japan	67	78	72	68	
6	Kyoto, Japan	61	63	71	74	
7	Seoul, South Korea	70	85	50	65	
8	Shanghai, China	79	51	59	66	
9	Hong Kong, China	60	81	65	68	
10	Bangkok, Thailand	56	50	78	73	
11	Singapore	72	63	76	69	
12	Total	465	471	471	483	

21. Select cell **B4** in the *Land Tour Group 4* workbook, and enter: **80**.

The Totals workbook is updated automatically through the workbook link. Now try a scenario in which a source workbook is changed while the dependent workbook is closed.

22. Save and close the **Land Tour Group Totals Create Links** and **Land Tour Group 4** workbooks.
23. Select cell **B4** in the *Land Tour Group 3* workbook, and enter: **50**.
24. Save the **Land Tour Group 3** workbook, then press **CTRL+W** to close it.
25. Open the **Land Tour Group Totals Create Links** workbook.

    A security warning message is displayed.



26. Click **Enable Content** in the security warning to update the links.

    Notice that cell C5 is now updated to the new changed value from the Land Tour Group 3 workbook.

27. Click on various cells of your choice in the cell range B5:E11, and look at the contents of the Formula Bar. It now contains the full drive, folder path, and file name of the source workbook, followed by the worksheet name and cell reference.
28. Close all workbooks without saving.

Modifying Workbook Links

Objective 1.1.2

When the location of a source workbook changes from one drive or folder to another, the dependent workbook link also has to be changed. If both the source and dependent workbooks are open at the same time, Excel will make the changes automatically. When Excel is unable to update the links on its own, you will have to change them manually.

To change the link references, you can change the address reference directly in the cell or use the Edit Links dialog box. To display this dialog box, on the Data tab, in the Queries & Connections group, click Edit Links.

The Edit Links dialog box includes several command buttons.

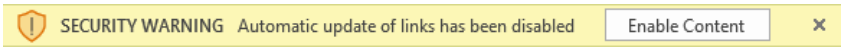
Update Values	Update all cells that reference this external workbook by incorporating the data from the workbook.
Change Source	Display the Change Source dialog box to enable you to find the drive, folder, and/or file name that has changed for this workbook.
Open Source	Open the selected source workbook as a new Excel window.
Break Link	Automatically converts all cells that reference this external workbook from a formula to the existing equivalent data values.
Check Status	Verify the integrity of all links to external source workbooks. The Status column will be updated.

Learn to update cell reference links

In this exercise, you will update the cell reference links when the name of a source workbook is changed.

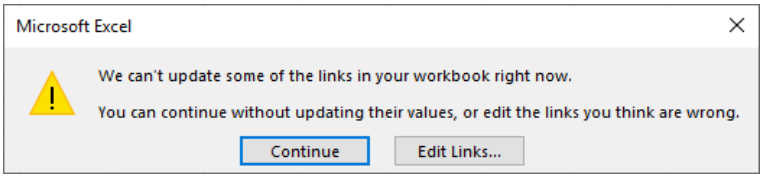
1. Use the Windows Explorer to navigate to the *3274 Exercise Files/StarterFiles* folder and change the name of **Land Tour Group 1** to **1a** (the full file name is now *Land Tour Group 1a*), but do not open it.
2. Close Windows Explorer and return to the Excel window.
3. Open **Land Tour Group Totals Modify Links.xlsx** located in the *StarterFiles* folder, and save it as **My Land Tour Group Totals Modify Links.xlsx** in the *MyProjects* folder.

   A security warning message may be displayed.

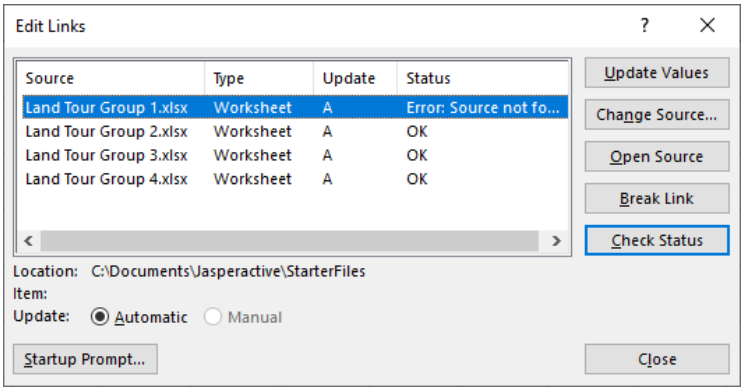


4. Click **Enable Content**.

   Excel now updates all formulas in the workbook that reference other workbooks. Because one of those source workbooks can no longer be found, the following message is displayed.



5. Click **Edit Links**.



   The Edit Links dialog box lists all external source workbooks and the status information for each of them. An error message appears next to the Land Tour Group 1 workbook, indicating that this source workbook cannot be found.

6. With *Land Tour Group 1.xlsx* selected, click **Change Source**.

   The Change Source dialog box, which is almost identical to the Open dialog box, opens, enabling you to find the correct location of this source workbook.

7. If necessary, navigate to the *StarterFiles* folder.
8. Click the **Land Tour Group 1a** workbook and click **OK**.

   The link is now updated with the correct workbook name. Furthermore, all data referenced from all linked workbooks has been validated.

9. Close the Edit Links dialog box, then save and close the workbook.

Removing Workbook Links

Objective 1.1.2

Links between workbooks can easily be deleted by clearing the linked cell. However, if you want to keep the data while breaking the link, you can copy the cell(s) for which you want to replace the links with their current equivalent data values, and then use the appropriate Paste Values option from the Paste drop-down menu, as shown in Figure 4-1.

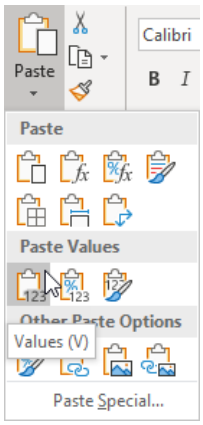


Figure 4-1: Paste drop-down menu – Paste Values options

You can use the Break Link button in the Edit Links dialog box to break the link from one or more workbooks. If you want to break the link for one workbook, select the workbook and click Break Link. If you want to break the links for multiple workbooks, use CTRL or SHIFT to select the desired workbooks, and then click Break Link.

For example, suppose you want to break the links from two of the four workbooks to which the current workbook is linked. Open the Edit Links dialog box and select the two workbooks, as shown in Figure 4-2.

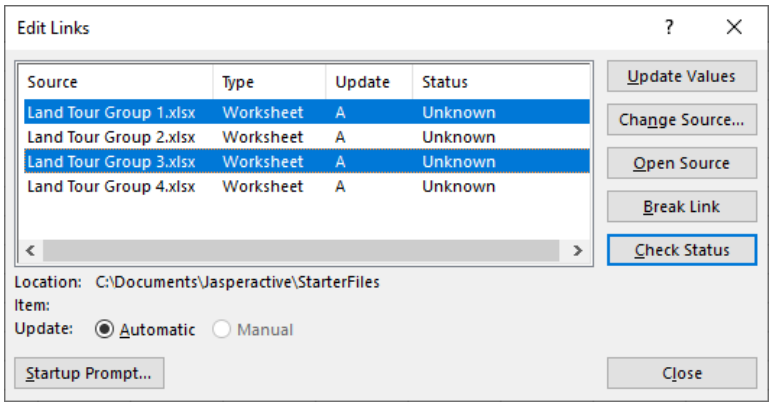


Figure 4-2: Edit Links dialog box – Two workbooks selected

Breaking links permanently converts formulas and external references to their existing values. When you click the Break Link button, the message shown in Figure 4-3 will appear.

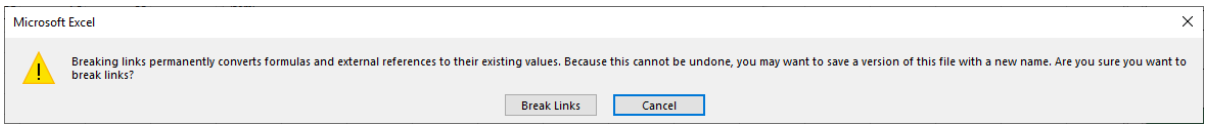


Figure 4-3: Microsoft Excel Breaking links information message

Click the Break Links button to complete the process. Once you click the Break Links button, the external references for the selected workbooks in the Edit Links dialog box will be removed. Notice that the Edit Links dialog box still displays the two remaining workbooks (the ones for which you did not break links), as shown in Figure 4-4.

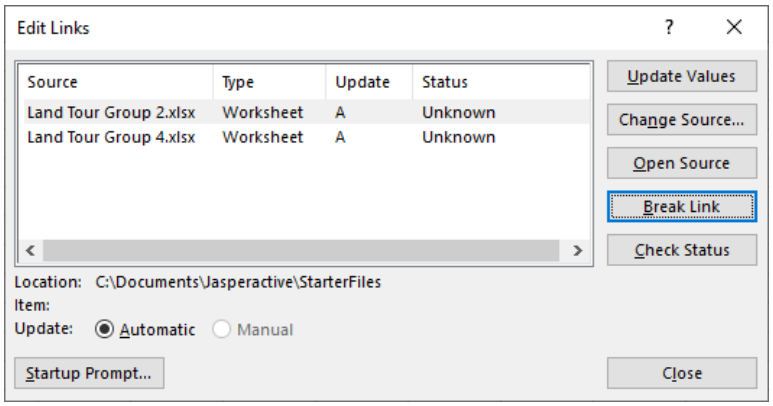


Figure 4-4: Edit Links dialog box – Two remaining linked workbooks

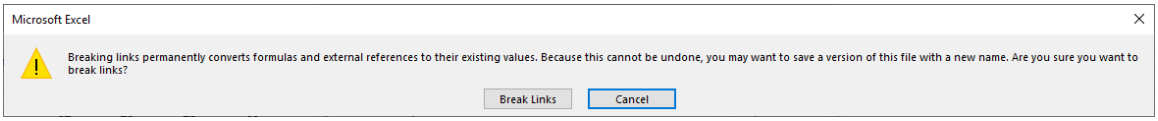
Learn to remove workbook links

In this exercise, you will remove links to other workbooks.

1. Open **Land Tour Group Totals Remove Links.xlsx** located in the *StarterFiles* folder, save it as **My Land Tour Group Totals Remove Links.xlsx** in the *MyProjects* folder, and then click **Enable Content** if necessary.
2. Copy cells **B5:E5**, then on the Home tab, in the Clipboard group, click the **Paste** arrow and click **Values (V)** (*Paste Values* section, first option).

   Each of these linked workbook cell references has now been converted to numeric values in this workbook.
3. Press **ESC** and select some of the cells in the range **B5:E12**.

   Notice that the cells in row 5 contain numeric values, but the rest of the rows still contain links. The alternative method is to use the Edit Links dialog box to break the links.
4. On the Data tab, in the Queries & Connections group, click **Edit Links**.
5. Click the first workbook link in the Edit Links dialog box, then press and hold the **SHIFT** key while clicking on the last workbook link. Release the **SHIFT** key.
6. Click **Break Link**.



7. Read the contents of the message box and click **Break Links**.

   With all the external references removed, notice that the Edit Links dialog box is now empty.
8. In the Edit Links dialog box, click **Close**.

9. Select some of the cells in the range **B6:E12**.

   Notice that the cells now contain numeric values. The links have been removed.

10. Save and close the workbook.

Consolidating Data

Objective 3.4.1

Consolidating data refers to the process of summarizing multiple ranges of data into a single range. You can consolidate data from different areas within a worksheet, from other worksheets in the same workbook, or from other workbooks.

You begin by selecting the range where you want the consolidated results to be placed. With the range selected, on the Data tab, in the Data Tools group, click Consolidate to open the Consolidate dialog box (Figure 4-5).

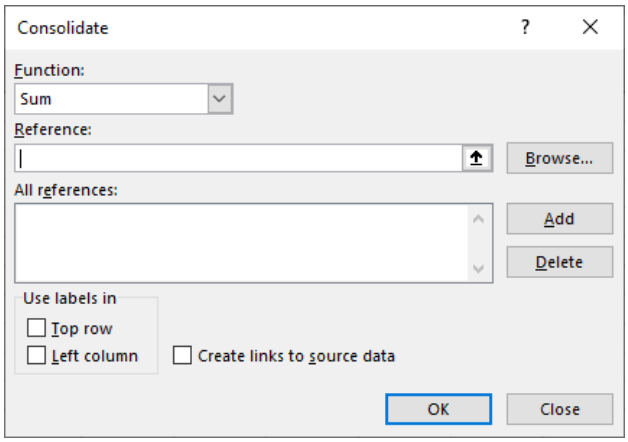


Figure 4-5: Consolidate dialog box

Function	Specifies the type of function (for example, Sum, Count, Average, Max, Min, and so on) to apply to the data being consolidated. For example, if Sum is selected (the default), then the consolidated data will be added together.
Reference	Specifies the cell range from the worksheet/workbook where the source data is located. When you click the Add button, the cell range selection is added to the All references list.
All references	Lists all the source cell ranges that have been selected. When you click OK, the data from all the source cell ranges will be consolidated using the selected function.
Use labels in	Designates whether any label row and/or column is to be used to consolidate the data.
Create links to source data	Will automatically update your consolidated data whenever the source data is changed.

In the Reference field, select the first cell or range of cells that you want to consolidate, then click Add to copy the cell range into the All references list. You can select the check boxes in the *Use labels in* section to specify where the labels are located relative to the data so Excel can determine which numbers to consolidate. Once you have selected and added all the cell ranges you want to include in the consolidation, click OK to perform the specified function and display the results.

Figure 4-6 shows the Consolidate dialog box with entered references, which will consolidate certain values from two workbooks (Group Tour 1 and Group Tour 2) into a third workbook.

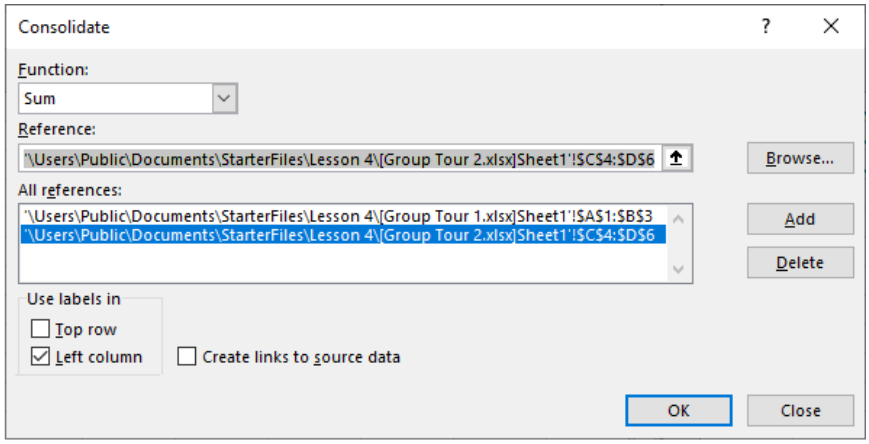


Figure 4-6: Consolidate dialog box with entered references

If you select an option in the *Use labels in* section, Excel will use the column or row labels to match the source ranges to the destination range; the order does not matter. When using labels to perform consolidation, the row and column labels must match exactly. The matching process is not case sensitive. For example, the parameters in Figure 4-6 will yield the values consolidated in the third workbook (Group Tour Total), as shown in Figure 4-7.

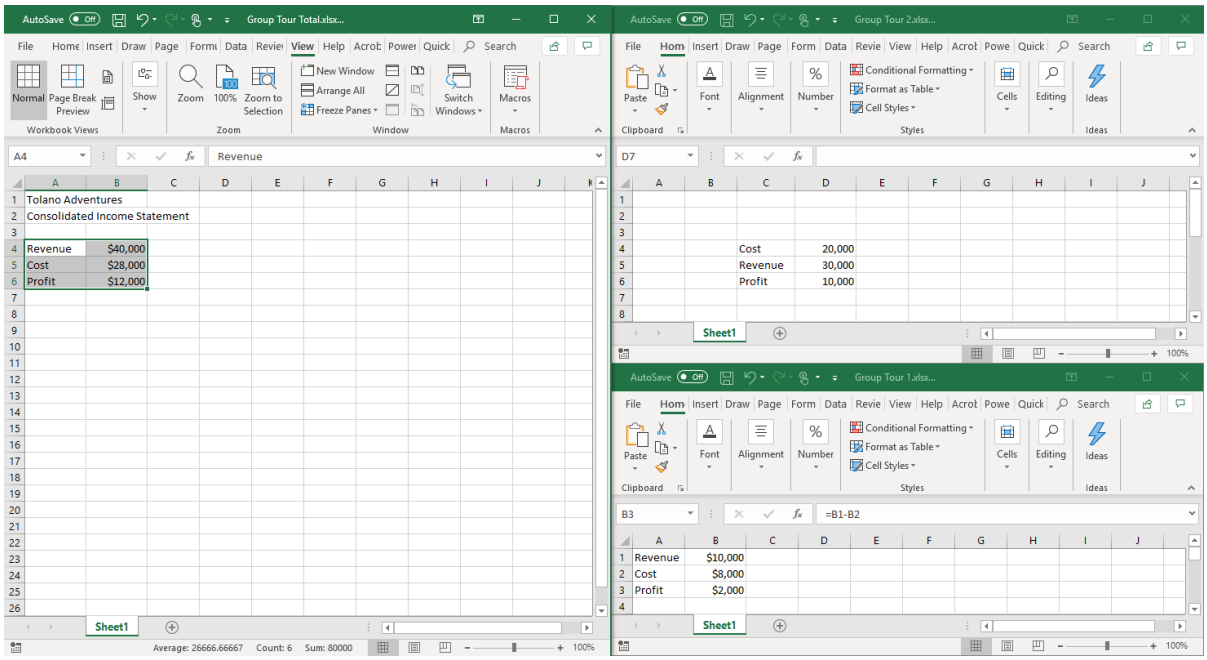


Figure 4-7: Consolidating data

Notice that, even though the data cells in the Group Tour 2 workbook are located in a different sequence than the Group Tour 1 workbook, the consolidate feature added the correct cells together. Excel knew to use the cell labels to the left of the numbers to determine which numbers to add together because you had specified to use “Left column” labels in the Consolidate dialog box.

When consolidating by position, the source ranges must have the same layout as the destination range (unlike the example shown above). Excel will process cell for cell from the source ranges to the destination range using the selected function. The data in each of the source worksheets must therefore be in the same positions; for example, the data in cell A1 from each of the source worksheets will be consolidated and placed in cell A1 of the destination worksheet.

Even though consolidating data is relatively easy, there are some points you should consider when you are using the consolidation process.

- Only numeric values are consolidated; any text in the source areas will display as a blank cell.
- Each consolidation area must be separate from other consolidation areas. For example, there must be a set area for the Eastern Region Sales, another area for Western Region Sales, and so on.
- Excel uses the same numeric format in the consolidated area as what is applied in the first source area.
- Excel consolidates data values only; formulas are not brought into the consolidated worksheet.
- To link different worksheets while consolidating select the *Create links to Source Data* check box. Creating links will result in a summary table with the details linked and that contains summation formulas to total each group.
- You can specify a maximum of 255 source areas.
- When referencing other workbooks, the workbooks do not need to be opened at the time you reference them.
- You can use range names in the source and destination worksheets. This makes it easier to find specific information, especially if you do not know exactly where the cells are.

Learn to consolidate data by category

In this exercise, you will consolidate data by category from two workbooks into a new summary workbook.

1. Open **Group Tour 1.xlsx**, **Group Tour 2.xlsx**, and **Group Tour Total.xlsx** from the *StarterFiles* folder.
2. On the View tab, in the Window group, click **Arrange All**.
3. Click **Tiled** and then click **OK**.
4. Select cells **A4:A6** of the *Group Tour Total* workbook.

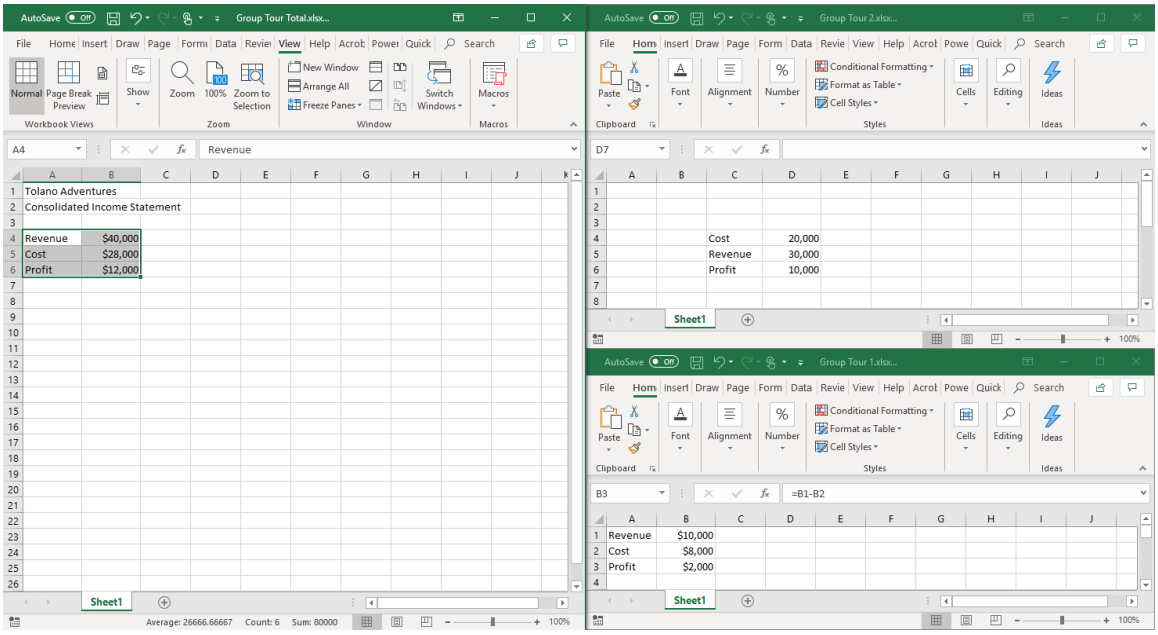
   Before starting the consolidation process, you must select the range where you want the results to be placed.
5. On the Data tab, in the Data Tools group, click **Consolidate**.
6. Select the cells containing the data to be consolidated. Be sure to include the row labels.
7. With the cursor in the *Reference* field, select cells **A1**:**B3** of the *Group Tour 1* workbook.

If the Consolidate dialog box is obstructing the cells that you need to select, you can either click and drag it out of the way or click the **Collapse** button at the right side of the *Reference* field.

Note: The referenced workbook does not need to be open, as it is in this exercise, for you to reference it. You can manually enter the cell reference; be sure to enter the name of the workbook in square brackets followed by the worksheet name all in single quotes. Follow this with a bang character (!) and then the cell range from the source worksheet.

8. In the *Use labels in* section of the Consolidate dialog box, select the **Left column** check box to turn it on.

9. Click **Add** to copy this cell range into the *All references* list.
10. With the cell range in the *Reference* field still highlighted, select cells **C4**:**D6** in the *Group Tour 2* workbook and click **Add** in the Consolidate dialog box.
11. In the Consolidate dialog box, click **OK**.



Notice that even though the data cells in the Group Tour 2 workbook were in a different sequence than the Group Tour 1 workbook, the consolidate feature added the correct cells together. Excel knew to use the cell labels to the left of the numbers to determine which numbers to add together.

Note: If the row labels do not appear in the consolidated worksheet, use the **Undo** feature and be sure to select the **Left column** check box.

12. Click each of the cells in the range **B4:B6** in the *Group Tour Total* workbook to view the values entered into these cells.
13. Save **Group Tour Total.xlsx** as **My Group Tour Total.xlsx** in the *MyProjects* folder, close it, and then close the remaining open workbooks without saving.

Using Comments

Objective 1.2.5

Comments are like "sticky" notes on a hard-copy document. You typically use them so that several users who are sharing a workbook can annotate the spreadsheet with their various comments. Excel automatically adds the current user's name at the top of the comment text box. The final reviewer can then act on each comment and follow up with the originator, if necessary.

You can also use comments to remind yourself about things you need to do, or to record detailed information about formulas you have used, for future reference. Spreadsheets typically contain large volumes of numbers, titles, and formulas to produce the desired results. Comments often help by providing explanations. You can insert comments directly into the cells they reference and display them only when you want to see them.

The command buttons used to create, delete, and move among comments are located on the Review tab in the Comments group (Figure 4-8).

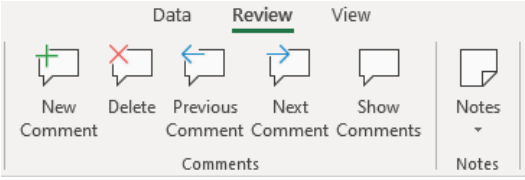


Figure 4-8: Review ribbon tab – Comments group

Note: The New Comment and Edit Comment buttons share the same position in the Review tab. If the active cell does not have a comment, the New Comment button is displayed; otherwise, the Edit Comment button is displayed.

In Office 365, the Notes group provides legacy-style commands for working with comments created in earlier versions of Excel, including Excel 2019 Professional Plus. (See the *Working with Comments in Office 2019 Professional Plus* section if you are using Excel 2019 Professional Plus.)

Creating Comments

Objective 1.2.5

To insert a comment into a worksheet, select the cell to which you want to add a comment and then, on the Review tab, in the Comments group, click New Comment. A comment box will open, as shown in Figure 4-9.

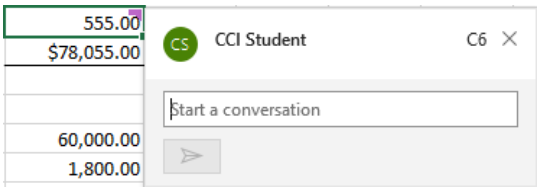


Figure 4-9: New comment box

Notice that the comment box displays your name and the active cell (C6) in the title bar. You can type whatever text you want in the *Start a conversation* field, and then click the Post button in the bottom left corner of the comment box to create your comment. As shown in the previous figure, Excel displays a purple marker in the top right corner of the commented cell to remind you that you have inserted a comment there. Otherwise, the comment would remain hidden until you position the mouse pointer over that cell.

If you want to display your comment(s) continuously, on the Review tab, in the Comments group, click Show Comments to open the Comments task pane (Figure 4-10). Simply close the Comments task pane or click the Show Comments button again to hide the comments.

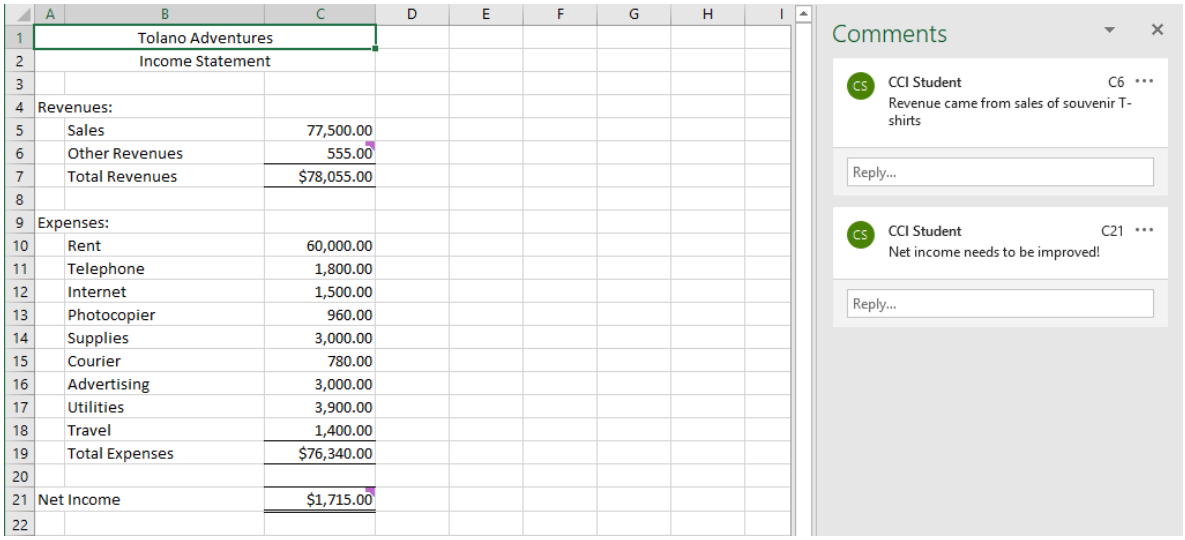


Figure 4-10: Comments task pane

Moving Among Comments

Objective 1.2.5

When the Comments task pane is open, you can move from comment to comment by clicking a comment in the task pane. For example, in the preceding figure, if you click the first comment, cell C6 will become the active cell; if you click the second comment, cell C21 will become the active cell.

When the Comments task pane is closed, you can move from comment to comment by clicking the Previous Comment and Next Comment buttons in the Comments section of the Review tab to move to the previous comment and next comment in the worksheet, respectively. For example, if the active cell is cell C6, click Next Comment to move to cell C21; click Previous Comment to move back to cell C6.

Replying to Comments

Objective 1.2.5

To reply to a comment, select the commented cell in the worksheet (or open the Comments task pane and select the comment). Enter your comment in the Reply field that appears below the original comment (Figure 4-11), and then click the Post button.

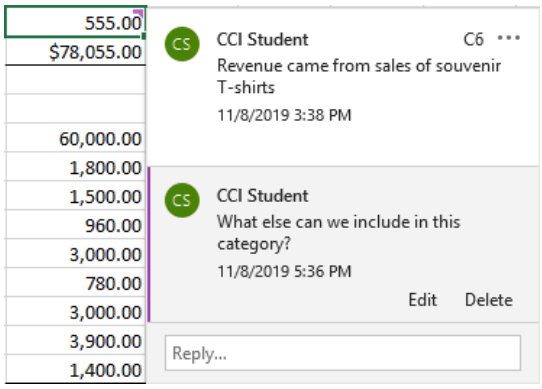


Figure 4-11: Replying to comment

Notice the Edit and Delete options that appear in the lower right portion of the reply. Once you've clicked the Post button to complete the comment, you can click the Edit option to change your reply or click the Delete option to delete it.

By replying to comments in this manner, you (and others) are creating a "conversation thread," which makes it easy to follow the flow of comments.

Deleting Comments

Objective 1.2.5

To remove a comment or an entire comment thread, select the comment you want to delete and, on the Review tab, in the Comments group, click Delete. You can also remove individual "reply" comments in a comment thread by clicking the Delete option in a particular "reply" comment. You can perform these actions in the worksheet if the Comments task pane is not open or in the Comments task pane if it is open.

Working with Comments in Office 2019 Professional Plus

Objective 1.2.5

In Office 2019 Professional Plus, comments appear in the worksheet as yellow notes, as shown in Figure 4-12.

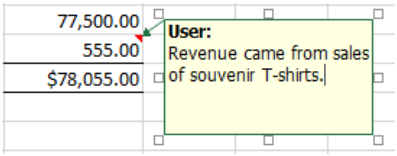


Figure 4-12: Comment (Office 2019 Professional Plus)

The command buttons used to create, delete, show, hide, and move among comments are located on the Review tab in the Comments group (Figure 4-13).

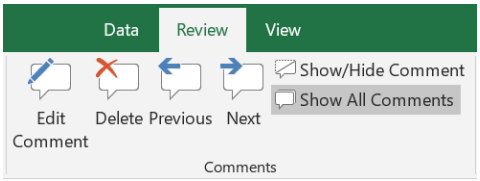


Figure 4-13: Review ribbon tab – Comments group (Office 2019 Professional Plus)

The New Comment and Edit Comment buttons share the same position in the Review tab. If the active cell does not have a comment, the New Comment button is displayed; otherwise, the Edit Comment button is displayed.

To insert a comment into a worksheet, use one of the following methods:

- Select the cell where the comment will be inserted, then on the Review tab, in the Comments group, click New Comment; or
- press SHIFT+F2; or
- right-click the cell where the comment will be inserted, and then click Insert Comment.

When you insert a comment, a yellow "sticky note" opens on the worksheet with the cursor positioned inside, below your name. Type your comment, then click outside the active cell. Excel displays a red (Comment Symbol) in the top right corner of the cell to remind you that you have inserted a comment there.

To temporarily display the contents of an individual comment, position the cursor over a cell containing the comment symbol. When you move the cursor away, only the Comment Symbol displays.

To force a comment to remain displayed, use one of the following methods:

- Select the cell containing the comment, then on the Review tab, in the Comments group, click Show/Hide Comment; or
- right-click the cell containing the comment and click Show/Hide Comment.

To display the contents of all comments in a worksheet, on the Review tab, in the Comments group, click Show All Comments.

To move among comments in a worksheet, on the Review tab, in the Comments group, click the Next or Previous buttons. Unlike in Office 365, the cell pointer moves to the comment instead of making the cell in which the comment is inserted the active cell.

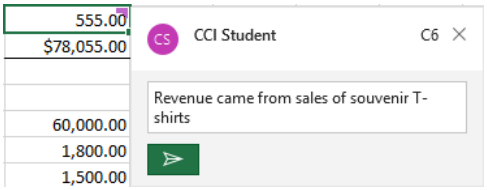
To delete a comment, use one of the following methods:

- Select the cell containing the comment, then on the Review tab, in the Comments group, click Delete; or
- right-click the cell, and then click Delete Comment; or
- select the cell containing the comment, then on the Home tab, in the Editing group, click Clear, and then click Clear Comments.

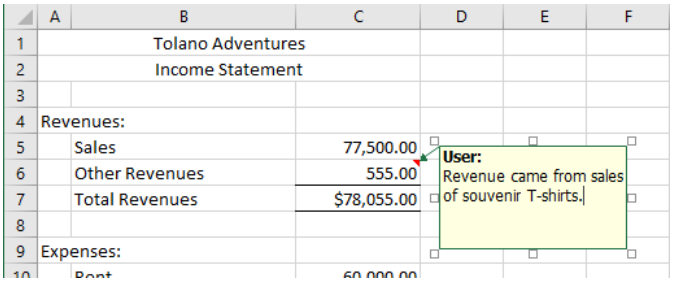
Learn to work with comments

In this exercise, you will work with comments.

1. Open **Income Statement.xlsx** located in the *StarterFiles* folder, and then select cell **C6**.
2. On the Review tab, in the Comments group, click **New Comment**.
3. In the *Start a conversation* field, type: **Revenue came from sales of souvenir T-shirts**.



Note: If you are using Office 2019 Professional Plus, enter the text in the comment box. Your screen will appear as shown below:



4. Click anywhere on the worksheet away from the comment.

Excel displays a comment indicator in the top right corner of the cell to remind you that you have inserted a comment there. Otherwise, the comment would remain hidden until you position the mouse pointer over that cell.

5. With the current active cell elsewhere on the worksheet, point the cursor at cell **C6**.

   The comment box reappears.

6. Click **Post** to post this comment.

   Note: If you are using Office 2019 Professional Plus, skip this step.

7. Select cell **C21** and, on the Review tab, in the Comments group, click **New Comment**.

8. In the *Start a conversation* field, type: **Net income needs to be improved!**, and then click the **Post** button.

   Note: If you are using Office 2019 Professional Plus, skip the posting portion of this step.

9. Click elsewhere on the worksheet to hide the comment.

If necessary, you can display all comments on a worksheet at one time.

10. On the Review tab, in the Comments group, click **Show Comments**.

    The Comments task pane opens displaying both comments in the worksheet.

    Note: If you are using Office 2019 Professional Plus, on the Review tab, in the Comments group, click **Show All Comments**.

    Both comments display in the worksheet.

11. On the Review tab, in the Comments group, click **Show Comments** again to close the Comments task pane.

    Note: If you are using Office 2019 Professional Plus, on the Review tab, in the Comments group, click **Show All Comments** again to hide the comments.

12. Make cell **A1** in the worksheet the active cell.

13. On the Review tab, in the Comments group, click **Next Comment**.

    Cell C6 should now be the active cell.

    Note: If you are using Office 2019 Professional Plus, on the Review tab, in the Comments group, click **Next**.

    The cell pointer will move to the first comment, which is attached to cell C6. Notice that "Comment 1" displays in the Name box.

14. Click the **Next Comment** button again.

    Cell C21 should now be the active cell.

    Note: If you are using Office 2019 Professional Plus, click the **Next** button again.

    The cell pointer moves to the second comment.

15. On the Review tab, in the Comments group, click **Previous Comment** to make cell C6 the active cell.

    Note: If you are using Office 2019 Professional Plus, on the Review tab, in the Comments group, click **Previous** to reselect the first comment.

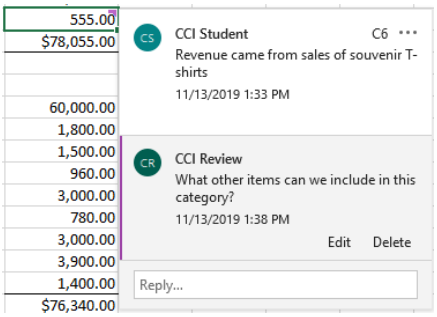
16. Open the Comments task pane. Click the second comment to select it. Notice that cell C21 is now the active cell.
17. Leave the Comments task pane open for the next task.

    Note: If you are using Office 2019 Professional Plus, on the Review tab, in the Comments group, click **Show All Comments**, then click the second comment to select it.

18. In the Comments task pane, click in the *Reply* field for the first task, type: **By how much?**, and then click the **Cancel** button to remove the text.

    Note: If you are using Office 2019 Professional Plus, skip to step 23.

19. Click in the *Reply* field again, type: **What else can we include in this category?**, and then click the **Post** button.
20. Close the Comments task pane and position the mouse cursor over cell **C6**. Notice that the reply comment appears below the original comment.
21. Select cell **C6**, select the reply comment, and then click **Edit**.
22. Double-click the word *else*, replace it with *other items*, and then click **Save**.



23. Click at the end of the first comment, press ENTER twice, then type: **What other items can we include in this category?**

    The Comment feature in Office 2019 Professional Plus is not as intuitive and user-friendly as the Comment feature in Office 365.

    Note: If you are using Office 365, skip this step.

24. Select cell **C6**. Point to the reply comment, and then click **Delete**.

    Notice that the original comment is still applied to the cell.

    Note: If you are using Office 2019 Professional Plus, select the *What other items can we include in this category?* text within the comment, then press **DELETE**.

25. On the Review tab, in the Comments group, click **Delete**.

    Note: If you are using Office 2019 Professional Plus, select the entire comment by clicking one of its borders, then press **DELETE**.

26. Delete the comment in cell **C21**.

    Note: If you are using Office 2019 Professional Plus, in the Comments group, click **Next**, then press **DELETE**.

27. Close the workbook without saving.

Protecting Your Workbook

Using Passwords

Eventually, you may find yourself developing spreadsheets that other people will use. Once other people use a workbook, you no longer have control over what is being changed—unless you protect the workbook.

Excel provides levels of protection that range from protecting individual cells up to full workbook files. By using the appropriate level of protection, you can permit access to selected areas of the workbook while hiding sensitive information and protecting your formulas.

When protection is enabled, Excel prompts the user to enter a password. If you are just protecting your worksheet or workbook from accidental changes, you can leave the password blank. Although this is equivalent to giving everyone the password, the intention here is simply to act as a friendly reminder; changes can be made if they are important. A password, however, protects against malicious data tampering or unauthorized viewing of sensitive data. Once a cell, worksheet, or workbook is password-protected, you will be able to remove the protection only by using the password.

Consider the following points when using passwords:

- It's advisable to keep a record of your passwords in a safe place because, if you forget the password, even Microsoft will not be able to help you remove the protection.
- Passwords are case-sensitive. If you use a mix of upper and lower case, you must remember the exact pattern. Remember that the CAPS LOCK key inverts the case when you are typing and be sure to check the Caps Lock indicator when setting and using passwords.
- Be careful as you type. Passwords do not display on the screen. You will be asked to retype the password to ensure that you typed it correctly the first time.
- If someone hacks the password (by guessing or other methods), the security will be lost. The best protection against this is to choose a strong password. There are numerous rules and guidelines for selecting strong passwords that cannot be easily guessed by others.

If you need a secure password (one that is more difficult to hack), here are some guidelines:

- The password must be at least six characters long. It is usually not necessary to exceed 10 characters.
- It must have at least one of each of these: lower-case alphabetic character (a to z), upper-case (A to Z), numeric digit (0 to 9), and other characters (for example, # ! % &). An example of a secure password is seC#r3T.

If you don't need as much security but do need a password that will be easy to remember, follow these guidelines:

- Choose a word that will not be obvious to others. For example, if you have a worksheet that lists the salaries of everyone in the company, you might choose "grsPaY-17" instead of "salary."
- Avoid associating the password with the job function. For instance, do not use "payroll" as a password for a payroll workbook.
- If the password is distributed to people whom you want to access the workbook, do not use any of your personal passwords. If you share a password you normally use for your own access to a secure network or system, you risk others gaining access to your own secure area.
- Avoid using names of people you know, or pets, as these are typically the first words hackers try.

Protecting the Worksheet

Objectives 1.2.1, 1.2.2

There are occasions when you may want to restrict others from making changes to designated cells or cell ranges. This is known as *enabling worksheet protection*. By default, ***worksheet protection*** is turned off and anyone can make any change to any cell.

In addition to preventing others from making unwanted changes to your worksheet, this feature can prevent you from making mistakes that could cause the loss of formulas or core information. When this is a consideration, you may want to enable protection that doesn't include the use of a password.

By default, every cell in a worksheet is set to *locked* (Figure 4-14a). Therefore, when you turn on worksheet protection, none of the cells will permit changes. To *unlock* individual cells or cell ranges, use one of the following methods:

- On the Home tab, in the Cells group, click Format and click Lock Cell to toggle it off. As shown in Figure 4-14b, you must look closely at the lock icon to confirm the current state.

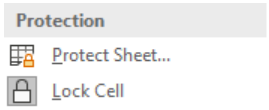


Figure 4-14a: Lock Cell enabled

Figure 4-14b: Lock Cell disabled

- On the Home tab, in the Cells group, click Format, click Format Cells to open the Format Cells dialog box, and click the Protection tab (Figure 4-15). Click the Locked check box to turn it off or on.

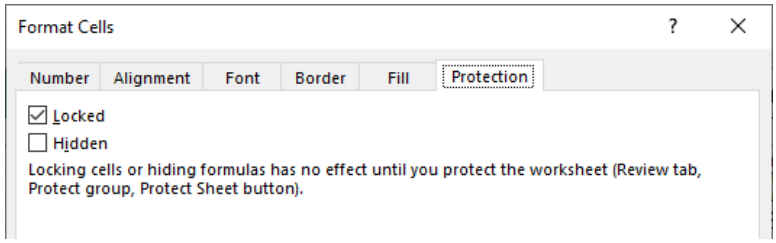


Figure 4-15: Format Cells dialog box – Protection tab

Note: You may find it less confusing to use the Protection tab of the Format Cells dialog box. The Locked check box clearly displays the locked status of the selected cells.

Once you have unlocked the selected cells, you can turn on worksheet protection. To do this, use one of the following methods:

- On the Home tab, in the Cells group, click Format, and click Protect Sheet; or
- on the Review tab, in the Protect group, click Protect Sheet; or
- on the File tab, in the Info group, click Protect Workbook, and click Protect Current Sheet.

The Protect Sheet dialog box opens (Figure 4-16).

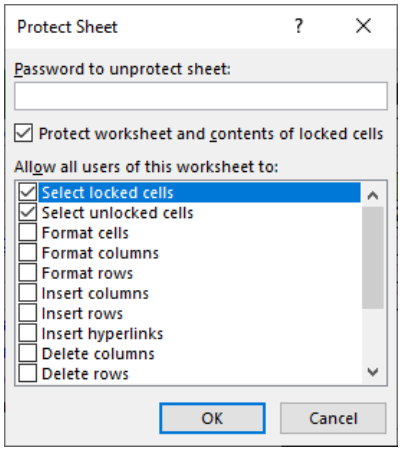


Figure 4-16: Protect Sheet dialog box

In this dialog box, you can choose from several additional protection options:

Select locked cells, Select unlocked cells	These options allow users to select the locked or unlocked cells. By default, these options are turned on when protecting a worksheet. Turning off *Select locked cells* may be useful because it will allow users to access only unlocked cells. If both the *Select unlocked cells* and *Select locked cells* options are turned off, users will not be able to select or enter data into any cell on the worksheet.
Format cells, Format columns, and Format rows	These options allow users to change any of the cell formatting in the worksheet. However, even with these options turned off, users are permitted to use locked cells as a source for the format painter (but not as target cells).
Insert columns, Delete columns, Insert rows, and Delete rows	Insert new rows or columns, or delete existing rows or columns.
Insert hyperlinks	Insert hyperlinks into cells.
Sort	Sort data into a different sequence.
Use AutoFilter	Apply AutoFilters.
Use PivotTable & PivotChart	Allow the use of pivot tables and pivot charts.
Edit objects	Delete or modify pictures, clipart, and other graphic objects.
Edit scenarios	Use or modify scenarios.

By selecting any of these options, you allow others to have the selected capabilities. When you choose the default settings, others are permitted to enter or change data only in unlocked cells and are prevented from doing anything else, such as inserting or deleting rows or columns, or formatting cells.

Note that the password is optional; if you leave it blank, the worksheet is protected but anyone can unprotect it. As you enter a password, the ● character displays in the dialog box for every character in the password; this prevents anyone else from seeing what your password is. If you enter a password, Excel prompts you to enter it again to ensure that you have entered it correctly.

When worksheet protection is turned on, the Review tab in the Ribbon will display Unprotect Sheet in the Protect group to indicate that this worksheet is currently in protected mode, as shown in Figure 4-17.

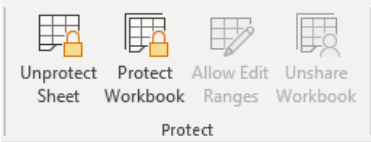


Figure 4-17: Unprotect Sheet in the Protect group - Review ribbon tab

The Info page in the Backstage view will also identify which worksheet is in protected mode (Figure 4-18).

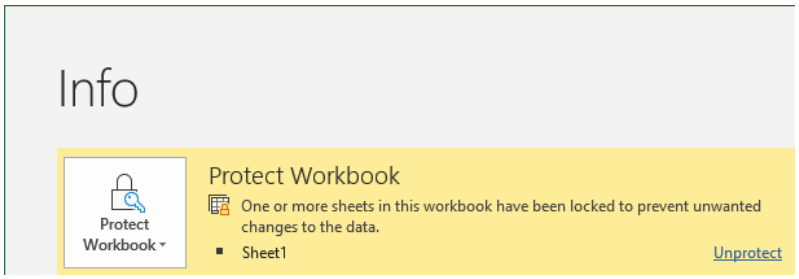


Figure 4-18: Info page of Backstage view – Protect Workbook

Note: Worksheet protection does not prevent anyone from deleting the entire worksheet or the workbook. It also does not prevent anyone from copying data to another worksheet or workbook.

Learn to protect a worksheet

In this exercise, you will protect a worksheet.

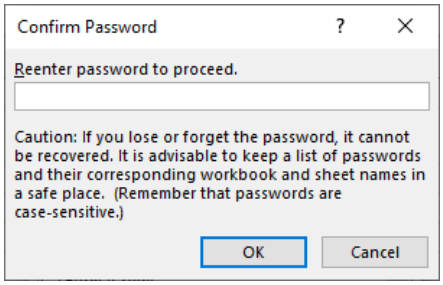
1. Open **Loan Calculator Protect Worksheet.xlsx** located in the *StarterFiles* folder, and save it as **My Loan Calculator Protect Worksheet.xlsx** in the *MyProjects* folder.
2. Select cells **B4:B6**.
3. On the Home tab, in the Cells group, click **Format**, and click **Format Cells**.
4. Click the **Protection** tab, deselect the **Locked** check box to turn the setting off, and click **OK**.

   You have now unlocked a range of cells that users will be permitted to update once worksheet protection is turned on.
5. On the Home tab, in the Cells group, click **Format**, and click **Protect Sheet**.

   The Protect Sheet dialog box opens so you can select which worksheet operations or objects to protect.
6. Leave all the check boxes at their default settings, then type: **123** in the *Password to unprotect sheet* field. Click **OK**.

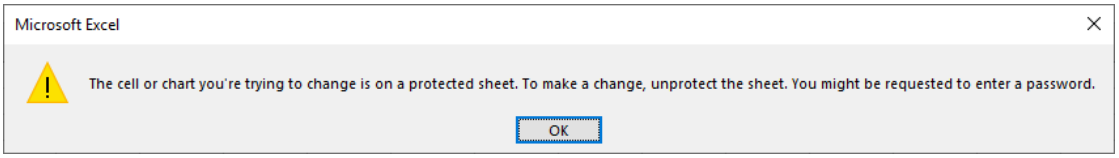
   Note: Do not use this password for your real workbooks! See the "Using Passwords" topic about selecting passwords to fit your security needs.

   The Confirm Password dialog box now appears; re-enter your password to ensure it is correct.



7. Type: **123** and click **OK**.
8. Move to cell **C12** and try to enter a value.

   When you press any key, the following message box appears:



9. Click **OK** to clear the error message.
10. On the Home tab, in the Cells group, click **Insert** or **Delete** to try to insert or delete a row or column.

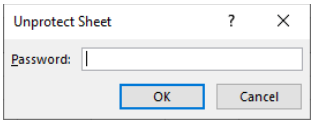
    Notice that the **Insert** and **Delete** (and other) commands in the Ribbon are grayed out, preventing you from accessing them. However, you do have the ability to insert new worksheets and copy data to different worksheets.

11. Enter the following information into the cells that were unlocked earlier:

    B4 **1000**
    B5 **.06**
    B5 **12**

12. On the Home tab, in the Cells group, click **Format**, then click **Unprotect Sheet**.

    The Unprotect Sheet dialog box opens.



13. Type: **123** in the *Password* field and click **OK**.

Now you will enter a value into a locked cell to verify that the worksheet is unprotected.

14. Move to cell **C12**, and enter: **10000**.
15. On the Review tab, in the Protect group, click **Protect Sheet**.
16. Deselect the **Select locked cells** and **Select unlocked cells** check boxes to turn them off and click **OK** without specifying a password.

    This worksheet is now in read-only mode.

17. Try to select any cell in this worksheet.

    You should not be able to click and select a cell.

18. On the Review tab, in the Protect group, click **Unprotect Sheet**.

    You did not need to enter a password to unprotect the worksheet because you did not use one when you had protected it previously.

    Once you have unlocked the worksheet, it remains unlocked until you protect it again.

19. Select cell **C12** and delete the value in that cell.

20. Save and close the workbook.

Allowing Ranges for Editing

Objectives 1.2.1, 1.2.2

Another way of allowing users to make changes to cells in an otherwise protected worksheet is to use the ***Allow Edit Ranges*** option. The Locked option described in the previous section allows all users to make changes to unlocked cells.

The Allow Edit Ranges option is different—it allows users to make changes to unlocked cells, but they need to know the password for that cell range. This feature enables you to allow only *some* users to update a particular cell range.

On the Review tab, in the Protect group, click Allow Edit Ranges to open the Allow Users to Edit Ranges dialog box (Figure 4-19).

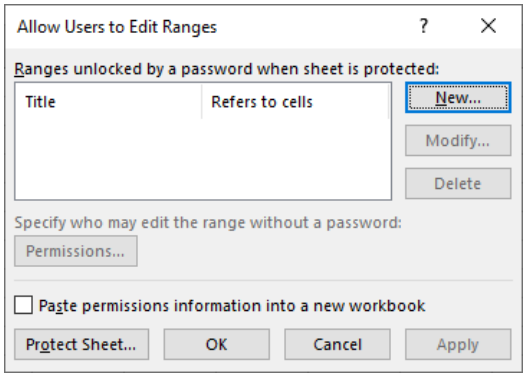


Figure 4-19: Allow Users to Edit Ranges dialog box

Click the New button to open the New Range dialog box (Figure 4-20).

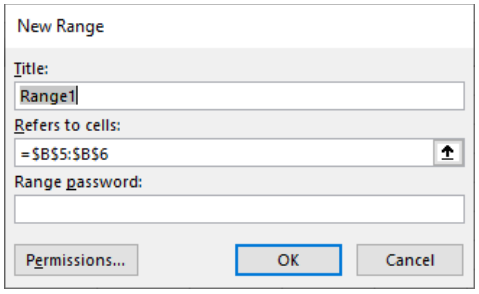


Figure 4-20: New Range dialog box

Use the New Range dialog box to specify different passwords and permission levels for each range of cells.

Title	Enter a title for this group of cell ranges.
Refers to cells	Identify the ranges of cells that are unlocked in this group. You can specify more than one range of cells for the worksheet by entering a comma between each range.
Range password	Use this password to unlock this group of cell ranges for editing.
Permissions	Identify the individual IDs or groups that will have open access to these cell ranges. This feature works best on computers connected to a domain-based (enterprise) network; managing security access privileges on individual computers is too time-consuming to be practical.

Note: You should not use the same password for the unlocked range as the password for locking the worksheet or workbook.

Click the Permissions button to open the Permissions dialog box (Figure 4-21). Any group or user name(s) that you add to the *Group or user names* list will be able to make changes to the selected cell range without having to enter the password. All other users must enter the password to make changes.

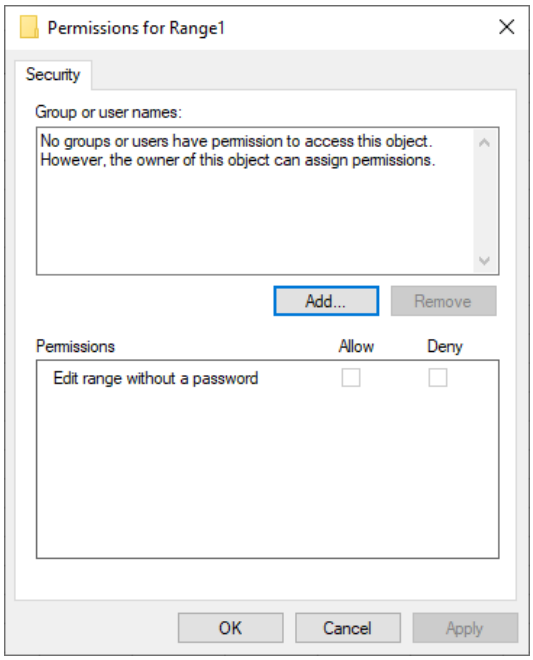


Figure 4-21: Permissions dialog box

Learn to unlock a cell range

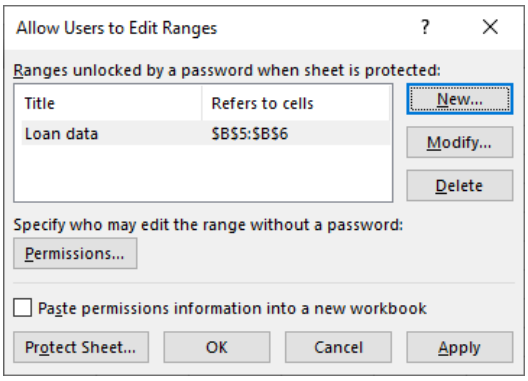
In this exercise, you will unlock a cell range using an alternate method.

1. Open **Loan Calculator Allow Ranges.xlsx** located in the *StarterFiles* folder, and save it as **My Loan Calculator Allow Ranges.xlsx** in the *MyProjects* folder.
2. Select cells **B5:B6**.
3. On the Home tab, in the Cells group, click **Format**, and then click **Lock Cell** to lock the selected cells.
4. With cells **B5:B6** still selected, on the Review tab, in the Protect group, click **Allow Edit Ranges**.

The Allow Users to Edit Ranges dialog box opens.

5. Click **New** to open the New Range dialog box.
6. Select the text in the *Title* field, then type: **Loan data**.
7. Click in the *Range password* field, and type: **456**.
8. Click **OK**.
9. In the Confirm Password dialog box, type: **456** and click **OK**.

   The completed Allow Users to Edit Ranges dialog box appears.

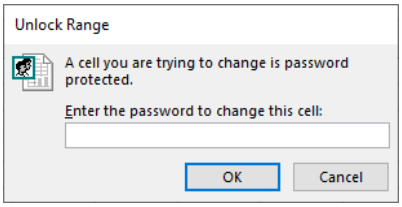


10. In the Allow Users to Edit Ranges dialog box, click **Protect Sheet**.
11. In the Protect Sheet dialog box, scroll up if necessary, then select the **Select locked cells** and **Select unlocked cells** check boxes to turn them back on.
12. Click in the *Password to unprotect sheet* field, type: **123** and click **OK**.
13. In the Confirm Password dialog box, type: **123** and click **OK**.

With the worksheet now protected, change the value in a cell that is simply unlocked.

14. Select cell **B4** and enter: **10,000**.
15. Select cell **B5** and press any key.

    Because this cell is one of the locked ranges, the Unlock Range dialog box appears. The key that you pressed to display this dialog box is ignored.



16. Enter: **456** and click **OK**.
17. Select cell **B5** and enter: **5**.
18. Select cell **B6** and enter: **36**.

	A	B	C
1	Tolano Adventures		
2	Vacation Financing Calculator		
3			
4	Loan Amount:	$10,000	
5	Interest Rate (annual %):	5%	
6	Length of Loan (months):	36	
7			
8	Payment/Month	$299.71	
9	Total Payments	$10,789.52	
10	Total Interest	$789.52	
11			

19. Save and close the workbook.

Protecting the Workbook Structure

Objective 1.2.3

Excel also provides protection for the ***workbook structure***, which will prevent users from adding, deleting, moving, or renaming worksheets within the workbook.

On the Review tab, in the Protect group, click Protect Workbook to open the Protect Structure and Windows dialog box (Figure 4-22). Specify what you want to protect, specify a password if desired, then click OK.

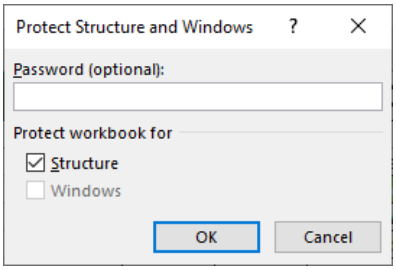


Figure 4-22: Protect Structure and Windows dialog box

Learn to enable workbook protection

In this exercise, you will enable workbook protection.

1. Open **Monthly Salary Protect Structure.xlsx** located in the *StarterFiles* folder, and save it as **My Monthly Salary Protect Structure.xlsx** in the *MyProjects* folder.
2. On the Home tab, in the Cells group, click the **Insert** arrow button, then click **Insert Sheet** to add a new worksheet.
3. On the Home tab, in the Cells group, click the **Delete** arrow button, then click **Delete Sheet** to delete this new worksheet.
4. On the Review tab, in the Protect group, click **Protect Workbook**.

   Note: Even though the button in the Ribbon is named *Protect Workbook*, it will lock down only the **structure** of the workbook. Other users will still be permitted to freely open the workbook and make changes to any cell in any worksheet.

5. If necessary, select the **Structure** check box to turn it on.
6. Type: **123** in the *Password* field, and then click **OK**.
7. Type: **123** in the *Reenter password to proceed* field, and then click **OK**.
8. On the Home tab, in the Cells group, click the **Insert** arrow button.

   Notice that the Insert Sheet option is grayed out.

9. On the Home tab, in the Cells group, click the **Delete** arrow button.

Notice that the Delete Sheet option is grayed out.

10. On the Home tab, in the Cells group, click the **Format** arrow button. The Organize Sheets menu options are also grayed out.
11. Right-click the **Sheet1** worksheet tab. After reviewing the different menu options that are grayed out, click any blank area of the worksheet to close the right-click menu.
12. Save and close the workbook.

Setting Global and Workbook-Specific Options

Objective 1.1.4, 1.2.4

Excel provides many options and settings that you can specify to affect how to work with a specific workbook or all workbooks. ***Global options*** affect all workbooks. You can specify both global and workbook-specific options and settings in the Excel Options dialog box, which you can access by clicking Options in the Backstage view.

The Save page of the Excel Options dialog box (Figure 4-23) includes settings that control default locations for saving files, and the frequency of generating automatically saved versions of files through the AutoSave/AutoRecover feature.

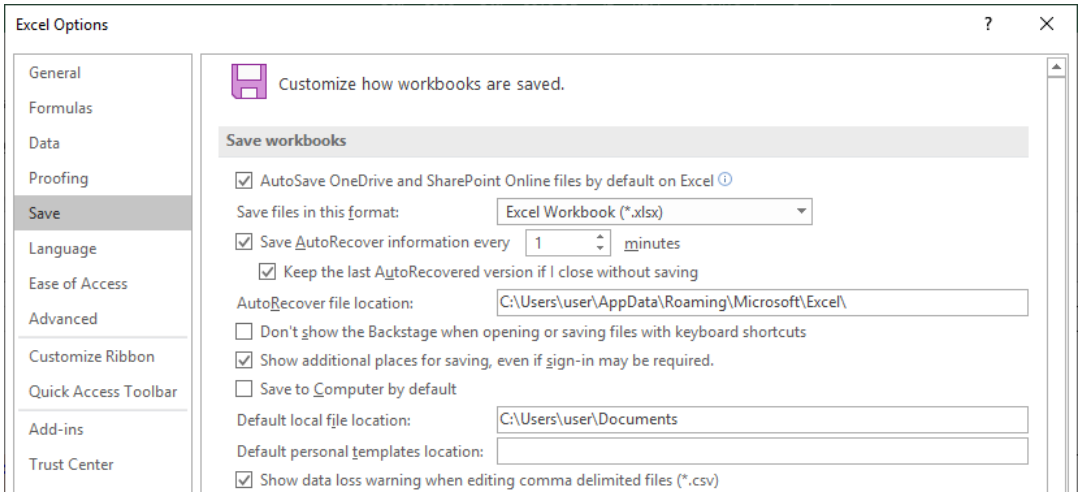


Figure 4-23: Excel Options dialog box – Save page

As you work, Excel saves copies of your workbooks using the ***AutoSave*** feature, creating ***versions*** you can use to recover the workbook in case you lose it as a result of a power failure or accidental deletion. These draft versions of your workbooks contain the contents prior to the last time you saved it (or when the AutoSave feature created a version).

You can configure the time interval at which Excel will save a copy of the workbook. The longer you work on a workbook, the more versions there will be if you do not manually save it occasionally.

You can also configure Excel to keep the last autosaved version if you close the file without saving it. If you enable this option, you can recover your work if you accidentally close a workbook without saving your latest changes. Re-open the workbook, then click File to access the Backstage view. The modified version is temporarily available in the Manage Workbook section (Figure 4-24).

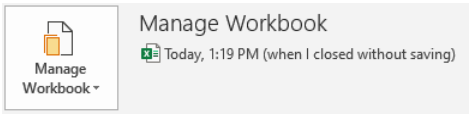


Figure 4-24: Info page of Backstage view – Manage Workbook section

The Formulas page of the Excel Options dialog box has two settings that affect how formulas and calculations are performed: *Workbook Calculation* and *Enable iterative calculation*, as shown in Figure 4-25.

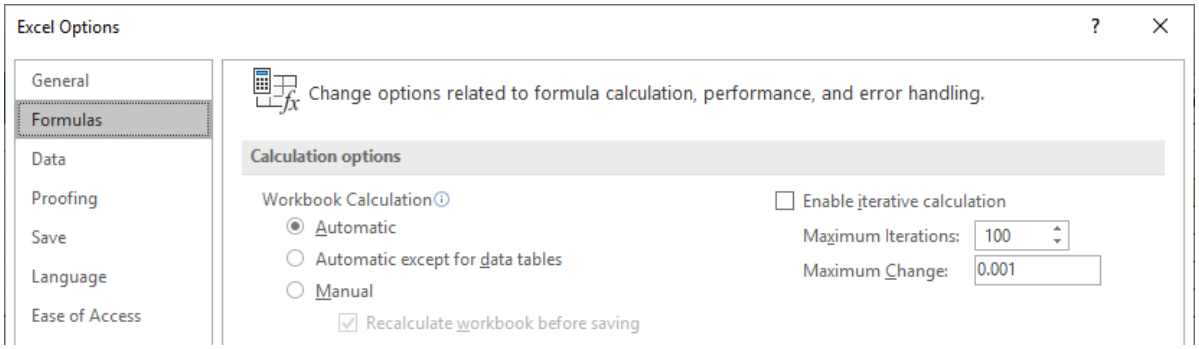


Figure 4-25: Excel Options dialog box – Formulas page

Workbook Calculation	Worksheets often contain many formulas, and when you update a value upon which one or more formulas is dependent, all formulas recalculate. In most situations, however, there is no noticeable delay and the default setting for workbook calculation is Automatic. There may be times, however, when you want to suspend recalculation until several values have been entered. You can do that by changing this setting to Manual. If you change the setting to Manual, formulas will not recalculate until you press the F9 keyboard key, or use the Calculate Now or Calculate Sheet commands in the Calculation group on the Formulas tab of the Ribbon. Notice that in conjunction with the manual setting, you can specify to force a recalculation when the workbook is saved.
Enable iterative calculation	Most Excel formulas require only one calculation to reach completion. Some types of calculations, such as circular references and formulas that result in a loop, require that formulas be recalculated several times. Some highly specialized applications, such as scientific applications, may require a very large number of recalculations. For these formulas, you can specify the maximum number of iterations to prevent Excel from recalculating endlessly.

You can also specify to manually or automatically calculate workbooks from the Ribbon. On the Formulas tab, in the Calculation group, click the Calculation Options arrow, and then click Manual or Automatic, respectively, as shown in Figure 4-26.

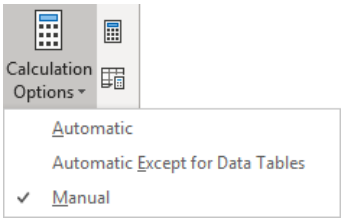


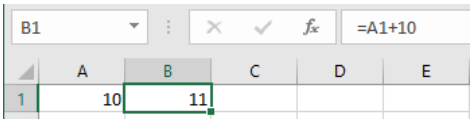
Figure 4-26: Calculation Options

Learn to change calculation options

In this exercise, you will change calculation options.

1. Create a new blank workbook.
2. Click **File**, then click **Options**.
3. In the Excel Options dialog box, click **Formulas**, click the **Manual** option button, and then click **OK** to save this setting.
4. Click in cell **A1** and enter: **1**.
5. Click in cell **B1** and enter: =**A1**+**10**.

   Cell B1 now shows the value 11, which is correct.
6. Click in cell **A1** and enter: **10**.



   Cell B1 has not changed to 20, which is what you would expect if Excel was performing the calculation automatically. You will need to manually force Excel to recalculate the formula.
7. Press the **F9** key. Cell B1 now shows the correct value.

   Note: Alternatively, you could also force Excel to perform the calculation by clicking **Calculate Now** in the Calculation group on the Formulas tab.
8. On the Formulas tab, in the Calculation group, click **Calculation Options**, and then click **Automatic**.
9. Click in cell **A1** and enter: **20**.

   Cell B1 now shows the value 30, which is correct because the formula automatically recalculated as soon as you changed the value in cell A1.
10. Close the workbook without saving.

Lesson Summary

Now that you have completed this lesson, you should be able to:

- ☑ Insert, modify, and remove links to external workbooks.
- ☑ Consolidate data from multiple workbooks.
- ☑ Create, navigate among, reply to, and delete comments.
- ☑ Create secure passwords.
- ☑ Protect a worksheet from unwanted changes.
- ☑ Allow users to edit specific ranges only.
- ☑ Protect a workbook structure from unwanted changes.
- ☑ Set global and workbook-specific options.

Key Terms

Term	Definition
Allow Edit Ranges	A feature that enables you to allow users to make changes to a cell or cell range as long as they know the password to be able to do so.
AutoSave	A feature that creates versions of your workbook that enables you to recover the workbook in case you lose it as a result of a power failure or accidental deletion. See Version.
Comment	Similar to a post-it note in which you can annotate a worksheet by entering information for yourself or others to review.
Consolidating data	The process of summarizing multiple ranges of data into a single range. You can consolidate data from different areas within a worksheet, from other worksheets in the same workbook, or from other workbooks.
Global Options	Options and settings you can specify in Excel that affect all workbooks.
Link	The process of referencing cells or worksheets in a "source" workbook, so that changes made in the source workbook will automatically change in the linked workbook.
Version	A draft of your workbook that contains the contents prior to the last time you saved it (or when the AutoSave feature created a version). See AutoSave.
Workbook Structure	Refers to the worksheet tabs within a workbook. You can protect the workbook structure to prevent users from adding, deleting, moving, or renaming worksheets within the workbook.
Worksheet Protection	A feature that enables you to restrict others from making changes to designated cells or cell ranges in a worksheet.

Quiz Questions

For each question, select the best answer.

1. Which of the following is the correct workbook link to obtain the value in cell B12 in Sheet1 of the January Sales workbook?

    a. ='C:\Users\Me\January Sales'!B12
    b. ='C:\Users\Me\[January Sales.xlsx]Sheet1'!B12
    c. ='C:\Users\Me\[Total Sales.xlsx]Sheet1'!B12
    d. = C:\Users\Me\[January Sales.xlsx]!B12

2. In which situation might you use the Edit Links dialog box?

    a. When a referenced value in a source workbook changes
    b. When a value in the dependent workbook changes
    c. When the location of a source workbook changes
    d. All of these situations require the use of the Edit Links dialog box.

3. What happens when you use the Break Link command in the Edit Links dialog box to break the link in cell C7?

    a. The link in cell C7 is converted to a data value.
    b. The contents of cell C7 are replaced with a zero (0).
    c. All values and formatting in cell C7 are removed.
    d. All values in cell C7 are removed.

4. On which Ribbon tab can you access the command to consolidate data?

    a. On the Formulas tab
    b. On the Insert tab
    c. On the Data tab
    d. On the Power Pivot tab

5. To reply to a comment in a worksheet, you should _____.

    a. add your own comment to the cell immediately to the right of the cell containing the original comment
    b. add your own comment to the cell immediately above the cell containing the original comment
    c. open the Comments task pane
    d. click Reply to Comment in the Comments group in the Ribbon

6. Ellen has created a large worksheet filled with formulas and she has just turned on worksheet protection. She notices that cell C25 contains an error. What will happen when she tries to make a correction to cell C25?

    a. She will be prompted to enter a password.
    b. She will receive a notification that the workbook has been marked as final.
    c. She will be able to make the correction without any difficulty.
    d. She will not be allowed to make changes to cell C25.

7. Which of the following statements about the Allow Edit Ranges option is TRUE?

    a. This option validates the data users enter into a specific cell range.
    b. The option allows all users to make changes to locked cell ranges.
    c. This option prevents users from adding or deleting worksheets.
    d. This option requires users to enter a password in order to edit an unlocked cell range.

8. Martin cannot add a new worksheet to the Quarterly Sales workbook. Why not?

    a. The workbook has been marked as final.
    b. Worksheet protection is enabled.
    c. Workbook protection is enabled.
    d. Martin is working on a domain-based network.

9. Which statement about setting workbook management options in Excel is NOT true?

    a. If you close a file without first saving it, the changes you made since your last save cannot be recovered.
    b. If you close a file without first saving it, the changes you made since your last save can be recovered.
    c. You can specify the frequency with which Excel will automatically save workbooks.
    d. You can specify the default file locations for saved files and autosaved files.

10. Where can you specify settings that affect how (and when) formula calculations are performed?

    a. In the Data Tools group on the Data tab
    b. On the Formulas page in the Excel Options dialog box
    c. In the Formula Auditing group on the Formulas tab
    d. In the Controls group on the Developer tab

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Lesson 5: Advanced Charts, Functions, and What-If Analysis

Lesson Objectives

In this lesson, you will work with advanced chart elements and chart types, work with financial and other advanced functions, and perform what-if analysis. Upon completion of this lesson, you will be able to:

- ☐ Add a secondary vertical axis.
- ☐ Use advanced chart types.
- ☐ Use financial functions.
- ☐ Nest functions inside other functions.
- ☐ Use conditional logic functions.
- ☐ Use conditional summary functions.
- ☐ Use the Goal Seek tool to perform what-if analysis.
- ☐ Use the Scenario Manager to perform what-if analysis.
- ☐ Use the cell Watch Window.

Using Advanced Chart Elements

The Excel charting feature is an extremely powerful tool that displays your data in a visual manner. The tabs on the Chart Tools contextual ribbon include a wide variety of options you can use to customize the appearance of your chart.

Because there are so many combinations to choose from, you may want to start with one of the selections in the Chart Layouts group in the Chart Tools Design tab. Each of these options commonly uses a pre-selected mix of titles, legend, and other chart formatting settings.

Adding a Secondary Vertical Axis

Objective 4.1.1

The Y-axis is always displayed on the left side of the chart. You can add an optional ***secondary Y-axis*** on the right side. The primary reason for having two axes is that the chart may display two types of data, each requiring its own scale. An example is a chart that shows data containing prices and sales volume. The sales volume may use the primary axis on the left with the scale reaching up to 1,000,000 units. The price data may use a secondary axis on the right with the scale reaching up to $10.00. If you displayed the price data using the primary axis, each data point will be very low compared to sales data, and therefore, not appear to be meaningful.

In many cases, you may want to configure the chart using two different chart types at the same time. This is known as a combo chart, in which some of the ***data series*** use one chart type (for example, a clustered column) while the rest of the data series use a different chart type (such as a line). You can select more than two chart types, but the chart will look too complex. You can also combine a combo chart with dual axes so that one chart type uses the primary axis, and the other chart type aligns to the secondary axis.

To change these chart type and secondary axis options, on the Chart Tools Design tab, in the Type group, click Change Chart Type. The Change Chart Type dialog box opens (Figure 5-1).

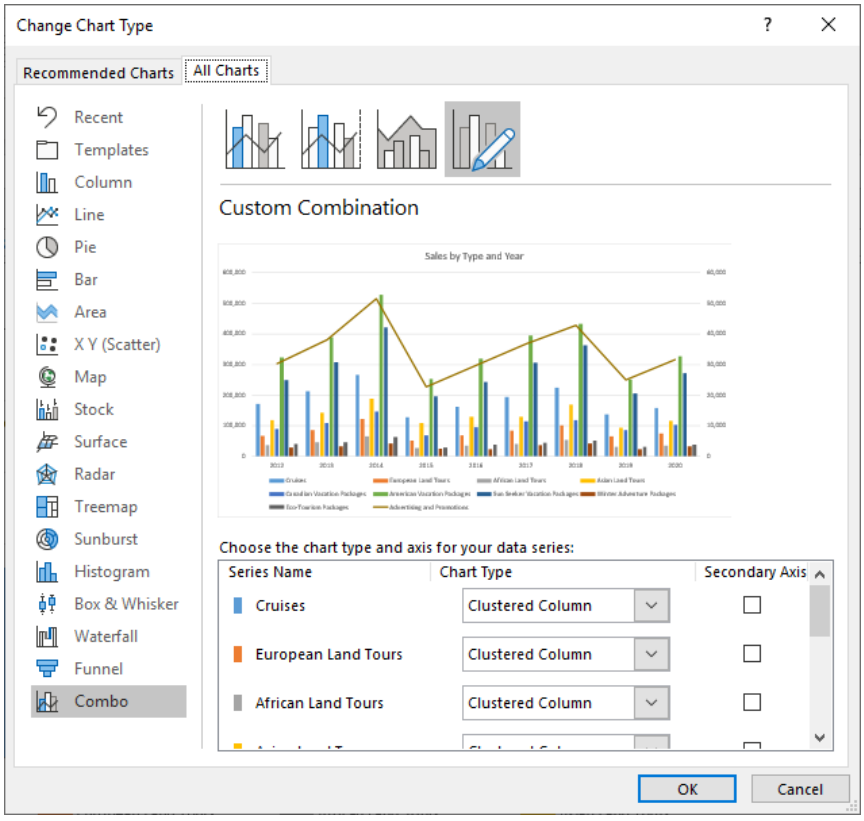


Figure 5-1: Change Chart Type dialog box

An alternative method of shifting a data series to the secondary axis is to right-click one of the data points (or bars) and click Format Data Series in the shortcut menu to open the Format Data Series pane (Figure 5-2). To switch to the other axis, select the Secondary Axis option in the Format Data Series pane. Note that you must select one of the data series—four resize handles will appear around each of the data bars in the series.

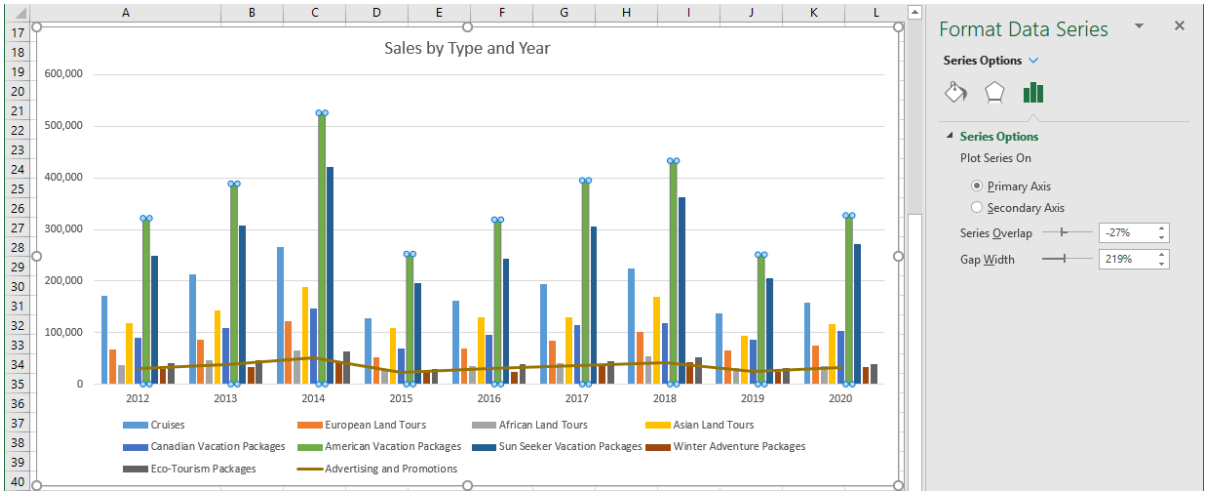
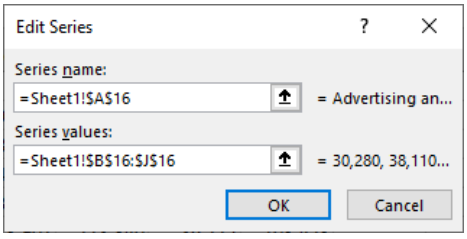


Figure 5-2: Format Data Series pane

Learn to set up a secondary Y-axis

In this exercise, you will add a secondary vertical axis to a chart.

1. Open **Sales by Type and Year Secondary Axis.xlsx** located in the *StarterFiles* folder, and save it as **My Sales by Type and Year Secondary Axis xlsx** in the *MyProjects* folder.
2. Click in a blank area of the chart to select it.
3. On the Chart Tools Design tab, in the Data group, click **Select Data**.
4. In the Select Data Source dialog box, click **Add**.
5. In the Edit Series dialog box, click in the **Series name** field, then click cell **A16**.
6. Delete the current contents of the *Series values* field, select cells **B16:J16**, then click **OK**.



7. In the Select Data Source dialog box, click **OK** to add this new row of data to the chart.

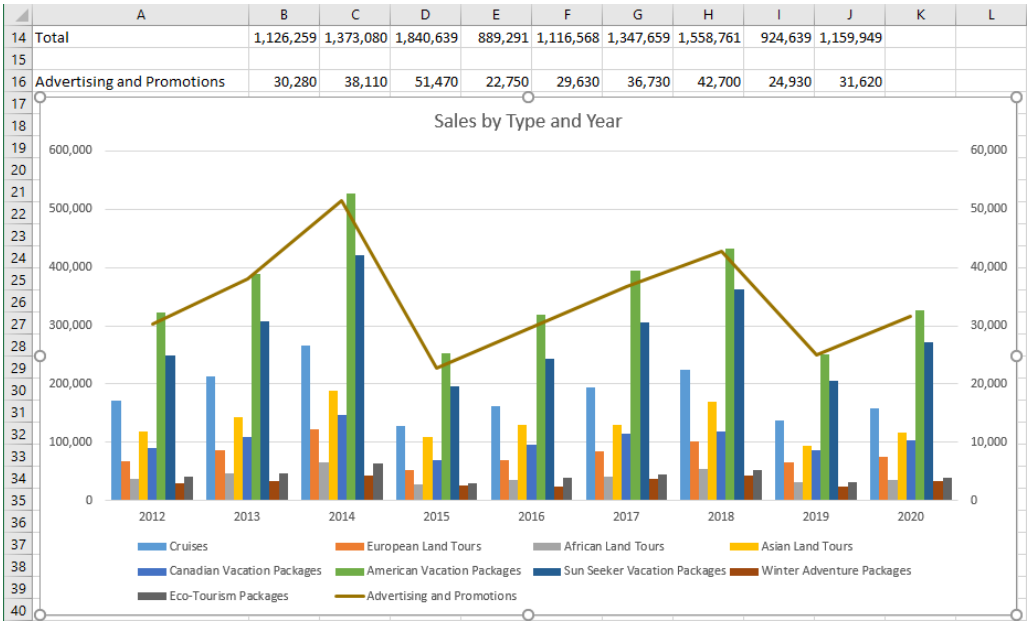
   This new data represents an expense, unlike the other data series, which represent income. It would therefore make better sense to display it as a different chart type with its own separate Y-axis.
8. On the Chart Tools Design tab, in the Type group, click **Change Chart Type**.
9. In the Change Chart Type dialog box, click the **Combo** chart type on the left.

By changing to the combo chart type, Excel changes the second half of the data series to the line type.

10. Scroll down the *Choose the chart type and axis for your data series* list box, and ensure the *Chart Type* for every series is **Clustered Column**. Only the last one, Advertising and Promotions should be **Line**.

11. Select the **Secondary Axis** check box for the *Advertising and Promotions* series, and click **OK**.

    The screen should look similar to the following example:



    Notice that if you had left the new data row as another column bar, its significance would not have been obvious. By changing the data series to a line, you can now see a very distinct pattern – the Advertising and Promotions amount rises and falls in direct proportion to the sales of the various travel types.

12. Save and close the workbook.

Using Advanced Chart Types

Objective 4.1.2

Note: Basic chart types, including Column, Line, Pie, and Bar are discussed in the Excel Associate course.

You can easily change the type of chart you have selected if it does not display the worksheet information appropriately.

Excel provides a variety of chart types and several subtypes within each major type. The following explains the uses for some of the advanced chart types:

Area – Use to compare a continuous change in volume. Figure 5-3 shows a stacked area chart in which the total height is the combined total. The relative size of each portion can be compared to each other as well as for each point along the horizontal axis. The area chart is useful for displaying trends.

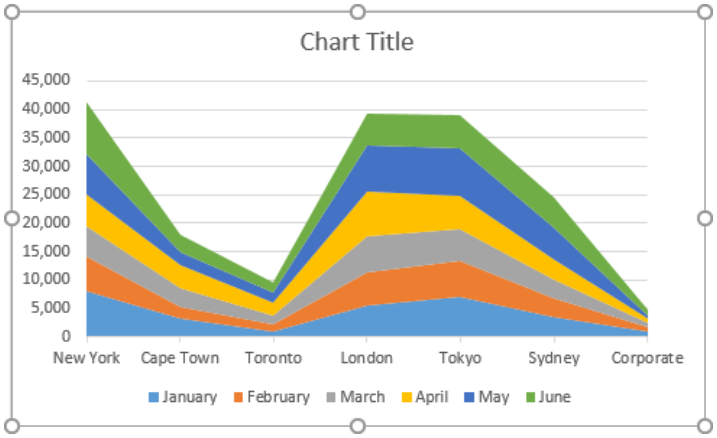


Figure 5-3: Stacked Area chart

XY (Scatter) – Use to determine data patterns where points are clustered close together. In Figure 5-4, the points are scattered with no apparent pattern.

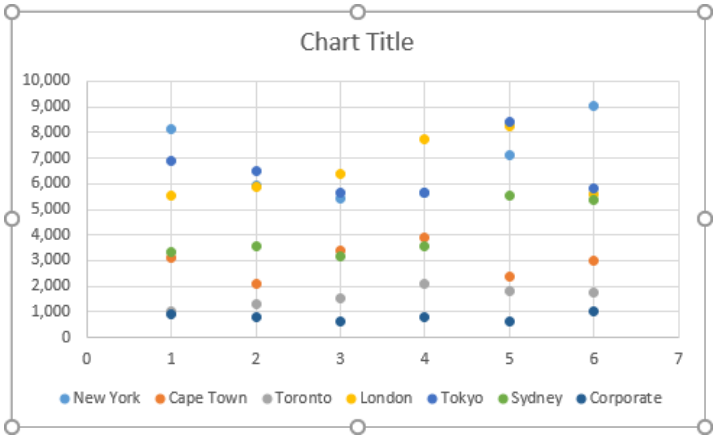


Figure 5-4: XY (Scatter) chart

Map – Use for showing the amount of data by region (state, country, province, and so on). Will show regions as shaded with a gradient, based on the amount or density of data relative to other regions. Useful for comparing a single statistic between regions.

Stock – Use to display high-low-close data (Figure 5-5). To use this display, you must have at least three sets of data for each point on the horizontal axis.

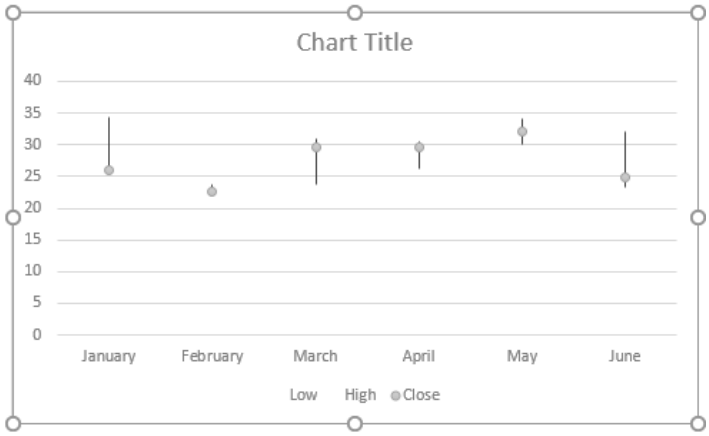


Figure 5-5: Stock chart

Surface – Use to display trends in values with a 3-D presentation and a continuous surface (Figure 5-6).

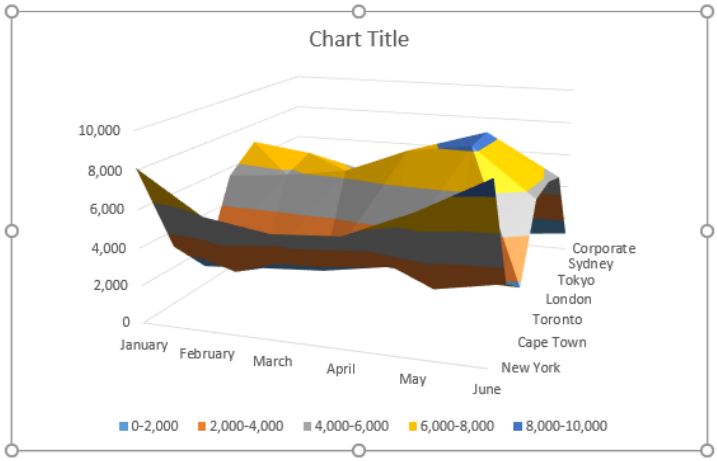


Figure 5-6: Surface chart

Radar – Use to determine patterns or trends with points connected by lines. It is also called a spider or star chart because of its appearance (Figure 5-7). This type of chart is most appropriate when the data series are "spiked" with high values in only certain categories (such as months). Examples of spike data are seasonal sales of flu medication, barbeque sauce, and tulip bulbs.

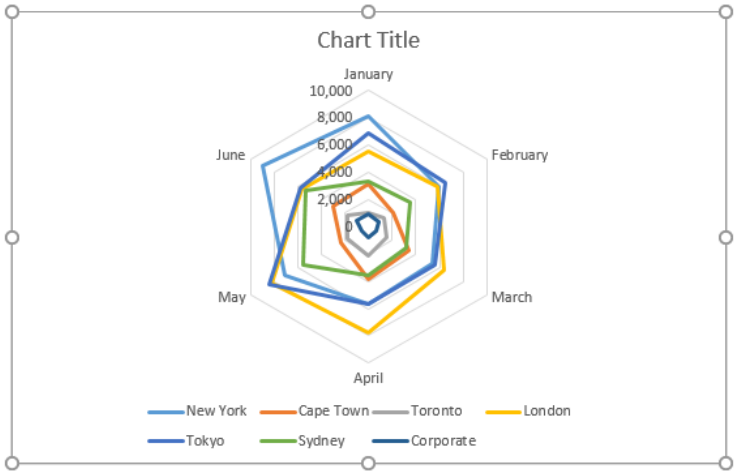


Figure 5-7: Radar chart

Treemap – Use to compare the relative size of each portion that together make up the combined total; each portion shows as a rectangle. A treemap is a hierarchical chart in that it can group the data values as subtotals. In Figure 5-8, you can not only compare the January values for each location, but also compare the (sub)total of each location to each other.

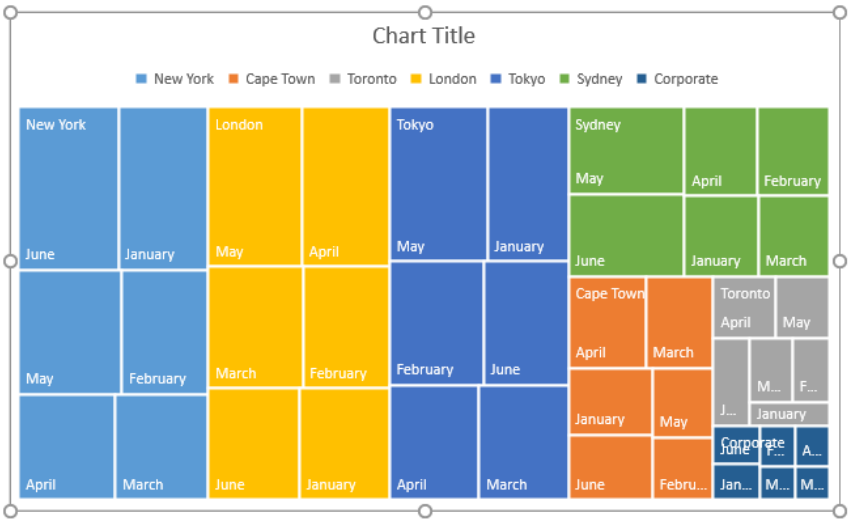


Figure 5-8: Treemap chart

Sunburst – Like a treemap chart, use to compare the relative size of each data value and their group subtotals as portions of the combined total. The portions appear as slices of the total in the shape of a doughnut (Figure 5-9).

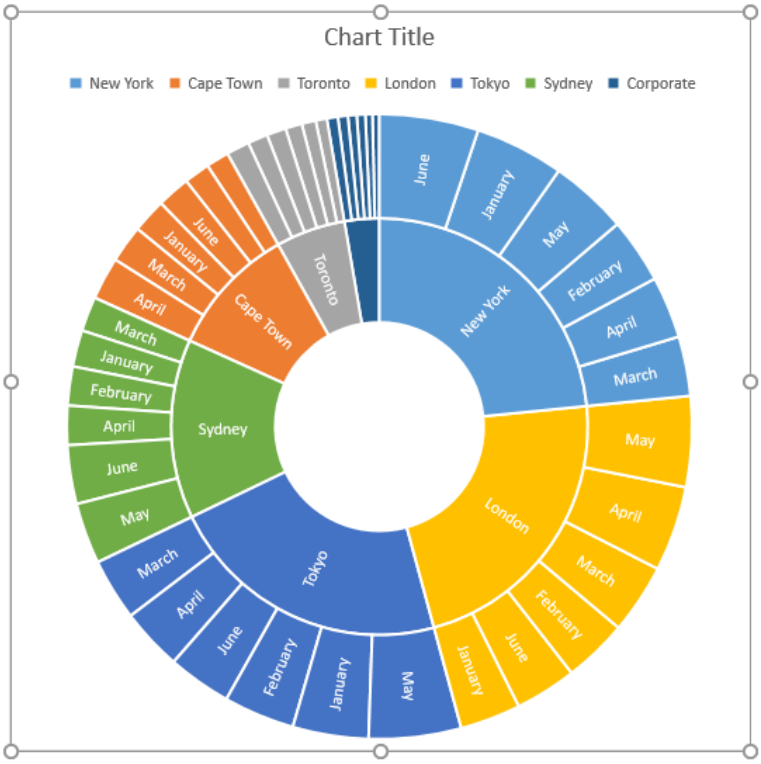


Figure 5-9: Sunburst chart

Histogram – Use to display the frequency (number of times) that each value appears in the data; for example, the number of men and women, or the number of people in different age groups. This type of chart is used primarily for statistical analysis. Only one data series can be selected for this chart (Figure 5-10).

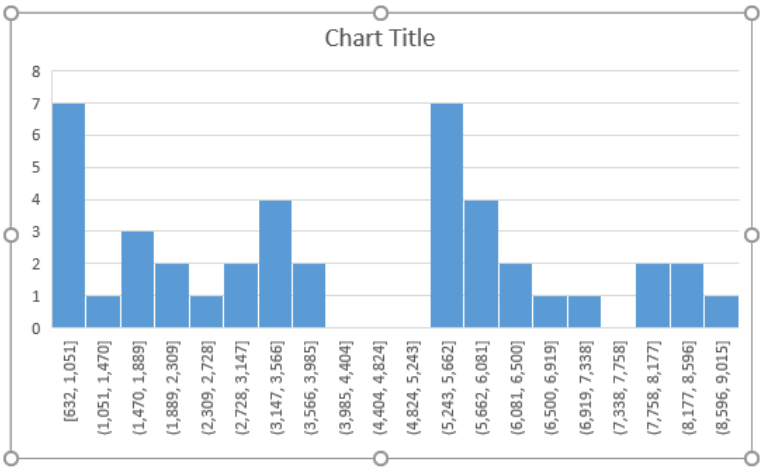


Figure 5-10: Histogram chart

A Pareto chart is a second type of histogram in which the results are sorted in descending order and a line is also drawn using the secondary Y-axis to show the cumulative total percentage. To create a Pareto chart (Figure 5-11), you can select it directly from the Histogram category in the All Charts tab of the Insert Chart dialog box.

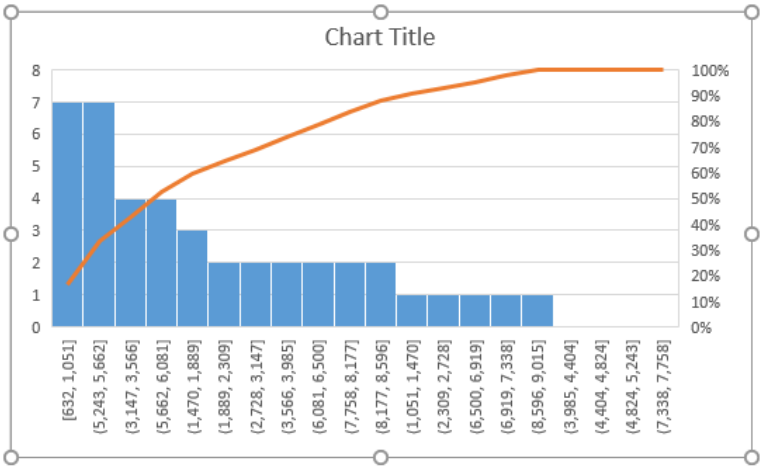


Figure 5-11: Pareto chart

Box & Whisker – Use to show more detailed statistical information about the spread of data values, including the mean, range, quartiles, and outliers (Figure 5-12).

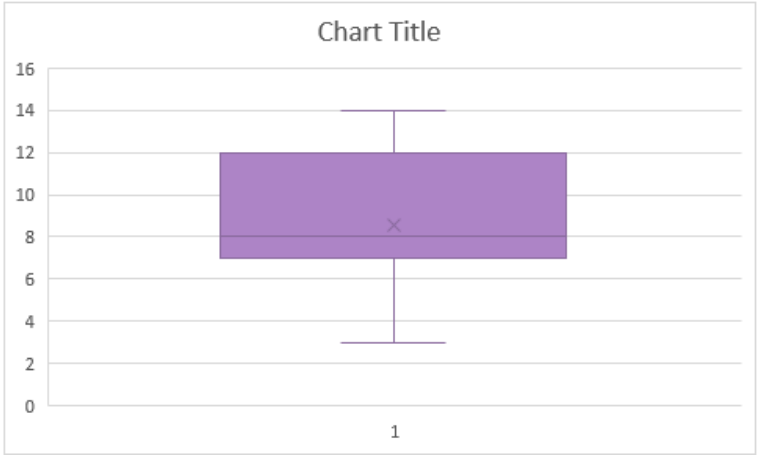


Figure 5-12: Box & Whisker chart

Waterfall – Use to graphically show an initial value and a final value, plus the increases and decreases between the two (Figure 5-13). This is useful for specific uses such as showing financial data that identifies where the major expenses are and how they affect a company's profits.

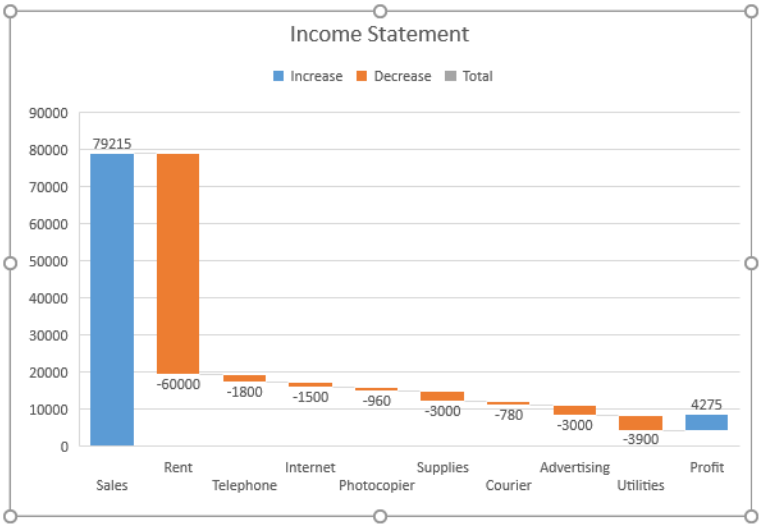


Figure 5-13: Waterfall chart

Funnel – Use to track the same set of data that is shrinking or growing. A funnel chart is the same as a bar chart; however, each bar is centered, causing it to look like a funnel (Figure 5-14). This is useful in cases where data is either always increasing or always decreasing between stages/bars. An example of this would be a graph of each stage of the sales process: from leads, to prospects, to opportunities, to closes. The graph could show the number of transactions that made it to each stage, which is always going to decrease.

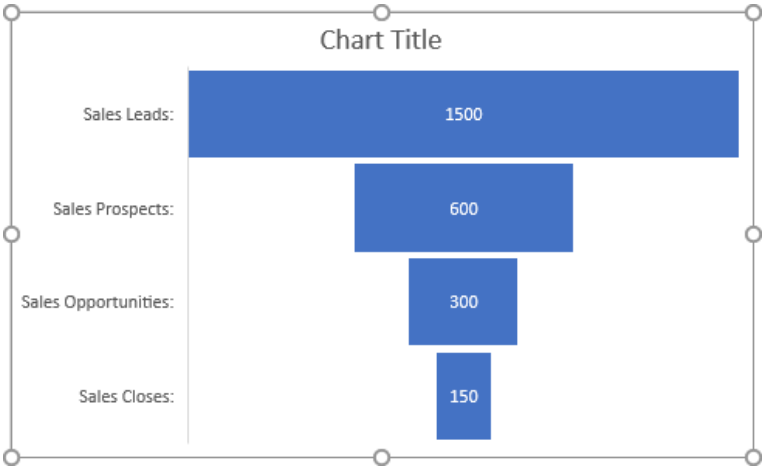


Figure 5-14: Funnel chart

Combo – Use to combine two different chart types together for a set of data values, such as a clustered column and a line chart.

Most of these chart types have both two-dimensional and three-dimensional choices. Three-dimensional charts can be more interesting to look at, but may be more difficult to read because they tend to look crowded.

To change the chart type, click the chart to access chart mode, and then use one of the following methods to open the Change Chart Type dialog box (Figure 5-15):

- On the Chart Tools Design tab, in the Type group, click Change Chart Type, or
- right-click any blank area of the chart, and then click Change Chart Type.

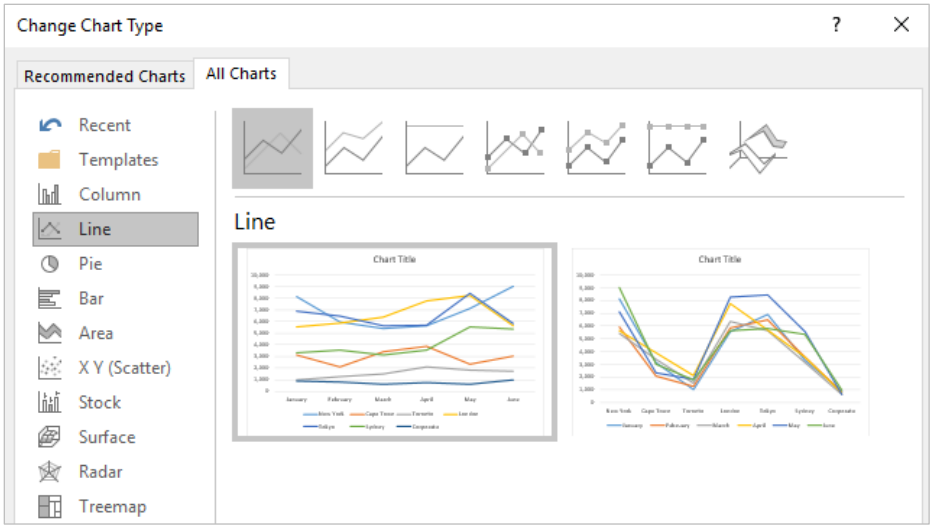


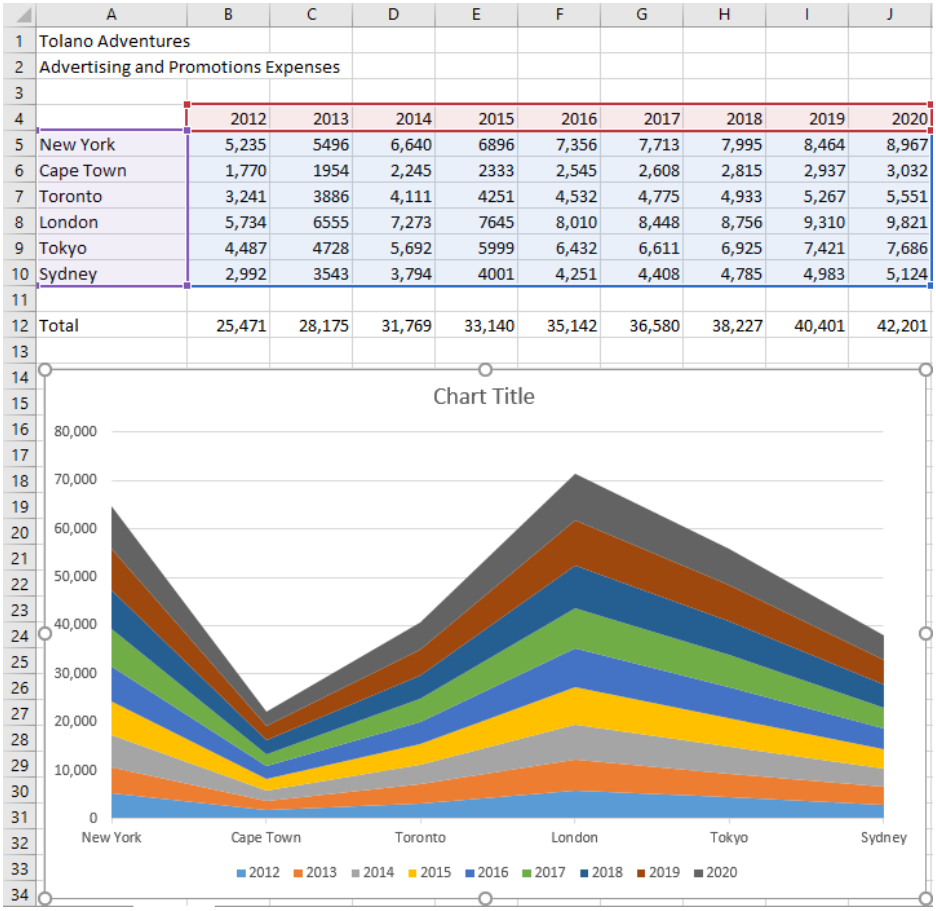
Figure 5-15: Change Chart Type dialog box

Learn to use advanced chart types

In this exercise, you will create advanced chart types.

1. Open **Advertising and Promotions Expense.xlsx** located in the *StarterFiles* folder, and save it as **My Advertising and Promotions Expense.xlsx** in the *MyProjects* folder.
2. Click any cell in the range **A5:J10**, then on the Insert tab, in the Charts group, click the **See All Charts** dialog box launcher.
3. In the Insert Chart dialog box, click the **All Charts** tab, click **Area**, click the **Stacked Area** icon, click the second chart image (the one on the right), and then click **OK**.
4. Click and drag the chart to a new location on the worksheet with the upper left corner in cell **A14**.
5. Click and drag the bottom right corner handle down to cell **J34**.

The screen should look similar to the following:

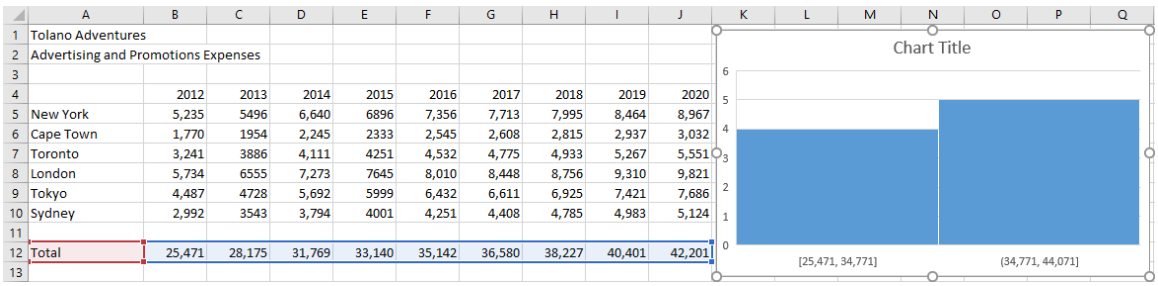


	2012	2013	2014	2015	2016	2017	2018	2019	2020
New York	5,235	5496	6,640	6896	7,356	7,713	7,995	8,464	8,967
Cape Town	1,770	1954	2,245	2333	2,545	2,608	2,815	2,937	3,032
Toronto	3,241	3886	4,111	4251	4,532	4,775	4,933	5,267	5,551
London	5,734	6555	7,273	7645	8,010	8,448	8,756	9,310	9,821
Tokyo	4,487	4728	5,692	5999	6,432	6,611	6,925	7,421	7,686
Sydney	2,992	3543	3,794	4001	4,251	4,408	4,785	4,983	5,124
Total	25,471	28,175	31,769	33,140	35,142	36,580	38,227	40,401	42,201

Notice that the stacked area chart shows the relative sizes of the total expenses for each city, and that the total height is the combined total.

6. Select cells **A12:J12**.
7. Open the Insert Chart dialog box and display the **All Charts** tab.
8. Click **Histogram**, and then click **OK**.
9. Click and drag the chart to a new location on the worksheet with the upper left corner in cell **K1**.
10. Click and drag the bottom right corner handle up to cell **Q13**.

The screen should look similar to the following:



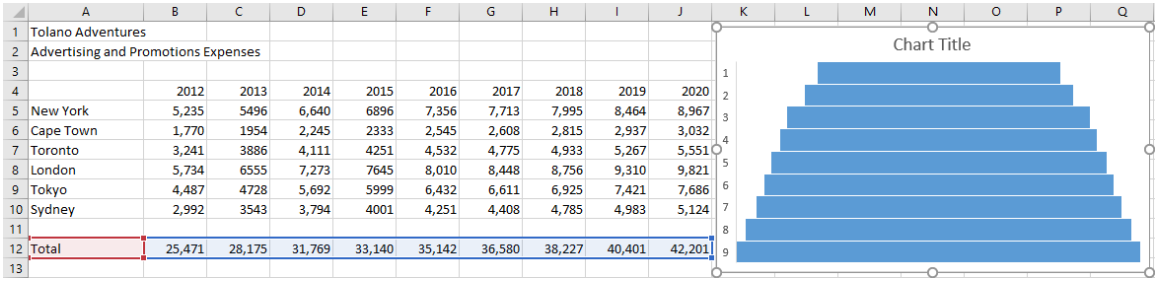
	2012	2013	2014	2015	2016	2017	2018	2019	2020
New York	5,235	5496	6,640	6896	7,356	7,713	7,995	8,464	8,967
Cape Town	1,770	1954	2,245	2333	2,545	2,608	2,815	2,937	3,032
Toronto	3,241	3886	4,111	4251	4,532	4,775	4,933	5,267	5,551
London	5,734	6555	7,273	7645	8,010	8,448	8,756	9,310	9,821
Tokyo	4,487	4728	5,692	5999	6,432	6,611	6,925	7,421	7,686
Sydney	2,992	3543	3,794	4001	4,251	4,408	4,785	4,983	5,124
Total	25,471	28,175	31,769	33,140	35,142	36,580	38,227	40,401	42,201

Notice that the histogram creates two columns that roughly divide the values in the Total row into halves. Four of the total expense values fall in the lower half, and five of the total expense values fall in the upper half.

11. With the histogram chart still selected, on the Chart Tools Design tab, in the Type group, click **Change Chart Type**.

12. Click **Funnel**, and then click **OK**.

    The screen should look similar to the following:



	A	B	C	D	E	F	G	H	I	J
1	Tolano Adventures									
2	Advertising and Promotions Expenses									
3										
4		2012	2013	2014	2015	2016	2017	2018	2019	2020
5	New York	5,235	5496	6,640	6896	7,356	7,713	7,995	8,464	8,967
6	Cape Town	1,770	1954	2,245	2333	2,545	2,608	2,815	2,937	3,032
7	Toronto	3,241	3886	4,111	4251	4,532	4,775	4,933	5,267	5,551
8	London	5,734	6555	7,273	7645	8,010	8,448	8,756	9,310	9,821
9	Tokyo	4,487	4728	5,692	5999	6,432	6,611	6,925	7,421	7,686
10	Sydney	2,992	3543	3,794	4001	4,251	4,408	4,785	4,983	5,124
11										
12	Total	25,471	28,175	31,769	33,140	35,142	36,580	38,227	40,401	42,201
13										

    Notice that the funnel chart displays bars whose sizes reflect the total expense values for each year relative to one another.

13. Save and close the workbook.

Using Advanced Functions and Features

Using Financial Functions

Objective 3.4.3, 3.4.4

Excel includes a rich variety of financial functions. These financial functions are particularly useful when using worksheets that require calculations of loan payments, annuities, and related calculations. Some of the more commonly-used financial functions are shown below.

PMT	Calculate the payment required for a given principal, interest rate, and number of time periods.
NPV	Calculate the Net Present Value of a stream of cash flows.
PV	Calculate the Present Value of an ordinary annuity or series of payments.
FV	Calculate the Future Value of an ordinary annuity or series of payments.
NPER	Calculate the number of periods left on an investment; for example, the amount of time before a set amount of money is made on an investment, or the number of payments remaining on a loan.
IRR	Calculate the Internal Rate of Return of a stream of cash flows.

The PMT Function

The PMT function requires that you specify the principal (amount borrowed), the interest rate, and the term (repayment period). The function also includes two optional arguments: ending balance (termination/buy out) and type (when payments will be made; enter "0" or leave this blank for the end of the month or enter "1" for the beginning of the month). The format is:

=PMT(interest,term,principal,ending balance,type)

When you enter the values for interest and term, ensure that you express them in the same time units. For example, if you want to find the monthly loan payment, you must ensure that both interest and term are expressed in months. If you are given an annual interest rate, you must divide that value by 12 to calculate the monthly interest rate. If the term is also expressed in years, then you must also multiply that value by 12 to calculate the total number of months (which is also the number of payments to be made).

For example, to calculate the monthly payment for a loan with an annual interest rate of 6% and a term life of five years, the arguments used in the PMT function are:

- interest rate = 6% / 12 = 0.5% per month
- term = 5 x 12 = 60 months

Note: The PMT function cannot be used to correctly calculate mortgage payments in some countries, such as Canada, where interest on residential mortgages is calculated semi-annually, not in advance. As a result, the monthly payment amount is lower because the interest is not compounded monthly. The PMT function does correctly calculate the mortgage payments in other countries where interest is compounded monthly, such as the United States.

In general, Excel calculates the Total per Term by using the number of monthly payments multiplied by the amount of the monthly payment. The Total Interest paid is based on the Total per Term minus the amount of the Loan.

The NPER Function

Another common financial function is NPER, which has the following syntax:

=NPER(rate,pmt,pv,[fv],[type])

For example, suppose you have the following data and want to calculate the number of periods (months) you will need to pay off a loan (Figure 5-16).

	A	B	C
1	Tolano Adventures		
2	Vacation Financing Calculator		
3			
4	Interest Rate (annual %):	5.0%	
5	Monthly Payment:	-$375	
6	Initial Payment	-$1,500	
7	Loan Amount:	$5,000	
8			
9	Length of Loan (months):		
10			

Figure 5-16: Loan repayment data

In this scenario, you make an initial payment of $1,500 and then make monthly payments of $375. The loan amount is $5,000 with an annual interest rate of 5%. You want to forecast the number of pay periods (months) it will take to pay off the loan. The formula to calculate this value is:

=NPER(B4/12,B5,B6,B7,0)

The arguments are as follows:

- B4 = rate = 5.0% divided by 12
- B5 = pmt = $375 (entered as a negative number so that a positive result will be calculated)
- B6 = pv = $1,500 (entered as a negative number so that a positive result will be calculated)
- B7 = fv = $5,000
- type = 0 = payment due at end of period (type = 1 indicates the payment would be due at the beginning of the period)

The result of the NPER function forecasts that it will take about 9 months to pay off the loan (Figure 5-17).

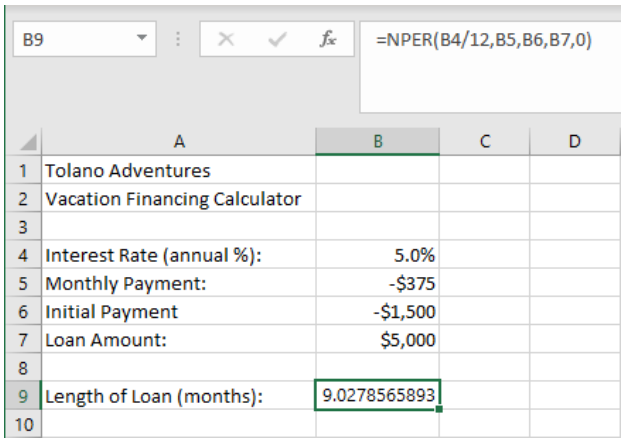


Figure 5-17: The NPER function

Learn to use financial functions

In this exercise, you will use the PMT and NPER functions.

1. Open **Monthly Payments.xlsx** located in the *StarterFiles* folder, and save it as **My Monthly Payments.xlsx** in the *MyProjects* folder.

A loan analysis table enables you to see the amount of principal and interest that is paid on a loan monthly or yearly. Once completed, the spreadsheet can be used to quickly determine the payments required for any loan amount, interest rate, and term.

2. Enter the following data in column B for the loan payment calculation:

Amount of Loan	**5,000**
Annual Interest Rate	**.06**
Term (months) – NPER	**12**
Ending Balance	**0**
Payment Type	**0**
Payment/Month	**=PMT(B2/12,B3,-B1,B4,B5)**
Total Payments	**=B7*B3**
Total Interest	**=B8-B1**

Notice that the interest rate used here is for a full year, but the term is in months. The interest rate must be converted into a monthly rate. The loan will be fully paid off at the end of the term, so the ending balance will be zero.

Note: Because the Ending Balance and Payment Type values are both zero, the last two arguments of the function could be omitted in this case.

3. In cell **B13**, enter: **=B1** to represent the initial loan amount.

4. In cell **C13**, enter: **=$B$7** as the monthly payment amount.

5. In cell **D13**, enter: **=B13*$B$2/12** to calculate the amount of interest paid for the month.

This formula will show the amount of interest to be paid in the first month. You will be copying this formula, which is why the annual interest rate cell (B2) is an absolute cell reference.

6. In cell **E13**, enter: **=C13-D13** to calculate the amount of the loan paid for this month by subtracting the interest paid from the monthly payment.
7. In cell **F13**, type: **=B13-E13** to calculate the remaining balance left to be paid by subtracting the amount paid towards the loan from the beginning balance of the loan for the current month.
8. In cell **B14**, type: **=F13** to represent the Ending Balance of the first month.
9. Copy the range of cells **C13:F13** to cells **C14:F14**.
10. Copy the range of cells **B14:F14** to cells **B15:F24**.

    The ending balance in cell F24 (after the last payment is made) is $0.00, showing that the loan has been completely paid off.
11. Select cell **B26**, and enter: **=PV(B2/12,B3,-B7,B4,B5)**
12. Select cell **B27**, and enter: **=FV(B2/12,B3,-B7,0,B5)**

    Because the IRR function, which you will add in step 14, requires the initial principal to be included in the range of cells as a negative number, the loan amount must be added at the top of the list of payments.
13. Select cell **C12**, and enter: **-5000**
14. Select cell **B28**, and enter: **=IRR(C12:C24)**

    The worksheet should appear similar to the following:

	A	B	C	D	E	F
1	Amount of Loan	$5,000.00				
2	Annual Interest Rate	6.0%				
3	Term (months) - NPER	12				
4	Ending Balance	$0.00				
5	Payment Type	0				
6						
7	Payment/Month	$430.33				
8	Total Payments	$5,163.99				
9	Total Interest	$163.99				
10						
11	**Month #**	**Beginning Principal**	**Monthly Payment**	**Interest Paid**	**Principal Paid**	**Ending Balance**
12			-$5,000.00			
13	1	$5,000.00	$430.33	$25.00	$405.33	$4,594.67
14	2	$4,594.67	$430.33	$22.97	$407.36	$4,187.31
15	3	$4,187.31	$430.33	$20.94	$409.40	$3,777.91
16	4	$3,777.91	$430.33	$18.89	$411.44	$3,366.47
17	5	$3,366.47	$430.33	$16.83	$413.50	$2,952.97
18	6	$2,952.97	$430.33	$14.76	$415.57	$2,537.40
19	7	$2,537.40	$430.33	$12.69	$417.65	$2,119.76
20	8	$2,119.76	$430.33	$10.60	$419.73	$1,700.03
21	9	$1,700.03	$430.33	$8.50	$421.83	$1,278.19
22	10	$1,278.19	$430.33	$6.39	$423.94	$854.25
23	11	$854.25	$430.33	$4.27	$426.06	$428.19
24	12	$428.19	$430.33	$2.14	$428.19	$0.00
25						
26	Present Value (PV)	$5,000.00				
27	Future Value (FV)	$5,308.39				
28	Internal Rate of Return (IRR)	0.5%				

15. Click the **NPER** worksheet tab.
16. Enter the following data in column B:

    Amount of Loan **5,000**
    Annual Interest Rate **.06**
    Monthly Payment **-325**

17. Select cell **B4**, and enter: **=NPER(B2/12,B3,B1)**

    The NPER function forecasts that the amount of time it will take to pay off a $5,000 loan with a 6% annual interest rate by making monthly payments of $325 is approximately 16 months.

	A	B	C
1	Amount of Loan	$5,000.00	
2	Annual Interest Rate	6.00%	
3	Monthly Payment	($325.00)	
4	Term (months) - NPER	16.04852962	
5			

18. Save and close the workbook.

Nesting Functions

Objective 3.1.1, 3.4.3

Excel functions are very flexible because they allow you to nest (or embed) one function inside another one. This is a very useful feature because Excel functions are designed to perform only one calculation. For example, the formula =MID(A1,6,10) will extract ten characters from the text string in cell A1, starting from character #6. If cell A1 contained the text string "Adam Smith", then this formula will return the second word "Smith". However, if the cell was changed to "Joe Zhukov", the result will be "hukov". The FIND function can be used to automatically adjust to different text:

=MID(A1,FIND(" ",A1)+1,10)

This FIND function will search the text string for the location of the blank space and return it to the MID function to indicate where to begin extracting characters. The "+1" is used to start at the next character to the right of that blank space in the text string.

You are not limited to nesting or embedding only one function inside another. You can nest up to 64 functions.

When you need to nest logical functions together, be sure to build them slowly, one function at a time. Nested functions are complex: the arguments, commas, and brackets must be in the right place to prevent them from being rejected by Excel, or from returning incorrect results.

Another function commonly used for nesting is IF. For example, a simple IF function will evaluate one logical test, and then return either one value or another value.

=IF(A1=10,"text A","text B")

This simple IF function will not permit you to choose from three different values. The logical test will return one of only two possible results: TRUE or FALSE. To work around this limitation, you can nest functions. An example of a nested IF function would look as follows:

=IF(A1=10,"text A",IF(A1=20,"text B","text C"))

In this example, the following values will be displayed when the conditions are met:

If A1 contains	**Then this will display**
10	text A
20	text B
Any other value	text C

Learn to nest a function

In this exercise, you will nest a function inside another function.

1. Open **Nesting Functions.xlsx** located in the *StarterFiles* folder, and save it as **My Nesting Functions.xlsx** in the *MyProjects* folder.

In this worksheet you will enter text formulas to extract the first names from column A and put them in column B, then extract the family names from column A and put them in column C. Enter the first set of formulas for row 4.

2. Enter the following formulas:

Cell	Formulas
B4	**=MID(A4,9,5)**
C4	**=LEFT(A4,6)**

Using these formulas, the first person's name is correctly separated into the first and last name components. You will copy these same formulas into the remaining rows to extract the first and last names for the remaining individuals.

3. Copy the formulas in cells **B4:C4** down to the cell range **B5:C12**.

	A	B	C
1	Tolano Adventures		
2	Travel Directors		
3			
4	Gibson, Jamie	Jamie	Gibson
5	McSweeney, Andrew	y, An	McSwee
6	Cowell, Madison	Madis	Cowell
7	Klassen, Nick	Nick	Klasse
8	Gorski, Curtis	Curti	Gorski
9	Jang, Lawrence	wrenc	Jang,
10	Akira, Christie	hrist	Akira,
11	Yamoto, Kanda	Kanda	Yamoto
12	Belanger, Toby	, Tob	Belang

The results demonstrate that you will need to adjust the parameters of almost every formula to correctly extract the names. The formulas will need to be changed again if any of the names in column A are changed afterwards. However, there is a better way to perform this same task—by using nested functions.

By looking at the names in column A, you will see that a comma always separates the first name from the last name. You will change the formulas in cells B4 and C4 to calculate the position of the comma in cell A4.

4. Select cell **B4** and enter the formula: **=FIND(",",A4)**

5. Enter the same formula into cell **C4** (but do not copy it from cell B4): **=FIND(",",A4)**

Both formulas yield the exact same results, as expected.

When you look at the name in cell A4, you can see the last name is to the left of the comma. You can then use the LEFT function to extract the last name from cell A4. The LEFT function requires two parameters: the original text string, and the number of characters to extract. The second parameter will be calculated for you by the FIND function, which you had just entered.

6. Select cell **C4** again, and modify the formula to: **=LEFT(A4,FIND(",",A4))**

The results demonstrate that the FIND function returns the position of the comma, which follows immediately after the last name. To extract the last name without the comma, simply subtract one from the results of the FIND function.

7. Select cell **C4** again, and modify the formula to: **=LEFT(A4,FIND(",",A4)-1)**

Use the same technique to extract the first name, which is located to the right of the comma, using the MID function. The MID function requires three parameters: the original text string, the starting position, and the number of characters. The starting position can be calculated again using the FIND function.

Because the first name is to the right of the comma, then the number of characters to extract is simply the number of characters to the right of the comma. This can be calculated by nesting yet another function to calculate the total length of the text string and subtract the length of the last name. However, the MID function is very forgiving; if you use a number that is greater than the number of characters available, it will still only return what is there and will not add blank spaces at the end. You can therefore use any number of your choice, but it must be big enough to extract enough characters. For this exercise, you will use a length of 20 characters, which you can adjust if necessary.

8. Select cell **B4** and modify the formula to: **=MID(A4,FIND(",",A4),20)**

   Like the last name, the FIND function includes the comma in its calculation. Add 2 to the result to skip over the comma and the blank space after it.

9. Select cell **B4** again, and modify the formula to: **=MID(A4,FIND(",",A4)+2,20)**

10. Copy the formulas in cells **B4:C4** down to the cell range **B5:C12**.

    The formula is designed to be flexible to handle any name changes, as long as the comma is in the correct position.

11. Select cell **A4** and enter: **Nye, Jim**

	A	B	C
1	Tolano Adventures		
2	Travel Directors		
3			
4	Nye, Jim	Jim	Nye
5	McSweeney, Andrew	Andrew	McSweeney
6	Cowell, Madison	Madison	Cowell
7	Klassen, Nick	Nick	Klassen
8	Gorski, Curtis	Curtis	Gorski
9	Jang, Lawrence	Lawrence	Jang
10	Akira, Christie	Christie	Akira
11	Yamoto, Kanda	Kanda	Yamoto
12	Belanger, Toby	Toby	Belanger

12. Click the **IF** worksheet tab.

    This worksheet will be used to calculate the number of corporate rewards points to be given to frequent travelers:

Range	Number of Points
Less than 5	1
5 to 9	3
10 to 19	6
20 to 29	10
30 and up	20

A good way of approaching this problem is to start with a very simple formula and then add to it in pieces.

13. Select cell **F5** and enter: **=IF(D5<5,1,3)**
14. Copy this formula down to the cell range **F6**:**F29**.

    You can see that every customer has either 1 or 3 points assigned to them. The maximum that a customer can get is 3 points, even though most of them should be getting more. Modify this formula so that a second IF function is nested inside the first one. The full formula will be: =IF(D5<5,1,IF(D5<10,3,6))
15. Select cell **F5** again, press **F2**, delete the **3** and replace it with: **IF(D5<10,3,6)**
16. Copy this formula down to the cell range **F6**:**F29**.

    Notice that the second IF function nested inside the other IF function uses the condition D5<10, even though the 3 points applies only to customers with 5 to 9 bookings. The condition should therefore be (D5>4) AND (D5<10). It turns out that the extra logic test (D5>4) is unnecessary because the nested function is performed only if the first IF condition (D5<5) results in a FALSE value.

    The points value are now getting closer to what they should be. The customers with less than 10 bookings are correctly getting 1 or 3 points, but many of the remaining customers should be getting more than 6 points. The next version of the formula will be: =IF(D5<5,1,IF(D5<10,3,IF(D5<20,6,10)))
17. Select cell **F5** again, press **F2**, delete the **6** and replace it with: **IF(D5<20,6,10)**
18. Copy this formula down to the cell range **F6**:**F29**.

    One more nested formula needs to be added to create the final formula: =IF(D5<5,1,IF(D5<10,3,IF(D5<20,6,IF(D5<30,10,20)))). As you can see, this formula can appear overwhelming when trying to enter it all at once.
19. Select cell **F5** again, press **F2**, delete the final **10** and replace it with: **IF(D5<30,10,20)**
20. Copy this formula down to the cell range **F6**:**F29**.
21. Look at each of the points values in column F to verify that they are correctly calculated.

Note: The VLOOKUP function will also produce the same results.

	A	B	C	D	E	F
1	Tolano Adventures					
2	Corporate Rewards Points					
3						
4	Customer	Last Name	First Name	Bookings	Spending	Points
5	1	Swierczynski	Pavel	32	$136,763.20	20
6	2	Wylie	Jayel	21	$76,552.98	10
7	3	Lowachee	Sharin	1	$1,112.89	1
8	4	Whitcomb	Isla	15	$74,696.85	6
9	5	Fleischer	Paul	24	$49,050.48	10
10	6	Strohmeyer	Alison	2	$4,744.26	1
11	7	Sijie	Dai	40	$42,927.20	20
12	8	Angelini	Sara	5	$26,559.05	3
13	9	Ruesch	Patrick	4	$10,117.40	1
14	11	Haarsma	Ben	28	$36,699.04	10
15	12	Frankel	Valerie	14	$63,088.62	6
16	13	Abidi	Azhar	17	$18,183.71	6
17	14	Aubert	Rosemary	41	$91,750.62	20
18	15	Pearson	Ryan	11	$39,929.34	6
19	17	Huso	Anthony	19	$29,205.66	6
20	18	Fai	Pai Kit	9	$48,549.87	3
21	19	Jablonski	Douglas	22	$76,687.82	10
22	20	Ramirez	Misa	4	$6,914.72	1

22. Save and close the workbook.

Using Conditional Logic Functions

Objective 3.1.1, 3.4.3

Most Excel functions simply perform their calculations and display the results in the cells in which they are located. ***Conditional logic*** functions are useful in situations where you want to perform one of two different calculations, depending on which value is in one or more cells other than the ones in which the logical functions are located.

When you use the IF function, you are permitted to have only one logical test that results in a TRUE or FALSE value. If you need to perform two or more different logic tests, then you must either nest the requisite number of IF functions inside each other, or use an AND or OR function.

AND	The AND function allows multiple logical tests to be performed, and all of them are combined to return a single TRUE or FALSE value. The AND function returns a TRUE value only if *all* of the logical tests are TRUE. It returns a FALSE value if *any* of the logical tests result in a FALSE value. AND(logical test 1, logical test 2, ...) You can have up to 255 logical tests in an AND function.
NOT	This function returns the logical opposite value of a logical result. That is, a TRUE value is reversed to a FALSE, and a FALSE is reversed to a TRUE. NOT(logical test) You can enter only one logical value in this function.
OR	Like the AND function, the OR function evaluates multiple logical tests to return a single TRUE or FALSE value. Unlike the AND function, this function returns a TRUE value if *any* of the logical tests are TRUE. It returns a FALSE value only if *all* of the logical tests result in a FALSE value. OR(logical test 1, logical test 2, ...) You can have up to 255 logical tests in an OR function.

Learn to use the AND, NOT, and OR functions

In this exercise, you will use the AND, NOT, and OR functions.

1. Open **AND OR Functions.xlsx** located in the *StarterFiles* folder, and save it as **My AND OR Functions.xlsx** in the *MyProjects* folder.

You will enter a formula to award the Gold designation if a customer had more than 25 bookings **and** spent more than $75,000 in travel this year.

2. Select cell **F5** and enter: **=IF(AND(D5>25,E5>75000),"Gold","")**
3. Copy this formula down to the cell range **F6**:**F29**.

   Using this formula, only two customers have qualified for the Gold membership. Try a different formula to see how many customers would qualify for the Gold designation if a customer had more than 25 bookings **or** spent more than $75,000 in travel this year.

4. Select cell **G5** and enter: **=IF(OR(D5>25,E5>75000),"Gold","")**
5. Copy this formula down to the cell range **G6**:**G29**.

Try a third alternative formula to label any customer who has spent $75,000 or less in travel this year with a Bronze designation. The formula can therefore be =IF(E5<=75000,"Bronze",""). However, you can also reverse the logical test using the NOT function.

6. Select cell **H5** and enter: **=IF(NOT(E5>75000),"Bronze","")**

7. Copy this formula down to the cell range **H6**:**H29**.

   The completed worksheet should appear similar to the following:

H5 =IF(NOT(E5>75000),"Bronze","")

	A	B	C	D	E	F	G	H
1	Tolano Adventures							
2	Corporate Gold Membership							
3								
4	Customer	Last Name	First Name	Bookings	Spending			
5	1	Swierczynski	Pavel	32	$136,763.20	Gold	Gold	
6	2	Wylie	Jayel	21	$76,552.98		Gold	
7	3	Lowachee	Sharin	1	$1,112.89			Bronze
8	4	Whitcomb	Isla	15	$74,696.85			Bronze
9	5	Fleischer	Paul	24	$49,050.48			Bronze
10	6	Strohmeyer	Alison	2	$4,744.26			Bronze
11	7	Sijie	Dai	40	$42,927.20		Gold	Bronze
12	8	Angelini	Sara	5	$26,559.05			Bronze
13	9	Ruesch	Patrick	4	$10,117.40			Bronze
14	11	Haarsma	Ben	28	$36,699.04		Gold	Bronze
15	12	Frankel	Valerie	14	$63,088.62			Bronze
16	13	Abidi	Azhar	17	$18,183.71			Bronze
17	14	Aubert	Rosemary	41	$91,750.62	Gold	Gold	
18	15	Pearson	Ryan	11	$39,929.34			Bronze
19	17	Huso	Anthony	19	$29,205.66			Bronze
20	18	Fai	Pai Kit	9	$48,549.87			Bronze
21	19	Jablonski	Douglas	22	$76,687.82		Gold	
22	20	Ramirez	Misa	4	$6,914.72			Bronze
23	21	Robotham	Maya	8	$23,087.52			Bronze
24	22	Karmazin	Panos	8	$33,186.48			Bronze
25	24	Kjelgaard	J D	21	$75,260.43		Gold	
26	25	Singh	Khushwant	4	$13,679.88			Bronze
27	28	Linaweaver	Jeannie	12	$32,151.36			Bronze
28	29	Popescu	Petra	24	$48,062.64			Bronze
29	30	D'Chancie	Francois	12	$26,383.80			Bronze

8. Save and close the workbook.

Using Conditional Summary Functions

Objective 3.1.1

The ***conditional summary*** versions of the commonly used summary functions AVERAGE, COUNT, and SUM are very powerful extensions of the base functions. Although the function name has an IF in it, the selection capability works more like filtering—for the given range of cells, Excel first selects only the rows that meet the criteria and applies the summary function on those rows. The remaining rows are ignored.

AVERAGEIF	Calculate the average value of a range of cells in which the criterion value is met. AVERAGEIF(criteria_range,criterion_value,average_range) The average range is optional. If it is not specified, the criteria range is assumed to be the average range.
COUNTIF	Count the number of cells that contain a non-blank value in a range of cells where the criterion value is met. COUNTIF(criteria_range,criterion_value)

SUMIF	Calculate the sum total of all cells containing a numeric value in a range of cells where the criterion value is met. SUMIF(criteria_range,criterion_value,sum_range) The sum range is optional. If it is not specified, the criteria range is assumed to be the sum range.

An example of a conditional summary function is:

=SUMIF(D4:D207,"Visa",F4:F207)

In this function, the criteria range is D4 to D207, the sum range is F4 to F207, and the criterion value is "Visa"; therefore, Excel will examine each of the cells in the range D4 to D207. If the cell contains the value "Visa," the corresponding numeric value in the cell range F4 to F207 will be included in the sum total.

Note that the SUMIF is very different from the more common SUM function. With SUM, the numeric value in *all* cells in the sum range are added to the sum total. With SUMIF, the cells are added *only if* the criterion value is met.

These three conditional summary functions permit you to perform only one criteria test. If you need to perform more than one criteria test at the same time, then a different version is needed.

AVERAGEIFS	Calculate the average value of a range of cells in which the multiple criteria are met. AVERAGEIFS(average_range,criteria_range 1,criteria 1,criteria_range 2,criteria 2…) The average range is mandatory.
COUNTIFS	Count the number of cells that contains a non-blank value in a range of cells where the criteria are met. COUNTIFS(range 1,criteria 1,range 2,criteria 2…)
SUMIFS	Calculate the sum total of all cells containing a numeric value in a range of cells where the criteria are met. SUMIFS(sum_range,criteria_range 1, criteria 1,criteria_range 2,criteria 2…) The sum range is mandatory.

An example of this kind of conditional summary function is:

=SUMIFS(F4:F207,D4:D207,"Visa",F4:F207,">100")

In this function, the sum range is F4 to F207, the first criteria range is D4 to D207, and its corresponding criterion value is "Visa"; the second criteria range is F4 to F207 and its corresponding criterion test is >100. This means that a value in the cell range F4 to F207 is included in the sum total only if *both* criteria tests are evaluated as true. For example, the value in cell F4 is included if D4 contains the word "Visa" and F4 contains a value that is greater than 100. If D4 does not contain the word "Visa," or if F4 is less than or equal to 100, or both, then the value in F4 is not included.

Because these functions have multiple selection criteria, the sequence of the arguments is different from the single criterion versions of these functions. The different sequence is necessary to allow multiple selection criteria to be entered as arguments.

Newly available if you have Office 2019 or an Office 365 subscription, you can also use different versions of the IF, MAX, and MIN functions if you need to perform more than one criteria test at the same time. The SWITCH function is also new to these versions of Office.

IFS	Returns a value that corresponds to the first TRUE condition when testing one or more criteria. IFS(test 1,value 1,test 2,value 2…) You can use IFS in lieu of multiple nested IF statements.
MAXIFS	Returns the largest numeric value when testing one or more criteria in a range of values. MAXIFS(max_range,range 1,criteria 1,range 2,criteria 2…)
MINIFS	Returns the smallest numeric value when testing one or more criteria in a range of values. MINIFS(min_range,range 1,criteria 1,range 2,criteria 2…)
SWITCH	Evaluates one value (the expression) against a list of values and returns the result that corresponds to the first matching value. SWITCH(expression,value 1,result 1,value 2,result 2…, "value if no match") If there is no match, an optional default value may be returned.

Learn to use conditional summary functions

In this exercise, you will use conditional summary functions.

1. Open **Summary Functions.xlsx** located in the *StarterFiles* folder, and save it as **My Summary Functions.xlsx** in the *MyProjects* folder.

You will enter the first set of conditional summary formulas that will calculate statistics for all customers who spent over $50,000. These formulas are straightforward because they only have one criterion: sales in column E is greater than $50,000.

2. Enter the following formulas into cells:

Cell	Text
I5	**=COUNTIF(E5:E29,">50000")**
I6	**=SUMIF(E5:E29,">50000")**
I7	**=AVERAGEIF(E5:E29,">50000")**

Notice that the SUMIF and AVERAGEIF conditional formulas used here perform their calculations on the same column in which the selection criteria are applied. In other words, these formulas select only those cells that meet the stated criteria and then perform the COUNT, SUM, and AVERAGE calculations on only those cells. The significance of this will become clearer as you examine the next sets of conditional formulas.

Suppose these statistics are similar to the first set, but the criterion is that the customer is a Gold customer. However, a Gold customer may have spent less than $50,000 this year, such as customers #7 and #11. Other customers have spent more than $50,000, but are not Gold customers, such as customers #4 and #12.

3. Enter the following formulas into cells:

Cell	Text
I9	**=COUNTIF(F5:F29,"Gold")**
I10	**=SUMIF(F5:F29,"Gold",E5:E29)**
I11	**=AVERAGEIF(F5:F29,"Gold",E5:E29)**

These are the same conditional formulas as the first set, except that an additional argument has been added to the SUMIF and AVERAGEIF. In this variation, the criteria are applied to the cells in column F (= "Gold"), but the SUM and AVERAGE are applied to the corresponding cells in column E, which is where the sales amounts are located. The average value can be verified by dividing the sum value into the count value. In contrast, the first set of conditional summary formulas calculated the statistics on the same column E on which you are applying the selection criteria.

These formulas are even more complex because they have two criteria: the sale must be with a Gold customer **and** the sales amount must be greater than $50,000. These functions are different than the ones used in the first and second set of formulas.

4. Enter the following conditional summary formulas into cells:

Cell	Text
I13	**=COUNTIFS(F5:F29,"Gold",E5:E29,">50000")**
I14	**=SUMIFS(E5:E29,F5:F29,"Gold",E5:E29,">50000")**
I15	**=AVERAGEIFS(E5:E29,F5:F29,"Gold",E5:E29,">50000")**

Notice that the sequence of the parameters for the sum and average formulas is different in the single-criterion and multiple-criteria versions.

Also notice that only five customers met the selection criteria. This is because not all Gold customers spent more than $50,000, and not all customers who spent more than $50,000 are Gold customers.

The worksheet should appear as follows:

	A	B	C	D	E	F	G	H	I
1	Tolano Adventures								
2	Corporate Gold Membership								
3									
4	Customer	Last Name	First Name	Bookings	Spending	Type			
5	1	Swierczynski	Pavel	32	$136,763.20	Gold		Sales Over $50,000	7
6	2	Wylie	Jayel	21	$76,552.98	Gold		Total Sales Over $50,000	$594,800.52
7	3	Lowachee	Sharin	1	$1,112.89			Avg Sales Over $50,000	$84,971.50
8	4	Whitcomb	Isla	15	$74,696.85				
9	5	Fleischer	Paul	24	$49,050.48			Gold Member Sales	7
10	6	Strohmeyer	Alison	2	$4,744.26			Total Gold Member Sales	$536,641.29
11	7	Sijie	Dai	40	$42,927.20	Gold		Average Gold Member Sales	$76,663.04
12	8	Angelini	Sara	5	$26,559.05				
13	9	Ruesch	Patrick	4	$10,117.40			Gold Members Over $50,000	5
14	11	Haarsma	Ben	28	$36,699.04	Gold		Total Gold Members Over $50,000	$457,015.05
15	12	Frankel	Valerie	14	$63,088.62			Avg Gold Members Over $50,000	$91,403.01
16	13	Abidi	Azhar	17	$18,183.71				
17	14	Aubert	Rosemary	41	$91,750.62	Gold			
18	15	Pearson	Ryan	11	$39,929.34				
19	17	Huso	Anthony	19	$29,205.66				
20	18	Fai	Pai Kit	9	$48,549.87				
21	19	Jablonski	Douglas	22	$76,687.82	Gold			
22	20	Ramirez	Misa	4	$6,914.72				
23	21	Robotham	Maya	8	$23,087.52				
24	22	Karmazin	Panos	8	$33,186.48				
25	24	Kjelgaard	J D	21	$75,260.43	Gold			
26	25	Singh	Khushwant	4	$13,679.88				
27	28	Linaweaver	Jeannie	12	$32,151.36				
28	29	Popescu	Petra	24	$48,062.64				
29	30	D'Chancie	Francois	12	$26,383.80				

5. Click the **IFS** worksheet tab.

6. Select cell **D4** and enter: **=IFS(B4>=5,"Megacity",B4>=2,"Large",B4>=1,"Medium")**

The IFS function allows you to run logical tests for multiple criteria without the need to nest multiple IF functions. In this example, you are labeling cities with populations greater than or equal to 5 million as "Megacity"; cities with populations greater than or equal to 2 million (but under 5 million) as "Large", and cities with populations greater than or equal to 1 million (but under 2 million) as "Medium".

7. Copy this formula down to the cell range **D5**:**D19**.

   The worksheet should appear as follows:

	A	B	C	D
1	European Urban Centers (in millions)			
2				
3	**City**	**Population**		**Classification**
4	Moscow	10.381		Megacity
5	London	7.557		Megacity
6	St. Petersburg	5.028		Megacity
7	Berlin	3.426		Large
8	Madrid	3.256		Large
9	Kiev	2.797		Large
10	Rome	2.318		Large
11	Paris	2.138		Large
12	Bucharest	1.877		Medium
13	Minsk	1.742		Medium
14	Budapest	1.741		Medium
15	Hamburg	1.739		Medium
16	Warsaw	1.702		Medium
17	Vienna	1.691		Medium
18	Barcelona	1.621		Medium
19	Stockholm	1.515		Medium

8. Click the **MAXIFS and MINIFS** worksheet tab.

9. Select cell **I5** and enter: =**MAXIFS(D5:D18,A5:A18,F5,B5:B18,G5)**

   The MAXIFS function allows you to find the maximum value for multiple criteria at the same time. In this example, you are finding the maximum number of tour packages for Group 1 in 2020. The cell range D5:D18 contains the value you want to display. The cell range A5:A18 represents the first criteria, and cell F5 specifies the first criteria's value (2020). The cell range B5:B18 represents the second criteria, and cell G5 specifies the second criteria's value (Group 1).

10. Select cell **I9** and enter: =**MINIFS(D5:D18,A5:A18,F9,B5:B18,G9)**

    The MINIFS function allows you to find the minimum value for multiple criteria at the same time. In this example, you are finding the minimum number of tour packages for Group 2 in 2020.

	A	B	C	D	E	F	G	H	I
1	Tolano Adventures								
2	Asia Cruise Land Tour Packages								
3									
4	**Year**	**Group**	**Location**	**No.**		**Find the highest number of packages for:**			
5	2020	Group 1	Mt Fuji, Japan	67		2020	Group 1		79
6	2020	Group 1	Kyoto, Japan	61					
7	2020	Group 1	Seoul, South Korea	70					
8	2020	Group 1	Shanghai, China	79		**Find the lowest number of packages for:**			
9	2020	Group 1	Hong Kong, China	60		2020	Group 2		50
10	2020	Group 1	Bangkok, Thailand	56					
11	2020	Group 1	Singapore	72					
12	2020	Group 2	Mt Fuji, Japan	78					
13	2020	Group 2	Kyoto, Japan	63					
14	2020	Group 2	Seoul, South Korea	85					
15	2020	Group 2	Shanghai, China	51					
16	2020	Group 2	Hong Kong, China	81					
17	2020	Group 2	Bangkok, Thailand	50					
18	2020	Group 2	Singapore	63					

11. Click the **SWITCH** worksheet tab.

12. Select cell **B5** and enter: **=SWITCH(A5,"Australia","Sydney","Asia","Hong Kong","Europe","London","Africa","Kinshasa","N/A")**

    The SWITCH function evaluates an expression against a list of values and returns the result that corresponds to that value. In this example, cell A5 contains the expression (Australia). The first value/result pair says that, if the value is Australia, the result is Sydney; the second value/result pair says that, if the value is Asia, the result is Hong Kong; and so on. The last value "N/A" says that, if there is no match, the result is N/A.

13. Copy this formula down to the cell range **B6**:**B9**.

    The worksheet should appear as follows:

	A	B	C	D	E
1	Tolano Adventures				
2	Main Offices outside of North and South America				
3					
4	**Division**	**Main Office**			
5	Australia	Sydney			
6	Africa	Kinshasa			
7	Asia	Hong Kong			
8	Europe	London			
9	Oceania	N/A			

14. Save and close the workbook.

Performing What-If Analysis

Spreadsheets can easily perform calculations such as simple arithmetic (for example, add and multiply) on a large volume of numbers. You don't need a computer to do this type of task. It can be done easily even with a basic calculator because the problem only needs to be solved once and then the task is completed.

Spreadsheets become invaluable when you need to perform a ***what-if analysis***, which involves repeating the calculation of a set of formulas many times using different numbers. The trial-and-error method of doing calculations is commonly used when there are multiple competing demands, and users try to find the best compromise from among the many choices they can make. "What-if" describes the thinking process that users face: "What if I change this number? Then what will the result look like?"

Because spreadsheets can recalculate a large number of formulas and display the results simultaneously, their introduction rendered the traditional manual method of performing a what-if analysis obsolete. This capability saved a tremendous amount of manual work and virtually eliminated calculation errors.

Using the Goal Seek Tool

Objective 3.4.2

When you create a worksheet, you enter formulas into cells and the results of your calculations are displayed in those same cells. This works well when you know all of the components required to create the formulas. But what happens when you don't know all the variables, yet you do know the answer you want? A very common business example is determining the break-even point for a new product. The trial-and-error method works, but it becomes tedious, especially considering that you have the ability to access the enormous computing power that modern computers offer. A much easier solution is to use the ***Goal Seek*** tool in Excel.

On the Data tab, in the Forecast group, click What-If Analysis, and then click Goal Seek to open the Goal Seek tool (Figure 5-18). This tool is used to automate the entire process of changing one variable while calculating a formula and trying to match the desired value. In a break-even situation, you can set the Goal Seek tool to make all necessary changes to the number of units produced to attain a zero profit. Using this tool, you can easily determine the impact of a 10% increase in labor cost on the number of units needed to break even.

The variables used to perform the Goal Seek are as follows:

Set cell	Select the cell in which you want Excel to display the result of your goal-seeking. This cell must contain a formula that will calculate the result you want using values from other cells in the worksheet.
To value	Enter the end result (value) that you want to achieve. It must be a numeric value—it cannot be a formula or reference a cell.
By changing cell	Select the cell in which you want Excel to display the variable result of your goal-seeking. This cell must *not* contain a formula.

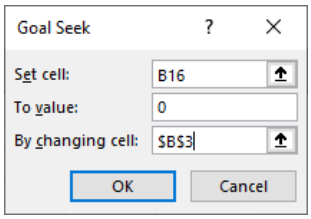


Figure 5-18: Goal Seek tool

When using the Goal Seek tool, keep the following in mind:

- The Goal Seek feature is a tool; it is *not* a function. That is, it changes the value of the variable cell to achieve the desired goal. If you change any of the values or formulas involved with the results, you must run the Goal Seek tool again.
- The cell displaying the outcome must contain a formula that is dependent on the variable cell, either directly or indirectly.
- You can reverse any changes you make with the Goal Seek tool by using the Undo feature.

Learn to use the Goal Seek Tool

In this exercise, you will use the Goal Seek tool.

1. Open **Whale Watching Goal Seek.xlsx** located in the *StarterFiles* folder, and save it as **My Whale Watching Goal Seek.xlsx** in the *MyProjects* folder.

Tolano Adventures is investigating the possibility of launching a new company that will provide whale-watching tours to its own customers as well as other travel agencies' customers.

The cost of renting the boats is estimated to be about 25% of revenues, and fuel is another 35%. The remaining costs are fixed monthly expenses for salaries, a small office near the pier, and various boat-related expenses.

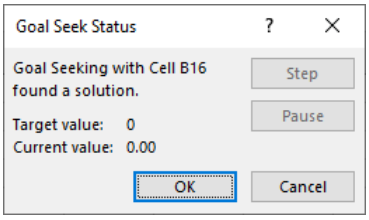
Use the Goal Seek tool to determine how much revenue is required to reach a break-even point (Net Income=0.00).

2. Select cell **B16**.
3. On the Data tab, in the Forecast group, click **What-If Analysis**, and then click **Goal Seek**.

   The Goal Seek dialog box appears with the **Set cell** field referring to the answer cell.
4. Select the **To value** field and set the value to: **0**.
5. Select the **By changing cell** field and type: **B3** or use the mouse to select cell **B3**.

6. Click **OK** to initiate the Goal Seek analysis.

   The Goal Seek tool displays the result in the Goal Seek Status dialog box. If Excel is able to find a solution, the Target value and Current value will be the same. The Goal Seek Status dialog box should appear as follows:



7. Click **OK** in the Goal Seek Status dialog box to accept the results of your goal-seeking.

   You would need to bring in $20,625 in revenue in order to break even.

	A	B	C
1	Tolano Whale Watching		
2			
3	Revenues	20,625.00	
4	Boat Rental	5,156.25	
5	Fuel	7,218.75	
6	Gross Income	8,250.00	
7			
8	Office Rent	2,500.00	
9	Salaries	4,000.00	
10	Utilities	450.00	
11	Office Supplies	150.00	
12	Moorage Fees	350.00	
13	Other Expenses	800.00	
14	Total Expenses	8,250.00	
15			
16	Net Income	0.00	
17			

Use the Goal Seek tool to determine how much revenue would be required to generate a profit of $5000 if rent and moorage fees increase.

8. Change cell **B8** to: **3,000** and cell **B12** to: **700**.
9. Select cell **B16**, then on the Data tab, in the Forecast group, click **What-If Analysis**, and then click **Goal Seek**.
10. Select the **To value** field and set the value to: **5000**.
11. Select the **By changing cell** field and type: **B3** or use the mouse to select cell **B3**.
12. Click **OK** to initiate the analysis.
13. Click **OK** in the Goal Seek Status dialog box to accept the results of your goal-seeking.

    You would need to bring in $35,250 to generate $5000 in profit in the face of increasing expenses.

	A	B	C
1	Tolano Whale Watching		
2			
3	Revenues	35,250.00	
4	Boat Rental	8,812.50	
5	Fuel	12,337.50	
6	Gross Income	14,100.00	
7			
8	Office Rent	3,000.00	
9	Salaries	4,000.00	
10	Utilities	450.00	
11	Office Supplies	150.00	
12	Moorage Fees	700.00	
13	Other Expenses	800.00	
14	Total Expenses	9,100.00	
15			
16	Net Income	5,000.00	
17			

14. Click the **Loan** worksheet.

15. Select cell **B4** and confirm the formula **=PMT(B2/12,B3,-B1)** has been entered.

Let's assume that you have an opportunity to purchase a boat suitable for running your business. You do not want to pay more than what you are currently spending on your boat rental, but you are willing to pay the loan off over a reasonable period of time that does not exceed 30 months. As the worksheet currently shows, you need to lower the monthly payment significantly, and increase the number of payments.

16. With cell B4 still selected, set the following Goal Seek values:

Field	**Value**
Set cell	**B4**
To value	**8812.50**
By changing cell	**B3**

17. Click **OK** to initiate the Goal Seek analysis, and click **OK** again to close the Goal Seek Status dialog box.

B4 =PMT(B2/12,B3,-B1)

	A	B	C	D	E	F	G	H	I	J
1	Loan amount	$210,000.00								
2	Annual interest rate	7.50%								
3	No. of payments (NPER)	25.88345395								
4	Monthly payment	$8,812.50								
5										
6	**Month**	**Beginning Balance**	**Monthly Payment**	**Interest**	**Principal Paid**	**Ending Balance**				
7	1	$210,000.00	$8,812.50	$1,312.50	$7,500.00	$202,500.00				
8	2	$202,500.00	$8,812.50	$1,265.62	$7,546.88	$194,953.12				
9	3	$194,953.12	$8,812.50	$1,218.46	$7,594.04	$187,359.08				
10	4	$187,359.08	$8,812.50	$1,170.99	$7,641.51	$179,717.58				
11	5	$179,717.58	$8,812.50	$1,123.23	$7,689.27	$172,028.31				
12	6	$172,028.31	$8,812.50	$1,075.18	$7,737.32	$164,290.99				
13	7	$164,290.99	$8,812.50	$1,026.82	$7,785.68	$156,505.31				
14	8	$156,505.31	$8,812.50	$978.16	$7,834.34	$148,670.96				
15	9	$148,670.96	$8,812.50	$929.19	$7,883.31	$140,787.66				
16	10	$140,787.66	$8,812.50	$879.92	$7,932.58	$132,855.08				
17	11	$132,855.08	$8,812.50	$830.34	$7,982.16	$124,872.93				
18	12	$124,872.93	$8,812.50	$780.46	$8,032.04	$116,840.88				
19	13	$116,840.88	$8,812.50	$730.26	$8,082.24	$108,758.64				
20	14	$108,758.64	$8,812.50	$679.74	$8,132.76	$100,625.88				
21	15	$100,625.88	$8,812.50	$628.91	$8,183.59	$92,442.29				
22	16	$92,442.29	$8,812.50	$577.76	$8,234.74	$84,207.55				
23	17	$84,207.55	$8,812.50	$526.30	$8,286.20	$75,921.35				
24	18	$75,921.35	$8,812.50	$474.51	$8,337.99	$67,583.36				
25	19	$67,583.36	$8,812.50	$422.40	$8,390.10	$59,193.26				
26	20	$59,193.26	$8,812.50	$369.96	$8,442.54	$50,750.71				
27	21	$50,750.71	$8,812.50	$317.19	$8,495.31	$42,255.41				
28	22	$42,255.41	$8,812.50	$264.10	$8,548.40	$33,707.00				
29	23	$33,707.00	$8,812.50	$210.67	$8,601.83	$25,105.17				
30	24	$25,105.17	$8,812.50	$156.91	$8,655.59	$16,449.58				
31	25	$16,449.58	$8,812.50	$102.81	$8,709.69	$7,739.89				
32	26	$7,739.89	$7,788.26	$48.37	$7,739.89	$0.00				
33	27	$0.00	$0.00	$0.00	$0.00	$0.00				

18. Save and close the workbook.

Working with Scenarios

Objective 3.4.2

The Goal Seek tool is excellent for performing what-if analysis. However, it can display only one result at a time; if you want to revert back to an earlier result set, you must re-enter the data to regenerate those same results. The ***Scenario Manager*** tool in Excel overcomes this limitation by allowing you to store each result set as a scenario. After creating several scenarios, you can compare them using the scenario summary.

When you create a scenario, you identify the cells to be changed. The Scenario Manager then lists the cells and values. To make the Scenario Manager easier to use, you should create range names for all the cells you expect to change. This allows Excel to display the cell names instead of cell addresses.

Once you have created your scenarios, use the Scenario Manager to display and switch from one scenario to another or to add more scenarios as you continue your what-if analysis. You can also modify existing scenarios or delete scenarios. To open the Scenario Manager dialog box (Figure 5-19), on the Data tab, in the Forecast group, click the arrow for What-If Analysis, and then click Scenario Manager.

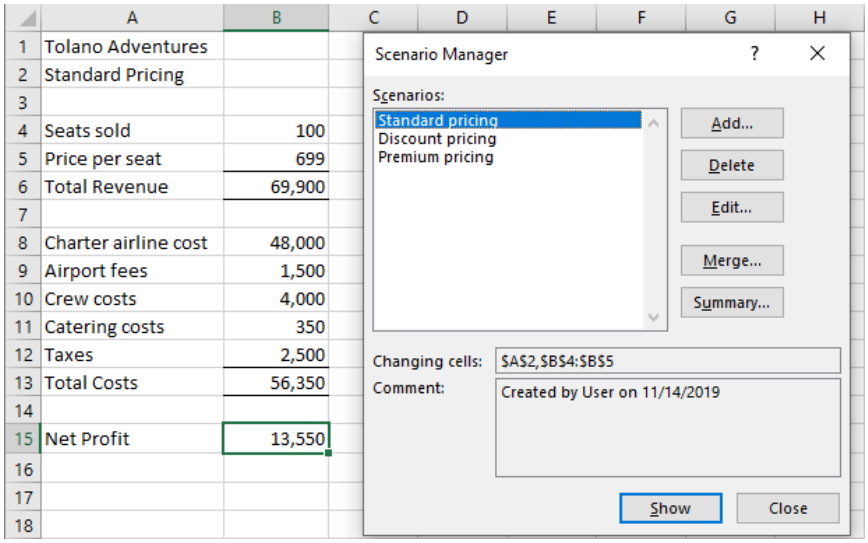
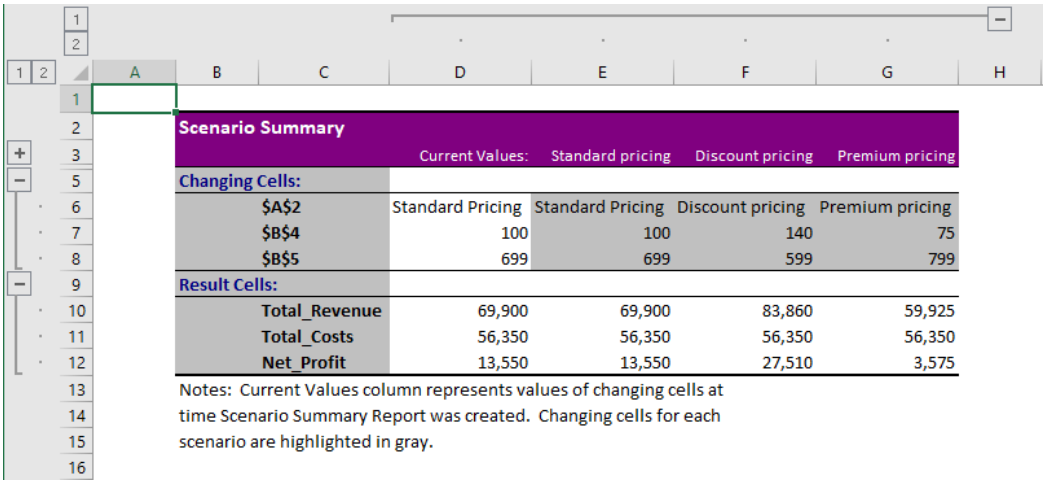


Figure 5-19: Scenario Manager dialog box

An important limitation of scenarios is that worksheet cells identified as *Changing cells* become fixed for all scenarios. Once you have set up at least one scenario, you cannot add cells or remove them from this list.

You can compare the results of all scenarios at the same time by clicking the Summary button in the Scenario Manager dialog box to create a Scenario Summary. The summary displays the input values and the result cells that you select from your worksheet, as shown in Figure 5-20.



Scenario Summary	Current Values:	Standard pricing	Discount pricing	Premium pricing
Changing Cells:				
$A$2	Standard Pricing	Standard Pricing	Discount pricing	Premium pricing
$B$4	100	100	140	75
$B$5	699	699	599	799
Result Cells:				
Total_Revenue	69,900	69,900	83,860	59,925
Total_Costs	56,350	56,350	56,350	56,350
Net_Profit	13,550	13,550	27,510	3,575

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

Figure 5-20: Scenario Summary

Learn to create three scenarios for a worksheet

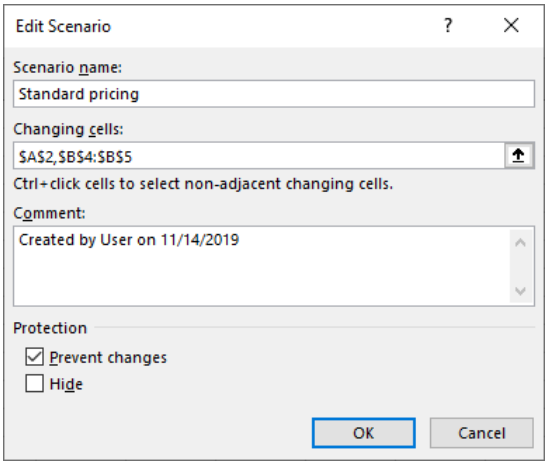
In this exercise, you will create a simple worksheet with three scenarios.

1. Open **Charter Flight Scenarios.xlsx** located in the *StarterFiles* folder, and save it as **My Charter Flight Scenarios.xlsx** in the *MyProjects* folder.

Tolano Adventures uses this worksheet to decide the price of a charter flight package offering. The travel company purchases all of the seats on a charter airline and sells the seats to its customers. The costs are set by the charter airline, airports, catering company, and so on. However, Tolano has to use their best guess on what price to charge and how many seats will be sold at that price.

You will use the Scenario Manager to help decide which price will result in the highest profit for the company.

2. On the Data tab, in the Forecast group, click the arrow for **What-If Analysis**, and then click **Scenario Manager**.
3. Click **Add** to open the Add Scenario dialog box.
4. In the *Scenario name* field, type: **Standard pricing**.
5. Click in the **Changing cells** field and delete the cell reference that is currently there.
6. Select cell **A2** on the worksheet, and then press and hold the **CTRL** key while selecting the cell range **B4**:**B5**.

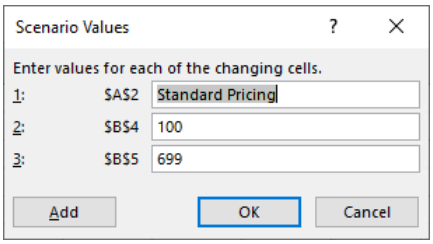


Cell A2 is not essential for scenarios; it is simply a cell that displays a descriptive comment whenever a scenario is activated for a worksheet.

You may also want to enter your own information in the comment field. By putting in some details (such as assumptions and explanations), you could potentially save many hours when you are using and changing the scenarios at a later date.

Note: You can select a maximum of 32 worksheet cells per scenario.

7. Click **OK**. The Scenario Values dialog box displays.



8. Click **Add** to save this scenario. The Add Scenario dialog box displays again.
9. In the *Scenario name* field, type: **Discount pricing** and click **OK**.
10. Change the values in the Scenario Values dialog box as follows:

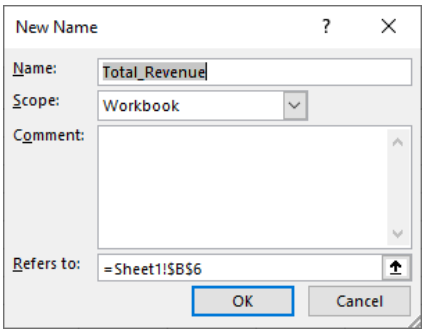
$A$2	**Discount Pricing**
$B$4	**140**
$B$5	**599**

11. Click **Add** to save this scenario.
12. In the *Scenario name* field, type: **Premium pricing** and click **OK**.
13. Change the values in the Scenario Values dialog box as follows:

$A$2	**Premium Pricing**
$B$4	**75**
$B$5	**799**

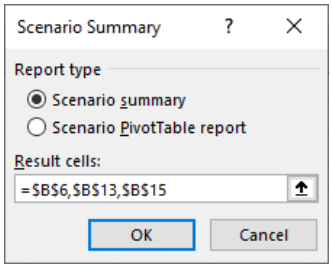
14. Click **OK** to save this scenario.
15. Select the **Premium pricing** scenario, and then click **Show**.
16. Click **Show** for each of three scenarios on the worksheet and observe the changes to the worksheet.

17. Click **Close** to go back to the worksheet.
18. Select cell **B6** and, on the Formulas tab, in the Defined Names group, click **Define Name**.



Note: If you create names for these cells, the Scenario Values dialog box displays these names instead of the cell reference. You may find these range names more meaningful than cell references.

19. Click **OK** to save this cell name.
20. Repeat steps 18-19 for cells **B13** (**Total_Costs**) and **B15** (**Net_Profit**).
21. On the Data tab, in the Forecast group, click the arrow for **What-If Analysis**, and then click **Scenario Manager**.
22. In the Scenario Manager dialog box, click **Summary**.
23. Verify that **Scenario summary** is selected.
24. Select cell **B6** on the worksheet, and then press and hold the CTRL key while selecting cells **B13** and **B15**.



The Result cells field is used to select the cell(s) in the worksheet that display the results of the scenario. These cells are important because they contain formulas that show the results of each scenario. In this exercise, the important result cells are the Total Revenue, Total Costs, and Net Profit cells. You can include as many or as few result cells as you wish.

25. Click **OK**.

    Notice that the cells that you had named earlier appear on this summary with those names, making the table more meaningful to you.

26. Save and close the workbook.

Using Cell Watch

Objective 3.5.2

In some situations, you may need to observe one or more cells while you are entering or changing data in a worksheet. The worksheet may be too large to display on your screen at one time. You could split the worksheet window or enter a formula into a cell to reference the other cell; however, these methods are strictly workarounds and have their own limitations.

A better solution is to set up a ***Watch Window*** to display the current value of these cells. To open the Watch Window (Figure 5-21), on the Formulas tab, in the Formula Auditing group, click Watch Window. Even if you move around the worksheet and workbook, the Watch Window conveniently displays the cells that you want to watch.

The Watch Window is especially useful in a what-if analysis involving large spreadsheets.

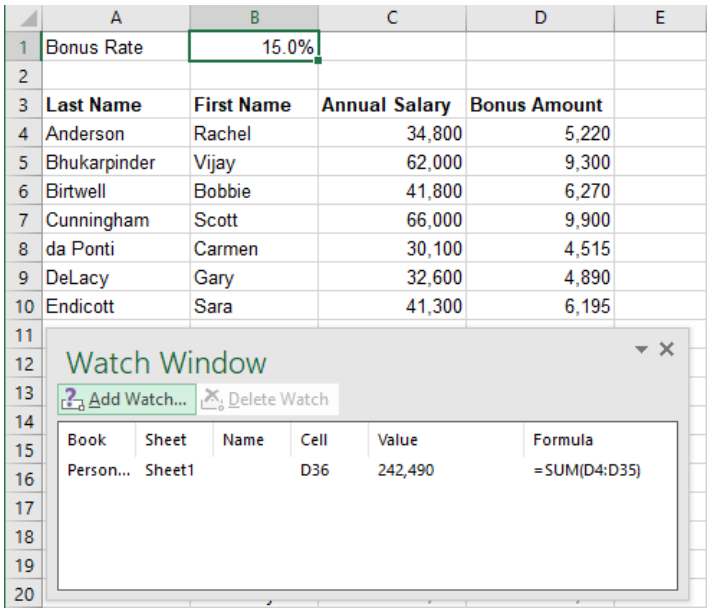


Figure 5-21: Watch Window

Learn to use the cell Watch Window

In this exercise, you will use the cell Watch Window.

1. Open **Personnel Bonus.xlsx** located in the *StarterFiles* folder, and save it as **My Personnel Bonus.xlsx** in the *MyProjects* folder.

In this worksheet, each employee's annual bonus is calculated using the bonus rate at the top of the worksheet. The bonus rate is limited to the amount of money available to pay—$200,000 for the purpose of this exercise. Column D calculates each employee's bonus. The total bonus amount is at the bottom of the list, but you will need to adjust the bonus rate while watching the total bonus amount. You can accomplish this by setting up a cell Watch Window.

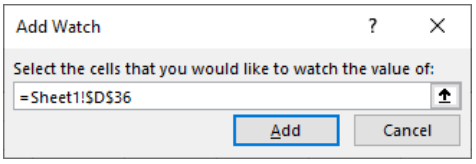
2. On the Formulas tab, in the Formula Auditing group, click **Watch Window**.

   A blank Watch Window appears.

3. Make the Watch Window bigger by clicking and dragging the bottom right corner of the Watch Window.

4. Click **Add Watch** in the Watch Window.
5. With the contents selected in the selection box, scroll down in the worksheet and select cell **D36**.

   The Add Watch dialog box now shows this cell reference:



6. Click the **Add** button in the Add Watch dialog box.

   The Watch Window now has this cell reference.
7. Scroll back to the top of the worksheet.
8. Move the Watch Window to an area of the worksheet where you can see it, but you can update cell B1 easily.
9. Change the bonus rate value in cell **B1** until cell **D36** is as close to $200,000 as possible (you can exceed that amount by no more than $499).
10. Select the **D36** cell reference in the Watch Window.
11. Click **Delete Watch** in the Watch Window.
12. Close the Watch Window, and save and close the workbook.

Lesson Summary

Now that you have completed this lesson, you should be able to:

- ☑ Add a secondary vertical axis.
- ☑ Use advanced chart types.
- ☑ Use financial functions.
- ☑ Nest functions inside other functions.
- ☑ Use conditional logic functions.
- ☑ Use conditional summary functions.
- ☑ Use the Goal Seek tool to perform what-if analysis.
- ☑ Use the Scenario Manager to perform what-if analysis.
- ☑ Use the cell Watch Window.

Key Terms

Term	Definition
Conditional Logic	A type of function used in situations in which you want to perform one of two different calculations, depending on which value is in one or more cells other than the ones in which the logical functions are located.
Conditional Summary	A type of summary function that is applied only to a given range of cells that meet a specific criteria.
Data Series	Each set of data used in a graphical chart.

Term	Definition
Goal Seek	A tool you can use to automate the entire process of changing one variable while calculating a formula and trying to match the desired value.
Nesting	Embedding one function inside of another one to yield a value that is the result of multiple calculations.
Scenario Manager	A tool that enables you to determine the impact on calculations of changing values without changing the actual data. You can store a set of values as a result of multiple scenarios and compare them.
Secondary Y-Axis	The secondary Y-axis appears on the far right of a chart. In a chart with dual axes, you can tie some of the data series to the primary axis on the left, and the remaining series to the secondary axis on the right.
Watch Window	A small pop-up window that displays the current value of selected worksheet cells. It is useful when working with large worksheets; the watch window displays these cell values regardless of what part of the worksheet you have currently displayed on the screen.
What-if Analysis	A process that involves repeating the calculation of a set of formulas many times using different numbers. It is a trial-and-error method that asks: "If I change this number, how does that affect the result?"

Quiz Questions

For each question, select the best answer.

1. What type of element can you add to a chart that will allow you to display two types of data, each requiring its own scale?

    a. Data labels
    b. A legend
    c. A trendline
    d. Dual axes

2. Which chart type can you use to show how often each different value in a set of data occurs?

    a. Waterfall
    b. Histogram
    c. Funnel
    d. Sunburst

3. Which chart type can you use to track a set of data that is shrinking or growing?

    a. Radar
    b. Funnel
    c. Treemap
    d. Sunburst

4. Which of the following statements about the PMT function is true?

    a. The function takes only one argument.
    b. You cannot use the function to determine the buyout left on a loan.
    c. If the interest rate is 6% per year and the term of the loan is 60 months, then you must divide the 6% by 12.
    d. The function will correctly calculate mortgage payments in all countries around the world.

5. Which arguments are required by the NPER function?

    a. Rate, pmt, and pv
    b. Rate and term
    c. Rate, principal, and pv
    d. Rate, term, and pv

6. How many functions can you nest within other functions?

    a. 16
    b. 32
    c. 64
    d. 128

7. Which of the following statements regarding the AND function is true?

    a. The AND function returns a TRUE value only if all of the logical tests are TRUE.
    b. The AND function returns the logical opposite value of a logical result.
    c. The AND function returns a TRUE value if any of the logical tests are TRUE.
    d. You can have up to 5 logical tests in an AND function.

8. Which statement correctly describes the following function: *=SUMIF(D4:D207,"Visa",F4:F207)*?

    a. Sum the values in column F if the value in column D equals Visa.
    b. Sum the values in column D if the value in column F equals Visa.
    c. Sum the values in column F except for those where the value in column D equals Visa.
    d. Sum the values in column D except for those where the value in column F equals Visa.

9. Which of the following conditional summary functions will perform more than one criteria test at the same time?

    a. SUMIF
    b. AVERAGEIFS
    c. COUNTIF
    d. All of the formulas listed will perform more than one criteria test at the same time.

10. Which of the following statements about the Goal Seek tool is TRUE?

    a. The Goal Seek tool automatically creates three scenarios.
    b. The Goal Seek tool automatically applies formatting to the cells involved in the calculation.
    c. The Goal Seek tool automates the process of changing one variable while calculating a formula and trying to match a desired value.
    d. The Goal Seek tool automatically creates a chart to illustrate the possible input values.

11. Which of the following tasks can make the Scenario Manager easier to use?

    a. Open a Watch Window.
    b. Nest functions within the Scenario Manager dialog box.
    c. Create range names for the cells you expect to change.
    d. Perform any of these tasks to make the Scenario Manager easier to use.

12. What is a cell watch?

    a. The ability of one worksheet cell to monitor the value of another cell, and perform an action if it changes.
    b. A special type of worksheet cell that displays each step of a macro as it is executed.
    c. A special type of worksheet cell that displays the current time of day.
    d. An Excel feature that allows you to always see the current value of one or more worksheet cells in a small pop-up window no matter where you are in the workbook.

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Lesson 6: Manipulating Data and Using Macros

Lesson Objectives

In this lesson, you will fill cells using the Fill Series and Flash Fill features. You will also remove duplicate rows; outline, group, and ungroup data; access hidden ribbon tabs; and create, edit, use, and copy macros among workbooks. Upon completion of this lesson, you will be able to:

- ☐ Use the Fill Series feature.
- ☐ Fill cells using the Flash Fill feature.
- ☐ Remove duplicate rows.
- ☐ Outline data using automatic subtotals.
- ☐ Group and ungroup data.
- ☐ Access hidden Ribbon tabs.
- ☐ Create and use macros.
- ☐ Save and open workbooks containing macros.
- ☐ Edit macros.
- ☐ Copy macros among workbooks.

Using the Fill Series Tool

Objective 2.1.2

Excel provides you with the ability to copy values or formulas into worksheet cells. In some situations, you need to fill a range of cells with incremental values, starting with an initial value.

The ***AutoFill*** feature performs the same function, except that it takes a guess on what the incremental value is. For example, if you select two cells containing the values 1 and 3, the autofilled cells will have the values 5, 7, 9, and so on because Excel has determined the increment is 2. If you select only one cell containing the value 1, the autofilled cells will all contain the value 1. If you select a cell containing the value Monday, the autofilled cells will be filled with Tuesday, Wednesday, and so on.

The Fill Series feature allows you to have more direct control over how much to increment each subsequent cell using only one starting cell. On the Home tab, in the Editing group, click Fill, and then click Series to open the Series dialog box (Figure 6-1).

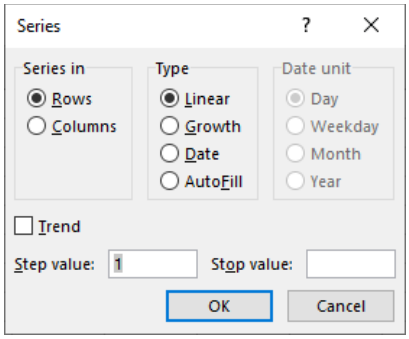


Figure 6-1: Series dialog box

You must pay careful attention to selecting the combination of Type, Date unit, and Trend option buttons to obtain the desired results. The following table explains the series types you can specify.

Linear	Excel will add a cell value and the Step value together, and place the sum in the next blank cell in the selected range.
Growth	Excel will multiply a cell value by the Step value, and place the product in the next blank cell in the selected range.
Date	Excel will open the Date unit section in the dialog box for you to select an option. By default, the Day option is selected. Excel will then add a cell value with the Step value together and place the sum in the next blank cell in the selected range.
AutoFill	This option is the same as the Linear type, but Excel will automatically determine the correct Step value to calculate each value to be placed in the blank cells of the range. This option works best with at least two starting values.

Excel will continue calculating values in blank cells until there are no more cells remaining in the selected range, or the Stop value is reached.

The Trend check box can be used as an alternative to entering a Step value of your own for the Linear and Growth types. It will perform a regression analysis for a linear or exponential best-fit – for Linear or Growth, respectively – using the starting values that are in the selected range. The blank cells are then filled with the calculated step value. This option requires at least two cells in the selected range with starting values.

The Date option button will allow you to add the Step value to the day, weekday, month, or year component of the date value in the starting value. In Figure 6-2, the start value of 20-Jan-20 is copied into the cell range B2:E2. The Fill Series tool is then used with a step value of 2 to fill *downwards* to row 7 in each respective column using the Day, Month, Year, and Weekday options.

	A	B	C	D	E
1	Date Unit	Day	Month	Year	Weekday
2	Start Value	20-Jan-20	20-Jan-20	20-Jan-20	Monday, January 20, 2020
3		22-Jan-20	20-Mar-20	20-Jan-22	Wednesday, January 22, 2020
4		24-Jan-20	20-May-20	20-Jan-24	Friday, January 24, 2020
5		26-Jan-20	20-Jul-20	20-Jan-26	Sunday, January 26, 2020
6		28-Jan-20	20-Sep-20	20-Jan-28	Tuesday, January 28, 2020
7		30-Jan-20	20-Nov-20	20-Jan-30	Thursday, January 30, 2020

Figure 6-2: Using the Fill Series tool

In this example, the Fill Series was applied in columns. Excel will automatically select the correct Series option for you based on the cell range you selected. You can override this selection by selecting the Rows or Columns option.

Learn to use the Fill Series feature for numbers

In this exercise, you will use the Fill Series feature for numbers.

1. Open **Fill Series.xlsx** located in the *StarterFiles* folder, and save it as **My Fill Series.xlsx** in the *MyProjects* folder.
2. Select cells **B4:B18**.
3. On the Home tab, in the Editing group, click **Fill**, then click **Series**.
4. Click **OK** to accept the default options.
5. Select cells **C4:C18**, then on the Home tab, in the Editing group, click **Fill**, then click **Series**.
6. In the *Step value* field, replace the 1 with the value of **4**, then click **OK**.
7. Select cells **D4:D18**, then on the Home tab, in the Editing group, click **Fill**, then click **Series**.
8. In the *Step value* field, replace the 1 with the value of **-4**, then click **OK**.
9. Select cells **E4:E18**, then on the Home tab, in the Editing group, click **Fill**, then click **Series**.
10. Select **Growth** in the *Type* section and click **OK**.
11. Select cells **F4:F18**, then on the Home tab, in the Editing group, click **Fill**, then click **Series**.
12. Select **Growth** in the *Type* section.
13. In the *Step value* field, replace the 1 with the value of **4**, and click **OK**.
14. Increase the width of column **F** to display the data.
15. Select cells **G4:G18**, then on the Home tab, in the Editing group, click **Fill**, then click **Series**.
16. Select **Growth** in the *Type* section.
17. In the *Step value* field, replace the 1 with the value of **4**.
18. In the *Stop value* field, enter: **100000**, and click **OK**.
19. Select cells **H4:H18**, then on the Home tab, in the Editing group, click **Fill**, then click **Series**.
20. Select **Growth** in the *Type* section.
21. In the *Step value* field, replace the 1 with the value of **-4**, and click **OK**.

22. Increase the width of column **H** to display the data.

    The worksheet should appear similar to the following:

	A	B	C	D	E	F	G	H
1	Type	Linear	Linear	Linear	Growth	Growth	Growth	Growth
2	Step	1	4	-4	1	4	4	-4
3	Stop						100,000	
4		15	15	15	15	15	15	15
5		16	19	11	15	60	60	-60
6		17	23	7	15	240	240	240
7		18	27	3	15	960	960	-960
8		19	31	-1	15	3,840	3,840	3,840
9		20	35	-5	15	15,360	15,360	-15,360
10		21	39	-9	15	61,440	61,440	61,440
11		22	43	-13	15	245,760		-245,760
12		23	47	-17	15	983,040		983,040
13		24	51	-21	15	3,932,160		-3,932,160
14		25	55	-25	15	15,728,640		15,728,640
15		26	59	-29	15	62,914,560		-62,914,560
16		27	63	-33	15	251,658,240		251,658,240
17		28	67	-37	15	1,006,632,960		-1,006,632,960
18		29	71	-41	15	4,026,531,840		4,026,531,840

23. Save and close the workbook.

Filling Cells Using Flash Fill

Objective 2.1.1

The ***Flash Fill*** feature is another labor-saving feature that will extract, combine, and/or re-sequence cell contents from one or more cells to create new values.

In order to use this feature, you must use the column to the immediate right of the column(s) from which you want Flash Fill to obtain its data. The target cells must also be empty.

After filling out the information, use the column immediately to the right to type how you want the information extracted, combined, or re-sequenced. Make sure the cell in which you typed is the active cell and then, on the Home tab, in the Editing group, click the Fill arrow, then click Flash Fill. The cells below the active cell will follow the same pattern using the data in the cells on the left, as shown in Figure 6-3.

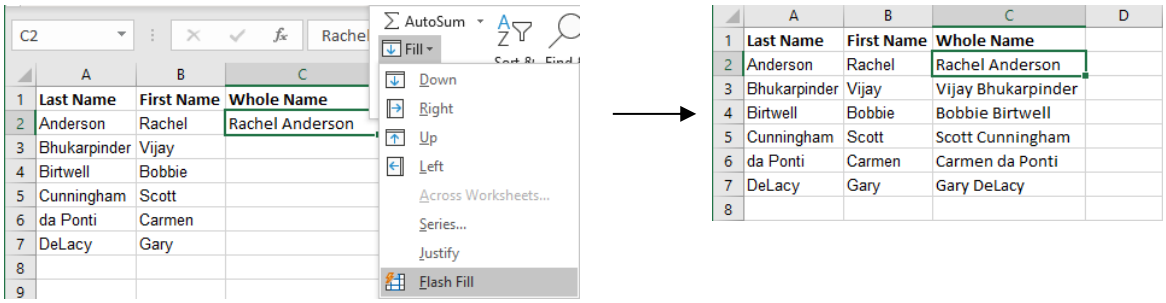


Figure 6-3: Filling Cells Using Flash Fill

Learn to use the Flash Fill feature

In this exercise, you will use the Flash Fill feature.

1. Open **Customer List Flash Fill.xlsx** located in the *StarterFiles* folder, and save it as **My Customer List Flash Fill.xlsx** in the *MyProjects* folder.

Your first task is to combine all of the first, middle, and last names in columns A to C together as one name in column D. Start by entering the first name.

2. Select cell **D2** and enter: **Jayel Sasha Wylie**

When you start entering the second name, Excel will recognize the pattern from the first row and apply it to the remaining rows.

3. Select cell **D3**, type: **B** but do not press any more keys.

   The Flash Fill feature then completes the rest of the customer's name in not only this cell, but also every cell below, saving you a lot of work. At this point, the flash fill data is only tentative—it is displayed in a light gray color to show what they will look like—and you need to confirm your acceptance.

	A	B	C	D	E
1	Last Name	Middle Name	First Name		
2	Wylie	Sasha	Jayel	Jayel Sasha Wylie	
3	Haarsma	Carter	Ben	Ben Carter Haarsma	
4	Swierczynski	Andreyev	Pavel	Pavel Andreyev Swierczynski	
5	Lowachee		Sharin	Sharin Lowachee	
6	Whitcomb	P	Isla	Isla P Whitcomb	
7	Fleischer	Samuel	Paul	Paul Samuel Fleischer	
8	Strohmeyer	Karen	Alison	Alison Karen Strohmeyer	
9	Sijie		Dai	Dai Sijie	
10	Angelini	B	Sara	Sara B Angelini	
11	Ruesch	John	Patrick	Patrick John Ruesch	
12	Frankel	Avril	Valerie	Valerie Avril Frankel	
13	Abidi		Azhar	Azhar Abidi	
14	Aubert	Leanne	Rosemary	Rosemary Leanne Aubert	
15	Pearson	Peter	Ryan	Ryan Peter Pearson	
16					

4. Press **ENTER** to let the Flash Fill feature complete the data entry for you.
5. Select cells **D3:D15**, and press the **DELETE** key to delete all of these entries.
6. Select cells **D2:D15**, then on the Data tab, in the Data Tools group, click **Flash Fill**.

You can also use the Flash Fill feature to pick out a specific word from a text string such as a name. For example, extract just the first name from column D.

7. Select cell **E2**, and enter: **Jayel**.
8. Select cell **E3**, type: **B** and press **ENTER** to accept the Flash Fill data.

Now pick out the middle name from column D, if there is any.

9. Select cell **F2**, and enter: **Sasha**.
10. Select cell **F3**, type: **C** and press **ENTER** to accept the Flash Fill data.

    Notice that the names that did not have a middle name did not appear in the flash fill list of names.

Finally, extract the family name from column D.

11. Select cell **G2**, and enter: **Wylie**.

12. Select cell **G3**, type: **H** and press **ENTER** to accept the Flash Fill data.

You can also change the pattern of the middle name to just the first letter.

13. Select cells **F2:F15**, and press the **DELETE** key.

14. Select cell **F2**, and enter: **S.** (uppercase letter "S" followed by the period at the end)

15. Select cell **F3**, type: **C** and press **ENTER** to accept the Flash Fill data.

This same technique can be applied in reverse to combine the contents of multiple cells together.

16. Select cells **D2:D15**, and press the **DELETE** key.

17. Select cell **D2**, and enter: **J. S. Wylie**

18. Select cell **D3**, and type: **B** so the worksheet appears similar to the following.

	A	B	C	D	E	F	G	H	I	J
1	Last Name	Middle Name	First Name						Phone	
2	Wylie	Sasha	Jayel	J. S. Wylie	Jayel	S.	Wylie		2064858314	
3	Haarsma	Carter	Ben	B. C. Haarsma	Ben	C.	Haarsma		2533574805	
4	Swierczynski	Andreyev	Pavel	P. A. Swierczynski	Pavel	A.	Swierczynski		2067881452	
5	Lowachee		Sharin	S. Lowachee	Sharin		Lowachee		3605647884	
6	Whitcomb	P	Isla	I. P. Whitcomb	Isla	P.	Whitcomb		2064257753	
7	Fleischer	Samuel	Paul	P. S. Fleischer	Paul	S.	Fleischer		2533770435	
8	Strohmeyer	Karen	Alison	A. K. Strohmeyer	Alison	K.	Strohmeyer		2069367601	
9	Sijie		Dai	D. Sijie	Dai		Sijie		2539623056	
10	Angelini	B	Sara	S. B. Angelini	Sara	B.	Angelini		2537463077	
11	Ruesch	John	Patrick	P. J. Ruesch	Patrick	J.	Ruesch		2062175156	
12	Frankel	Avril	Valerie	V. A. Frankel	Valerie	A.	Frankel		2066066807	
13	Abidi		Azhar	A. Abidi	Azhar		Abidi		2066309230	
14	Aubert	Leanne	Rosemary	R. L. Aubert	Rosemary	L.	Aubert		2533183047	
15	Pearson	Peter	Ryan	R. P. Pearson	Ryan	P.	Pearson		2069266750	
16										

19. Press **ENTER** to accept the Flash Fill data.

Numeric values can also be re-patterned as text strings, such as phone numbers.

20. Select cell **J2** and enter: **(206) 485-8314**

21. Select cell **J3**, and type: **(** so the worksheet appears similar to the following:

	A	B	C	D	E	F	G	H	I	J
1	Last Name	Middle Name	First Name						Phone	
2	Wylie	Sasha	Jayel	J. S. Wylie	Jayel	S.	Wylie		2064858314	(206) 485-8314
3	Haarsma	Carter	Ben	B. C. Haarsma	Ben	C.	Haarsma		2533574805	(253) 357-4805
4	Swierczynski	Andreyev	Pavel	P. A. Swierczynski	Pavel	A.	Swierczynski		2067881452	(206) 788-1452
5	Lowachee		Sharin	S. Lowachee	Sharin		Lowachee		3605647884	(360) 564-7884
6	Whitcomb	P	Isla	I. P. Whitcomb	Isla	P.	Whitcomb		2064257753	(206) 425-7753
7	Fleischer	Samuel	Paul	P. S. Fleischer	Paul	S.	Fleischer		2533770435	(253) 377-0435
8	Strohmeyer	Karen	Alison	A. K. Strohmeyer	Alison	K.	Strohmeyer		2069367601	(206) 936-7601
9	Sijie		Dai	D. Sijie	Dai		Sijie		2539623056	(253) 962-3056
10	Angelini	B	Sara	S. B. Angelini	Sara	B.	Angelini		2537463077	(253) 746-3077
11	Ruesch	John	Patrick	P. J. Ruesch	Patrick	J.	Ruesch		2062175156	(206) 217-5156
12	Frankel	Avril	Valerie	V. A. Frankel	Valerie	A.	Frankel		2066066807	(206) 606-6807
13	Abidi		Azhar	A. Abidi	Azhar		Abidi		2066309230	(206) 630-9230
14	Aubert	Leanne	Rosemary	R. L. Aubert	Rosemary	L.	Aubert		2533183047	(253) 318-3047
15	Pearson	Peter	Ryan	R. P. Pearson	Ryan	P.	Pearson		2069266750	(206) 926-6750
16										

22. Press **ENTER** to accept the Flash Fill data.

23. Save and close the workbook.

Removing Duplicate Rows

Objective 2.2.5

Excel has the ability to find and remove duplicate data rows from a cell range. This is often a useful feature for worksheets with a lot of data especially when the data came from multiple sources or the data entry system does not have an ability to prevent duplicates from occurring. After selecting the cell range:

- On the Data tab, in the Data Tools group, click Remove Duplicates.
- On the Table Tools Design tab, in the Tools group, click Remove Duplicates.

Use the Remove Duplicates dialog box (Figure 6-4) to specify the criteria to remove duplicate rows.

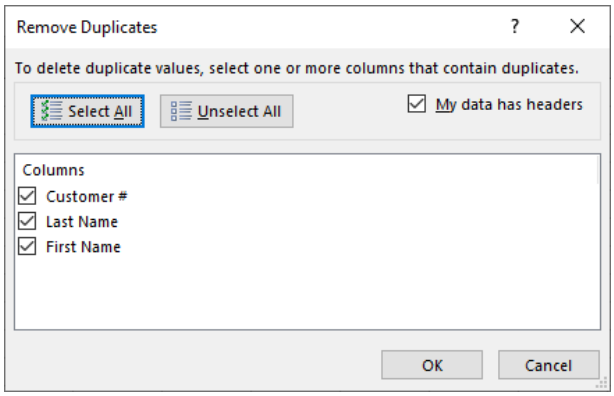


Figure 6-4: Remove Duplicates dialog box

You can select all columns or only selected columns to be used for comparing the data. For example, you can scan a data table containing customer numbers, names, and addresses to find any rows where the same customer is listed two or more times. Alternatively, you can select just the last name and first name columns to find and remove duplicate rows.

On the other hand, Excel will look only for identical data when comparing rows. For example, Excel will consider two rows as different if the address in one row contains "1234 Miller Road" and the other row contains "1234 Miller Rd.". Every blank space, comma, number, and other character in each cell is used to find exact matches.

Learn to remove duplicate rows

In this exercise, you will remove duplicate rows from a cell range.

1. Open **Customer List Duplicates.xlsx** located in the *StarterFiles* folder, and save it as **My Customer List Duplicates.xlsx** in the *MyProjects* folder.
2. Scan through the data to see if you can spot any duplicates.
3. Select any cell in the table.
4. Click the **Data** tab and, in the Data Tools group, click **Remove Duplicates**.
5. In the Remove Duplicates dialog box, click **OK**.

   A message box appears with the message: "No duplicate values found."

   That should be enough to confirm that there are no duplicate rows in the data. Or maybe we did not use the command correctly.

6. Click **OK** to close the message box.
7. On the Data tab, in the Data Tools group, click **Remove Duplicates**.

This time use only the columns that really matter.

8. Deselect the **Customer #** check box to turn it off and click **OK**.

   A message box appears with the message: "3 duplicate values found and removed; 25 unique values remain."

9. Click **OK** to close the message box.

   By comparing the results from the original table, customers 16, 26, and 27 were found to be duplicates.

10. Save and close the workbook.

Outlining Data

Outlining Data Using Automatic Subtotals

Objective 2.2.4

Many worksheets become very large due to the sheer amount of information needed for analysis. Often, summary totals are added for each major group of data as well as grand totals. The end result can be a worksheet that is difficult to see from one end to another.

To help organize the data, Excel provides an automatic outlining tool that enables you to insert subtotals whenever the selected field changes in value. You can make a very big worksheet easier to understand by setting it up so that you see only the subtotals for each group of data.

With the ***Outline*** feature turned on, you can quickly expand all or selected groups of data and collapse them again. Before creating the subtotals, an important step is organizing the data by column or row to group these related rows together. Otherwise, the results will not make much sense.

The first step is to sort the data so that the subtotals are displayed for the data groups you want. Sorting information is quick and easy when using the sort feature. Select a cell anywhere in the column or row by which you want the information sorted, and on the Data tab, in the Sort & Filter group, click the Sort A to Z button to automatically sort the data.

Now that the data is sorted by the desired category, the worksheet is ready to add subtotals. On the Data tab, in the Outline group, click Subtotal. When the Subtotal dialog box appears (Figure 6-5), you can choose the criteria for which to create subtotals. For example, if you have a large worksheet listing every sales transaction for 12 months, and you need to know how many sales were made with each type of credit card, you would first sort the information by credit card, and create subtotals using the options in the Subtotal dialog box.

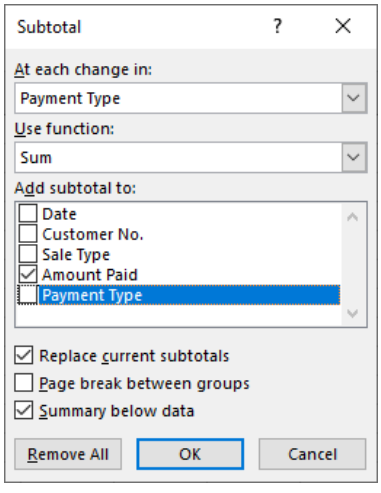


Figure 6-5: Subtotal dialog box

In this example, after clicking OK, outlining features would appear to the left of the cells. The data is categorized by three different levels. Clicking the 3 over the outlining bars shows all the data with the subtotals in bold at the end of each category (Figure 6-6).

	A	B	C	D	E
153	17-Nov-20	362	Hotel	444.00	Air Miles
154	18-Nov-20	398	Flight+Hotel	964.00	Air Miles
155	18-Nov-20	329	Rock climbing	56.00	Air Miles
156	20-Nov-20	319	Hotel	720.00	Air Miles
157	21-Nov-20	309	Nature tour	145.00	Air Miles
158	28-Nov-20	309	Car rental	376.00	Air Miles
159	2-Dec-20	341	Flight+Hotel	766.00	Air Miles
160	2-Dec-20	370	Hotel	449.00	Air Miles
161	3-Dec-20	339	Hotel+Car rental	179.00	Air Miles
162	4-Dec-20	330	Flight+Hotel	986.00	Air Miles
163	6-Dec-20	347	Car rental	266.00	Air Miles
164	16-Dec-20	349	Car rental	391.00	Air Miles
165	17-Dec-20	306	Flight+Cruise	1,418.00	Air Miles
166	22-Dec-20	327	Car rental	55.00	Air Miles
167	23-Dec-20	304	Hotel+Car rental	403.00	Air Miles
168	26-Dec-20	367	Hotel+Car rental	369.00	Air Miles
169				196,059.00	**Air Miles Total**
170	2-Jan-20	354	Car rental	56.00	Amex
171	3-Jan-20	325	Car rental	345.00	Amex
172	4-Jan-20	366	Cruise	3,503.00	Amex
173	4-Jan-20	359	Car rental	272.00	Amex
174	4-Jan-20	380	Flight+Cruise	4,316.00	Amex
175	9-Jan-20	376	Flight	305.00	Amex
176	9-Jan-20	313	Flight+Cruise	6,308.00	Amex
177	10-Jan-20	324	Nature tour	147.00	Amex

Figure 6-6: Data subtotals categorized by three different levels

At each subtotal, a mark appears under the 2 in the outline. When you click the 2, only the subtotals and grand total appear (Figure 6-7). The row numbers show the cells in which the subtotals are located and the outlining markers (+ under the 2) show how many subtotals there are on the sheet. This can be a great time saver for finding pertinent information without the need to scroll through hundreds or thousands of rows.

	A	B	C	D	E	F
1	Date	Customer No.	Sale Type	Amount Paid	Payment Type	
169				196,059.00	**Air Miles Total**	
534				493,317.00	**Amex Total**	
608				85,424.00	**Cash Total**	
741				146,198.00	**Diner's Card Total**	
1380				871,447.00	**Mastercard Total**	
2015				785,593.00	**Visa Total**	
2016				2,578,038.00	**Grand Total**	

Figure 6-7: Data showing only subtotals and grand total

Finally, by clicking the 1 at the top of the outlining section, only the grand total appears, because that is the last level of the outline.

You can also create multiple subtotals for a single column or several layers of columns. For example, you can calculate the sum, average, and variance subtotals for as many numeric columns as you require. You must add each different type of subtotal as a separate row to identify the type of subtotal.

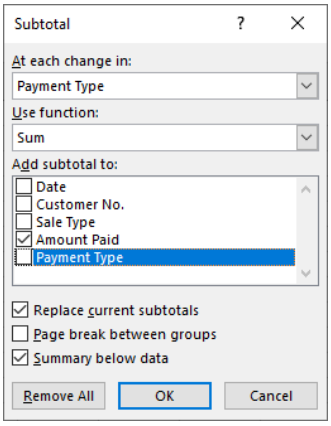
You can create a more complex type of multiple subtotals by nesting them. For example, suppose you have a sales report listing every sales transaction for a year. As long as you have a separate column for the month value, you can create subtotals based on the month. You can then create another layer of subtotals based on the date of each sale, which is in a different column. Assuming that you will have multiple sales each day, you can nest your subtotals by the day of each month and by the month of the year. The outline feature then allows you to quickly open or collapse your worksheet at the year, month, or day level.

The key difference in creating multiple subtotals is how you use the *Replace current subtotals* option in the Subtotal dialog box. When creating the first (or only) subtotal for a worksheet, ensure that this check box is selected. When creating subsequent subtotals, ensure that this check box is deselected.

Learn to insert automatic subtotals

In this exercise, you will use automatic subtotals to create an outline.

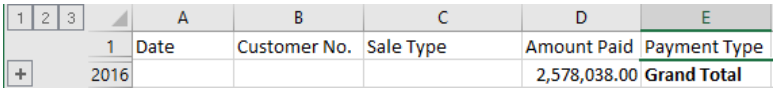
1. Open **Sales Subtotals.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Subtotals.xlsx** in the *MyProjects* folder.
2. Scroll down the worksheet to see how many rows of data are present.
3. Select any cell in column **E**.
4. Click the **Data** tab and, in the Sort & Filter group, click **Sort A to Z**.
5. On the Data tab, in the Outline group, click **Subtotal**.
6. In the Subtotal dialog box, click the drop-down arrow for **At each change in** and select **Payment Type**.
7. In the *Use function* list box, click the drop-down arrow and select **Sum**.
8. In the *Add subtotal to* list, select the **Amount Paid** check box to turn it on, and deselect all other check boxes in this list.
9. If necessary, select **Replace current subtotals** and **Summary below data** to turn them on, and deselect **Page break between groups**.



10. Click **OK**. Then scroll down the worksheet to see how the data appears.

    Notice that the worksheet now has three outline levels at the left side. Each of these numbers corresponds to a different level of detail: clicking **1** compresses the data rows so that only the grand total is displayed. Clicking **2** also compresses the data rows but displays the subtotal rows and grand total. Clicking **3** shows all data rows for that level as well as the subtotals and the grand total.

11. Click **1** at the top of the outline section, and then scroll up to the top of the worksheet.



		A	B	C	D	E
	1	Date	Customer No.	Sale Type	Amount Paid	Payment Type
+	2016				2,578,038.00	**Grand Total**

The **+** and **-** buttons work the same way as in File Explorer—clicking the **+** opens the level and shows the data in the next level; clicking the **-** collapses the details.

12. Click **3** to display all rows again.
13. Scroll down (or up) and click the **-** to the left of the *Mastercard Total* and then scroll up the worksheet for a few more rows.
14. Click **2** at the top of the outline section, and then scroll up to the top of the worksheet.

    The worksheet displays only the subtotal rows and the grand total row.

    Note: When you remove some subtotals, you remove all subtotal functions. You cannot remove some subtotals and keep the rest.

15. Click **3** to display all rows again.
16. Click any cell in the data area to ensure that it is selected, then on the Data tab, in the Outline group, click **Subtotal**.
17. In the Subtotal dialog box, click the **Remove All** button to clear the subtotals.

    You can also calculate two different types of subtotals for the same (or different) column(s) in the worksheet at the same time.

18. On the Data tab, in the Outline group, click **Subtotal**.
19. Verify that the Subtotal dialog box has the following settings and click **OK**:

At each change in	**Payment Type**
Use function	**Sum**
Add subtotal to	**Amount Paid**
Replace current subtotals	**On**
Summary below data	**On**

20. On the Data tab, in the Outline group, click **Subtotal** again.
21. In the Subtotal dialog box, configure the following settings and click **OK**:

At each change in	**Payment Type**
Use function	**Count**
Add subtotal to	**Amount Paid**
Replace current subtotals	**Off**
Summary below data	**On**

    Notice that when you are adding another subtotal to an existing one, you need to deselect the Replace current subtotals check box.

22. Scroll down the data and see how the subtotal values appear. Each payment type should have a count subtotal and a sum subtotal.

	A	B	C	D	E	F
166	22-Dec-20	327	Car rental	55.00	Air Miles	
167	23-Dec-20	304	Hotel+Car rental	403.00	Air Miles	
168	26-Dec-20	367	Hotel+Car rental	369.00	Air Miles	
169				167	**Air Miles Count**	
170				196,059.00	**Air Miles Total**	
171	2-Jan-20	354	Car rental	56.00	Amex	
172	3-Jan-20	325	Car rental	345.00	Amex	
173	4-Jan-20	366	Cruise	3,503.00	Amex	

23. Save and close the workbook.

Manually Grouping and Ungrouping Data

Objective 2.2.3

Creating an outline of an Excel worksheet using automatic subtotals is a very useful feature but only if the data are structured consistently, as demonstrated in the previous topic. However, not all worksheets have data designed in such a way that there is a clear break from one group of rows or columns to the next group.

Manually grouping data is a useful feature to help organize large amounts of data. This can be applied to rows and/or columns of data. Once the groups are created, the outline buttons can be used to show just the subtotals for the different categories and grand totals.

The figure below shows the sales of a tire company. The information is grouped by rows to show the different quarters while the columns are grouped by type of customer. To group the data, you need to manually insert the subtotals by row after every 3 months (or quarter), and by column within each product group. To do this, rows and columns are inserted to make space for the Quarter rows and Total columns. Then, SUBTOTAL formulas are manually inserted in the appropriate cells.

Once this is completed, the worksheet is ready to manually group the data. Select the desired rows (for example, rows 6-8), then on the Data tab, in the Outline group, click Group. This group is marked under the 2 in the outline with a dash (-). Repeat this process with all the other groups both in rows and columns, as shown in Figure 6-8. While this is more time consuming at first than using automatic subtotals, it will save time in the long run so you can quickly look at groups. By selecting the different numbers in the outline, you can hide the extra information and see only the subtotals and grand totals.

	A	B	C	D	E	F	G	H	I	J	K
1	**Tires R Us**										
2	**Year-to-Date Sales (in thousands)**										
3											
4		**Consumer**			**Industrial**			**Speciality**			**Grand**
5	**Month**	**Cars**	**Vans**	**Total**	**Trucks**	**Retreads**	**Total**	**Bicycles**	**Racing**	**Total**	**Total**
6	January	63	78	*141*	7	6	*13*	6	6	*12*	***166***
7	February	42	21	*63*	3	3	*6*	2	11	*13*	***82***
8	March	4	47	*51*	3	9	*12*	7	8	*15*	***78***
9	*Quarter 1*	*109*	*146*	*255*	*13*	*18*	*31*	*15*	*25*	*40*	***326***
10	April	46	10	*56*	9	3	*12*	1	2	*3*	***71***
11	May	16	16	*32*	6	2	*8*	1	1	*2*	***42***
12	June	32	74	*106*	1	5	*6*	2	2	*4*	***116***
13	*Quarter 2*	*94*	*100*	*194*	*16*	*10*	*26*	*4*	*5*	*9*	***229***
14	July	98	9	*107*	4	6	*10*	3	7	*10*	***127***
15	August	28	81	*109*	2	2	*4*	4	6	*10*	***123***
16	September	10	66	*76*	3	1	*4*	4	8	*12*	***92***
17	*Quarter 3*	*136*	*156*	*292*	*9*	*9*	*18*	*11*	*21*	*32*	***342***
18	October	28	89	*117*	9	8	*17*	2	3	*5*	***139***
19	November	77	46	*123*	5	7	*12*	5	4	*9*	***144***
20	December	81	28	*109*	4	6	*10*	5	7	*12*	***131***
21	*Quarter 4*	*186*	*163*	*349*	*18*	*21*	*39*	*12*	*14*	*26*	***414***
22	***Total***	***525***	***565***	***1090***	***56***	***58***	***114***	***42***	***65***	***107***	***2622***

Figure 6-8: Data grouped by quarter and customer type

To create an outline of a worksheet using this manual grouping method, you must adhere to the following guidelines:

- The worksheet must already contain summation formulas including SUM, SUBTOTAL, or simple addition (+) operators in the rows and/or columns where they need to be.
- Although Excel assumes the summary formulas will refer to the data above or to the left of the cell in which you place the formula, you can override these assumptions by changing the settings. On the Data tab, in the Outline group, click the Outline dialog box launcher to display the Settings dialog box (Figure 6-9).

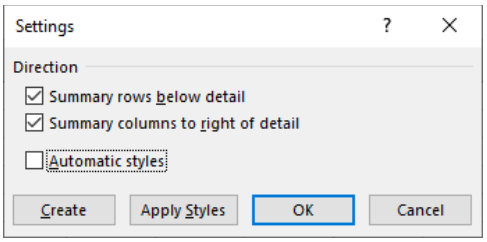


Figure 6-9: Settings dialog box

By default, Excel assumes that the subtotals will appear to the right of and/or below the grouped data. Deselect the check boxes if the summary formulas are in the opposite direction.

- You can have only one outline for each worksheet.

Learn to manually group data

In this exercise, you will group data manually.

1. Open **Sales Group Ungroup.xlsx** located in the *StarterFiles* folder, and save it as **My Sales Group Ungroup.xlsx** in the *MyProjects* folder.
2. Scroll down and select row **180**. On the Home tab, in the Cells group, click **Insert**.
3. Enter the following:

Cell	Value or Formula
A180	**Subtotal - January**
D180	**=SUBTOTAL(9,D2:D179)**

4. Make note of the first row of the February sales.
5. Select rows **2** to **179**. You can select this group of rows by starting at the bottom with row 179 and select the rest of the rows in an upward direction, or scroll to the top of the worksheet, start with row 2, and select downwards.

   Note: Do not include the row containing the subtotal formula.

6. Click the **Data** tab and, in the Outline group, click **Group**.

   The group outline bar is now displayed for the January rows.

7. Scroll down and select row **339**. Then, on the **Home** tab, in the Cells group, click **Insert**.
8. Enter the following:

Cell	Value or Formula
A339	**Subtotal - February**
D339	**=SUBTOTAL(9,D181:D338)**

How did you know the range for this SUBTOTAL would start at row 181? Because you made note of that in step 4.

9. Select rows **181** to **338** and then, on the **Data** tab, in the Outline group, click **Group**.
10. Click **-** at the left of the headers for rows **339** and **180** to collapse both groups created so far.

You still have another 10 months' worth of data to group, and the process is beginning to appear tedious and error prone because the SUBTOTAL function must reference the correct cell range. For the remaining 10 months, you can use the same steps but in a different sequence to help streamline the process.

11. Scroll down and insert a new blank row at row **500**.
12. Select rows **340** to **499** and then, on the Data tab, in the Outline group, click **Group**.

    When selecting the rows to be grouped together, be sure to not include the blank row in the group.

13. Check that the **-** appears at the blank row.

    Note: If you have accidentally left out one or more rows of data, select these missing rows, then, on the Data tab, in the Outline group, click **Group**. Excel automatically adds these cells to the group.

14. Click **-** at the left of the row header to collapse this group. Alternatively, click **1** (to the left of the column label row).
15. Enter the following:

Cell	Value or Formula
A500	**Subtotal - March**
D500	**=SUBTOTAL(9,D340:D499)**

    How did you know the range for this SUBTOTAL? You have collapsed all of the groups created so far, so look at the row numbers at the left side of the worksheet. The range for March starts at row 340 because that is the next row after the February subtotal. It ends at row 499 because that is the last row just above the March subtotal.

16. Save and close the workbook.

Accessing Hidden Ribbon Tabs

Excel includes a rich variety of commands, tools, and features. There are so many that even the Ribbon does not display all of them. Many commands and tools are buried inside a dialog box that is displayed only when you click the dialog box Launcher from the Ribbon, or when you click a link in another dialog box.

The Ribbon contains the commands and tools that most users will need. By default, all tabs are displayed except one—the Developer tab. You can display hidden tabs by customizing the Ribbon.

You can use one of the following methods to customize the Ribbon:

- Click File, click Options, and then click Customize Ribbon; or
- right-click anywhere on the Ribbon, then click Customize the Ribbon.

Both methods will open the Customize Ribbon page of the Excel Options dialog box (Figure 6-10).

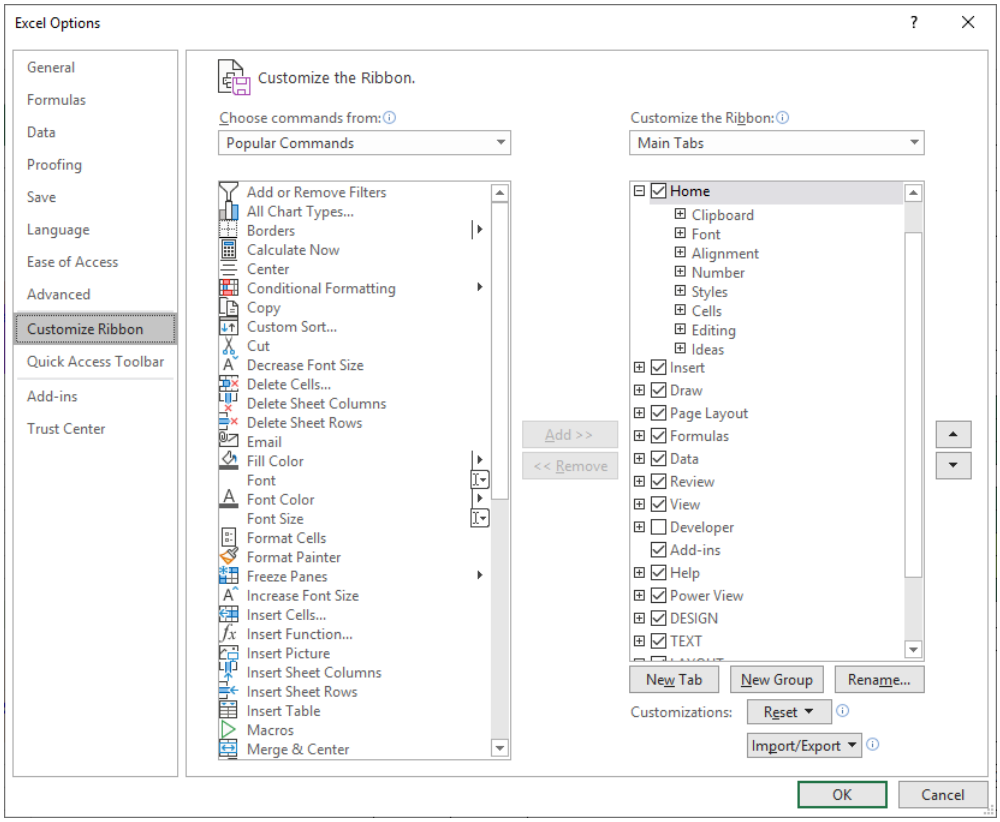


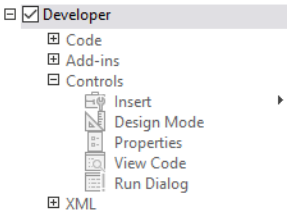
Figure 6-10: Excel Options dialog box – Customize Ribbon page

If you want to display the Developer tab, in the Customize the Ribbon list on the right side of the dialog box, select the Developer check box, and then click OK. To hide a Ribbon tab, deselect the appropriate check box and click OK.

Learn to reactivate a hidden Ribbon tab

In this exercise, you will reactivate a hidden Ribbon tab.

1. Create a new blank workbook, click **File**, then click **Options**.
2. In the Excel Options dialog box, click **Customize Ribbon**.
3. In the *Customize the Ribbon* list on the right side of the screen, select the **Developer** check box (if necessary) to turn it on.
4. Deselect the **Power Pivot** check box (if necessary) to turn it off, then click **OK**.
5. Click the **Developer** tab to view it in the Ribbon.
6. Right-click anywhere on the Ribbon, then click **Customize the Ribbon**.
7. Move the Excel Options dialog box down so that you can view all the buttons on the Developer tab in the Ribbon.
8. In the Excel Options dialog box, click the **Open Tree** (+) button for **Developer**, and then click the **Open Tree** button for **Controls**.



Notice that the various levels and commands shown in the dialog box match the commands and groups in the Developer tab in the Ribbon.

9. Click the **Choose commands from** drop-down arrow and click **Commands Not in the Ribbon**.
10. Scroll down this list of commands to view the many commands that are available.
11. Click any command in the list.

    Notice the Add button is no longer grayed out, indicating that you can add this command to the Ribbon.
12. In the *Customize the Ribbon* list on the right side of the screen, select the **Power Pivot** check box to add it back to the Ribbon, then click **OK**.
13. Close the workbook without saving.

Creating Macros

The term ***macro*** typically refers to a set of actions that can be recorded and then executed with a single command. This capability is very useful when you are performing tasks that must be repeated on different cells in a workbook. You can create macros to perform almost any command that you can access from the Ribbon. Typically, you use macros to format cells, copy data from one cell range to another, or update charts and pivot tables.

The building blocks that perform the work inside a macro are components of a programming language called Visual Basic for Applications, or VBA.

To make it simple to create macros, Excel provides a tool to record your actions and keystrokes, storing the information in a macro for later execution. This is extremely useful if you do not have time to learn the VBA language.

You can execute a macro in many ways. You can run the macro by name, create a shortcut key combination to run the macro, assign the macro to the Quick Access Toolbar or to a command button, or set it up as an auto-execute macro (that is, a macro that runs automatically whenever the workbook is opened).

You can access basic macro features by clicking the Macros arrow on the View tab in the Macros group. You can access more advanced macro features in the Code group on the Developer tab.

Configuring Security for Macros

Objective 1.1.3

The default security settings in Excel disable macros in workbooks when you open them because historic system attacks have been launched through malicious code hiding in macros. When you want to save a macro in a workbook, you must save the workbook specifically as a ***macro-enabled workbook***. You can recognize a workbook that has been saved as a macro-enabled workbook by the icon associated with the file, as shown here: 

When you open a macro-enabled workbook (and the default security settings are in effect), the macros are automatically disabled and you must enable the content (assuming you have sufficient rights on the system) before you can run the macros (Figure 6-11).

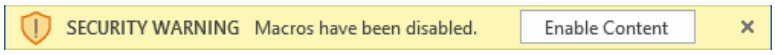


Figure 6-11: Security Warning – Macros have been disabled message

When macros are disabled, you can click the Enable Content button to enable them. You can also click the *Macros have been disabled* link in the security bar to go to the Info page of the Backstage (Figure 6-12).

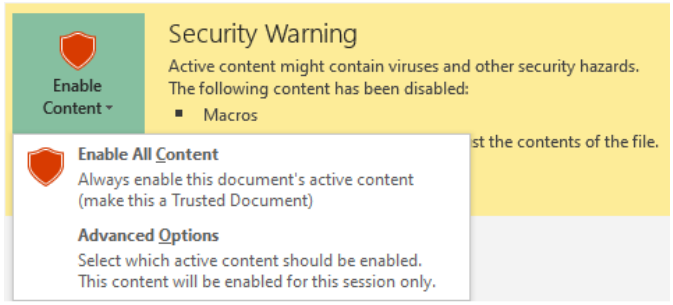


Figure 6-12: Info page of Backstage view – Enable Content button

From here, you can click the Enable Content button and specify to enable all content or specify which active content to enable for the current session only.

If you are unsure of the content, always scan the file with the antivirus program installed on your system before opening the workbook and enabling the content.

To examine or change the macro security level, click the Developer tab and, in the Code group, click Macro Security to open the Macro Settings page of the Trust Center dialog box (Figure 6-13).

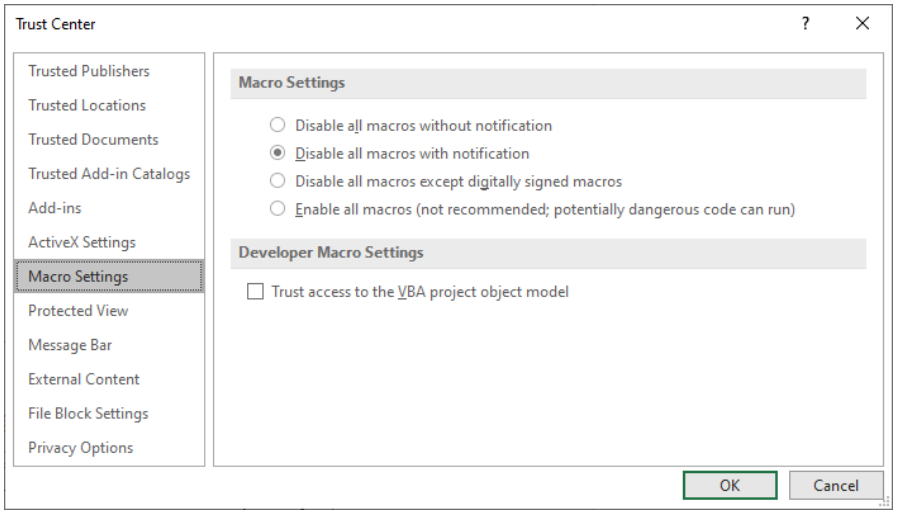


Figure 6-13: Trust Center dialog box – Macro Settings page

Disable all macros without notification – All macros are disabled and you are not notified via a security alert.

Disable all macros with notification – All macros are disabled, but security alerts appear if there are macros present in the workbook, allowing you to enable macros on an individual workbook basis. (This is the default setting.)

Disable all macros except digitally signed macros – Allows only macros that include a digital signature to run, and then, only if the publisher is listed in your list of Trusted Publishers. If the publisher of a signed macro is not in your list of Trusted Publishers, you are prompted to enable the signed macro and to trust the publisher.

Enable all macros (not recommended; potentially dangerous code can run) – All macros can run. This setting is not recommended because it makes your computer vulnerable to any malicious code hidden inside a macro.

Trust access to the VBA project object model – Choose whether to allow programmatic access to the Visual Basic for Applications (VBA) object model. That is, if you enable this option, you are allowing code to read and possibly insert new code into an existing VBA module. By default, access is denied preventing unauthorized programs from building harmful self-replicating code.

You should always maintain a sufficient level of security for macro-enabled workbooks and exercise caution when enabling content. Be certain that the workbooks come from a trusted source.

Running Macros

If a macro has been assigned to a toolbar button or to a keyboard shortcut, you can run the macro using these options.

Remember that you must enable macros in a workbook (click Enable Content in the notification bar) before you run them. If you attempt to run a macro that is currently disabled, an error message appears (Figure 6-14).

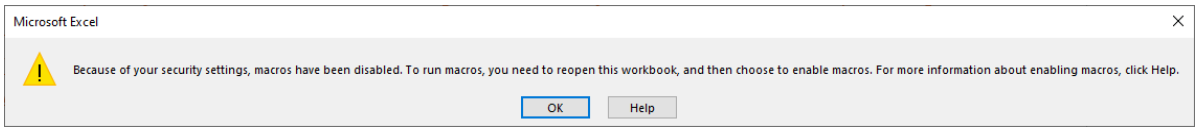


Figure 6-14: Microsoft Excel macros have been disabled error message

Any macro that is available in a workbook can also be accessed via the Macros dialog box. From this dialog box, you can run, step through, edit, create, or delete macros.

To open the Macro dialog box (Figure 6-15), use one of the following methods:

- On the Developer tab, in the Code group, click Macros; or
- on the View tab, in the Macros group, click Macros; or
- press ALT+F8.

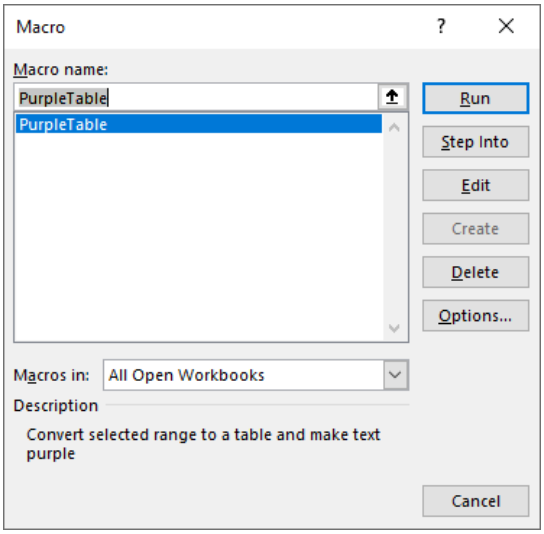


Figure 6-15: Macro dialog box

Macro name – Displays the name of the currently selected macro. If no macros have been defined, this field is blank. The list box shows all the macros available for the current workbook. The contents of the list box are affected by the value in the *Macros in* field.

Macros in – Lists the open workbooks and the Personal Macro Workbook (PERSONAL.xlsb). When you create a new macro, you must specify where you want to store it. When you want to run a macro, specify where you want to find the macros.

Description – Displays the description for the currently selected macro.

Run – Runs the selected macro.

Step Into – Opens the Visual Basic Editor and steps through each line of code. This allows you to view the effect of each step in the macro.

Edit – Opens the selected macro in the Code window of the Visual Basic Editor, so you can modify your macro.

Create – Opens a new module in the Code window so you can create a new macro by typing visual basic code.

Delete – Removes the selected macro. To keep macros easy to manage, consider deleting macros you no longer need.

Options – Opens the Macro Options dialog box where you assign or re-assign a shortcut key and/or edit the macro description.

Learn to work with macro settings and run macros

In this exercise, you will examine macro security settings and run macros.

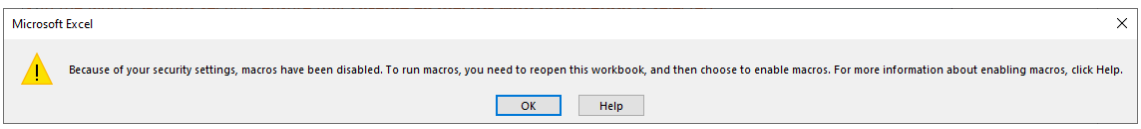
1. Create a new blank workbook.
2. On the Developer tab, in the Code group, click **Macro Security**.

   The Macro Settings page of the Trust Center dialog box opens.
3. In the *Macro Settings* section, ensure that **Disable all macros with notification** is selected.
4. In the *Developer Macro Settings* section, select the **Trust access to the VBA project object model** check box, if necessary.
5. Click **OK**.
6. Open the **Sparkline Macro.xlsm** macro-enabled workbook from the *ResourceFiles* folder.

   A notification that macros have been disabled appears below the Ribbon.
7. Click the **Developer** tab, then in the Code group, click **Macros**.

   The Macro dialog box opens.
8. In the Macro dialog box, ensure that the macro is selected, then click **Run**.

   You are not able to run the macro because it has been disabled.



9. In the message box, click **OK**.

10. Close and then re-open the **Sparkline Macro** macro-enabled workbook in the *ResourceFiles* folder.
11. In the notification bar, click **Enable Content**.

    The macro in the workbook is enabled.
12. On the Developer tab, in the Code group, click **Macros**.

    The Macro dialog box appears.
13. In the Macro dialog box, ensure that the **Sparks** macro is selected, then click **Run**.

    The macro code is executed and Excel inserts sparkline charts into column J.
14. Save the workbook as **My Sparkline Macro.xlsm** in the *MyProjects* folder, and then close it.

Recording Macros

Objectives 3.6.1, 3.6.2

The quickest way to create a macro in Excel is to use the ***Macro Recorder***. Once turned on, the Macro Recorder will track your Ribbon selections and activities on the worksheets. It will continue recording until you turn it off. After the recording is stopped, Excel converts the macro into a VBA program.

You can use one of the following methods to record a macro:

- On the View tab, in the Macros group, click Macros, and then click Record Macro; or
- on the Developer tab, in the Code group, click Record Macro; or
- click the macro recording button ( ) at the left end of the status bar.

All of these methods will open the Record Macro dialog box (Figure 6-16).

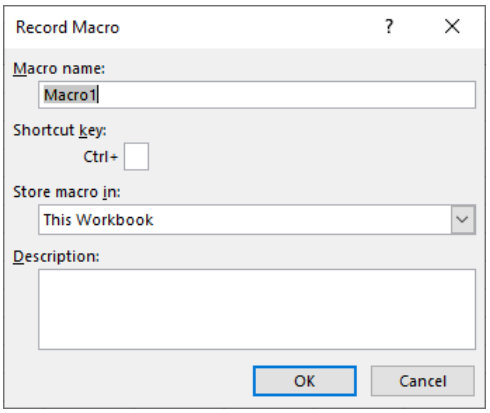


Figure 6-16: Record Macro dialog box

Macro name	Identifies the macro. The first character of the name must be an alphabetic character. The rest of the name can be any combination of letters, numbers, and the underscore character. You are not permitted to use any other character or blanks.
Shortcut key	Activates the macro in the worksheet by assigning a letter key as a shortcut. You can use only one uppercase or lowercase alphabetic character. It cannot be a number or a special character such as # or @. If you use one of Excel's default shortcut keys (such as CTRL+P to print), the macro will override the default command while the worksheet containing your macro is open.

Store macro in	Selects where to store the macro. If the macro is stored in This Workbook, it will be available only within the current workbook. Storing the macro in the Personal Macro Workbook makes it available in any workbook that is opened on your computer.
Description	Allows you to enter additional information about the macro.

Once the record mode is active, every keystroke you type, every keyboard key you press, and every option you click will now be recorded in the macro. This is similar to turning on the Record button on a video camera, which records every movement you make until you turn off the record mode.

When you have finished recording the steps for the macro, stop the record mode by using one of the following methods:

- On the Developer tab, in the Code group, click Stop Recording; or
- click the ■ box in the status bar.

Assigning Shortcut Keys

While it is not mandatory, assigning a shortcut key to a macro saves you time later when you want to run the macro. However, you should choose the letter to assign as the shortcut key for your macro carefully. If Excel uses the same letter as a default keyboard shortcut for a command, your macro will take precedence whenever your workbook is open and active. For example, you can create a macro that deletes the contents of the selected cells, and assign lower-case "c" as the shortcut key. Imagine the surprise of someone who opens your workbook and tries to copy a range of cells by pressing CTRL+C only to find that instead of copying the data, Excel deletes it!

To avoid this problem, you should generally choose the CTRL+SHIFT combination (upper case alphabetic characters) instead. If you do select a shortcut key with only the CTRL key, avoid the following letters:

- b—Bold
- c—Copy
- f—Find
- h—Replace
- i—Italics
- n—New workbook
- o—Open workbook
- p—Print
- s—Save
- u—Underline
- v—Paste
- w—Close workbook
- x—Cut
- y—Redo/repeat
- z—Undo

Saving a Workbook with Macros

Because of its powerful capabilities, the macro has attracted an inordinate amount of publicity over its exposure to computer viruses (that is, macro viruses). To protect users, Microsoft has redeveloped the architecture of the security components in the Office suite of applications. One of the changes is that the standard Excel workbook does not permit you to store any macros. Any workbook containing a macro must be stored as an Excel Macro-Enabled Workbook. If you do try to save a workbook containing a macro as a standard workbook, the warning message shown in Figure 6-17 appears.

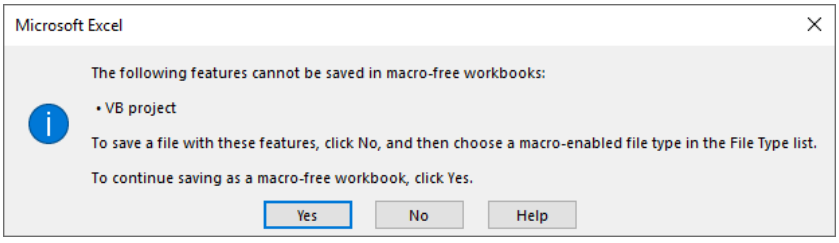


Figure 6-17: Microsoft Excel save as a macro-free workbook warning message

You must choose to continue saving the workbook as a standard workbook without the macros, or click No and change the workbook type to a macro-enabled workbook.

Note: The macro protection feature in Excel detects only the presence of macros in a workbook. It cannot determine if a macro contains a virus. You must use antivirus software to detect and remove macro viruses.

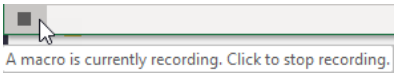
Learn to create a basic macro

In this exercise, you will create a basic macro and execute it using a shortcut key.

1. Open **Balance Sheet Macro.xlsx** located in the *StarterFiles* folder, and save it as **My Balance Sheet Macro.xlsx** in the *MyProjects* folder.
2. Select cell **B5** and then, on the View tab, in the Macros group, click the **Macros** arrow, and click **Record Macro**.
3. In the *Macro name* field, type: **Title** and press **TAB** to move to the *Shortcut key* field.
4. Press and hold the **SHIFT** key, type: **A**, and then release the **SHIFT** key. Notice that the shortcut key changes from *Ctrl+* to *Ctrl+Shift+*.
5. In the *Store macro in* drop-down list, click **This Workbook**, if necessary.
6. Click **OK**.

   Note: If you enter a lower-case alphabetic character (that is, a to z), you only need to use the CTRL key to activate the macro. If you enter an upper-case letter (A to Z), you must use both the CTRL and SHIFT keys to activate the macro. The Shortcut key indicator will change if you enter an upper-case letter.

At the left end of the Excel Status Bar, the macro indicator is displayed. By pointing at it, you will see the current macro state.



Starting from this point, any actions that you perform on the workbook will be recorded in the macro.

7. On the Home tab, in the Font group, click **Bold**. Then in the Alignment group, click **Center**.
8. On the View tab, in the Macros group, click the **Macros** arrow, and then click **Stop Recording**.
9. Select cell **D5**, and then press **CTRL+SHIFT+A**.
10. Repeat step 9 for cells **A6**, **A13**, and **A18**.
11. Click on the Excel Status Bar to open the Record Macro dialog box again.
12. In the *Macro name* field, type: **Numbers**, press **TAB** to access the *Shortcut key* field, press and hold the **SHIFT** key, type: **N**, and then click **OK**.
13. Select cells **B7**:**B11** and then, on the Home tab, in the Number group, click the **Number Format** dialog box launcher.
14. In the Format Cells dialog box, select the **Number** category and reduce the *Decimal places* to **0**. Select the **Use 1000 Separator (,)** check box to turn it on, and then click **OK**.
15. Click on the Excel Status Bar to stop the macro recording.

16. Click **Undo**.
17. Select cells **D7:D11**, and then press **CTRL+SHIFT+N**.

    Notice that the formatting was performed again for the cell range **B7:B11**. This macro will work only on those cells because they were selected while the macro was being recorded. As a result, the macro will not apply formatting to other cells in the workbook.

    You can fix this problem easily using one of two methods. Select all cells **before** recording a macro (this is usually the easier method); or use the Relative Reference option button while recording the macro.
18. Select cells **B7**:**B11** if necessary. Then on the Home tab, in the Editing group, click **Clear**, and click **Clear Formats**.
19. On the View tab, in the Macros group, click the **Macros** arrow, and then click **View Macros**.
20. Select the **Numbers** macro and click **Delete**.

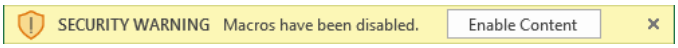
    Excel displays a message box with the warning "*Do you want to delete macro Numbers?*"
21. Click **Yes**.
22. With cells **B7**:**B11** still selected, click on the Excel Status Bar to open the Record Macro dialog box.
23. In the *Macro name* field, type: **Numbers**, and then click **OK**.
24. On the Home tab, in the Number group, click the **Number Format** dialog box launcher.
25. In the Format Cells dialog box, select the **Number** category, and reduce the *Decimal places* to **0**. Select the **Use 1000 Separator (,)** check box to turn it on, and then click **OK**.
26. Click on the Excel Status Bar to stop the macro recording.
27. On the View tab, in the Macros group, click the **Macros** arrow, and then click **View Macros**.
28. With the **Numbers** macro selected, click **Options**.
29. In the Macro Options dialog box, type: **n** in the *Shortcut key* field, and then click **OK**.
30. Click **Cancel** to close the Macro dialog box.
31. Select cells **D7:D11**, and then press **CTRL+N** (you do not need the **SHIFT** key because you did not use it when defining your shortcut key for this macro).

	A	B	C	D	E
1	Tolano Adventures				
2	Consolidated Balance Sheet				
3	As at June 30				
4					
5		Current Year		Previous Year	
6	Assets				
7	Cash	45,430		44,536	
8	Customer Deposits	85,930		75,930	
9	Equipment, Net	234,824		235,924	
10	Buildings, Net	1,927,245		1,927,350	
11	Total Assets	2,293,429		2,283,740	
12					
13	Liabilities				
14	Accounts Payable	42569		36096	
15	Mortgage Payable	1592742		1592850	
16	Total Liabilities	1635311		1628946	
17					
18	Shareholders' Equity				
19	Share Capital	100000		100000	
20	Retained Earnings	558118		554794	
21	Total Shareholders' Equity	658118		654794	
22					
23	Total Liabilities and Equity	2293429		2283740	

32. Click **File**, click **Save As**, and then navigate to the *MyProjects* folder.
33. Click **Save**.

    Excel displays a warning message stating that your workbook contains a VB project and therefore can't be saved as a macro-free workbook. You need to change the workbook type to a macro-enabled workbook.
34. Click **No**.
35. In the Save As page, change the *Save as type* to **Excel Macro-Enabled Workbook**, and then click **Save**.
36. Create a new blank workbook and close the *My Balance Sheet Macro.xlsm* workbook.
37. Open the *My Balance Sheet Macro.xlsm* workbook again.

    A security warning is displayed to inform you that this workbook contains a macro. Since you know you created this workbook, you can assume that it is still safe to use.



38. Click **Enable Content** in the Security Warning bar.
39. Select cells **B14**:**B16**, and then press **CTRL+N**.
40. Save the workbook.

    If you open this workbook again on this computer, Excel will no longer display the security warning message. By clicking the **Enable Content** button, you have tagged the workbook as "safe." Other users will still see the security warning message if they open this workbook for the first time.
41. Close the workbook.

Editing and Sharing Macros

Objective 1.1.1, 3.6.3

Arguably, the easiest way to edit a macro is to re-record it. However, even without programming experience, you can make simple edits to the code for a macro in the Visual Basic Editor.

Editing in the Visual Basic Editor

Objective 3.6.3

Excel records a macro as a sequence of Visual Basic commands, which you can edit in the ***Visual Basic Editor***. To edit a macro, on the Developer tab, in the Code group, click Macros, click the macro you want to edit, and then click Edit. The Visual Basic Editor opens a code window that displays the Visual Basic code, which is simple text that you can edit (Figure 6-18).

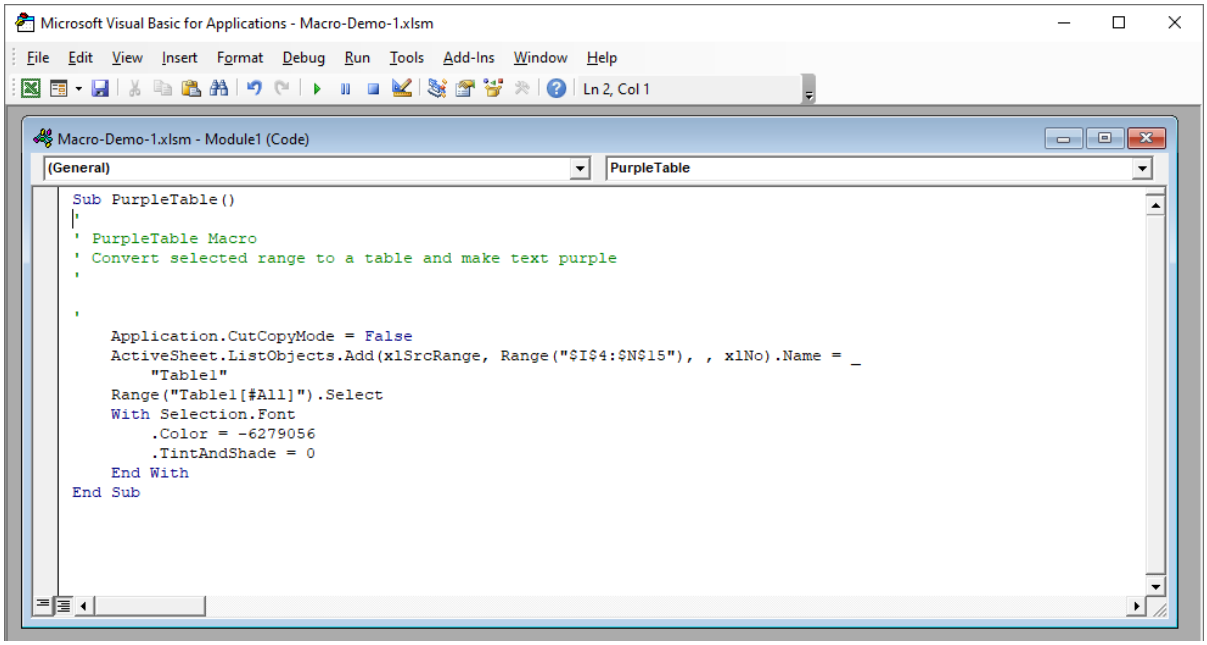


Figure 6-18: Microsoft Visual Basic for Applications window

All the code for the macro appears between the *Sub* and *End Sub* statements.

The text immediately following the Sub statement is the macro name. If you simply want to rename a macro, change the name in this line, save your change and exit the editor. (Be careful not to change the word *Sub* or the space that follows it.)

You can improve the speed, efficiency, and accuracy of your macro by removing unnecessary properties or changing code elements. For example, when you record a step that selects an option from a dialog box, the macro records all the settings in the dialog box. To speed up your macro, you can remove the unnecessary properties by deleting those lines of code.

A basic understanding of the Visual Basic programming language is helpful but, for the purposes of this courseware, you will learn simple editing procedures. This topic is included as an introduction to editing macros. If you are unfamiliar with Visual Basic or do not plan to learn it, you may want to re-create your macros whenever a change is required.

Within the code window, move the cursor to the location at which you want to make changes and use one of the following methods:

- To replace existing text in the code, select the text and type the replacement text.
- To enter code, begin typing. If a drop-down list appears, move through the list of options to select the appropriate code.
- To delete text, select the text and press DELETE.
- To insert a line of code, move the cursor to the beginning of the line where you want to insert the new line of text and press ENTER. Inserting a blank line will help you to identify where the new code will be placed. Move to the blank line and enter the line of code.
- To indent the line of code, press TAB.
- To turn a line of code into a comment, type a single apostrophe at the beginning of the line.

To save the changes, use one of the following methods:

- Click File, and then click Save; or
- click the  (Save) button in the Visual Basic toolbar; or
- press CTRL+S.

To switch from the Visual Basic window to the workbook, use one of the following methods:

- Click View, and then click Microsoft Excel; or
- click the  (View Microsoft Excel) button in the Visual Basic toolbar; or
- press ALT+F11.

To close and exit the Visual Basic window, use one of the following methods:

- Click File, and then click Close and Return to Microsoft Excel; or
- click the Close button for the Microsoft Visual Basic window.

Note: If you simply want to assign/re-assign a shortcut key or add/modify a description for the macro, open the Macros dialog box, then click the Options button to open the Macro Options dialog box, in which you can edit these macro options.

Learn to edit a macro

In this exercise, you will edit a macro.

1. Open **Pie Chart Macro.xlsm** located in the *StarterFiles* folder, and save it as **My Pie Chart Macro.xlsm** in the *MyProjects* folder.
2. Enable the content.
3. On the Developer tab, in the Code group, click **Macros**, then in the Macro dialog box, select **PieChart** and click **Run**.

   The macro inserts a pie chart and applies a color scheme and style.
4. Select the chart if necessary, then on the Chart Tools Design tab, in the Location group, click **Move Chart**.
5. In the Move Chart dialog box, click **New sheet**, and then click **OK**.

   The chart is moved into its own chart sheet.
6. Click **Sheet1**.

7. On the Developer tab, in the Code group, click **Macros**.
8. In the Macro dialog box, select **PieChart**, then click **Options** to open the Macro Options dialog box.
9. Press **SHIFT+T** to assign the CTRL+SHIFT+T shortcut key to the macro.
10. Click in the *Description* field and type: **Insert a pie chart**.
11. Click **OK**.
12. With the **PieChart** macro still selected in the list box, click **Edit** to open the Visual Basic Editor.
13. Within the macro code, locate the command *ActiveChart.ChartColor = 21* and change it so that it reads: **ActiveChart.ChartColor = 12**

    The command changes the color scheme.
14. Within the macro code, locate the command *ActiveChart.ChartStyle = 257* and change it so that it reads: **ActiveChart.ChartStyle = 258**

    The command changes the chart style.
15. Press **CTRL+S**, then click the close button to return to the Excel window.
16. Press **CTRL+SHIFT+T** to run the edited macro.

    The macro inserts a pie chart and applies the new color scheme and chart style.
17. Save and close the macro-enabled workbook.

Copying Macros Among Workbooks

Objective 1.1.1

As described above, workbook macros are created in each individual workbook. As a result, they are accessible only in the workbook where they are created. If you store your commonly-used macros in your Personal Macro Workbook, they will be accessible in all your workbooks. But to safeguard against unwanted macro viruses, you may prefer to avoid using a Personal Macro Workbook and restrict your use of macros to individual workbooks.

To save yourself time and effort entering every macro from scratch into every workbook, you can simply copy them from one workbook to another using the Visual Basic Project Explorer.

On the Developer tab, in the Code group, click Visual Basic. If necessary, click View, then click Project Explorer to ensure that the Project pane appears at the left side of the Microsoft VBA window, as shown in Figure 6-19.

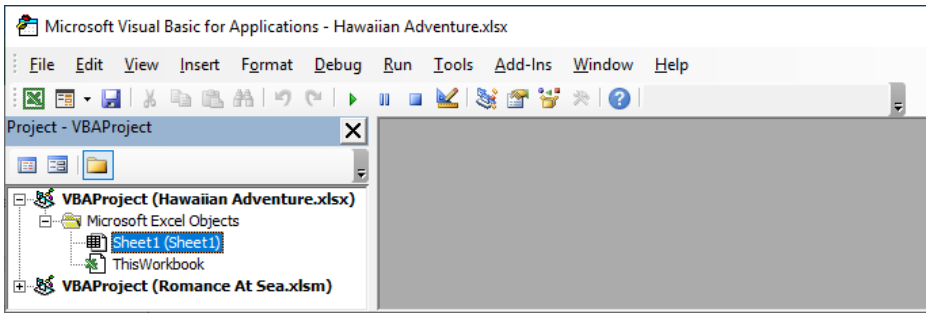


Figure 6-19: Microsoft Visual Basic Project pane

Assume in our example that Romance At Sea.xlsm contains a macro that you want to copy into Hawaiian Advenure.xlsx. Click the Plus symbol next to VBAProject (Romance At Sea.xlsm) to open its tree structure, drag Module1 at the bottom of the tree and drop it on VBAProject (Hawaiian Adventure.xlsx). This action will create a new Modules folder under VBAProject (Hawaiian Adventure.xlsx). Click the Plus symbol next to it and you will see a Module1 macro under VBAProject (Hawaiian Adventure.xlsx). You can double-click both Module1's to open them in separate Code windows to confirm that the macros are identical in both workbooks, as shown in Figure 6-20.

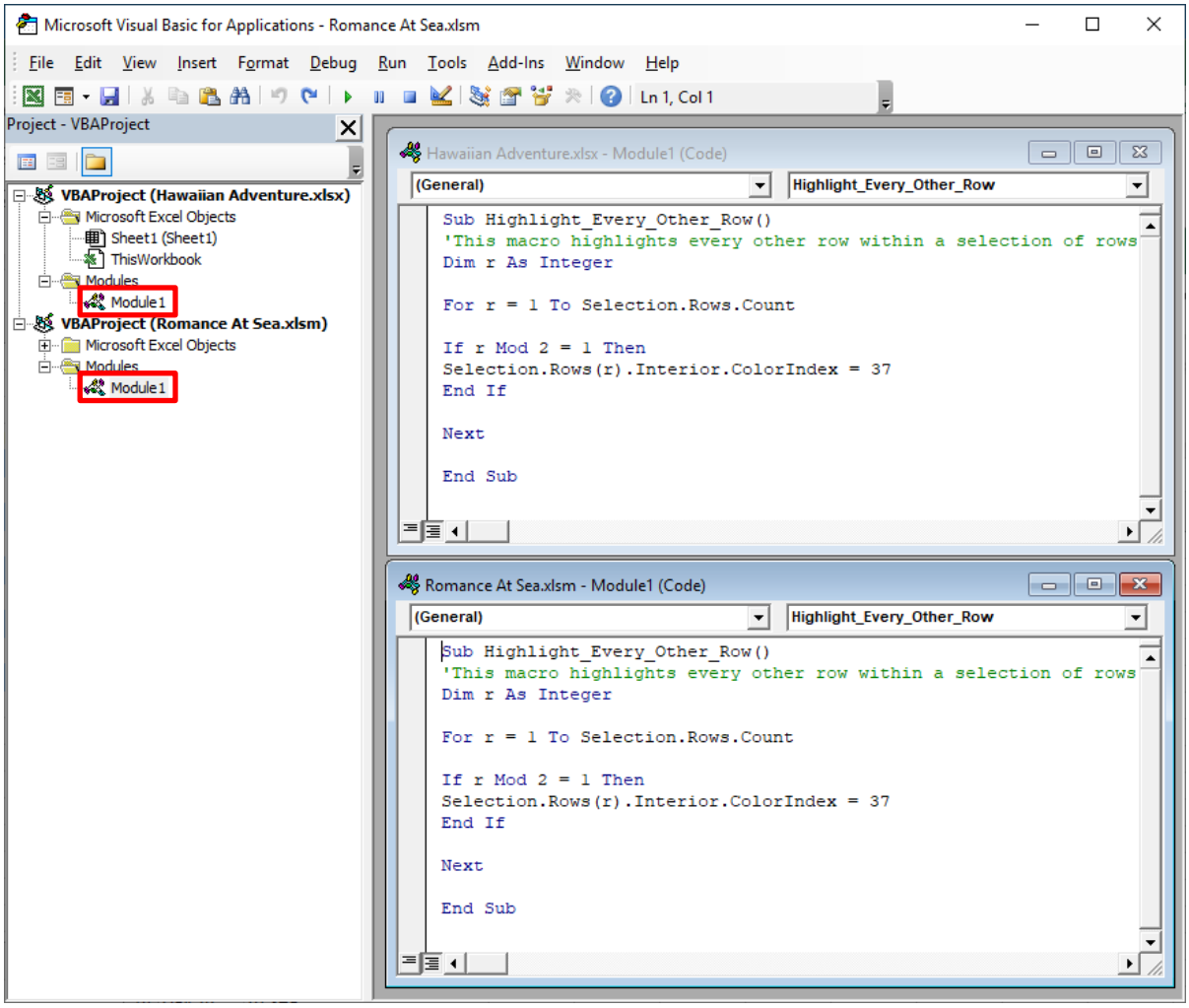
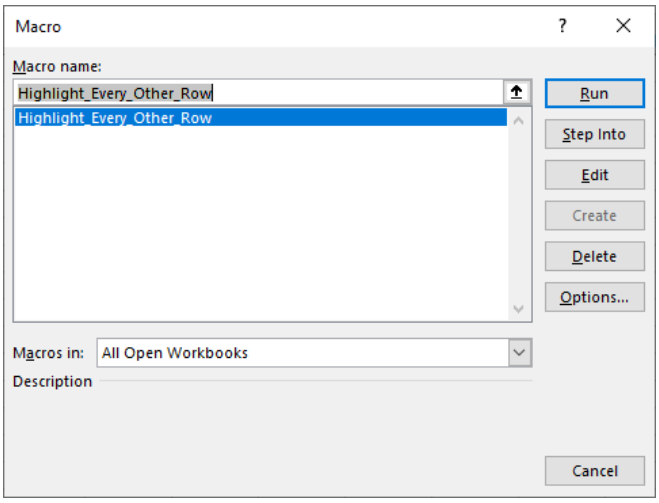


Figure 6-20: Microsoft Visual Basic Project pane with workbook code windows open

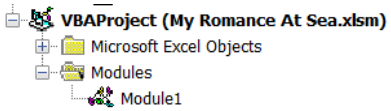
Learn to copy a macro from a workbook

In this exercise, you will copy a macro from one workbook to another workbook.

1. Open **Romance At Sea.xlsm** located in the *StarterFiles* folder, and save it as **My Romance At Sea.xlsm** in the *MyProjects* folder.
2. Click the **Enable Content** button, and then select the cell range **A5:D13**.
3. On the View tab, in the Macros group, click **Macros**.



4. Select the macro listed in this dialog box and click **Run**.
5. If necessary, click any blank cell away from this cell range to see the results of the macro.
6. Open **Hawaiian Adventure.xlsx** located in the *ResourceFiles* folder, and save it as **My Hawaiian Adventure.xlsx** in the *MyProjects* folder.
7. On the Developer tab, in the Code group, click **Visual Basic**.
8. If necessary, click **View**, then click **Project Explorer** to ensure that the Project pane is displayed on the left side of the Microsoft VBA window.
9. If necessary, click the **Open Tree (+)** icon at the *VBAProject (My Romance At Sea.xlsm)* and *Modules* levels to open them up.



10. Double-click **Module1** under *VBAProject (My Romance At Sea.xlsm)* to open this VB code window.
11. Click **Module1** under *VBAProject (My Romance At Sea.xlsm)*, and then drag it to **VBAProject (My Hawaiian Adventure.xlsx)**.
12. Click the **Open Tree (+)** icon for the newly-created *Modules* tree under *VBAProject (My Hawaiian Adventure.xlsx)*, and then double-click **Module1** to view its contents.

    An identical copy of the macro is now in the Hawaiian Adventure workbook.
13. In the Microsoft Visual Basic for Applications window, click **File**, then click **Close and Return to Microsoft Excel**.
14. With the *My Hawaiian Adventure* workbook as the active workbook, click **File**, click **Save As**, and then navigate to the *MyProjects* folder.
15. In the Save As page, click the **Save as type** drop-down arrow, select **Excel Macro-Enabled Workbook**, and then click **Save**.
16. Close all worksheets without saving any changes.
17. Open **My Hawaiian Adventure.xlsm** located in the *MyProjects* folder, and then click **Enable Content** to enable the macro.

18. Select the cell range **A5:D22**.
19. On the View tab, in the Macros group, click the **Macros** arrow, then click **View Macros**.
20. Select the macro listed in this dialog box, and click **Run**.
21. Click any blank cell away from this cell range to see the results of the macro.

    The screen should look similar to the following:

	A	B	C	D
1	Tolano Adventures			
2	Hawaiian Adventure Cruise Itinerary			
3				
4	Day	Port	Arrive	Depart
5	Day 1	San Diego, California		5:00 PM
6	Day 2	At sea		
7	Day 3	At sea		
8	Day 4	At sea		
9	Day 5	At sea		
10	Day 6	At sea		
11	Day 7	Lahaina, Hawaii	10:00 AM	11:00 PM
12	Day 8	Honolulu, Hawaii	7:00 AM	11:00 PM
13	Day 9	Nawiliwili Kauai, Hawaii	8:00 AM	5:00 PM
14	Day 10	Kona, Hawaii	8:00 AM	5:00 PM
15	Day 11	Hilo, Hawaii	8:00 AM	5:00 PM
16	Day 12	At sea		
17	Day 13	At sea		
18	Day 14	At sea		
19	Day 15	At sea		
20	Day 16	At sea		
21	Day 17	Ensenada, Mexico	Noon	6:00 PM
22	Day 18	San Diego, California	7:00 AM	

22. Save and close the macro-enabled workbook.

Lesson Summary

Now that you have completed this lesson, you should be able to:

- ☑ Use the Fill Series feature.
- ☑ Fill cells using the Flash Fill feature.
- ☑ Remove duplicate rows.
- ☑ Outline data using automatic subtotals.
- ☑ Group and ungroup data.
- ☑ Access hidden Ribbon tabs.
- ☑ Create and use macros.
- ☑ Save and open workbooks containing macros.
- ☑ Edit macros.
- ☑ Copy macros among workbooks.

Key Terms

Term	Definition
AutoFill	A method of copying data and formulas or creating data series by dragging the lower right corner of a cell or range.
Flash Fill	A feature that will extract, combine, and/or re-sequence cell contents from one or more cells to create new values.
Macro	A set of actions that can be recorded and then executed with a single command.

Term	Definition
Macro-enabled Workbook	A workbook in which one or more macros is saved.
Macro Recorder	A feature that enables you to track your Ribbon selections and activities on the worksheets to create a macro. See Macro.
Outline	A feature that enables you to quickly expand all or selected groups of data and collapse them again.
Visual Basic Editor	A feature that enables you to edit macros by making changes to the macro code, which is written in the Visual Basic programming language.

Quiz Questions

For each question, select the best answer.

1. Which of the following is an advantage of using the Fill Series feature as opposed to the AutoFill feature?

    a. The Fill Series feature lets you apply formatting as you fill the range.
    b. The Fill Series feature automatically inserts Quick Analysis Data Bars.
    c. The Fill Series feature gives you control over how much to increment each subsequent cell.
    d. The Fill Series feature allows you to select from up to 3 scenarios as you fill the range.

2. Which of the following statements about the Flash Fill feature is TRUE?

    a. You can use Flash fill to combine and re-sequence data; but you cannot use it to extract data.
    b. You can use Flash fill to extract and combine data; but you cannot use it to re-sequence data.
    c. You can use Flash fill to extract and re-sequence data; but you cannot use it to combine data.
    d. None of these statements about the Flash Fill feature are true.

3. Sarah is using the Remove Duplicates feature to remove duplicate rows in her address list. She knows there are duplicate entries for Zachary B who lives on Miller Road. What can she expect when using the feature?

    a. Excel will skip duplicate entries if they are not identical in every way.
    b. Excel will skip duplicate entries if one contains a comma and one does not.
    c. Excel will skip duplicate entries if one contains an extra blank space and one does not.
    d. Excel will skip duplicate entries if one contains an extra period and one does not.

4. What should you do before inserting automatic subtotals?

    a. Sort the data by date.
    b. Sort the data by the desired category.
    c. Sort the data by the left-most column.
    d. Sort the data by the right-most column.

5. Which statement about manually grouping data is TRUE?

    a. The worksheet must not contain any summation formulas.
    b. You can have only one outline for each worksheet.
    c. Excel assumes that subtotals will appear to the left of and/or above the grouped data.
    d. All of these statements are true.

6. Where can you find and display hidden Ribbon tabs?

    a. On the Customize Ribbon page of the Excel Options dialog box
    b. On the New page in Backstage view
    c. On the View tab, in the Show group
    d. On the Page Layout tab, in the Display group

7. Where can you find a setting that will configure Excel to disable all macros without any notification?

    a. On the General page of the Excel Options dialog box
    b. On the Account page in the Backstage view
    c. On the Security page in the Backstage view
    d. On the Macro Settings page of the Trust Center dialog box

8. How do you turn off the Macro Recorder?

    a. In the status bar, click REC OFF.
    b. On the Developer tab, in the Code group, click Stop Recording.
    c. On View tab, in the Macros group, click Recorder Off.
    d. You can use any of these methods to turn off the Macro Recorder.

9. Which of the following is a valid name for a macro?

    a. 1st macro
    b. FirstMacro
    c. F!rstM@cro
    d. All of the names listed are valid names for a macro.

10. If you want to modify the shortcut key assigned to a macro, you can _____.

    a. click the Edit button in the Record Macro dialog box
    b. click the Edit Shortcut Key command in the Macros group on the Developer tab of the Ribbon
    c. click the Options button in the Macro dialog box
    d. You can use any of these methods to modify the shortcut key assigned to a macro.

11. Dean created several macros in his TaxPrep-Q1 workbook. How can he use these macros in his TaxPrep-Q2 workbook?

    a. He should export each macro to the VBA project named SharedMacros.
    b. He should save his Q1-version of the workbook over the Q2-version and replace the Q1 data with Q2 data.
    c. He should re-create the Q1-version macros in his Q2-version workbook.
    d. He should copy his macros from the Q1-version workbook to the Q2-version of the workbook.

Microsoft®

Excel

Expert Certification Guide

Appendices

Appendix A

Courseware Mapping

Appendix B

Glossary of Terms

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Appendix A: Courseware Mapping

Skills required for the Microsoft® Office Specialist Excel 365-2016 Expert Exam MOS-201:

Objective Domain				Lesson
1	**Manage Workbook Options and Settings**			
	1.1	**Manage workbooks**		
		1.1.1	Copy macros between workbooks	6
		1.1.2	Reference data in other workbooks	4
		1.1.3	Enable macros in a workbook	6
		1.1.4	Manage workbook versions	4
	1.2	**Prepare workbooks for collaboration**		
		1.2.1	Restrict editing	4
		1.2.2	Protect worksheets and cell ranges	4
		1.2.3	Protect workbook structure	4
		1.2.4	Configure formula calculation options	4
		1.2.5	Manage comments	4
	1.3	**Use and configure language options**		
		1.3.1	Configure editing and display language	1
		1.3.2	Use language-specific features	1
2	**Manage and Format Data**			
	2.1	**Fill cells based on existing data**		
		2.1.1	Fill cells by using Flash Fill	6
		2.1.2	Fill cells by using advanced Fill Series options	6
	2.2	**Format and validate data**		
		2.2.1	Create custom number formats	1
		2.2.2	Configure data validation	2
		2.2.3	Group and ungroup data	6
		2.2.4	Calculate data by inserting subtotals and totals	6
		2.2.5	Remove duplicate records	6
	2.3	**Apply advanced conditional formatting and filtering**		
		2.3.1	Create custom conditional formatting rules	1
		2.3.2	Create conditional formatting rules that use formulas	1
		2.3.3	Manage conditional formatting rules	1

Objective Domain				Lesson
3	**Create Advanced Formulas and Macros**			
	3.1	**Perform logical operations in formulas**		
		3.1.1	Perform logical operations by using nested formulas including the IF(), IFS(), SWITCH(), SUMIF(), AVERAGEIF(), COUNTIF(), SUMIFS(), AVERAGEIFS(), COUNTIFS(), MAXIFS(), MINIFS(), AND(), OR(), and NOT() functions	5
	3.2	**Look up data by using functions**		
		3.2.1	Look up data by using the VLOOKUP(), HLOOKUP(), MATCH(), and INDEX() functions	2
	3.3	**Use advanced date and time functions**		
		3.3.1	Reference data and time by using the NOW() and TODAY() functions	2
		3.3.2	Calculate dates by using the WEEKDAY() and WORKDAY() functions	2
	3.4	**Perform data analysis**		
		3.4.1	Summarize data from multiple ranges by using the Consolidate feature	4
		3.4.2	Perform what-if analysis by using Goal Seek and Scenario Manager	5
		3.4.3	Forecast data by using the AND(), IF(), and NPER() functions	5
		3.4.4	Calculate financial data by using the PMT() function	5
	3.5	**Troubleshoot formulas**		
		3.5.1	Trace precedence and dependence	2
		3.5.2	Monitor cells and formulas by using the Watch Window	5
		3.5.3	Validate formulas by using error checking rules	2
	3.6	**Create and modify simple macros**		
		3.6.1	Record simple macros	6
		3.6.2	Name simple macros	6
		3.6.3	Edit simple macros	6
4	**Manage Advanced Charts and Tables**			
	4.1	**Create and modify advanced charts**		
		4.1.1	Create and modify dual axis charts	5
		4.1.2	Create and modify charts including Box & Whisker, Combo, Funnel, Histogram, Map, Sunburst, and Waterfall charts	5
	4.2	**Create and modify PivotTables**		
		4.2.1	Create PivotTables	3
		4.2.2	Modify field selections and options	3
		4.2.3	Create slicers	3

Objective Domain				Lesson
		4.2.4	Group PivotTable data	3
		4.2.5	Add calculated fields	3
		4.2.6	Format data	3
	4.3	**Create and modify PivotCharts**		
		4.3.1	Create PivotCharts	3
		4.3.2	Manipulate options in existing PivotCharts	3
		4.3.3	Apply styles to PivotCharts	3
		4.3.4	Drill down into PivotChart details	3

Appendix B: Glossary of Terms

Allow Edit Ranges – A feature that enables you to allow users to make changes to a cell or cell range as long as they know the password to be able to do so.

AutoFill – A method of copying data and formulas or creating data series by dragging the lower right corner of a cell or range.

AutoFilter – A feature that allows you to filter records in a worksheet by specifying filter criteria. See Filter.

AutoSave – A feature that creates versions of your workbook that enables you to recover the workbook in case you lose it as a result of a power failure or accidental deletion. See Version.

Built-in Functions – Pre-programmed formulas used to perform specific calculations. You can either type these functions in or use the Insert Function wizard to assist in creating the function. See Insert Function.

Calculated Fields – Simple formulas that use math operators such as add (+), subtract (-), multiply (*), and divide (/) that you can insert into a pivot table to create new data based on existing data. See Pivot Table.

Comment – Similar to a post-it note in which you can annotate a worksheet by entering information for yourself or others to review.

Conditional Formatting – A feature that enables you to change the appearance of a cell, depending on that cell's value.

Conditional Logic – A type of function used in situations in which you want to perform one of two different calculations, depending on which value is in one or more cells other than the ones in which the logical functions are located.

Conditional Summary – A type of summary function that is applied only to a given range of cells that meet a specific criteria.

Consolidating data – The process of summarizing multiple ranges of data into a single range. You can consolidate data from different areas within a worksheet, from other worksheets in the same workbook, or from other workbooks.

Data Series – Each set of data used in a graphical chart.

Data Slicers – Buttons you can click to filter the data in a table or pivot table.

Data Validation – A feature that helps you set up validation checks in cells; for example, numbers only, list of inventory items available only, and so on.

Display Language – Refers to the language-specific text used in menus, tool tips, and the Help system.

Editing Language – Refers to the language-specific keyboard layout and proofing tools such as dictionaries for spelling and grammar checking, and paragraph direction buttons.

Error Checking – An auditing tool used to assist in checking any errors that may exist in the formulas. Any errors are marked with a dark green triangle in the upper left corner of a cell.

Filter – The process of temporarily hiding data rows and/or columns that do not meet the filter criteria.

Flash Fill – A feature that will extract, combine, and/or re-sequence cell contents from one or more cells to create new values.

Format – Instructions that tell Excel how it should display styles, fonts, colors, numbers, bullets, and so on.

Formula – A calculation that displays a new result based on the values in other cells. Composed of values, cell references, arithmetic operators, and special functions. These results may be used in other formulas located in other cells.

Global Options – Options and settings you can specify in Excel that affect all workbooks.

Goal Seek – A tool you can use to automate the entire process of changing one variable while calculating a formula and trying to match the desired value.

Grouping – A feature you can use to simplify a large table or pivot table by condensing data into logical groups (for example, grouping date values by month, quarter, or year).

Insert Function – The feature that Excel provides to help you select the desired function to perform calculations.

Link – The process of referencing cells or worksheets in a "source" workbook, so that changes made in the source workbook will automatically change in the linked workbook.

Macro – A set of actions that can be recorded and then executed with a single command.

Macro Recorder – A feature that enables you to track your Ribbon selections and activities on the worksheets to create a macro. See Macro.

Macro-enabled Workbook – A workbook in which one or more macros is saved.

Nesting – Embedding one function inside of another one to yield a value that is the result of multiple calculations.

Outline – A feature that enables you to quickly expand all or selected groups of data and collapse them again.

Pivot Chart – A chart that displays the data in a pivot table. See Pivot Table.

Pivot Table – A table that summarizes or cross-tabulates large amounts of data by selecting fields for rows and columns and performing a summary function on the intersections of the row and column fields.

Rules Manager – A feature you can use to create new conditional formatting rules, modify existing ones, and delete rules that are no longer needed. See Conditional Formatting.

Scenario Manager – A tool that enables you to determine the impact on calculations of changing values without changing the actual data. You can store a set of values as a result of multiple scenarios and compare them.

Secondary Y-Axis – The secondary Y-axis appears on the far right of a chart. In a chart with dual axes, you can tie some of the data series to the primary axis on the left, and the remaining series to the secondary axis on the right.

Tracing Tool – An audit tool that draws arrows to help you find or trace formula errors in cells that are precedents or dependents of the current cell.

Version – A draft of your workbook that contains the contents prior to the last time you saved it (or when the AutoSave feature created a version). See AutoSave.

Visual Basic Editor – A feature that enables you to edit macros by making changes to the macro code, which is written in the Visual Basic programming language.

Watch Window – A small pop-up window that displays the current value of selected worksheet cells. It is useful when working with large worksheets; the watch window displays these cell values regardless of what part of the worksheet you have currently displayed on the screen.

What-if Analysis – A process that involves repeating the calculation of a set of formulas many times using different numbers. It is a trial-and-error method that asks: "If I change this number, how does that affect the result?"

Workbook Structure – Refers to the worksheet tabs within a workbook. You can protect the workbook structure to prevent users from adding, deleting, moving, or renaming worksheets within the workbook.

Worksheet Protection – A feature that enables you to restrict others from making changes to designated cells or cell ranges in a worksheet.

Appendix C: Index

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