Beginning Excel 2019

Noreen Brown, Barbara Lave, Hallie Puncochar, Julie Romey, Mary Schatz, Art Schneider, and Diane Shingledecker

OpenOregon Educational Resources

Beginning Excel 2019

Beginning Excel 2019

NOREEN BROWN; BARBARA LAVE; HALLIE PUNCOCHAR; JULIE ROMEY; MARY SCHATZ; ART SCHNEIDER; AND DIANE SHINGLEDECKER

Open Oregon Educational Resources

Contents

Introduction vii

CHAPTER 1 – FUNDAMENTAL SKILLS

1.1 Overview of Microsoft Excel 2

1.2 Entering, Editing, and Managing Data 22

1.3 Formatting and Data Analysis 49

1.4 Printing 74

1.5 Chapter Practice 80

1.6 Scored Assessment 83

CHAPTER 2 – MATHEMATICAL COMPUTATIONS

2.1 Formulas 86

2.2 Introductory Statistical Functions 102

2.3 Functions for Personal Finance 126

2.4 Preparing to Print 144

2.5 Chapter Practice 151

2.6 Chapter Scored 157

CHAPTER 3 – FORMULAS, FUNCTIONS, LOGICAL AND LOOKUP FUNCTIONS

3.1 More on Formulas and Functions 162

3.2 Logical and Lookup Functions 169

3.3 Conditional Formatting 181

3.4 Preparing to Print 190

3.5 Chapter Practice 202

3.6 Chapter Scored 205

CHAPTER 4 – PRESENTING DATA WITH CHARTS

4.1 Choosing a Chart Type 208

4.2 Formatting Charts 239

4.3 Using Charts with Microsoft® Word® and Microsoft® PowerPoint® 245

4.4 Preparing to Print 253

4.5 Chapter Practice 259

4.6 Scored Assessment 266

CHAPTER 5 – TABLES

5.1 Table Basics 271

5.2 Intermediate Table Skills 294

5.3 Preparing to Print 331

5.4 Chapter Practice 337

5.5 Scored Assessment 344

CHAPTER 6 – MULTIPLE SHEET FILES

6.1 Multiple Sheet Basics 348

6.2 Formulas with 3-D References 358

6.3 Templates 363

6.4 Preparing to Print 367

6.5 Chapter Practice 371

6.6 Scored Assessment 375

Appendix 378

Introduction

This core Microsoft® Excel® text provides students with the skills needed to execute many personal and professional activities. It also prepares them to go on to more advanced skills using the Excel software. The text takes the approach of making decisions using Excel. Personal decisions introduced include important purchases, such as homes and automobiles, savings for retirement, and personal budgets. Professional decisions include budgets for managing expenses, merchandise items to mark down or discontinue, and inventory management. Students are given clear, easy-to-follow instructions for each skill presented and are also provided with opportunities to learn additional skills related to the personal or professional objectives presented. For example, students learn the key terms with respect to home mortgages and understand the impact interest rates have on monthly mortgage payments. This text also places an emphasis on "what-if" scenarios so students gain an appreciation for the computational power of the Excel application. In addition, students learn how Excel is used with Microsoft® Word® and Microsoft® PowerPoint® to accomplish a variety of personal and professional objectives.

Screenshots that appeared in How to Use Microsoft Excel: The Careers in Practice Series, adapted by The Saylor Foundation, were used with permission from Microsoft Corporation, which owns their copyright. How to Use Microsoft® Excel®: The Careers in Practice Series is an independent publication and is not affiliated with, nor has it been authorized, sponsored, or otherwise approved by Microsoft Corporation. Our adapted work uses all Microsoft Excel screenshots under fair use. If you plan to redistribute our book, please consider whether your use is also fair use.

ATTRIBUTION

CHAPTER 1 – FUNDAMENTAL SKILLS

Microsoft® Excel® is a tool that can be used in virtually all careers and is valuable in both professional and personal settings. Whether you need to keep track of medications in inventory for a hospital or create a financial plan for your retirement, Excel enables you to do these activities efficiently and accurately. This chapter introduces the fundamental skills necessary to get you started in using Excel. You will find that just a few skills can make you very productive in a short period of time.

ATTRIBUTION

1.1 Overview of Microsoft Excel

Learning Objectives

1. Examine the value of using Excel to make decisions.
2. Learn how to start Excel.
3. Become familiar with the Excel workbook.
4. Understand how to navigate worksheets.
5. Examine the Excel Ribbon.
6. Examine the right-click menu options.
7. Learn how to save workbooks.
8. Examine the Status Bar.
9. Become familiar with the features in the Excel Help window.

Microsoft® Office contains a variety of tools that help people accomplish many personal and professional objectives. Microsoft Excel is perhaps the most versatile and widely used of all the Office applications. No matter which career path you choose, you will likely need to use Excel to accomplish your professional objectives, some of which may occur daily. This chapter provides an overview of the Excel application along with an orientation for accessing the commands and features of an Excel workbook.

MAKING DECISIONS WITH EXCEL

Taking a very simple view, Excel is a tool that allows you to enter quantitative data into an electronic spreadsheet to apply one or many mathematical computations. These computations ultimately convert that quantitative data into information. The information produced in Excel can be used to make decisions in both professional and personal contexts. For example, employees can use Excel to determine how much inventory to buy for a clothing retailer, how much medication to administer to a patient, or how much money to spend to stay within a budget. With respect to personal decisions, you can use Excel to determine how much money you can spend on a house, how much you can spend on car lease payments, or how much you need to save to reach your

retirement goals. We will demonstrate how you can use Excel to make these decisions and many more throughout this text.

Figure 1.1 shows a completed Excel worksheet that will be constructed in this chapter. The information shown in this worksheet contains sales data for a hypothetical merchandise retail company. The worksheet data can help a retailer analyze the business and determine the number of salespeople needed for each month for example.

	A	B	C	D
1	***Merchandise City, USA Retail Sales***			
2	**Month**	**Unit Sales**	**Average Price**	**Sales Dollars**
3	January	2,670	$ 9.99	$ 26,685
4	February	2,160	$ 12.49	$ 26,937
5	March	515	$ 14.99	$ 7,701
6	April	590	$ 17.49	$ 10,269
7	May	1,030	$ 14.99	$ 15,405
8	June	2,875	$ 12.49	$ 35,916
9	July	2,700	$ 9.99	$ 26,937
10	August	900	$ 19.99	$ 17,958
11	September	775	$ 19.99	$ 15,708
12	October	1,180	$ 19.99	$ 23,562
13	November	1,800	$ 17.49	$ 31,416
14	December	4,560	$ 14.99	$ 75,125
15	**Total Sales**	21,755		$ 313,619
16				
17				

Figure 1.1 Example of an Excel Worksheet

STARTING EXCEL

1. Locate Excel on your computer.
2. Click Microsoft Excel to launch the Excel application where you are presented with workbook options to help get you started.
3. Click the first option; “Blank Workbook”.

EXCEL FOR WINDOWS VS EXCEL FOR MAC

The Excel for Windows and Excel for Mac software versions are very similar. Most of the features, tools and commands are available in both versions. There are, however, some differences with the Excel interface. There are also a few features that are not available in the Excel for Mac version. The screenshots and step-by-step instructions in this textbook are specific to Excel for Windows. We have attempted to provide alternate screenshots and instructions for the Mac version when the differences are significant. When you see this icon , it means we are providing information specific to Mac users.

The Excel Workbook

A workbook is an Excel file that contains one or more worksheets (referred to as spreadsheets). Excel will assign a file name to the workbook, such as **Book1**, **Book2**, **Book3**, and so on, depending on how many new workbooks are opened. **Figure 1.2** shows a blank workbook after starting Excel. Take some time to familiarize yourself with this screen. Your screen may be slightly different based on the version you're using.

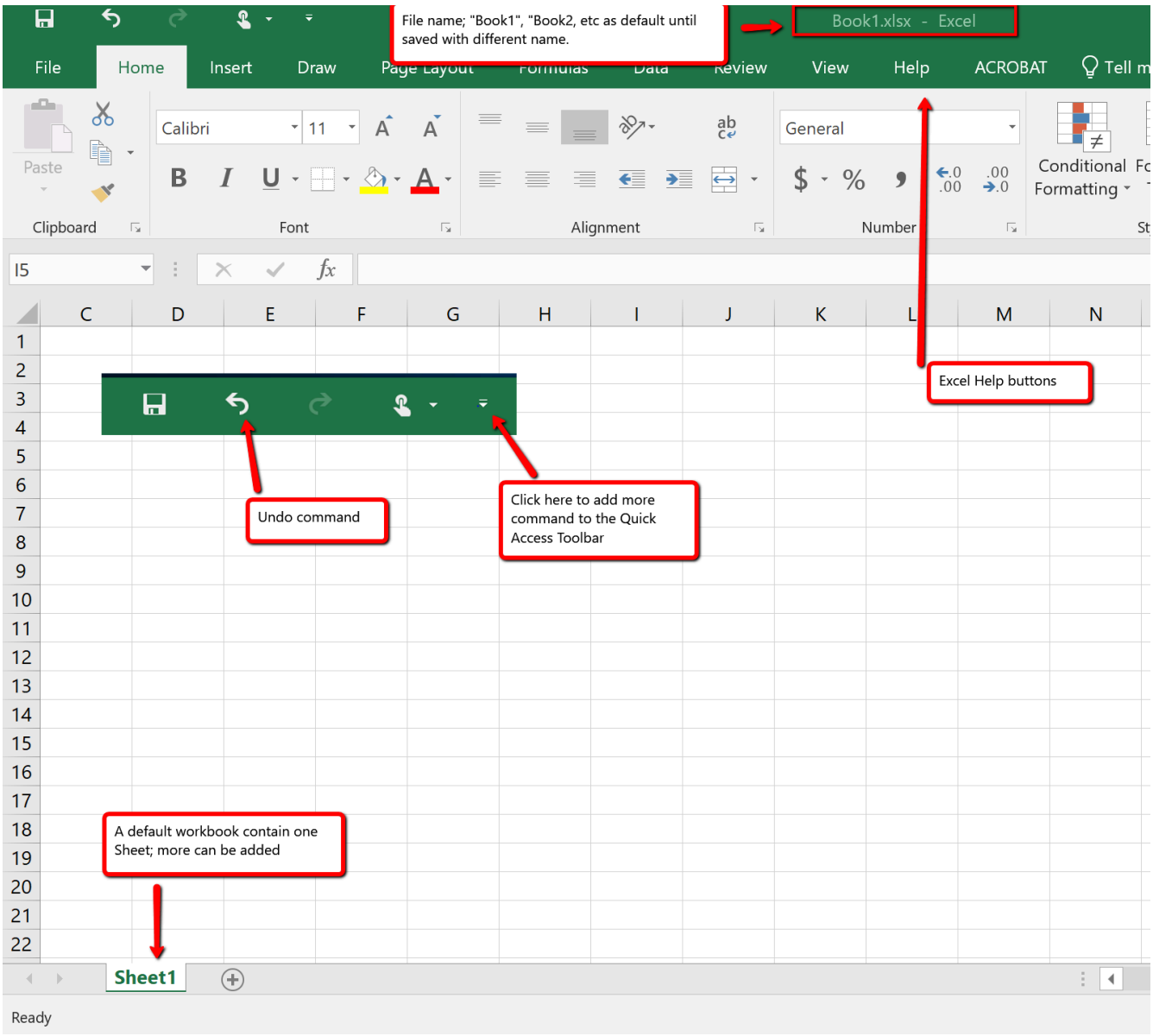


Figure 1.2 Blank Workbook

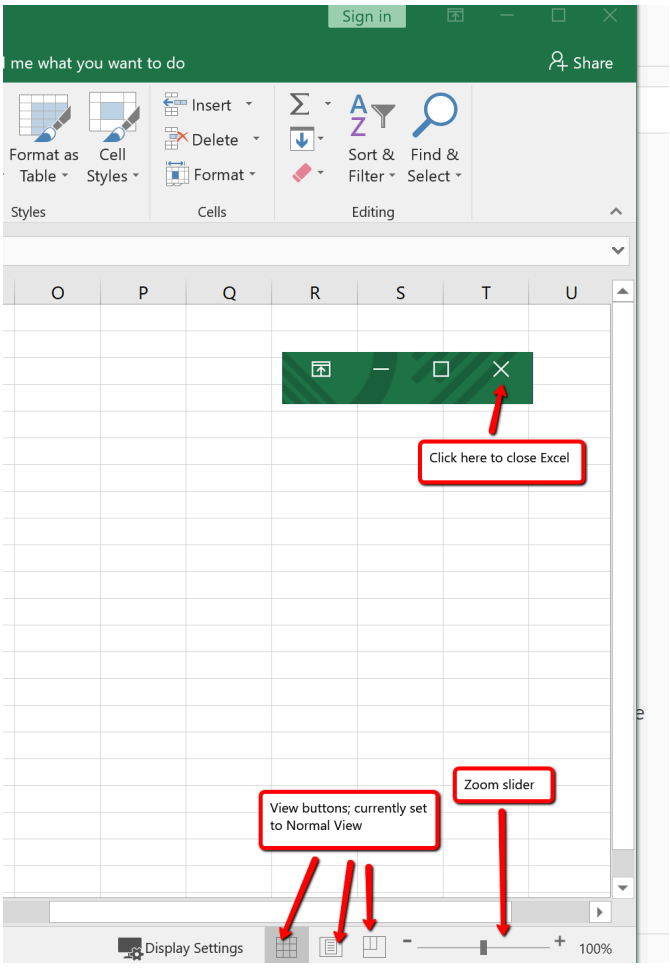


Figure 1.2a Blank Workbook (right-side)

Your workbook should already be maximized (or shown at full size) once Excel is started, as shown in **Figure 1.2**. However, if your screen looks like **Figure 1.3** after starting Excel, you should click the Maximize button, as shown in the figure.

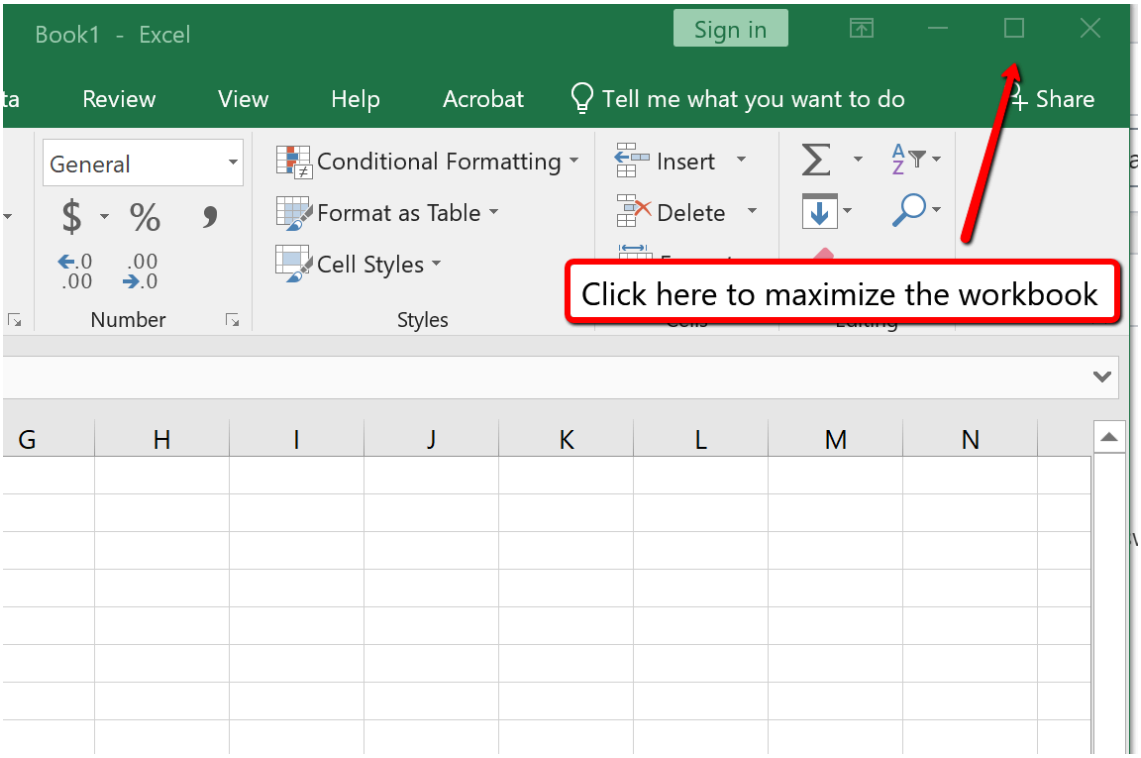


Figure 1.3 Restored Worksheet

NAVIGATING WORKSHEETS

Data are entered and managed in an Excel worksheet. The worksheet contains several rectangles called cells for entering numeric and non-numeric data. Each cell in an Excel worksheet contains an address, which is defined by a column letter followed by a row number. For example, the cell that is currently activated in **Figure 1.3** is **A1**. This would be referred to as cell location A1 or cell reference A1. The following steps explain how you can navigate in an Excel worksheet:

1. Place your mouse pointer over cell D5 and click.
2. Check to make sure column letter D and row number 5 are highlighted, as shown in **Figure 1.4**.

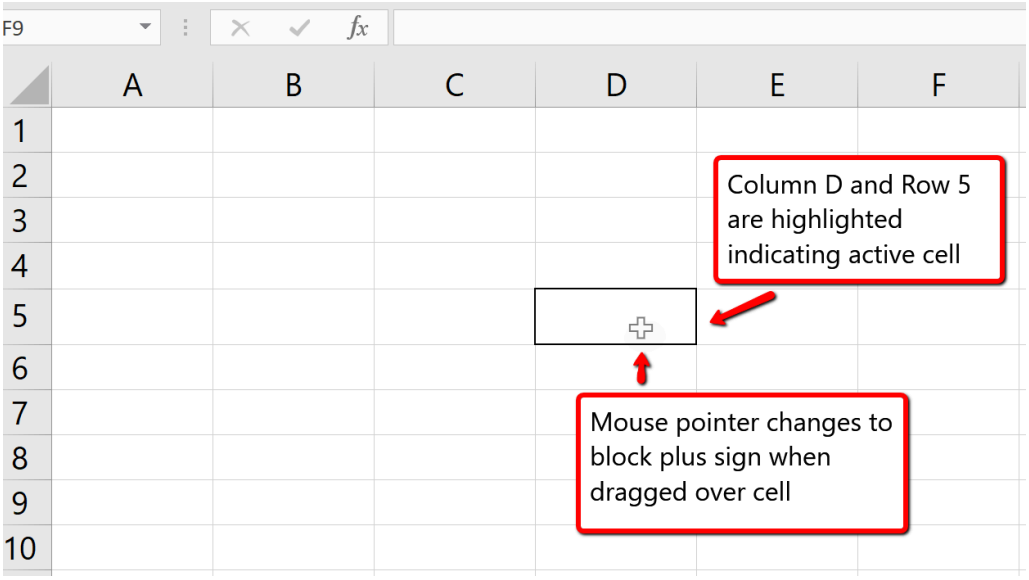


Figure 1.4 Activating a Cell Location

1. Move the mouse pointer to cell A1.
2. Click and hold the left mouse button and drag the mouse pointer back to cell D5.
3. Release the left mouse button. You should see several cells highlighted, as shown in **Figure 1.5**.

This is referred to as a ***cell range*** and is documented as follows: **A1:D5**. Any two cell locations separated by a colon are known as a cell range. The first cell is the top left corner of the range, and the second cell is the lower right corner of the range.

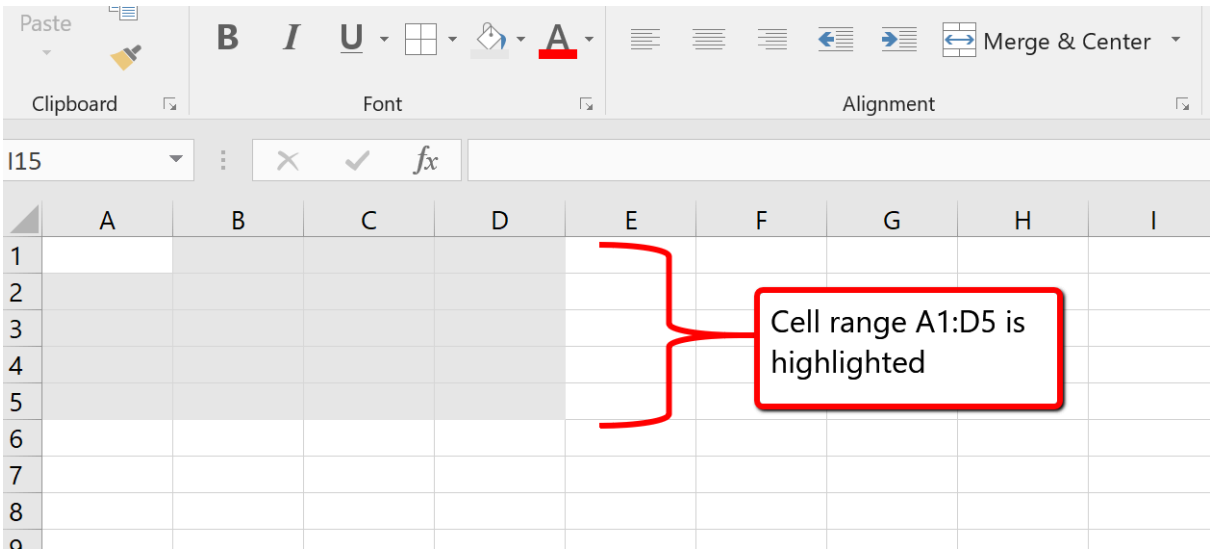


Figure 1.5 Highlighting a Range of Cells

1. At the bottom of the screen, you'll see a sheet tab indicated by "**Sheet1"**. Clicking on the + adds additional worksheets. This is how you open or add a worksheets within a workbook. To see how this works, click on the + to add another worksheet so that you now have two sheets
2. Click the Sheet1 worksheet tab at the bottom of the worksheet to return to the worksheet shown in **Figure 1.5**.

Keyboard Shortcuts

Basic Worksheet Navigation

- Use the arrow keys on your keyboard to activate cells on the worksheet.
- Hold the SHIFT key and press the arrow keys on your keyboard to highlight a range of cells in a worksheet.
- Hold the CTRL key while pressing the PAGE DOWN or PAGE UP keys to open other worksheets in a workbook.
- Mac Users: Hold down the Fn and Command keys and press the left or right arrow keys

THE EXCEL RIBBON

Excel's features and commands are found in the Ribbon, which is the upper area of the Excel screen that contains several tabs running across the top. Each tab provides access to a different set of Excel commands. **Figure 1.6** shows the commands available in the Home tab of the Ribbon. **Table 1.1 "Command Overview for Each Tab of the Ribbon"** provides an overview of the commands that are found in each tab of the Ribbon.

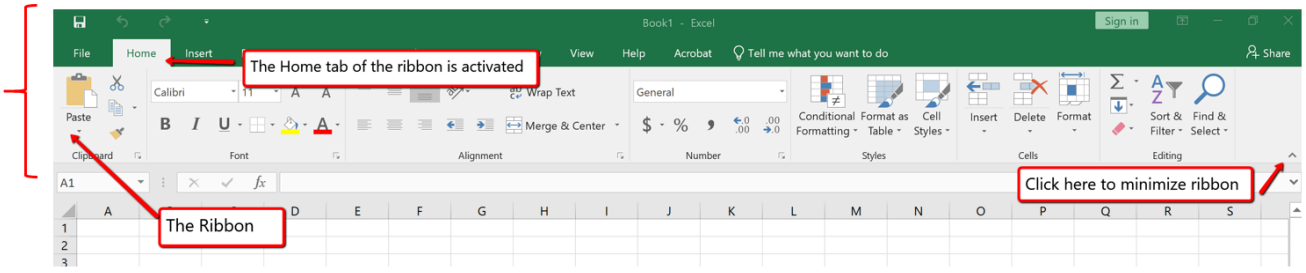


Figure 1.6 Home Tab of Ribbon

The Excel for Mac ribbon, as shown in **Figure 1.6a** below, has two primary differences:

- The older dropdown menu structure is still available with Excel for Mac.
- The specific commands and tools within each tab are slightly different between the two Excel Ribbons. Some of the commands found within the Excel for Windows Ribbon tabs are located within the dropdown menu structure in the Excel for Mac version. So, if you can't find the tool on the Excel for Mac Ribbon, then try to find the tool by looking through the dropdown menu instead.

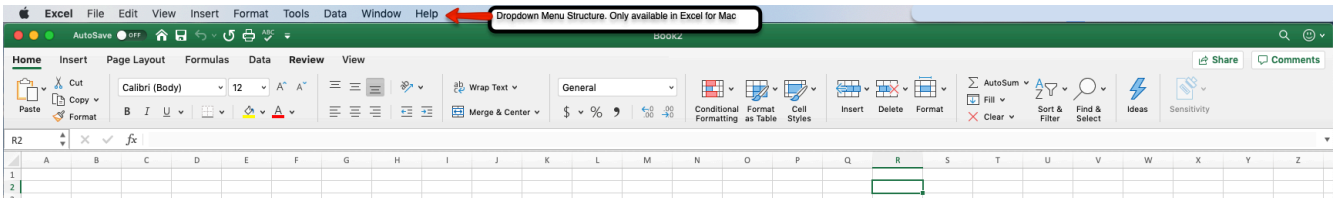


Figure 1.6a Home tab of Excel for Mac Ribbon with dropdown menu structure

Group Title Names on the Ribbon

If you look closely at the Excel Ribbon (See Figure 1.6 above), you will see that the Ribbon is separated in groups of tool buttons, and each group has a title name. On Home tab, the group title names are "Clipboard", "Font", "Alignment", "Number", "Styles". "Cells", "Editing", etc. The tool buttons within each group are all related to the group title.

Mac Users Only: The default "View" for the Excel for Mac ribbon **does not display** these "group title names". Notice in Figure 1.6a above, there are no group title names. It is a good idea to change this "view" so you can see the group title names. Here are the steps:

1. Click the **"Excel" menu option at top left above the Ribbon**
2. Choose **"Preferences"**
3. Click the **"View" button**
4. Scroll down and check the box for **"Group Titles"**
5. Close the "View" dialog box. The group title names should now display as shown in Figure 6.1 (not Figure 6.1a) above

Table 1.1 Command Overview for Each Tab of the Ribbon

Tab Name	Description of Commands
File	Also known as the Backstage view of the Excel workbook. Contains all commands for opening, closing, saving, and creating new Excel workbooks. Includes print commands, document properties, e-mailing options, and help features. The default settings and options are also found in this tab.
Home	Contains the most frequently used Excel commands. Formatting commands are found in this tab along with commands for cutting, copying, pasting, and for inserting and deleting rows and columns.
Insert	Used to insert objects such as charts, pictures, shapes, PivotTables, Internet links, symbols, or text boxes.
Page Layout	Contains commands used to prepare a worksheet for printing. Also includes commands used to show and print the gridlines on a worksheet.
Formulas	Includes commands for adding mathematical functions to a worksheet. Also contains tools for auditing mathematical formulas.
Data	Used when working with external data sources such as Microsoft® Access®, text files, or the Internet. Also contains sorting commands and access to scenario tools.
Review	Includes Spelling and Track Changes features. Also contains protection features to password protect worksheets or workbooks.
View	Used to adjust the visual appearance of a workbook. Common commands include the Zoom and Page Layout view.
Help	This tab provides access to help and support features such as contacting Microsoft support, sending feedback, suggesting a new feature, and community discussion groups. **This tab is not available with Excel for Mac.**
Draw	Provides drawing options for using a digital pen, mouse or finger depending on the type of device (laptop with touch screen, tablet, computer, etc). This tab is not visible by default. See below on how to customize the Ribbon to add or remove tabs.
Developer	Provides access to some advanced features such as macros, form controls, and XML commands. This tab is not visible by default. See below on how to customize the Ribbon to add or remove tabs.

The Ribbon shown in **Figure 1.6 and Figure 1.6a** (above) is full, or maximized. The benefit of having a full Ribbon is that the commands are always visible while you are developing a worksheet. However, depending on the screen dimensions of your computer, you may find that the Ribbon takes up too much vertical space on your worksheet. If this is the case, you can minimize the Ribbon by clicking the button shown in **Figure 1.6**. When minimized, the Ribbon will show only the tabs and not the command buttons. When you click on a tab, the command buttons will appear until you select a command or click anywhere on your worksheet.

To hide the Ribbon with Excel for Mac you can use the keyboard shortcut:

Hold down the “Command and Option” keys and tap the “R” key

The same keyboard shortcut will unhide the Ribbon as well.

HOW TO CUSTOMIZE THE EXCEL RIBBON

Here are the steps to add additional tabs to the Excel Ribbon

1. Click the File tab and choose Options

2. Click on “Customize Ribbon” at the left side of the Options screen
3. Click the checkbox next to the Tab name that you want to add (See Figure 1.7 below)

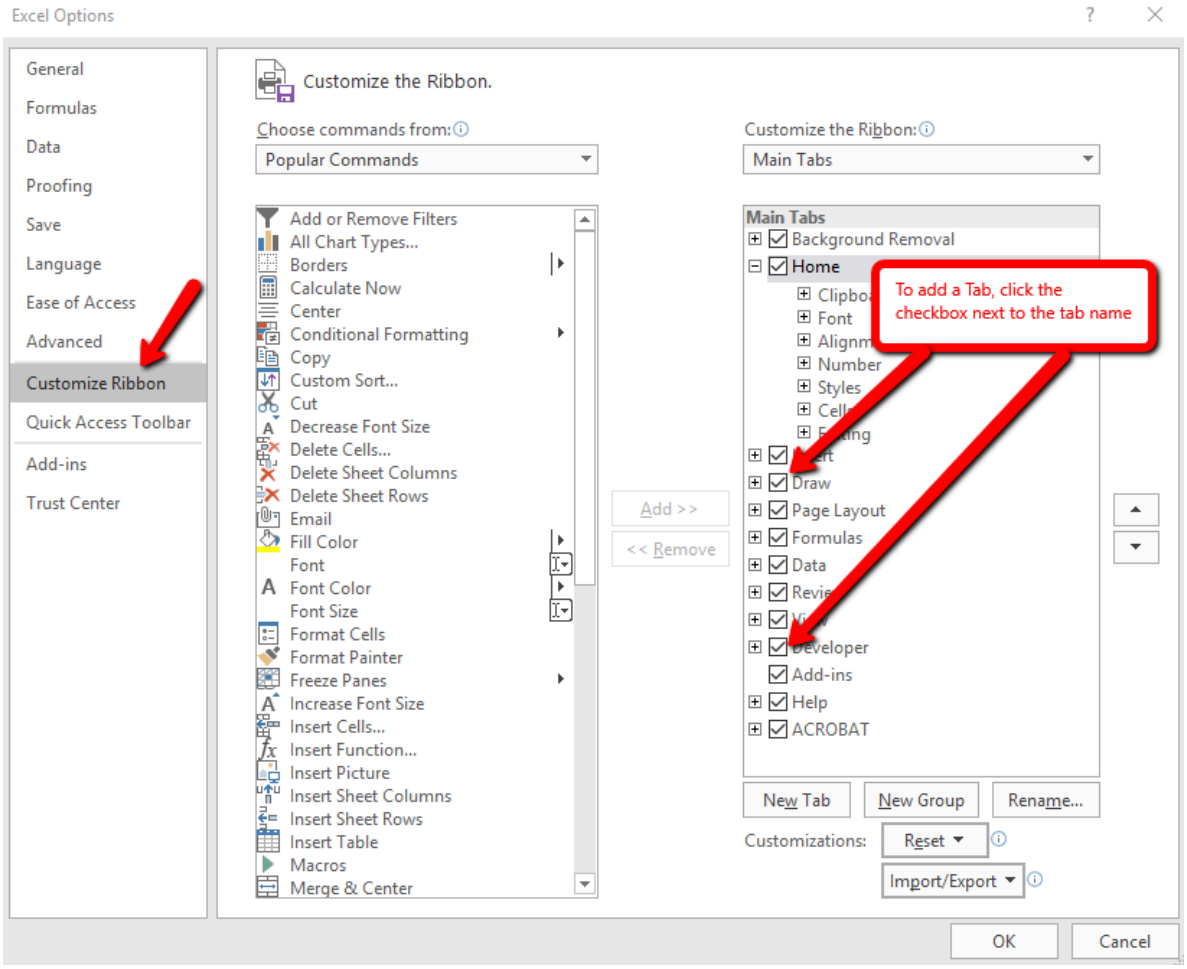


Figure 1.7 Customize the Ribbon Dialog Box

Keyboard Shortcuts

Minimizing or Maximizing the Ribbon

- Hold down the CTRL key and press the F1 key.
- Hold down the CTRL key and press the F1 key again to maximize the Ribbon.
- Mac Users: Hold down the Command and Option keys and press R

QUICK ACCESS TOOLBAR AND RIGHT-CLICK MENU

The Quick Access Toolbar is found at the upper left side of the Excel screen above the Ribbon, as

shown in **Figure 1.7**. This area provides access to the most frequently used commands, such as Save and Undo. You also can customize the Quick Access Toolbar by adding commands that you use on a regular basis. By placing these commands in the Quick Access Toolbar, you do not have to navigate through the Ribbon to find them. To customize the Quick Access Toolbar, click the down arrow as shown in **Figure 1.8**. This will open a menu of commands that you can add to the Quick Access Toolbar. If you do not see the command you are looking for on the list, select the More Commands option.

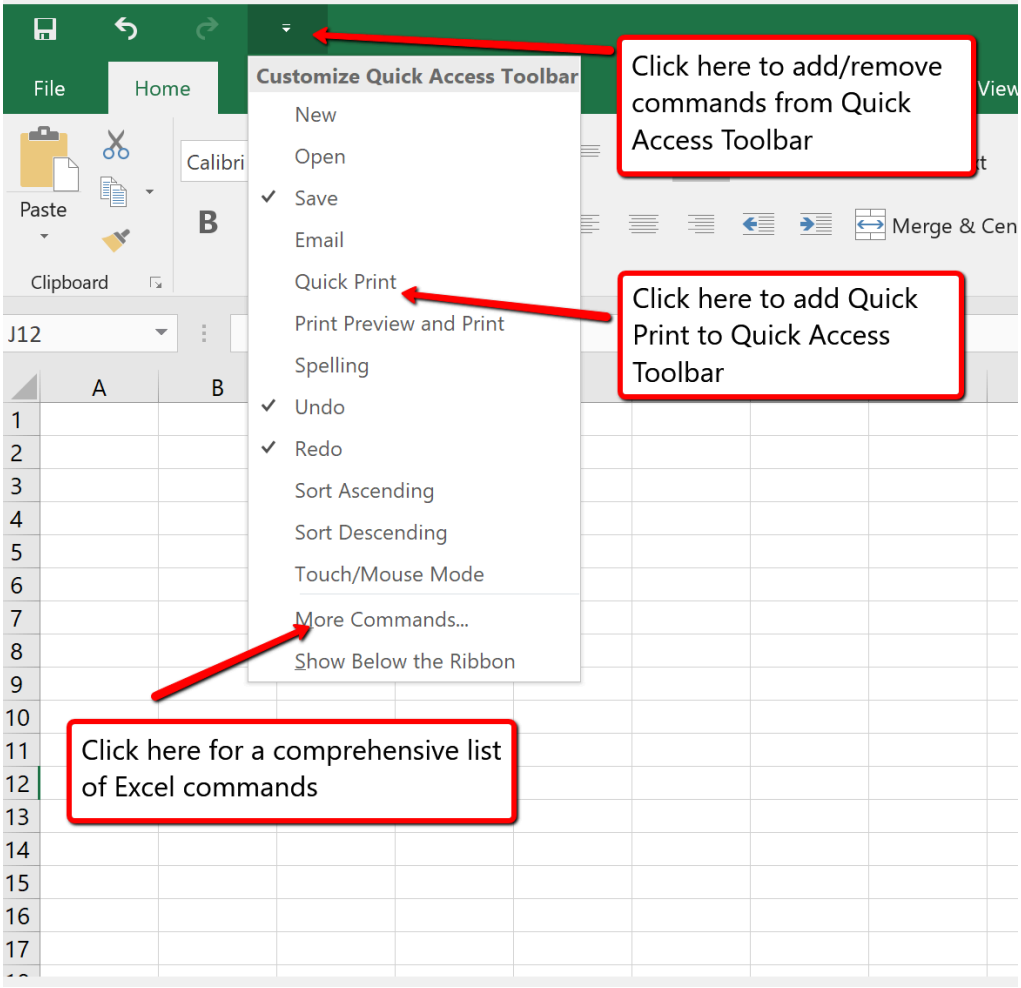


Figure 1.8 Customizing the Quick Access Toolbar

In addition to the Ribbon and Quick Access Toolbar, you can also access many commands by right clicking anywhere on the worksheet. **Figure 1.9** shows an example of the commands available in the right-click menu.

There is no "Right-click" option for Excel for Mac. To access the same commands with Excel for Mac, hold down the Control key and click the mouse button.

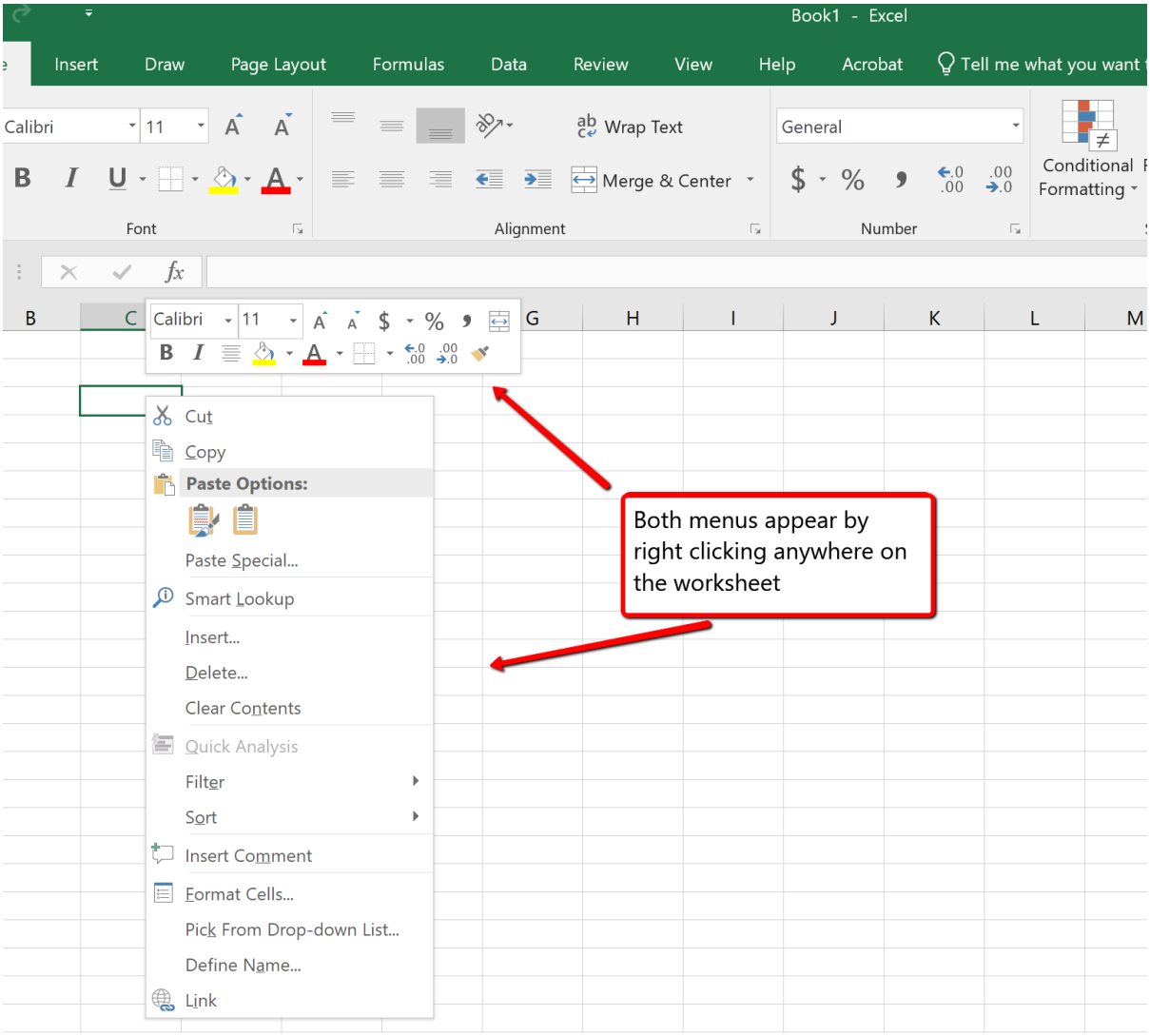


Figure 1.9 Right-Click Menu

THE FILE TAB

The File tab is also known as the **Backstage** view of the workbook. It contains a variety of features and commands related to the workbook that is currently open, new workbooks, or workbooks stored in other locations on your computer or network. **Figure 1.10** shows the options available in the File tab or Backstage view. To leave the Backstage view and return to the worksheet, click the arrow in the upper left-hand corner as shown below.

Figure 1.10 File Tab or Backstage View of a Workbook

Included in the File tab are the default settings for the Excel application that can be accessed and modified by clicking the Options button. **Figure 1.11** shows the Excel Options window, which gives you access to settings such as the default font style, font size, and the number of worksheets that appear in new workbooks.

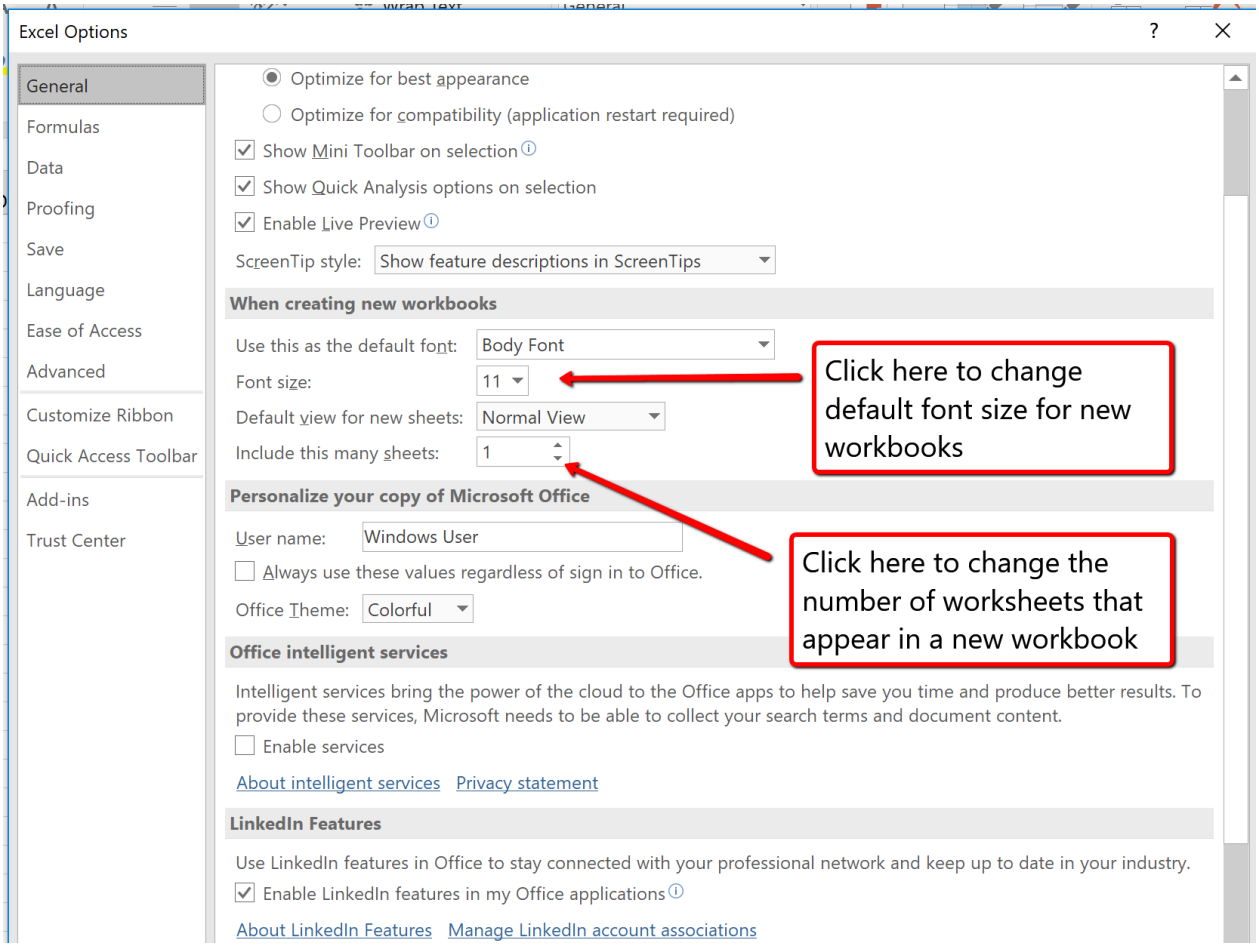


Figure 1.11 Excel Options Window

To access these same options in Excel for Mac, you must click the "Excel" menu option and choose "Preferences" (see **Figure 1.12** below)

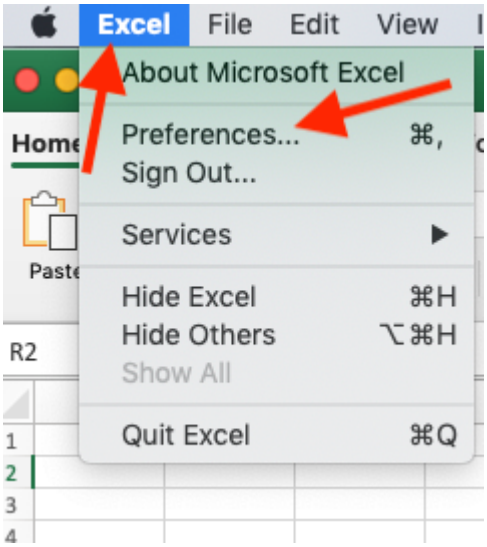


Figure 1.12 The Excel for Mac "Excel" menu option

SAVING WORKBOOKS (SAVE AS)

Once you create a new workbook, you will need to change the file name and choose a location on your computer or network to save that file. It is important to remember where you save this workbook on your computer or network as you will be using this file in the **Section 1.2 "Entering, Editing, and Managing Data"** to construct the workbook shown in **Figure 1.1**. The process of saving can be different with different versions of Excel. Please be sure you follow the steps for the version of Excel you are using. The following steps explain how to save a new workbook and assign it a file name.

SAVING WORKBOOKS IN EXCEL 365

1. If you have not done so already, open a blank workbook in Excel.
2. Click the File tab and then the **Save As** button in the left side of the Backstage view window. This will open the **Save As** dialog box.
3. Determine a location for saving on your computer by clicking **Browse** on the left side to open the **Save As** dialog box.
4. Click in the File Name box near the bottom of the **Save As** dialog box. Type the new file name: **CH1 Merchandise City Sales Data**
5. Review the settings in the screen for correctness and click the Save button.

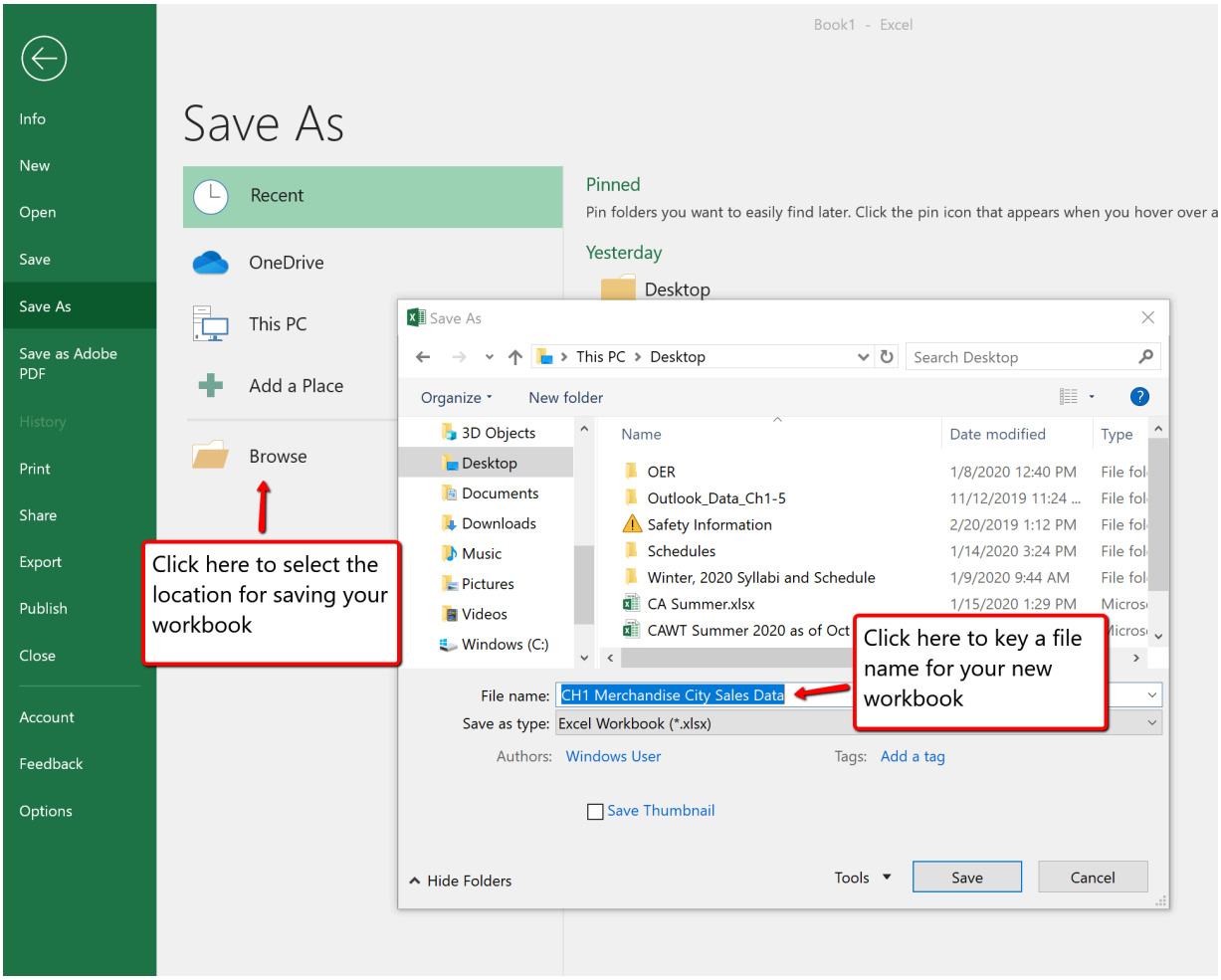


Figure 1.13 Save As Dialog entries for Excel 365

Keyboard Shortcuts

Save As

- Press the F12 key and use the tab and arrow keys to navigate around the Save As dialog box. Use the ENTER key to make a selection.
- Or press the ALT key on your keyboard. You will see letters and numbers, called Key Tips, appear on the Ribbon. Press the F key on your keyboard for the File tab and then the A key. This will open the Save As dialog box.
- The Mac shortcut is: Hold down the Command and Shift keys and press S

Skill Refresher

Saving Workbooks (Save As)

1. Click the File tab on the Ribbon.
2. Click the Save As option.
3. Click on Browse to select a location on your PC to save.
4. Click in the File name box and type a new file name if needed.
5. Click the down arrow next to the "Save as type" box and select the appropriate file type if needed. Excel will default to the file type of .xlsx
6. Click the Save button.

THE STATUS BAR

The Status Bar is located below the worksheet tabs on the Excel screen (**see Figure 1.13**). It displays a variety of information, such as the status of certain keys on your keyboard (e.g., CAPS LOCK), the available views for a workbook, the magnification of the screen, and mathematical functions that can be performed when data are highlighted on a worksheet. You can customize the Status Bar as follows:

1. Place the mouse pointer over any area of the Status Bar and right click to display the "Customize Status Bar" list of options (**see Figure 1.14**).

   Mac Users: use "Control-click" on the Status Bar to display the "Customize Status Bar" options.
2. Select the Caps Lock option from the menu (see **Figure 1.14**).
3. Press the CAPS LOCK key on your keyboard. You will see the Caps Lock indicator on the lower right side of the Status Bar.
4. Press the CAPS LOCK on your keyboard again. The indicator on the Status Bar goes away.

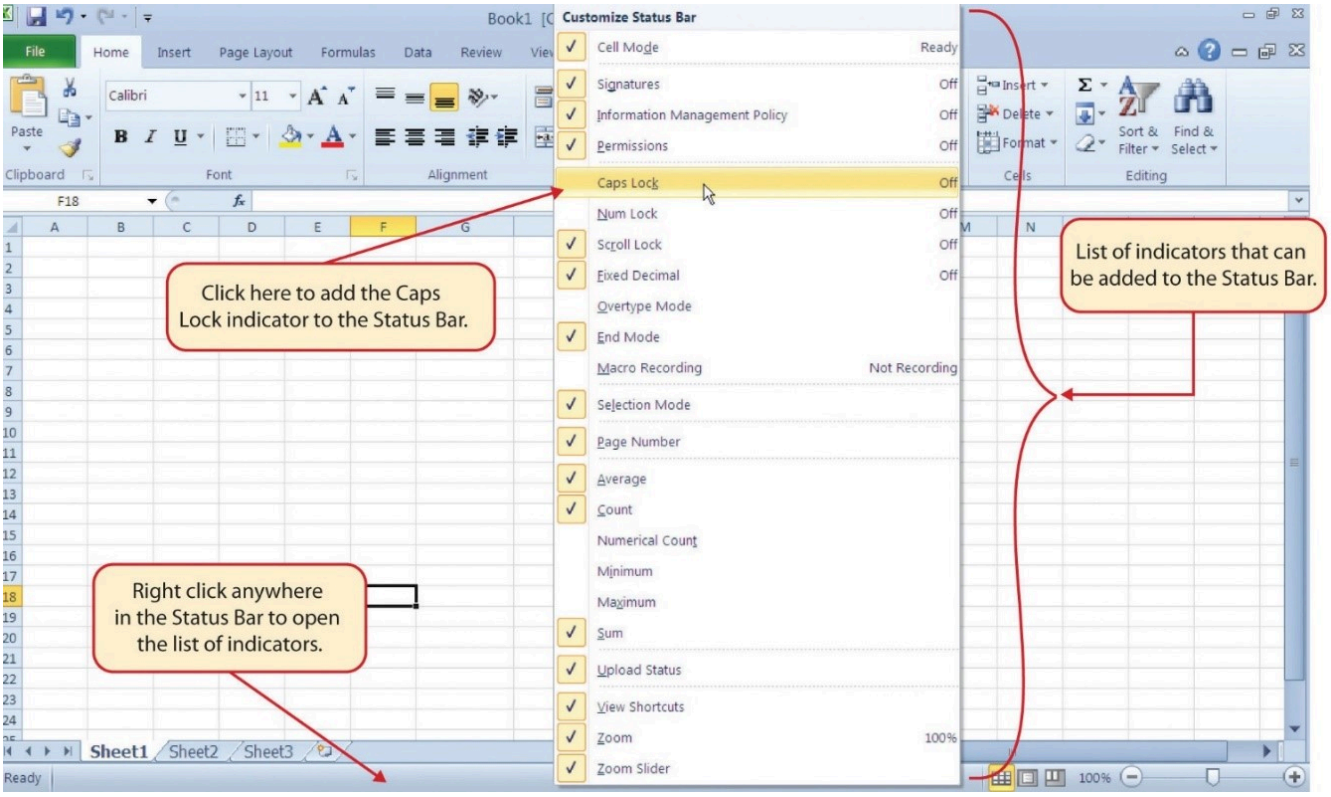


Figure 1.14 Customizing the Status Bar

EXCEL HELP

The Help feature provides extensive information about the Excel application. Although some of this information may be stored on your computer, the Help window will automatically connect to the Internet, if you have a live connection, to provide you with resources that can answer most of your questions. You can open the Excel Help window by clicking the question mark in the upper right area of the screen or ribbon. With newer versions of Excel, use the query box to enter your question and select from helpful option links or select the question mark from the dropdown list to launch Excel Help windows.

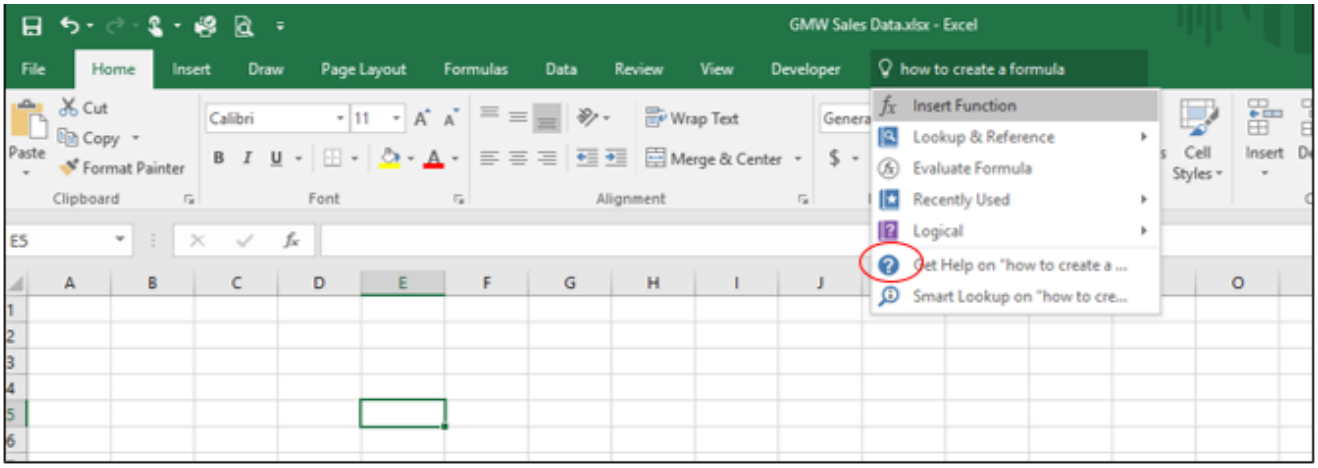


Figure 1.15 Excel Help Window

Keyboard Shortcuts

Excel Help

- Press the F1 key on your keyboard.
- Mac Users: Press F1 or hold down the Command key and press /

Key Takeaways

- Excel is a powerful tool for processing data for the purposes of making decisions.
- You can find Excel commands throughout the tabs in the Ribbon.
- You can customize the Quick Access Toolbar by adding commands you frequently use.
- You can add or remove the information that is displayed on the Status Bar.
- The Help window provides you with extensive information about Excel.

ATTRIBUTION

1.2 Entering, Editing, and Managing Data

Learning Objectives

1. Understand how to enter data into a worksheet.
2. Examine how to edit data in a worksheet.
3. Examine how Auto Fill is used when entering data.
4. Understand how to delete data from a worksheet and use the Undo command.
5. Examine how to adjust column widths and row heights in a worksheet.
6. Understand how to hide columns and rows in a worksheet.
7. Examine how to insert columns and rows into a worksheet.
8. Understand how to delete columns and rows from a worksheet.
9. Learn how to move data to different locations in a worksheet.

In this section, we will begin the development of the workbook shown in **Figure 1.1**. The skills covered in this section are typically used in the early stages of developing one or more worksheets in a workbook.

ENTERING DATA

You will begin building the workbook shown in **Figure 1.1** by manually entering data into the worksheet. The following steps explain how the column headings in Row 2 are typed into the worksheet:

1. Click cell location A2 on the worksheet.
2. Type the word **Month**.
3. Press the RIGHT ARROW key. This will enter the word into cell A2 and activate the next cell to the right.
4. Type **Unit Sales** and press the RIGHT ARROW key.
5. Repeat step 4 for the words **Average Price** and then again for **Sales Dollars**.

Figure 1.15 shows how your worksheet should appear after you have typed the column headings into Row 2. Notice that the word **Price** in cell location C2 is not visible. This is because the column is too narrow to fit the entry you typed. We will examine formatting techniques to correct this problem in the next section.

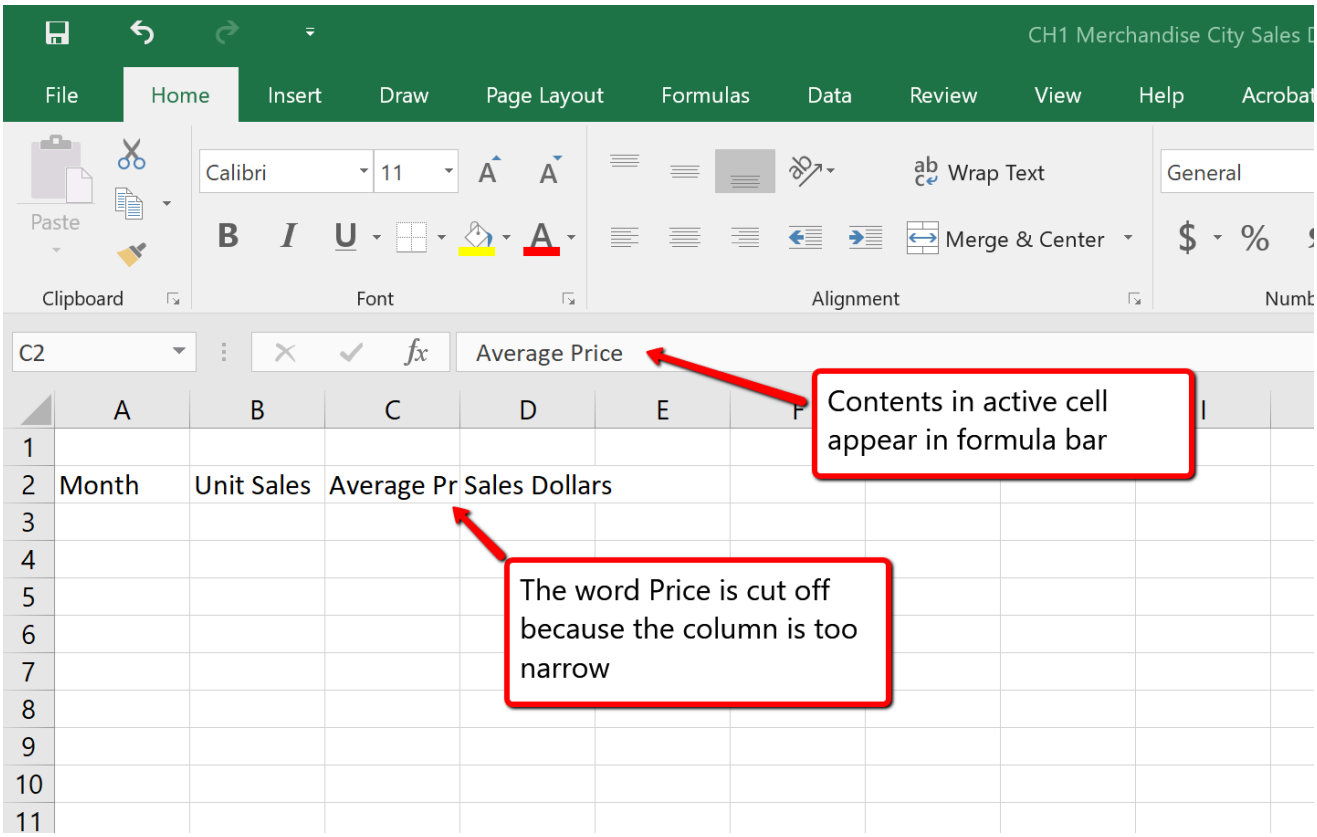


Figure 1.15 Entering Column Headings into a Worksheet

Integrity Check

Column Headings

It is critical to include column headings that accurately describe the data in each column of a worksheet. In professional environments, you will likely be sharing Excel workbooks with coworkers. Good column headings reduce the chance of someone misinterpreting the data contained in a worksheet, which could lead to costly errors depending on your career.

1. Click cell B3.
2. Type the number **2670** and press the ENTER key. After you press the ENTER key, cell B4 will be activated. Using the ENTER key is an efficient way to enter data vertically down a column.
3. Enter the following numbers in cells B4 through B14:
   2160, **515, 590, 1030, 2875, 2700, 900, 775, 1180, 1800**, and **4560**.
4. Click cell C3.
5. Type the number **9.99** and press the ENTER key.
6. Enter the following numbers in cells C4 through C14: **12.49, 14.99, 17.49, 14.99, 12.49, 9.99, 19.99, 19.99, 19.99, 17.49**, and **14.99**.
7. Click cell D3.
8. Type the number 26685 and press the ENTER key.
9. Enter the following numbers in cells D4 through D14: **26937, 7701, 10269, 15405, 35916, 26937, 17958, 15708, 23562, 31416**, and **75125**.
10. When finished, check that the data you entered matches **Figure 1.16**.

Why?

Avoid Formatting Symbols When Entering Numbers

When typing numbers into an Excel worksheet, it is best to avoid adding any formatting symbols such as dollar signs and commas. Although Excel allows you to add these symbols while typing numbers, it slows down the process of entering data. It is more efficient to use Excel's formatting features to add these symbols to numbers after you type them into a worksheet.

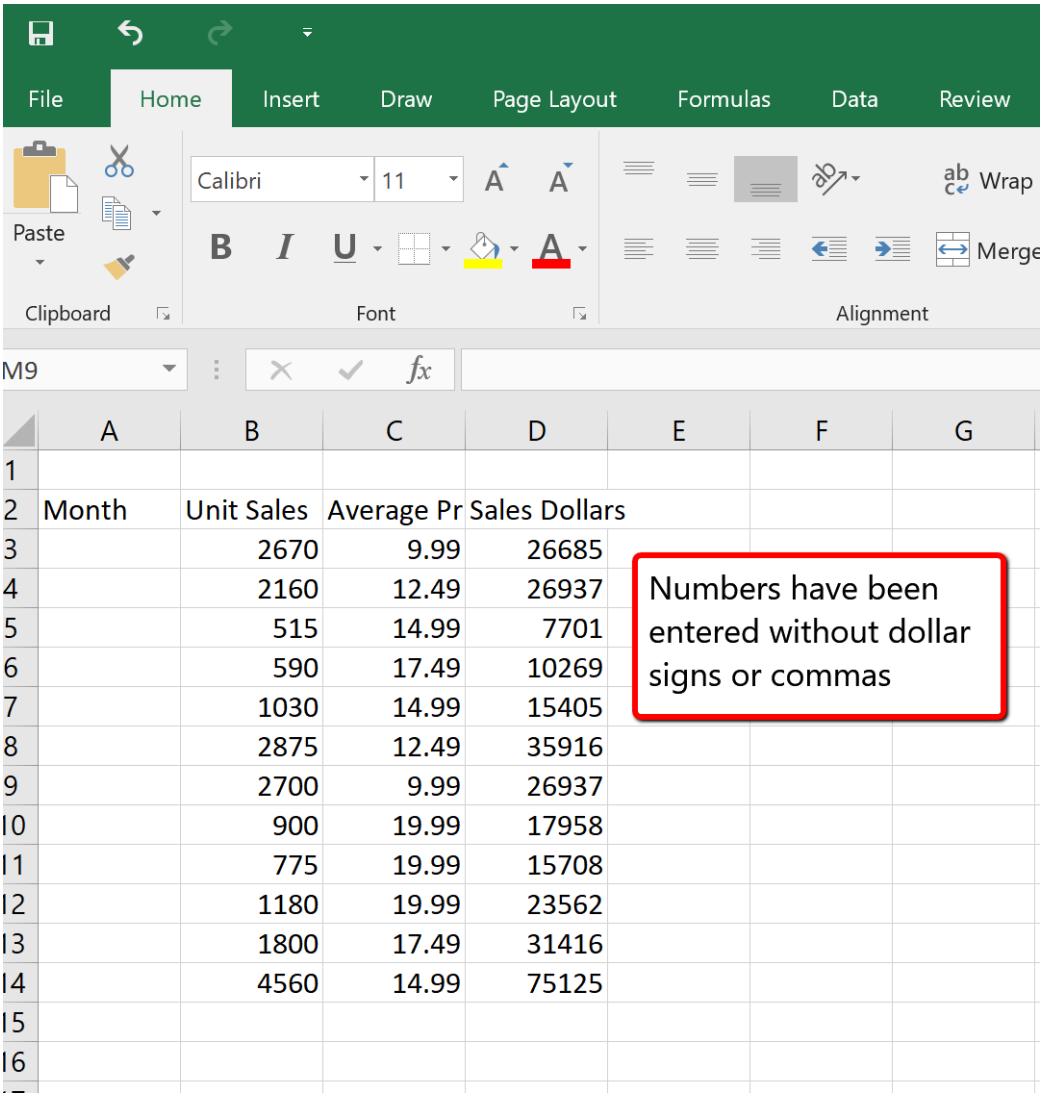
Integrity Check

Data Entry

It is very important to proofread your worksheet carefully, especially when you have entered numbers. Transposing numbers when entering data manually into a worksheet is a common error. For example, the number **563** could be transposed to **536.** Such errors can seriously compromise the integrity of your workbook.

Integrity Check

Figure 1.16 shows how your worksheet should appear after entering the data. Check your numbers carefully to make sure they are accurately entered into the worksheet.



	A	B	C	D	E	F	G
1							
2	Month	Unit Sales	Average Pr	Sales Dollars			
3		2670	9.99	26685			
4		2160	12.49	26937			
5		515	14.99	7701			
6		590	17.49	10269			
7		1030	14.99	15405			
8		2875	12.49	35916			
9		2700	9.99	26937			
10		900	19.99	17958			
11		775	19.99	15708			
12		1180	19.99	23562			
13		1800	17.49	31416			
14		4560	14.99	75125			
15							
16							

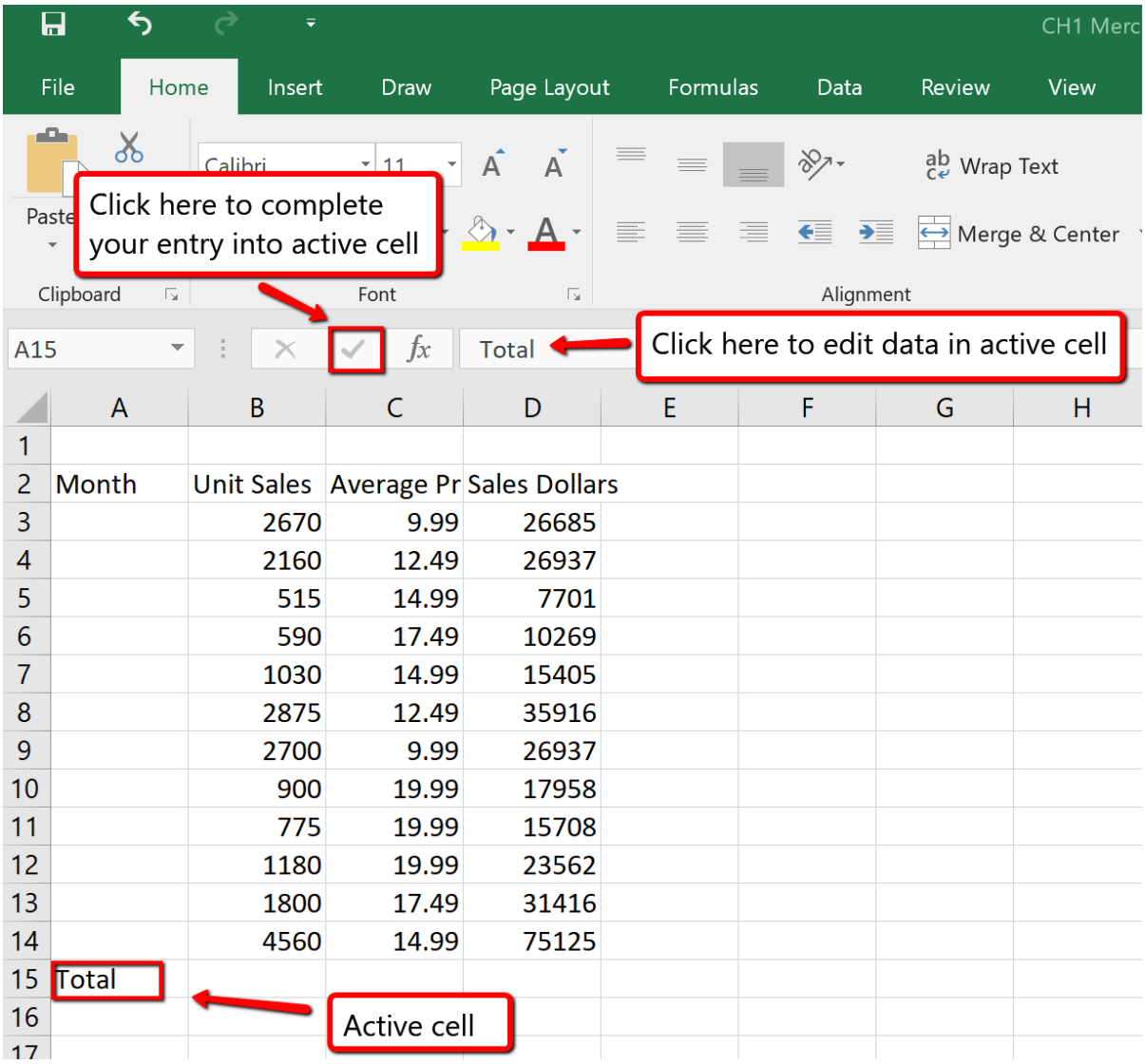
Figure 1.16 Completed Data Entry for Columns B, C, and D

EDITING DATA

Data that has been entered in a cell can be changed by double clicking the cell location or using the Formula Bar. You may have noticed that as you were typing data into a cell location, the data you typed appeared in the Formula Bar. The Formula Bar can be used for entering data into cells as well as for editing data that already exists in a cell. The following steps provide an example of entering and then editing data that has been entered into a cell location:

1. Click cell A15 in the Sheet1 worksheet.
2. Type the abbreviation **Tot** and press the ENTER key.
3. Click cell A15.
4. Move the mouse pointer up to the Formula Bar. You will see the pointer turn into a cursor. Move the cursor to the end of the abbreviation **Tot** and left click.

5. Type the letters **al** to complete the word Total.
6. Click the check mark to the left of the Formula Bar (see **Figure 1.17**). This will enter the change into the cell.



	A	B	C	D
1				
2	Month	Unit Sales	Average Pr	Sales Dollars
3		2670	9.99	26685
4		2160	12.49	26937
5		515	14.99	7701
6		590	17.49	10269
7		1030	14.99	15405
8		2875	12.49	35916
9		2700	9.99	26937
10		900	19.99	17958
11		775	19.99	15708
12		1180	19.99	23562
13		1800	17.49	31416
14		4560	14.99	75125
15	Total			
16				

Figure 1.17 Using the Formula Bar to Edit and Enter Data

1. Double click cell A15.
2. Add a space after the word Total and type the word **Sales**.
3. Press the ENTER key.

Keyboard Shortcuts

Editing Data in a Cell

- Activate the cell that is to be edited and press the F2 key on your keyboard.
  - Same for Mac Users

AUTO FILL

The Auto Fill feature is a valuable tool when manually entering data into a worksheet. This feature has many uses, but it is most beneficial when you are entering data in a defined sequence, such as the numbers 2, 4, 6, 8, and so on, or nonnumeric data such as the days of the week or months of the year. The following steps demonstrate how Auto Fill can be used to enter the months of the year in Column A:

1. Click cell A3 in the Sheet1 worksheet.
2. Type the word **January** and press the ENTER key.
3. Click cell A3 again.
4. Move the mouse pointer to the lower right corner of cell A3. You will see a small square in this corner of the cell; this is called the Fill Handle (See **Figure 1.18**) When the mouse pointer gets close to the Fill Handle, the white block plus sign will turn into a black plus (+) sign.

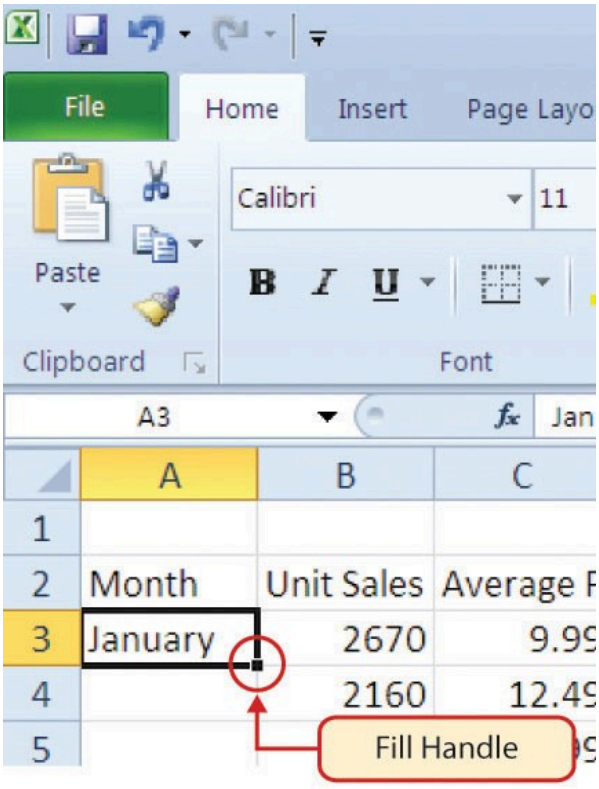


Figure 1.18 Fill Handle

Left click and drag the Fill Handle to cell A14. Notice that the Auto Fill tip box indicates what month will be placed into each cell (see **Figure 1.19**). Release the mouse button when the tip box reads "December."

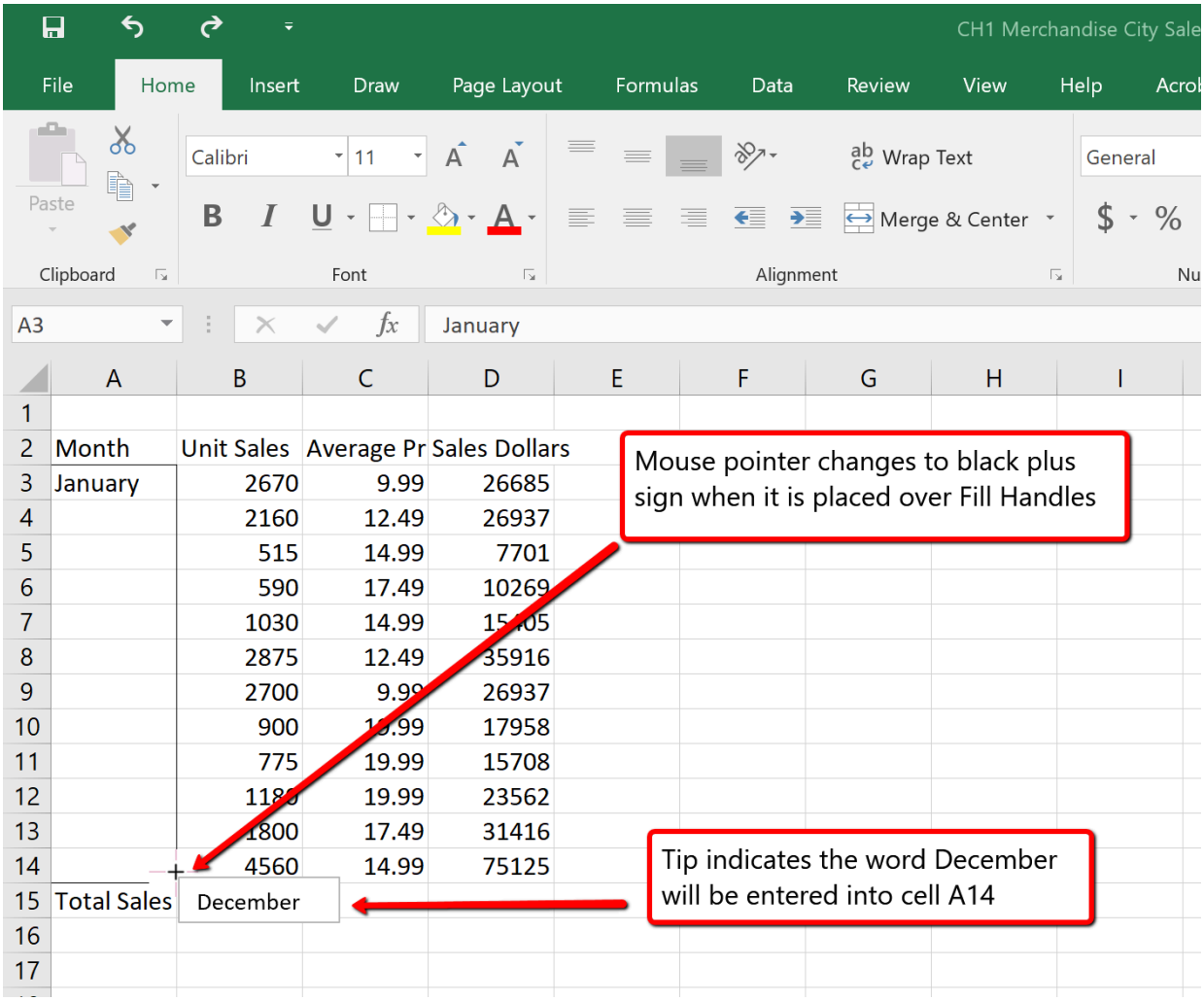


Figure 1.19 Using Auto Fill to Enter the Months of the Year

Once you release the left mouse button, all twelve months of the year should appear in the cell range A3:A14, as shown in **Figure 1.20**. You will also see the Auto Fill Options button. By clicking this button, you have several options for inserting data into a group of cells.

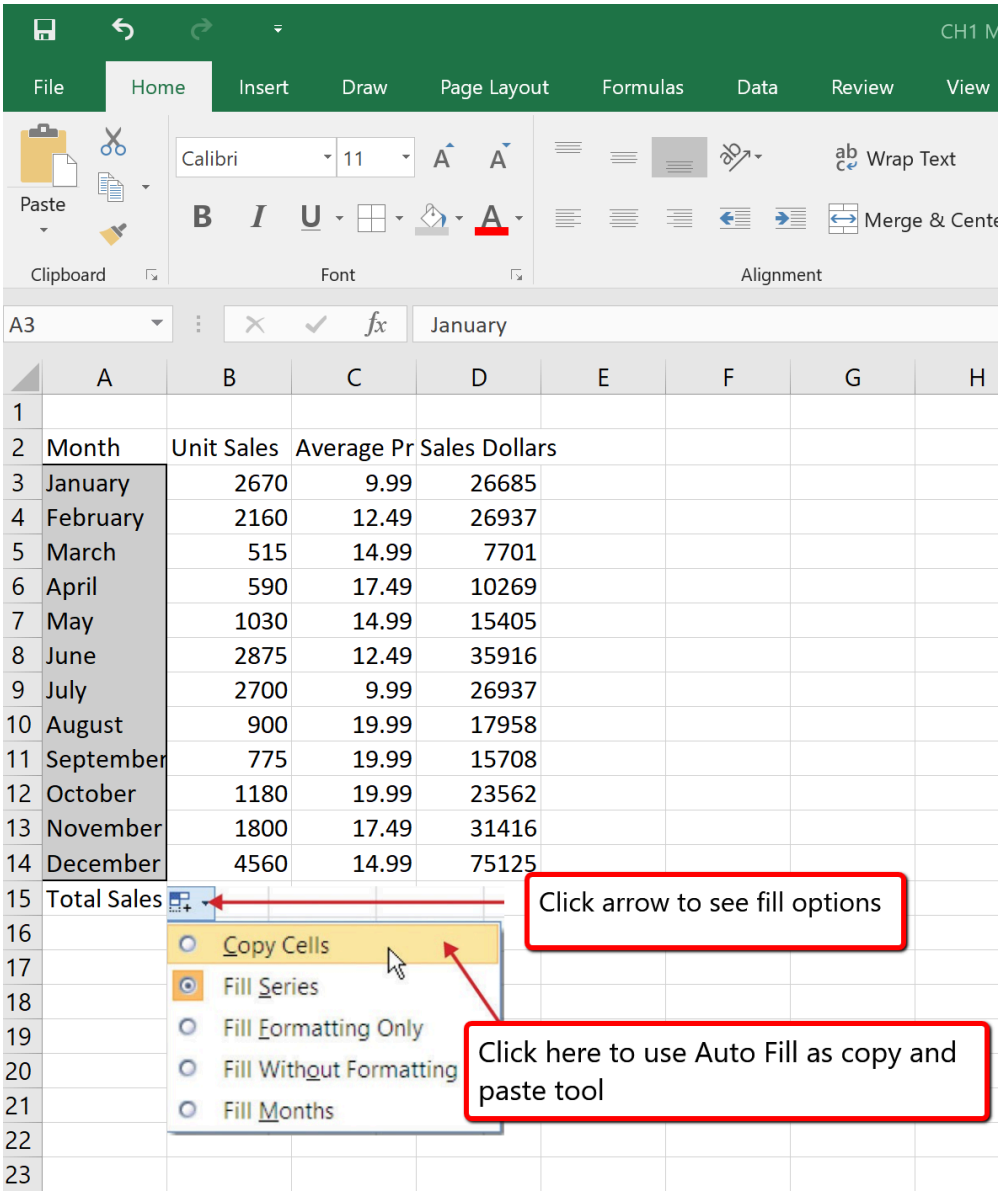


Figure 1.20 Auto Fill Options Button

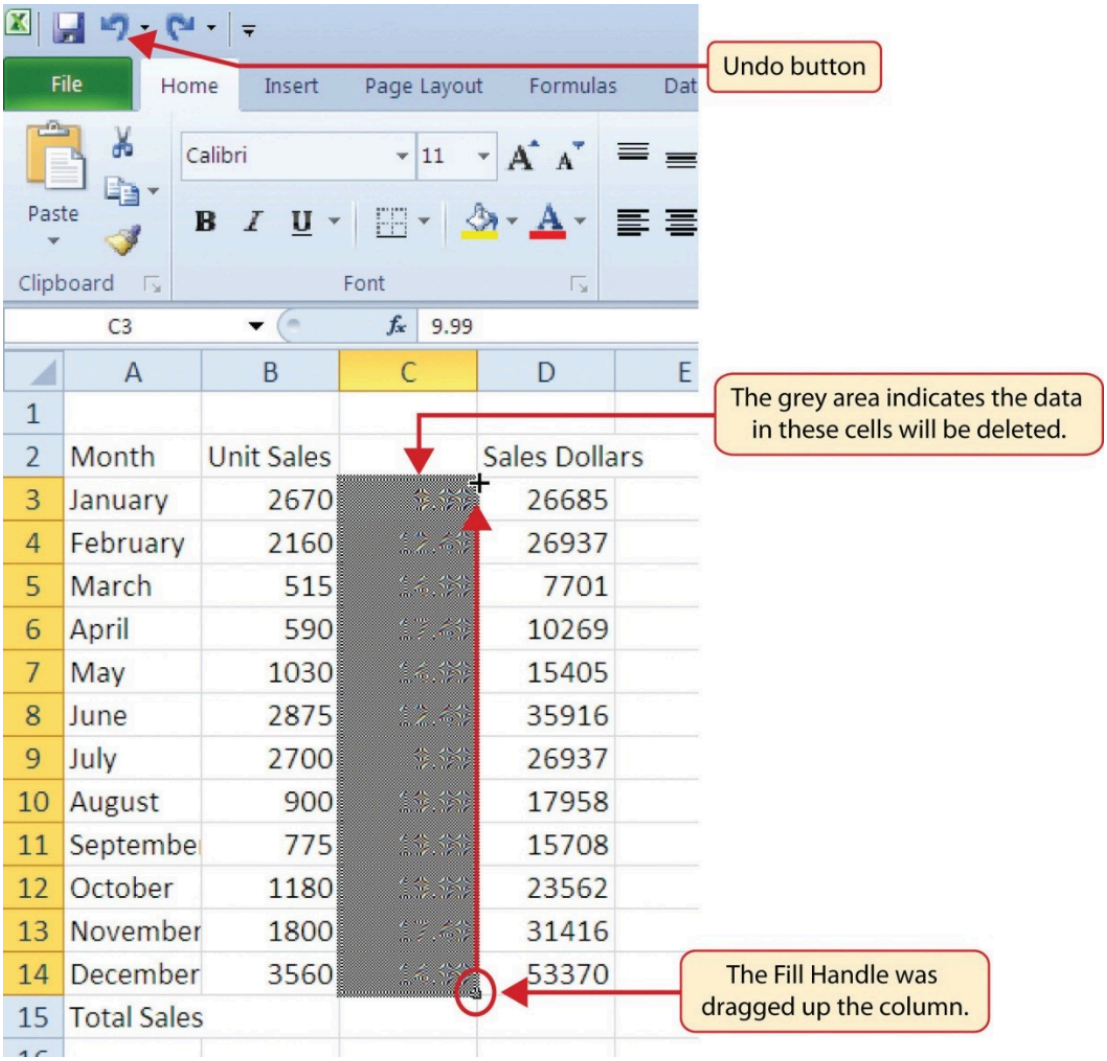
1. Click the Auto Fill Options button.
2. Click the Copy Cells option. This will change the months in the range A4:A14 to January.
3. Click the Auto Fill Options button again.
4. Click the Fill Months option to return the months of the year to the cell range A4:A14. The Fill Series option will provide the same result.

DELETING DATA AND THE UNDO COMMAND

There are several methods for removing data from a worksheet, a few of which are demonstrated

here. With each method, you use the Undo command. This is a helpful command in the event you mistakenly remove data from your worksheet. The following steps demonstrate how you can delete data from a cell or range of cells:

1. Click cell C2.
2. Press the **DELETE** key on your keyboard. This removes the contents of the cell.
   Mac Users: Hold down the Fn key and press the Delete key
3. Highlight the range C3:C14. Then left click and drag the mouse pointer down to cell C14.
4. Place the mouse pointer over the Fill Handle. You will see the white block plus sign change to a black plus sign (+).
5. Click and drag the mouse pointer up to cell C3 (see **Figure 1.21**). Release the mouse button. The contents in the range C3:C14 will be removed.



	A	B	C	D	E
1					
2	Month	Unit Sales		Sales Dollars	
3	January	2670		26685	
4	February	2160		26937	
5	March	515		7701	
6	April	590		10269	
7	May	1030		15405	
8	June	2875		35916	
9	July	2700		26937	
10	August	900		17958	
11	Septembe	775		15708	
12	October	1180		23562	
13	November	1800		31416	
14	December	3560		53370	
15	Total Sales				

Figure 1.21 Using Auto Fill to Delete Contents of Cell

1. Click the Undo button in the Quick Access Toolbar (see **Figure 1.2**). This should replace

the data in the range C3:C14.

2. Click the Undo button again. This should replace the data in cell C2.

Keyboard Shortcuts

Undo Command

- Hold down the CTRL key while pressing the letter Z on your keyboard.
    - Same for Mac Users.
- Highlight the range C2:C14 by placing the mouse pointer over cell C2. Then left click and drag the mouse pointer down to cell C14.
- Click the Clear button in the Home tab of the Ribbon, which is next to the Cells group of commands (see **Figure 1.22**). This opens a drop-down menu that contains several options for removing or clearing data from a cell. Notice that you also have options for clearing just the formats in a cell or the hyperlinks in a cell.
- Click the Clear All option. This removes the data in the cell range.
- Click the Undo button. This replaces the data in the range C2:C14.

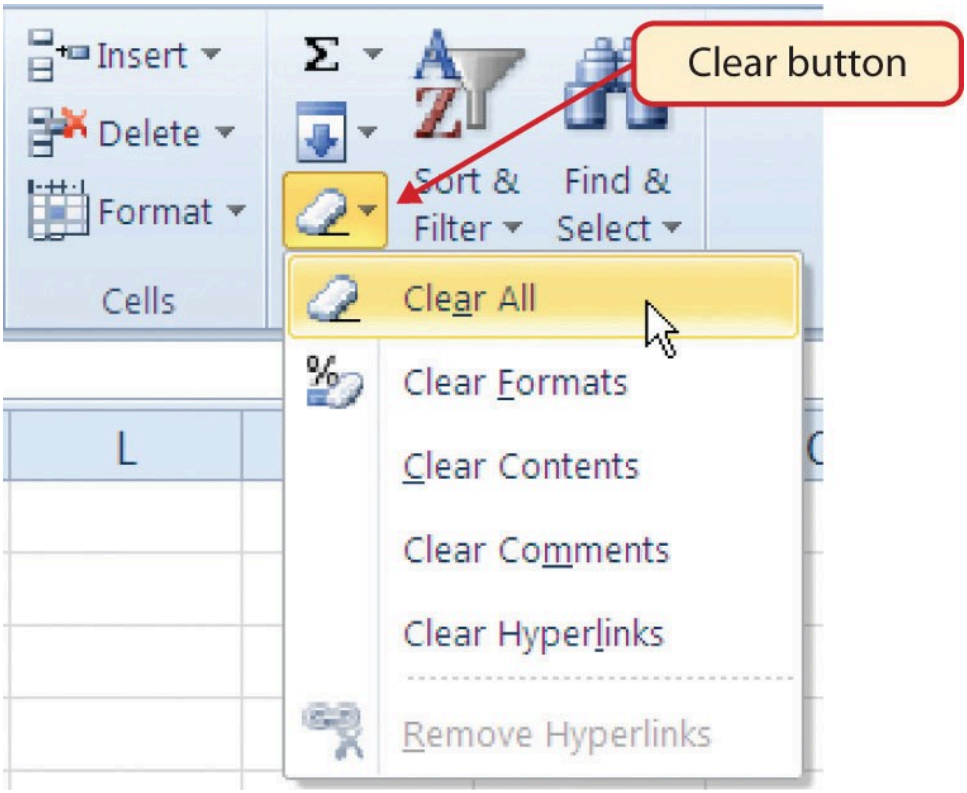


Figure 1.22 Clear Command Drop-Down Menu

ADJUSTING COLUMNS AND ROWS

There are a few entries in the worksheet that appear cut off. For example, the last letter of the word September cannot be seen in cell A11. This is because the column is too narrow for this word. The columns and rows on an Excel worksheet can be adjusted to accommodate the data that is being entered into a cell using three different methods. The following steps explain how to adjust the column widths and row heights in a worksheet:

1. Bring the mouse pointer between Column A and Column B in the Sheet1 worksheet, as shown in **Figure 1.23**. You will see the white block plus sign turn into double arrows.
2. Click and drag the column to the right so the entire word September in cell A11 can be seen. As you drag the column, you will see the column width tip box. This box displays the number of characters that will fit into the column using the Calibri 11-point font which is the default setting for font/size.
3. Release the left mouse button.

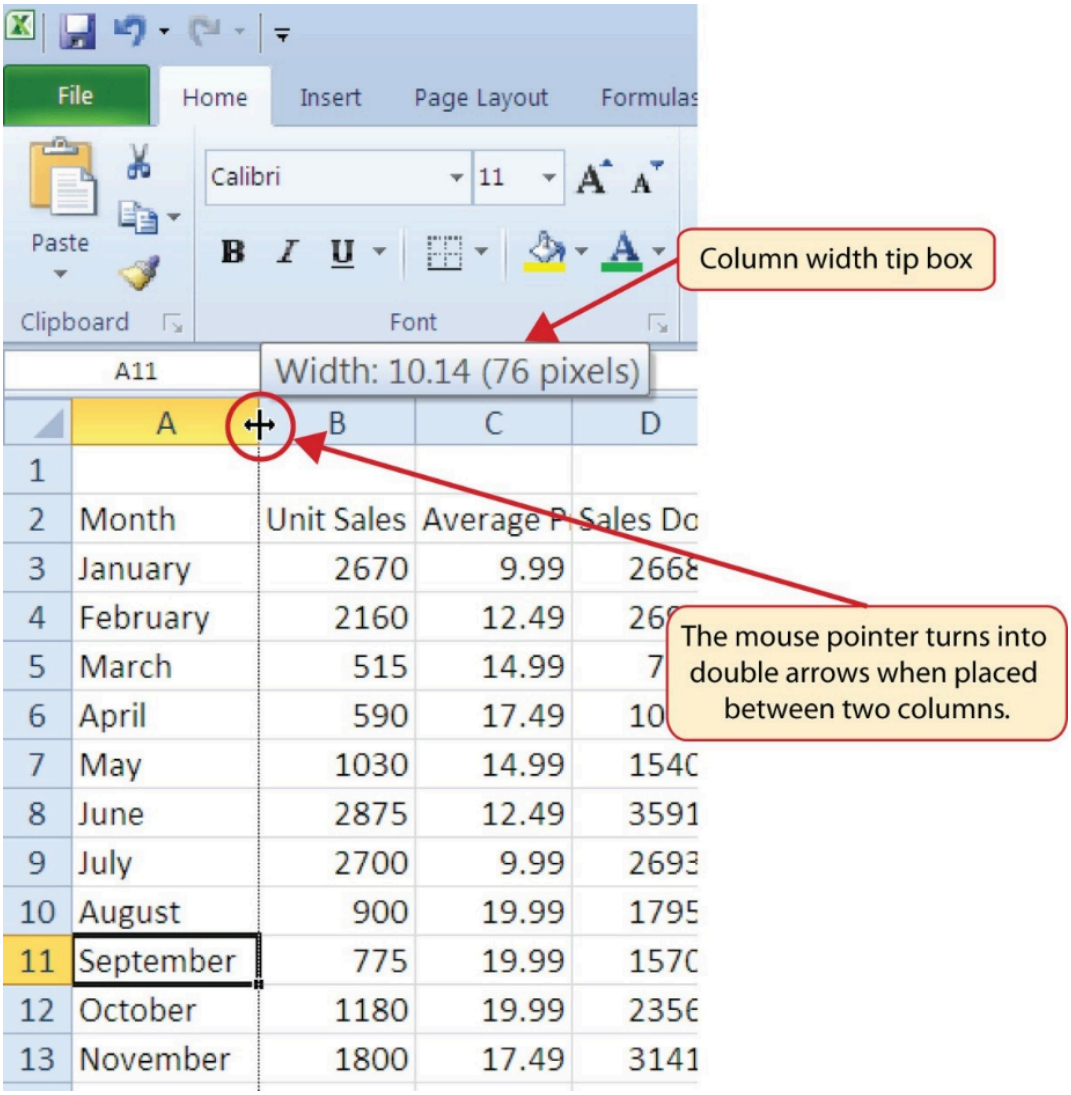


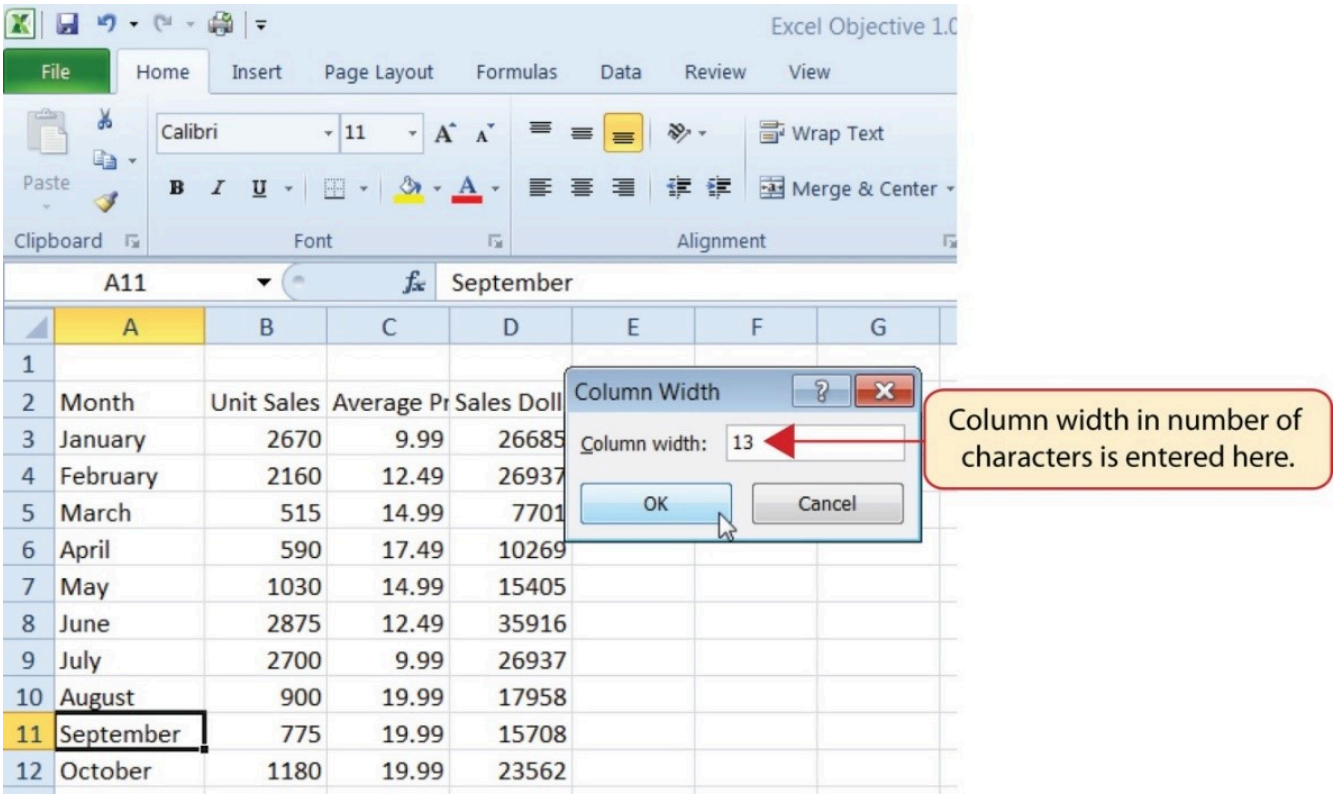
Figure 1.23 Adjusting Column Widths

You may find that using the click-and-drag method is inefficient if you need to set a specific character width for one or more columns. Steps 1 through 6 illustrate a second method for adjusting column widths when using a specific number of characters:

1. Click any cell location in Column A by moving the mouse pointer over a cell location and clicking the left mouse button. You can highlight cell locations in multiple columns if you are setting the same character width for more than one column.
2. In the Home tab of the Ribbon, left click the Format button in the Cells group.
3. Click the Column Width option from the drop-down menu. This will open the Column Width dialog box.
4. Type the number **13** and click the OK button on the Column Width dialog box. This will set Column A to this character width (see **Figure 1.24**).
5. Once again bring the mouse pointer between Column A and Column B so that the double arrow pointer displays and then double-click to activate AutoFit. This features adjusts

the column width based on the longest entry in the column.

6. Use the Column Width dialog box (step 6 above) to reset the width to 13.



	A	B	C	D
1				
2	Month	Unit Sales	Average Pr	Sales Doll
3	January	2670	9.99	26685
4	February	2160	12.49	26937
5	March	515	14.99	7701
6	April	590	17.49	10269
7	May	1030	14.99	15405
8	June	2875	12.49	35916
9	July	2700	9.99	26937
10	August	900	19.99	17958
11	September	775	19.99	15708
12	October	1180	19.99	23562

Figure 1.24 Column Width Dialog Box

Keyboard Shortcuts

Column Width

- Press the ALT key on your keyboard, then press the letters H, O, and W one at a time.
- This keyboard shortcut is not available for Excel for Mac

Steps 1 through 4 demonstrate how to adjust row height, which is similar to adjusting column width:

1. Click cell A15.
2. In the Home tab of the Ribbon, left click the Format button in the Cells group.
3. Click the Row Height option from the drop-down menu. This will open the Row Height dialog box.

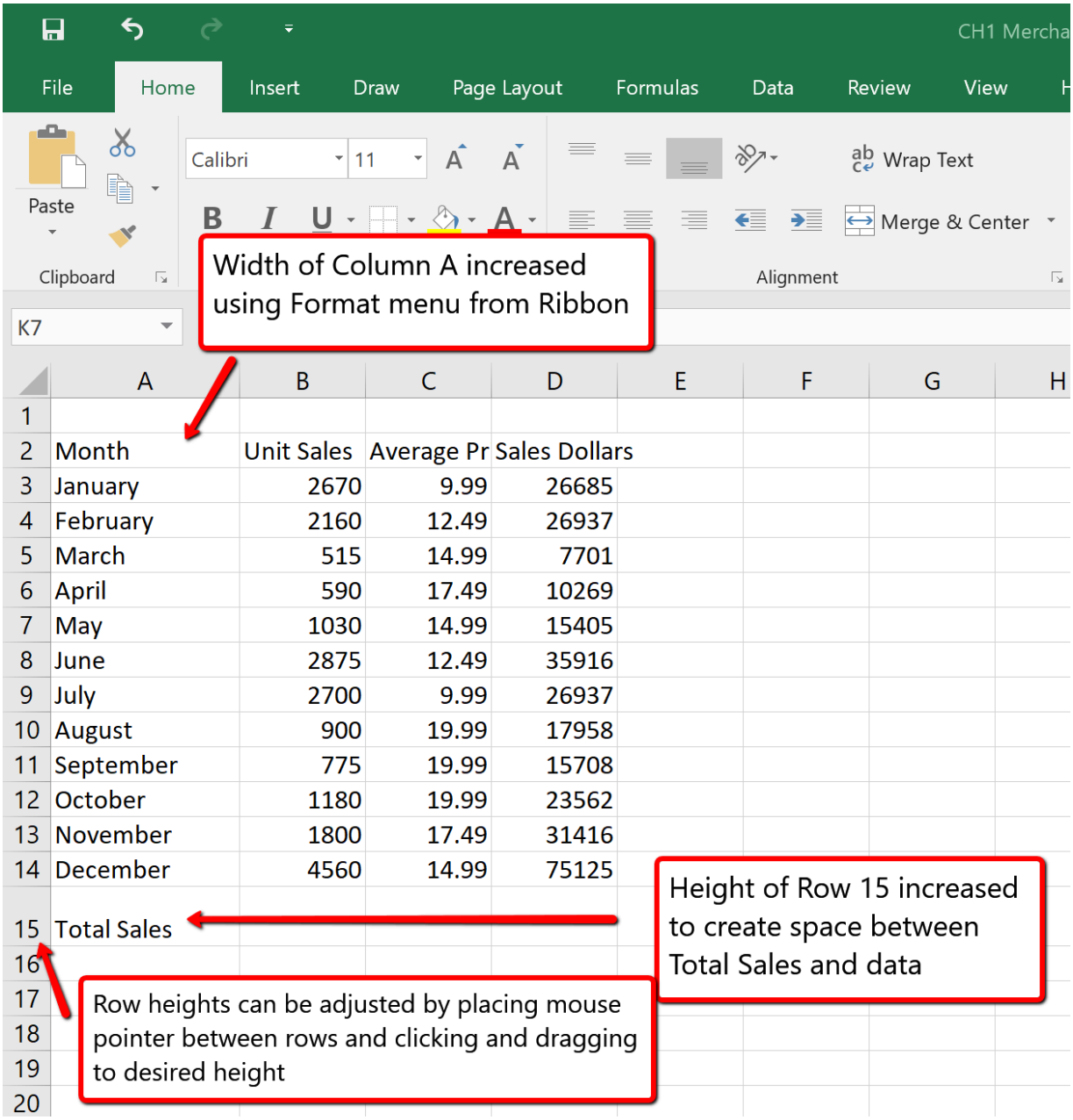
4. Type the number **24** and click the OK button on the Row Height dialog box. This will set Row 15 to a height of 24 points. A point is equivalent to approximately 1/72 of an inch. This adjustment in row height was made to create space between the totals for this worksheet and the rest of the data.

Keyboard Shortcuts

Row Height

- Press the ALT key on your keyboard, then press the letters H, O, and H one at a time.
- This keyboard shortcut is not available for Excel for Mac

Figure 1.25 shows the appearance of the worksheet after Column A and Row 15 are adjusted.



	A	B	C	D	E	F	G	H
1								
2	Month	Unit Sales	Average Pr	Sales Dollars				
3	January	2670	9.99	26685				
4	February	2160	12.49	26937				
5	March	515	14.99	7701				
6	April	590	17.49	10269				
7	May	1030	14.99	15405				
8	June	2875	12.49	35916				
9	July	2700	9.99	26937				
10	August	900	19.99	17958				
11	September	775	19.99	15708				
12	October	1180	19.99	23562				
13	November	1800	17.49	31416				
14	December	4560	14.99	75125				
15	Total Sales							
16								
17								
18								
19								
20								

Figure 1.25 Sales Data with Column A and Row 15 Adjusted

Skill Refresher

Adjusting Columns and Rows

1. Activate at least one cell in the row or column you are adjusting.
2. Click the Home tab of the Ribbon.
3. Click the Format button in the Cells group.
4. Click either Row Height or Column Width from the drop-down menu.

5. Enter the Row Height in points or Column Width in characters in the dialog box.
6. Click the OK button.

HIDING COLUMNS AND ROWS

In addition to adjusting the columns and rows on a worksheet, you can also hide columns and rows. This is a useful technique for enhancing the visual appearance of a worksheet that contains data that is not necessary to display. These features will be demonstrated using the GMW Sales Data workbook. However, there is no need to have hidden columns or rows for this worksheet. The use of these skills here will be for demonstration purposes only.

1. Click cell C1.
2. Click the Format button in the Home tab of the Ribbon.
3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu. This will open a submenu of options.
4. Click the Hide Columns option in the submenu of options (see **Figure 1.26**). This will hide Column C.

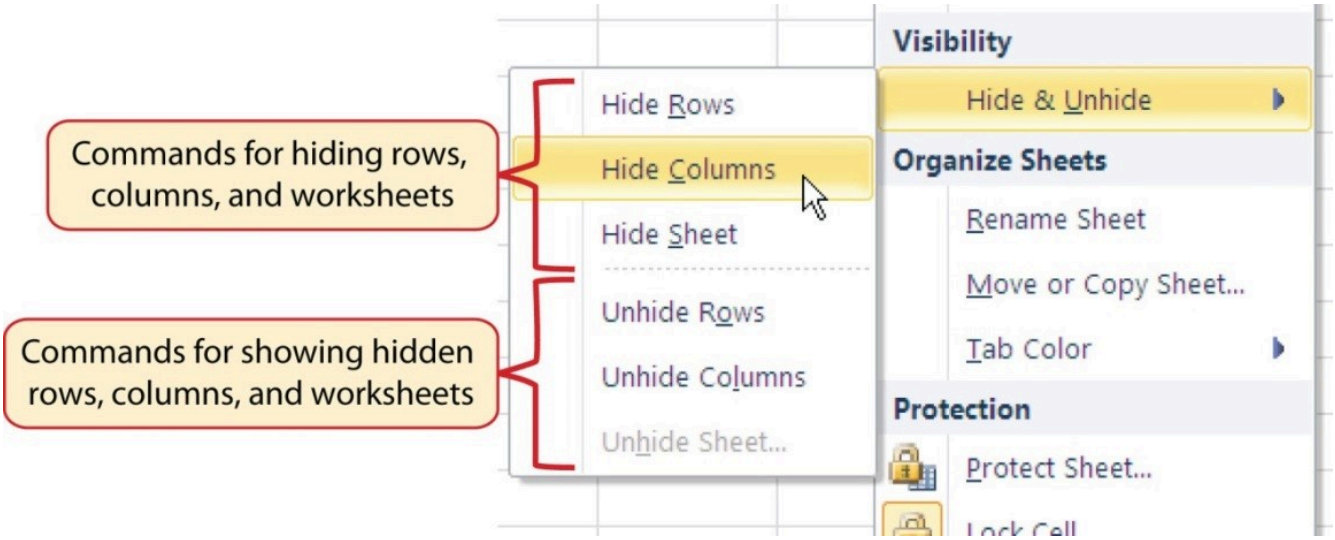


Figure 1.26 Hide & Unhide Submenu

Keyboard Shortcuts

Hiding Columns

- Hold down the CTRL key while pressing the number 0 on your keyboard.
  - Same for Mac Users

Figure 1.27 shows the workbook with Column C hidden in the Sheet1 worksheet. You can tell a column is hidden by the missing letter C.

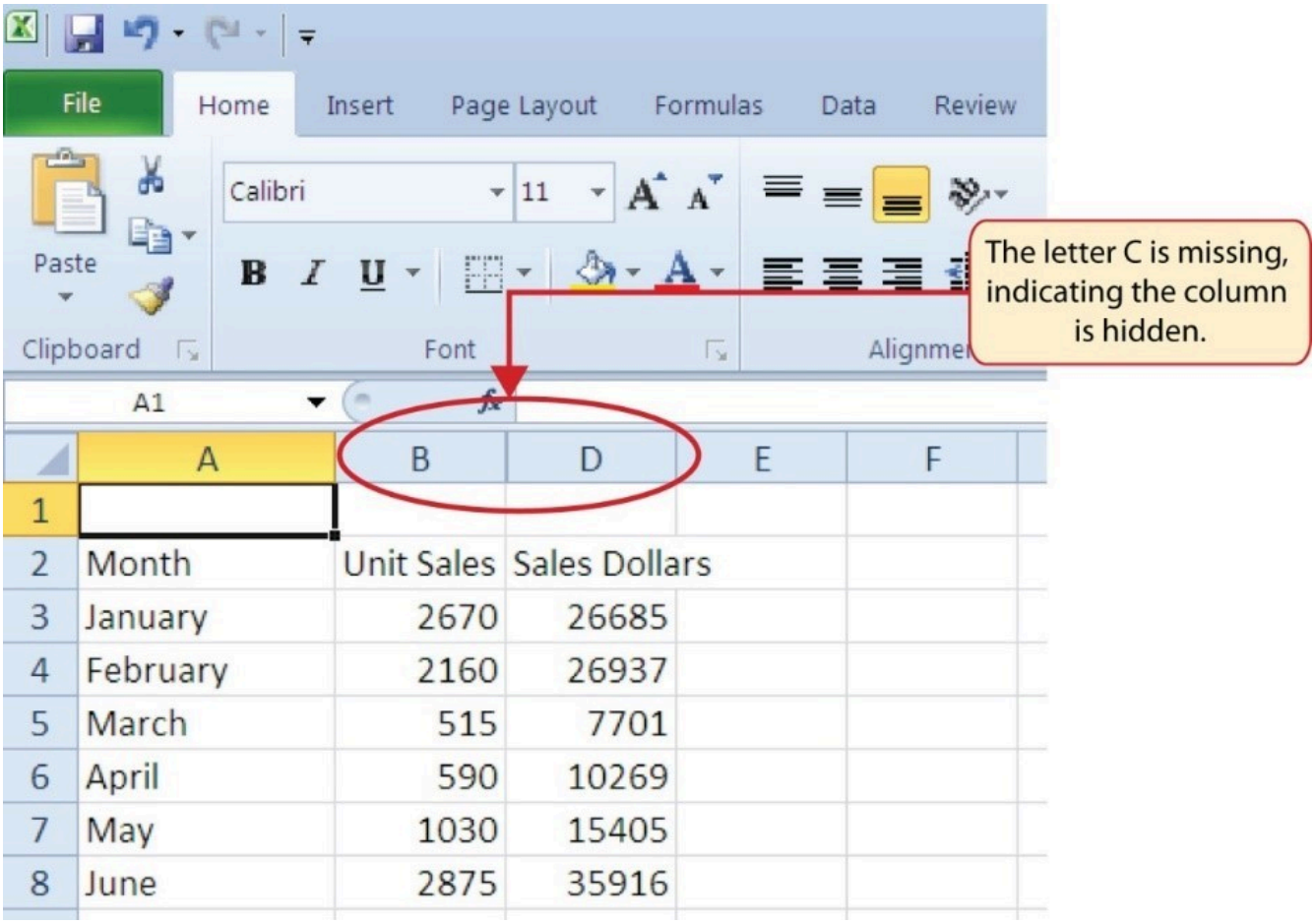


Figure 1.27 Hidden Column

To unhide a column, follow these steps:

1. Select the range B1:D1.
2. Click the Format button in the Home tab of the Ribbon.
3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu.

4. Click the Unhide Columns option in the submenu of options. Column C will now be visible on the worksheet.

Keyboard Shortcuts

Unhiding Columns

- Highlight cells on either side of the hidden column(s), then hold down the CTRL key and the SHIFT key while pressing the close parenthesis key ()) on your keyboard.
- Mac Users: Hold down Control and Shift keys and press the number 0

The following steps demonstrate how to hide rows, which is similar to hiding columns:

1. Click cell A3.
2. Click the Format button in the Home tab of the Ribbon.
3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu. This will open a submenu of options.
4. Click the Hide Rows option in the submenu of options. This will hide Row 3.

Keyboard Shortcuts

Hiding Rows

- Hold down the CTRL key while pressing the number 9 key on your keyboard.
    - Same for Mac Users

To unhide a row, follow these steps:

1. Select the range A2:A4.
2. Click the Format button in the Home tab of the Ribbon.
3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu.
4. Click the Unhide Rows option in the submenu of options. Row 3 will now be visible on the worksheet.

Keyboard Shortcuts

Unhiding Rows

- Highlight cells above and below the hidden row(s), then hold down the CTRL key and the SHIFT key while pressing the open parenthesis key (() on your keyboard.
- Mac Users: Hold down Control and Shift keys and press the number 9

Integrity Check

Hidden Rows and Columns

In most careers, it is common for professionals to use Excel workbooks that have been designed by a coworker. Before you use a workbook developed by someone else, always check for hidden rows and columns. You can quickly see whether a row or column is hidden if a row number or column letter is missing.

Skill Refresher

Hiding Columns and Rows

1. Activate at least one cell in the row(s) or column(s) you are hiding.
2. Click the Home tab of the Ribbon.
3. Click the Format button in the Cells group.
4. Place the mouse pointer over the Hide & Unhide option.
5. Click either the Hide Rows or Hide Columns option.

Skill Refresher

Unhiding Columns and Rows

1. Highlight the cells above and below the hidden row(s) or to the left and right of the hidden column(s).
2. Click the Home tab of the Ribbon.

3. Click the Format button in the Cells group.
4. Place the mouse pointer over the Hide & Unhide option.
5. Click either the Unhide Rows or Unhide Columns option.

INSERTING COLUMNS AND ROWS

Using Excel workbooks that have been created by others is a very efficient way to work because it eliminates the need to create data worksheets from scratch. However, you may find that to accomplish your goals, you need to add additional columns or rows of data. In this case, you can insert blank columns or rows into a worksheet. The following steps demonstrate how to do this:

1. Click cell C1.
2. Click the down arrow on the Insert button in the Home tab of the Ribbon (see **Figure 1.28**).

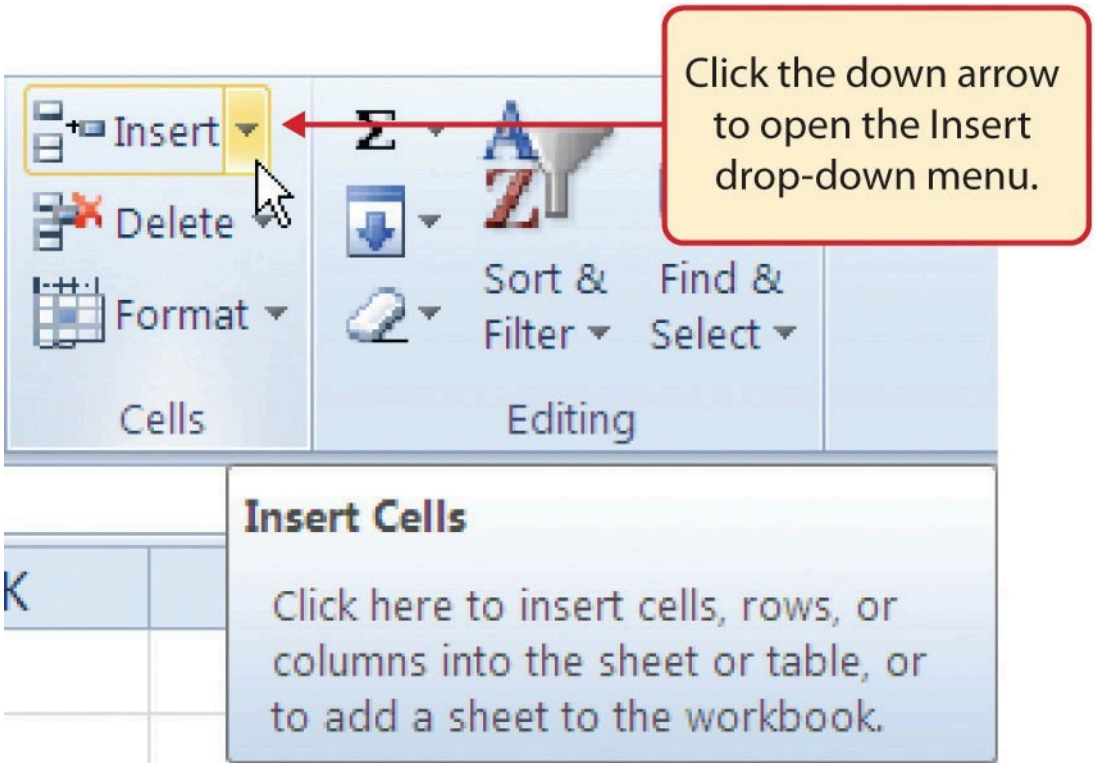


Figure 1.28 Insert Button (Down Arrow)

3. Click the Insert Sheet Columns option from the drop-down menu (see **Figure 1.29**). A blank column will be inserted to the left of Column C. The contents that were previously in Column C now appear in Column D. Note that columns are always inserted to the left

of the activated cell.

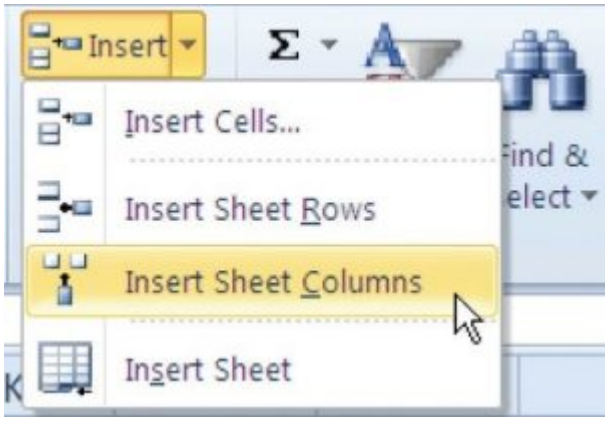


Figure 1.29 Insert Drop-Down Menu

Keyboard Shortcuts

Inserting Columns

- Press the ALT key and then the letters H, I, and C one at a time. A column will be inserted to the left of the activated cell.
- Mac Users: First hold down the Control key and press the spacebar to select the column; then hold down the Shift and Controls keys and press the + symbol

4. Click cell A3.
5. Click the down arrow on the Insert button in the Home tab of the Ribbon (see **Figure 1.28**).
6. Click the Insert Sheet Rows option from the drop-down menu (see **Figure 1.29**). A blank row will be inserted above Row 3. The contents that were previously in Row 3 now appear in Row 4. Note that rows are always inserted above the activated cell.

Keyboard Shortcuts

Inserting Rows

- Press the ALT key and then the letters H, I, and R one at a time. A row will be inserted above the activated cell.
- Mac Users: First hold down the Shift key and press the spacebar to select the row; then

hold down the Shift and Controls keys and press the + symbol

Skill Refresher

Inserting Columns and Rows

1. Activate the cell to the right of the desired blank column or below the desired blank row.
2. Click the Home tab of the Ribbon.
3. Click the down arrow on the Insert button in the Cells group.
4. Click either the Insert Sheet Columns or Insert Sheet Rows option.

MOVING DATA

Once data are entered into a worksheet, you have the ability to move it to different locations. The following steps demonstrate how to move data to different locations on a worksheet:

1. Select the range D2:D15.
2. Bring the mouse pointer to the left edge of cell D2. You will see the white block plus sign change to cross arrows (see **Figure 1.30**). This indicates that you can left click and drag the data to a new location.

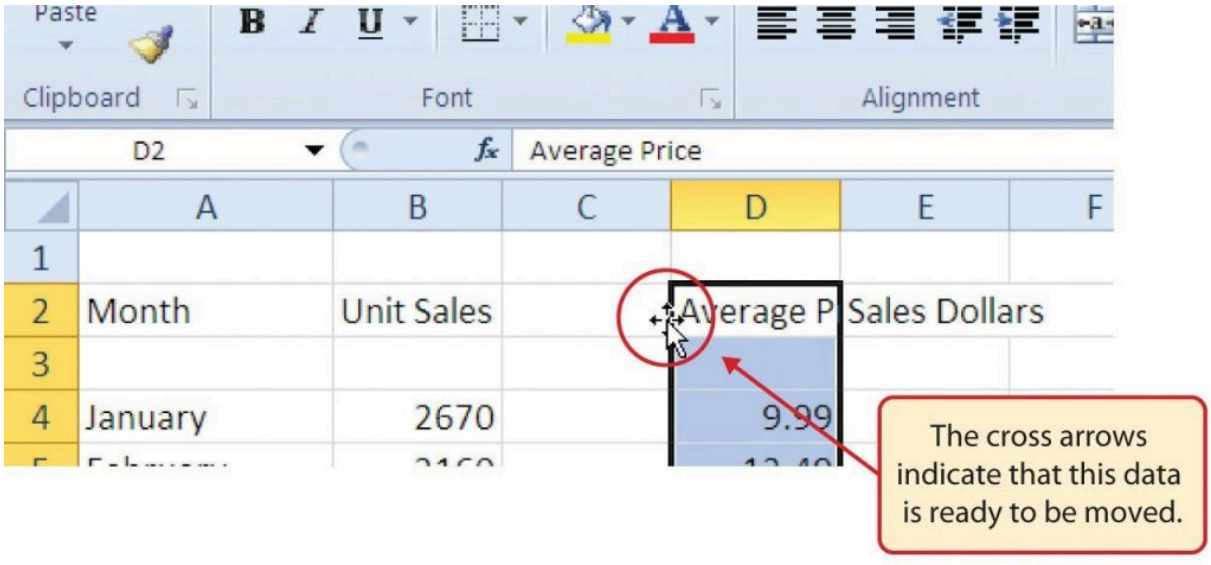


Figure 1.30 Moving Data

Mac Users: when the mouse hovers over the left edge of cell D2, the pointer will turn into a small hand that looks like this: 

3. Left Click and drag the mouse pointer to cell C2.
4. Release the left mouse button. The data now appears in Column C.
5. Click the Undo button in the Quick Access Toolbar. This moves the data back to Column D.

Integrity Check

Moving Data

Before moving data on a worksheet, make sure you identify all the components that belong with the series you are moving. For example, if you are moving a column of data, make sure the column heading is included. Also, make sure all values are highlighted in the column before moving it.

DELETING COLUMNS AND ROWS

You may need to delete entire columns or rows of data from a worksheet. This need may arise if you need to remove either blank columns or rows from a worksheet or columns and rows that contain data. The methods for removing cell contents were covered earlier and can be used to delete unwanted data. However, if you do not want a blank row or column in your workbook, you can delete it using the following steps:

1. Click cell A3.
2. Click the down arrow on the Delete button in the Cells group in the Home tab of the Ribbon.
3. Click the Delete Sheet Rows option from the drop-down menu (see **Figure 1.31**). This removes Row 3 and shifts all the data (below Row 2) in the worksheet up one row.

Keyboard Shortcuts
Deleting Rows

- Press the ALT key and then the letters H, D, and R one at a time. The row with the activated cell will be deleted.
- Mac Users: First hold down the Shift key and press the spacebar to select the row; then hold down Control key and press the – symbol

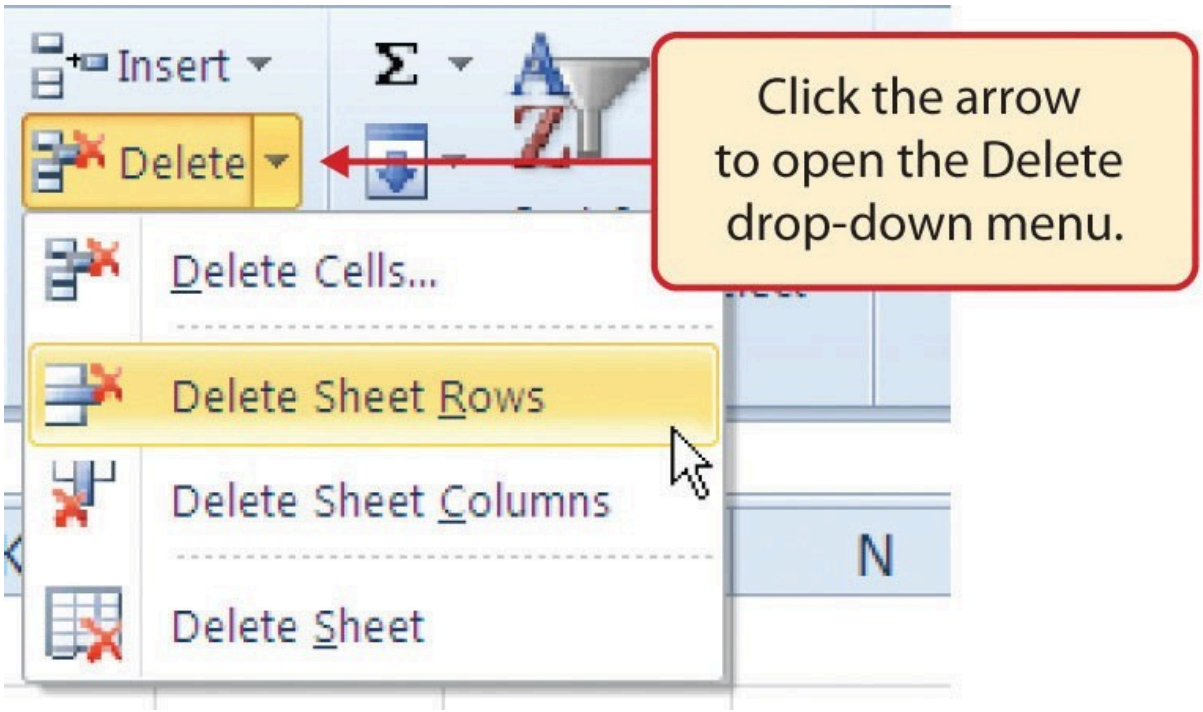


Figure 1.31 Delete Drop-Down Menu

4. Click cell C1.
5. Click the down arrow on the Delete button in the Cells group in the Home tab of the Ribbon.
6. Click the Delete Sheet Columns option from the drop-down menu (see **Figure 1.31**). This removes Column C and shifts all the data in the worksheet (to the right of Column B) over one column to the left.
7. Save the changes to your workbook by clicking either the **Save** button on the Home ribbon; or by selecting the **Save** option from the File menu.

Keyboard Shortcuts

Deleting Columns

- Press the ALT key and then the letters H, D, and C one at a time. The column with the activated cell will be deleted.
- Mac Users: First hold down the Control key and press the spacebar to select the column; then hold down Control key and press the – symbol

Skill Refresher

Deleting Columns and Rows

1. Activate any cell in the row or column that is to be deleted.
2. Click the Home tab of the Ribbon.
3. Click the down arrow on the Delete button in the Cells group.
4. Click either the Delete Sheet Columns or the Delete Sheet Rows option.

Key Takeaways

- Column headings should be used in a worksheet and should accurately describe the data contained in each column.
- Using symbols such as dollar signs when entering numbers into a worksheet can slow down the data entry process.
- Worksheets must be carefully proofread when data has been manually entered.
- The Undo command is a valuable tool for recovering data that was deleted from a worksheet.
- When using a worksheet that was developed by someone else, look carefully for hidden columns or rows.

ATTRIBUTION

1.3 Formatting and Data Analysis

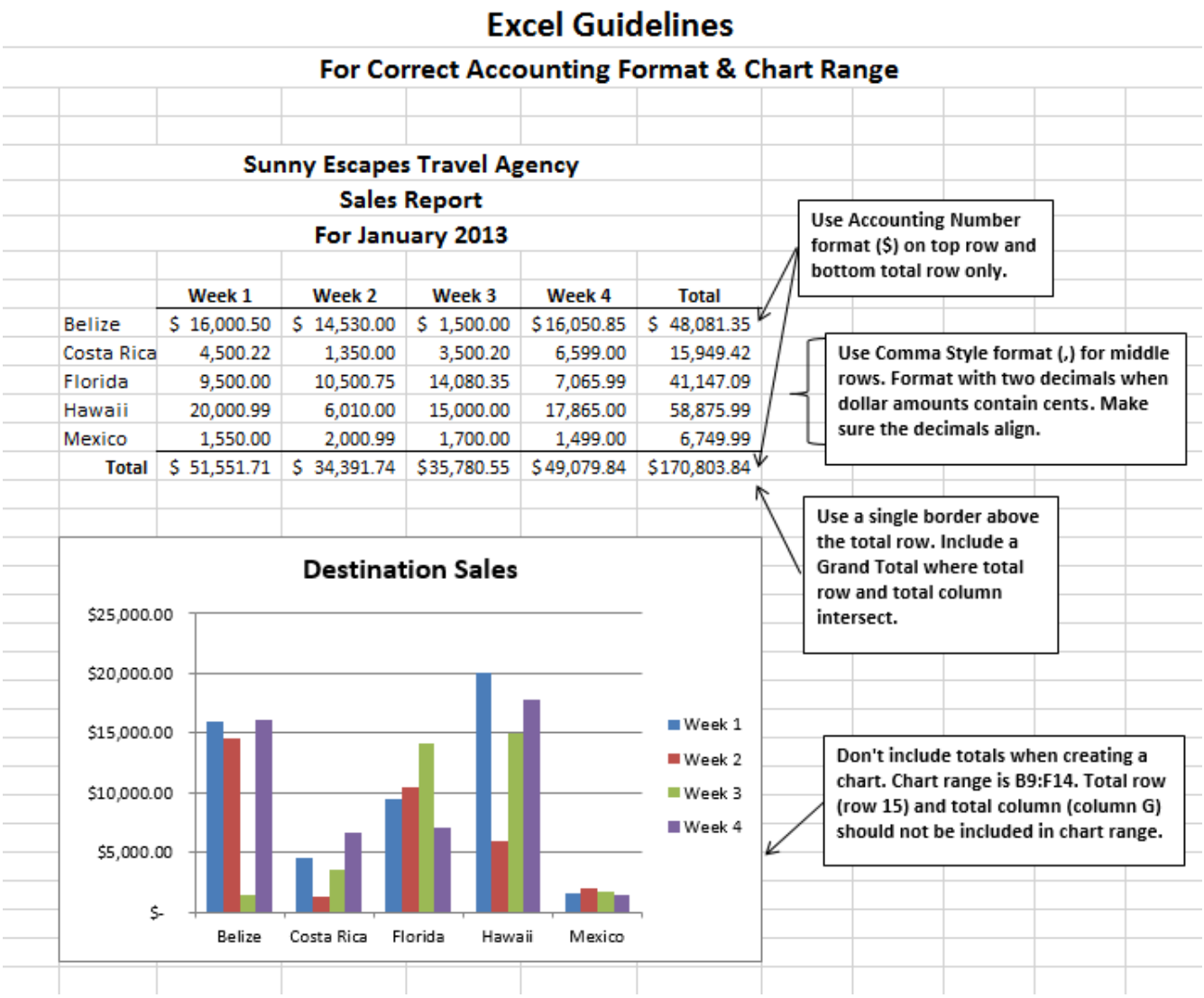
Learning Objectives

1. Use formatting techniques as introduced in the Excel Spreadsheet Guidelines to enhance the appearance of a worksheet.
2. Understand how to align data in cell locations.
3. Examine how to enter multiple lines of text in a cell location.
4. Understand how to add borders to a worksheet.
5. Examine how to use the AutoSum feature to calculate totals.
6. Use the Cut, Copy, and Paste commands to manipulate the data on a worksheet.
7. Understand how to move, rename, insert, and delete worksheet tabs.

This section addresses formatting commands that can be used to enhance the visual appearance of a worksheet. It also provides an introduction to mathematical calculations. The skills introduced in this section will give you powerful tools for analyzing the data that we have been working with in this workbook and will highlight how Excel is used to make key decisions in virtually any career. Additionally, Excel Spreadsheet Guidelines for format and appearance will be introduced as a format for the course and spreadsheets submitted.

FORMATTING DATA AND CELLS

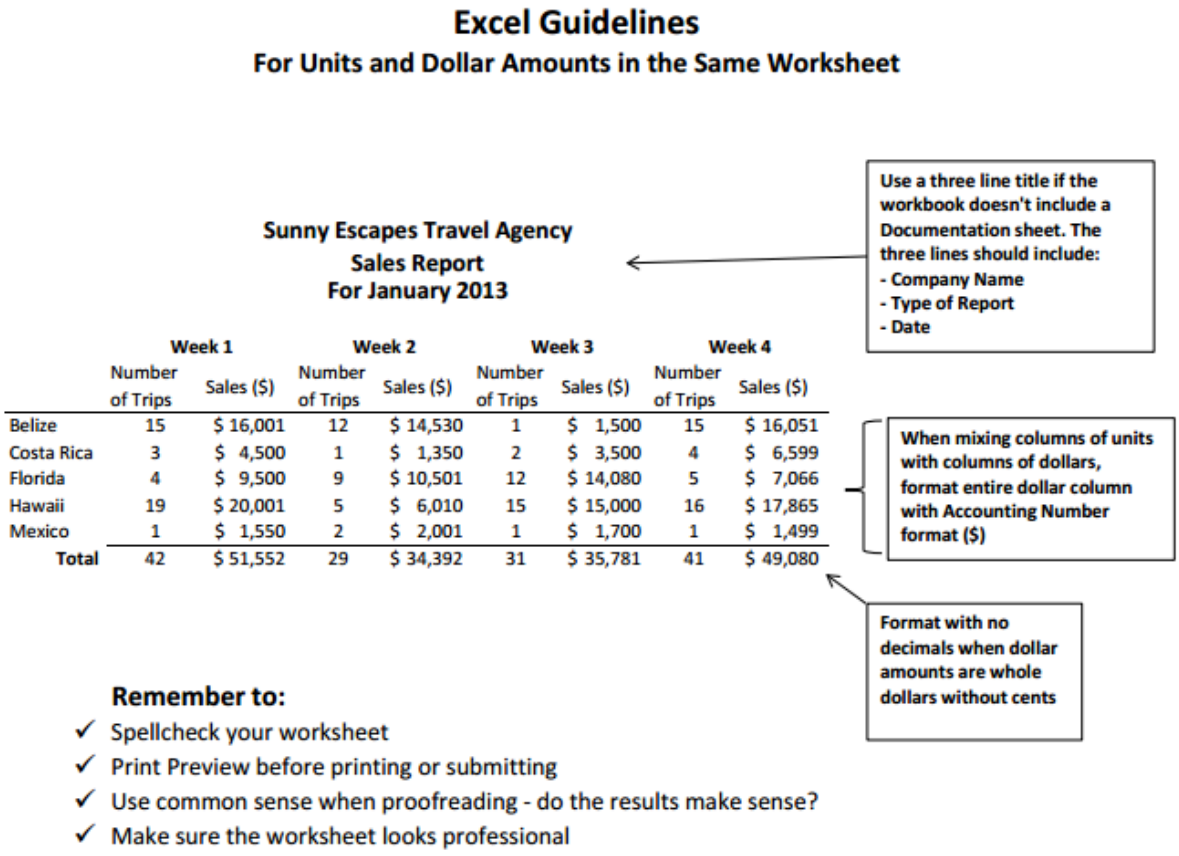
Enhancing the visual appearance of a worksheet is a critical step in creating a valuable tool for you or your coworkers when making key decisions. There are accepted professional formatting standards when spreadsheets contain only currency data. For this course, we will use the following Excel Guidelines for Formatting. The first figure displays how to use Accounting number format when ALL figures are currency. Only the first row of data and the totals should be formatted with the Accounting format. The other data should be formatted with Comma style. There also needs to be a Top Border above the numbers in the total row. If any of the numbers have cents, you need to format all of the data with two decimal places.



	Week 1	Week 2	Week 3	Week 4	Total
Belize	$ 16,000.50	$ 14,530.00	$ 1,500.00	$ 16,050.85	$ 48,081.35
Costa Rica	4,500.22	1,350.00	3,500.20	6,599.00	15,949.42
Florida	9,500.00	10,500.75	14,080.35	7,065.99	41,147.09
Hawaii	20,000.99	6,010.00	15,000.00	17,865.00	58,875.99
Mexico	1,550.00	2,000.99	1,700.00	1,499.00	6,749.99
Total	$ 51,551.71	$ 34,391.74	$35,780.55	$ 49,079.84	$170,803.84

Figure 1.31a

Often, your Excel spreadsheet will contain values that are both currency and non-currency in nature. When that is the case, you'll want to use the guidelines in the following figure:



	Week 1		Week 2		Week 3		Week 4	
	Number of Trips	Sales ($)	Number of Trips	Sales ($)	Number of Trips	Sales ($)	Number of Trips	Sales ($)
Belize	15	$ 16,001	12	$ 14,530	1	$ 1,500	15	$ 16,051
Costa Rica	3	$ 4,500	1	$ 1,350	2	$ 3,500	4	$ 6,599
Florida	4	$ 9,500	9	$ 10,501	12	$ 14,080	5	$ 7,066
Hawaii	19	$ 20,001	5	$ 6,010	15	$ 15,000	16	$ 17,865
Mexico	1	$ 1,550	2	$ 2,001	1	$ 1,700	1	$ 1,499
Total	42	$ 51,552	29	$ 34,392	31	$ 35,781	41	$ 49,080

Figure 1.31b

The following steps demonstrate several fundamental formatting skills that will be applied to the workbook that we are developing for this chapter. Several of these formatting skills are identical to ones that you may have already used in other Microsoft applications such as Microsoft® Word® or Microsoft® PowerPoint®.

1. Select the range A2:D2. Click the Bold button in the Font group of commands in the Home tab of the ribbon.
2. Click the Border button in the Font group of commands in the Home tab of the Ribbon (see **Figure 1.32**). Select the Bottom Border option from the list to achieve the goal of a border on the bottom of row 2 below the column headings.

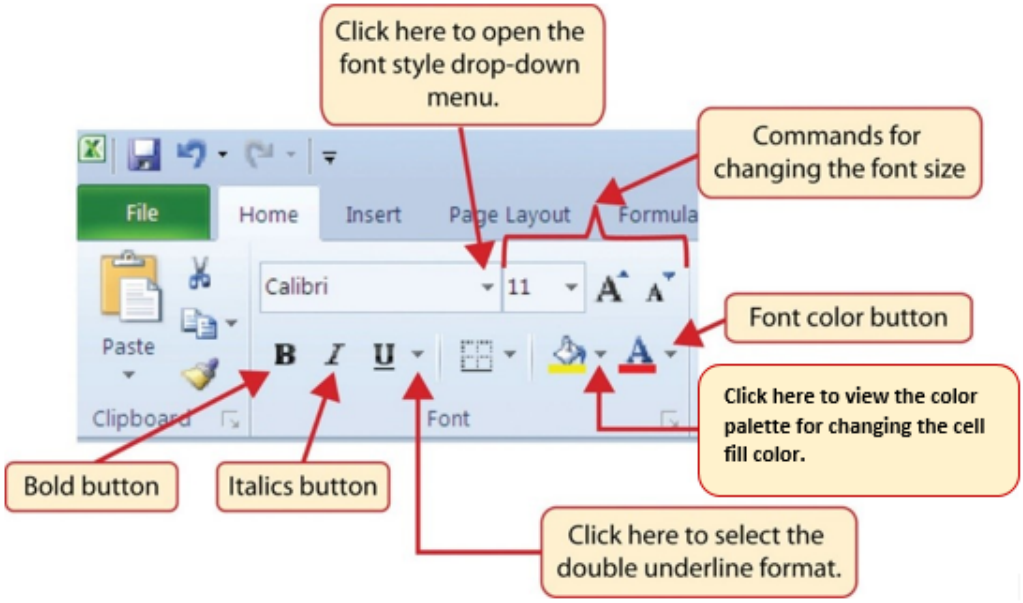


Figure 1.32 Font Group of Commands

Keyboard Shortcuts

Bold Format

- Hold down the CTRL key while pressing the letter B on your keyboard.
- Mac Users: Hold the Control key and press the letter B **or** hold down the Command key and press the letter B

3. Select the range A15:D15.
4. Click the Bold button in the Font group of commands in the Home tab of the Ribbon.
5. Click the Border button in the Font group of commands in the Home tab of the Ribbon (see **Figure 1.32**). Select the Top Border option from the list to achieve the goal of a border on the top of row 15 where totals will eventually display.

Keyboard Shortcuts

Italics Format

- Hold the CTRL key while pressing the letter I on your keyboard.
- Mac Users: Hold the Control key and press the letter I **or** hold down the Command key and press the letter I

Keyboard Shortcuts

Underline Format

- Hold the CTRL key while pressing the letter U on your keyboard.
- Mac Users: Hold the Control key and press the letter U **or** hold down the Command key and press the letter U

Why?

Format Column Headings and Totals

Applying formatting enhancements to the column headings and column totals in a worksheet is a very important technique, especially if you are sharing a workbook with other people. These formatting techniques allow users of the worksheet to clearly see the column headings that define the data. In addition, the column totals usually contain the most important data on a worksheet with respect to making decisions, and formatting techniques allow users to quickly see this information.

1. Select the range B3:B14.
2. Click the Comma Style button in the Number group of commands in the Home tab of the Ribbon. This feature adds a comma as well as two decimal places. (see **Figure 1.33**).

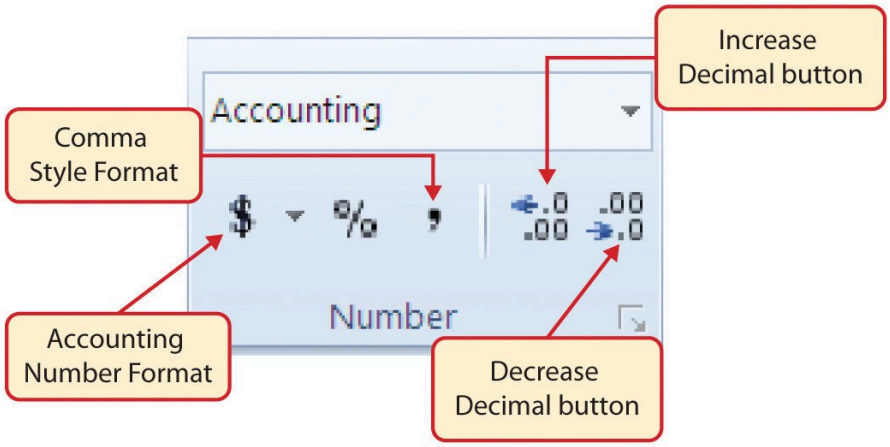


Figure 1.33 Number Group of Commands

3. Since the figures in this range do not include cents, click the Decrease Decimal button in the Number group of commands in the Home tab of the Ribbon two times (see **Figure 1.33**).
4. The numbers will also be reduced to zero decimal places.
5. Select the range C3:C14.
6. Click the Accounting Number Format button in the Number group of commands in the Home tab of the Ribbon (see **Figure 1.33**). This will add the US currency symbol and two decimal places to the values. This format is common when working with pricing data. As discussed above in the Formatting Data and Cells section, you will want to use Accounting format on all values in this range since the worksheet contains non-currency as well as currency data.
7. Select the range D3:D14.
8. Again, select the Accounting Number Format; this will add the US currency symbol to the values as well as two decimal places.
9. Click the Decrease Decimal button in the Number group of commands in the Home tab of the Ribbon.
10. This will add the US currency symbol to the values and reduce the decimal places to zero since there are no cents in these figures.
11. Select the range A1:D1.
12. Click the down arrow next to the Fill Color button in the Font group of commands in the Home tab of the Ribbon (see **Figure 1.34**). This will add background fill color the range for a worksheet title when entered.

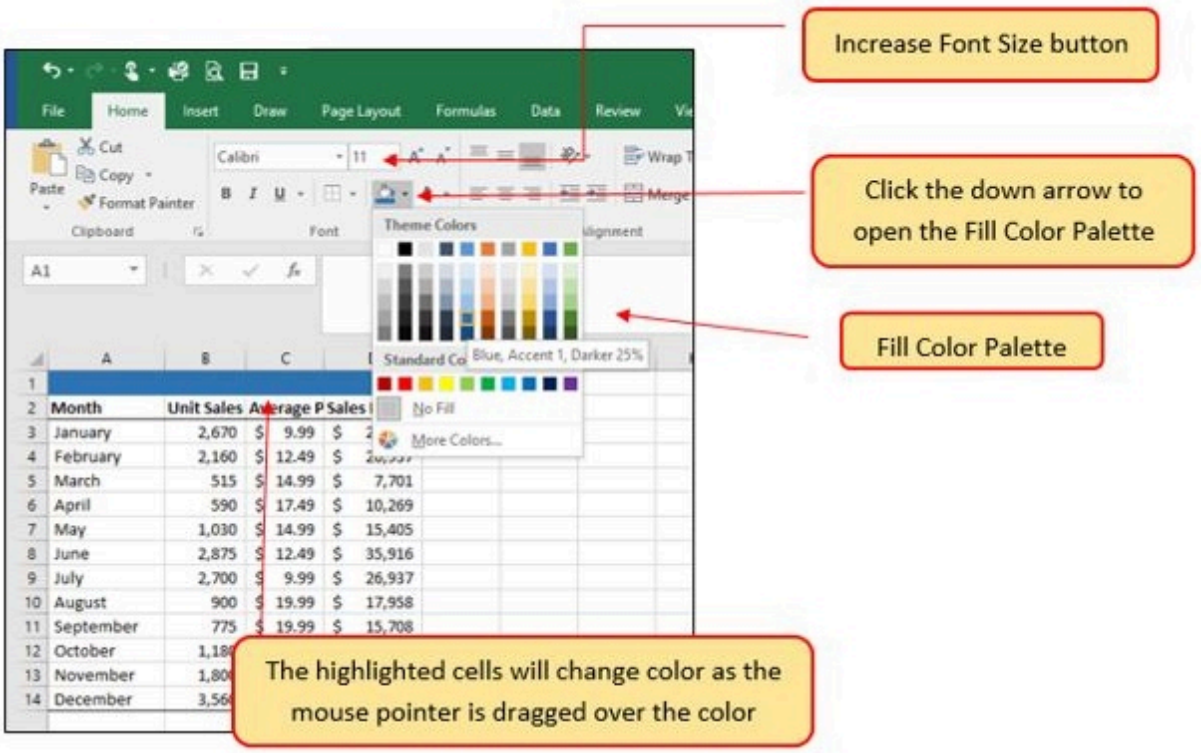


Figure 1.34 Fill Color Palette

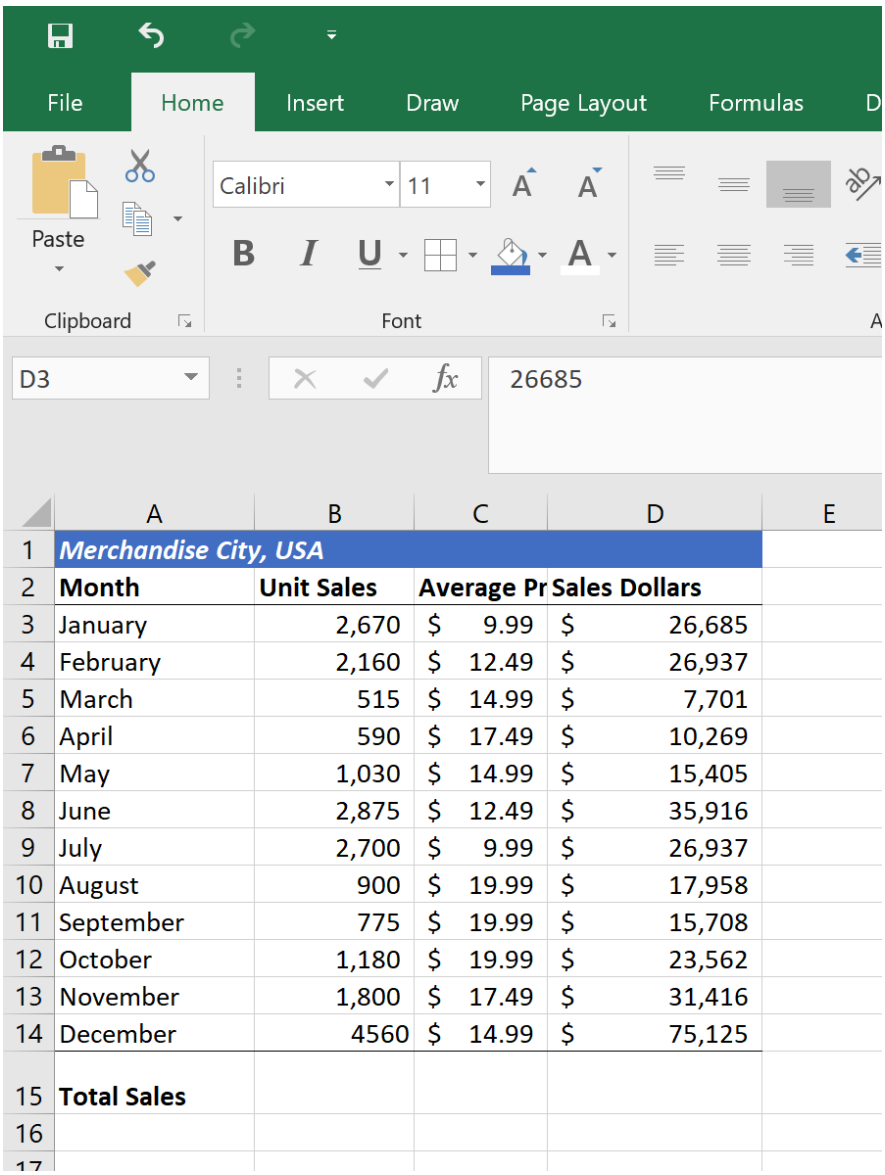
13. Click the Blue, Accent 1, Darker 25% color from the palette (see **Figure 1.34**). Notice that as you move the mouse pointer over the color palette, you will see a preview of how the color will appear in the highlighted cells. Experiment with this feature.
14. Click on A1 and enter the worksheet title: **Merchandise City, USA** and click on the check mark in the formula bar to enter this information.
15. Since the black font is difficult to read on the blue background, you'll change the font color to be more visible. Click the down arrow next to the Font Color button in the Font group of commands in the Home tab of the Ribbon; select **White** as the font color for this range (see **Figure 1.32**).
16. Select the range A1:D1 and format for **Italics** by clicking on "I" in the Font group.
17. Click the drop-down arrow on the right side of the Font button in the Home tab of the Ribbon; select Arial as the font for this range and format for **Bold** click on "B" in the Font group. (see **Figure 1.32**).
18. Notice that as you move the mouse pointer over the font style options, you can see the font change in the highlighted cells.
19. Expand the column width of Column D to 14 characters.

Why?

Pound Signs (####) Appear in Columns

When a column is too narrow for a long number, Excel will automatically convert the number to a series of pound signs (####). In the case of words or text data, Excel will only show the characters that fit in the column. However, this is not the case with numeric data because it can give the appearance of a number that is much smaller than what is actually in the cell. To remove the pound signs, increase the width of the column.

Figure 1.35 shows how the Sheet1 worksheet should appear after the formatting techniques are applied.



	A	B	C	D	E
1	*Merchandise City, USA*				
2	**Month**	**Unit Sales**	**Average Pr**	**Sales Dollars**	
3	January	2,670	$ 9.99	$ 26,685	
4	February	2,160	$ 12.49	$ 26,937	
5	March	515	$ 14.99	$ 7,701	
6	April	590	$ 17.49	$ 10,269	
7	May	1,030	$ 14.99	$ 15,405	
8	June	2,875	$ 12.49	$ 35,916	
9	July	2,700	$ 9.99	$ 26,937	
10	August	900	$ 19.99	$ 17,958	
11	September	775	$ 19.99	$ 15,708	
12	October	1,180	$ 19.99	$ 23,562	
13	November	1,800	$ 17.49	$ 31,416	
14	December	4560	$ 14.99	$ 75,125	
15	**Total Sales**				
16					

Figure 1.35 Formatting Techniques Applied

DATA ALIGNMENT (WRAP TEXT, MERGE CELLS, AND CENTER)

The skills presented in this segment show how data are aligned within cell locations. For example, text and numbers can be centered in a cell location, left justified, right justified, and so on. In some cases you may want to stack multiword text entries vertically in a cell instead of expanding the width of a column. This is referred to as wrapping text. These skills are demonstrated in the following steps:

1. Select the range A2:D2.
2. Click the Center button in the Alignment group of commands in the Home tab of the Ribbon (see **Figure 1.36**). This will center the column headings in each cell location.

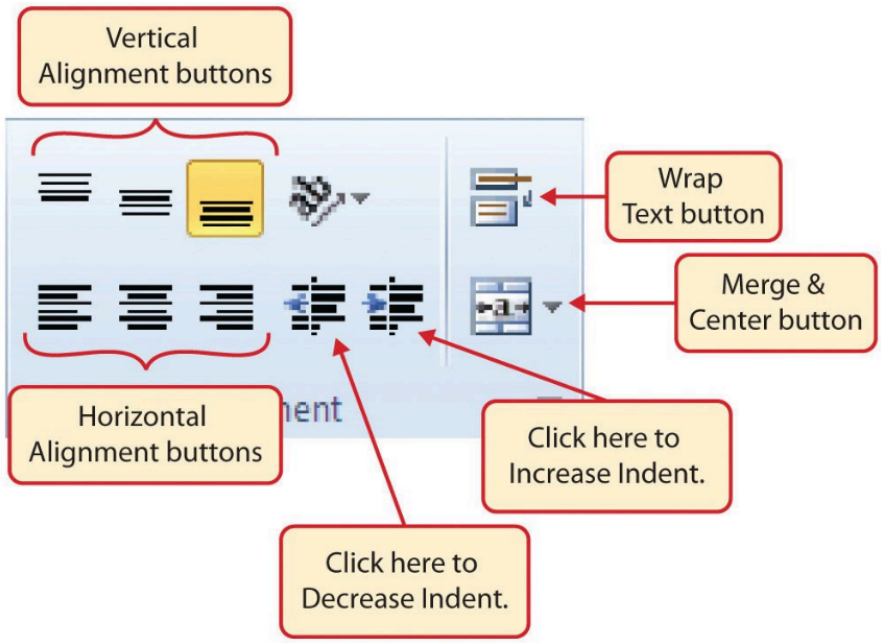


Figure 1.36 Alignment Group in Home Tab

3. Click the Wrap Text button in the Alignment group (see **Figure 1.36**). The height of Row 2 automatically expands, and the words that were cut off because the columns were too narrow are now stacked vertically.

Keyboard Shortcuts

Wrap Text

- Press the ALT key and then the letters H and W one at a time.
- There is no equivalent shortcut for Excel for Mac

Why?

Wrap Text

The benefit of using the Wrap Text command is that it significantly reduces the need to expand the column width to accommodate multiword column headings. The problem with increasing the col-

umn width is that you may reduce the amount of data that can fit on a piece of paper or one screen. This makes it cumbersome to analyze the data in the worksheet and could increase the time it takes to make a decision.

4. Select the range A1:D1.
5. Click the down arrow on the right side of the Merge & Center button in the Alignment group of commands in the Home tab of the Ribbon.
6. Click the Merge & Center option (see **Figure 1.37**). This will create one large cell location running across the top of the data set and center the text in that cell.

Keyboard Shortcuts

Merge Commands

- Merge & Center: Press the ALT key and then the letters H, M, and C one at a time.
- Merge Cells: Press the ALT key and then the letters H, M, and M one at a time.
- Unmerge Cells: Press the ALT key and then the letters H, M, and U one at a time.
    - There are no equivalent shortcuts for Excel for Mac

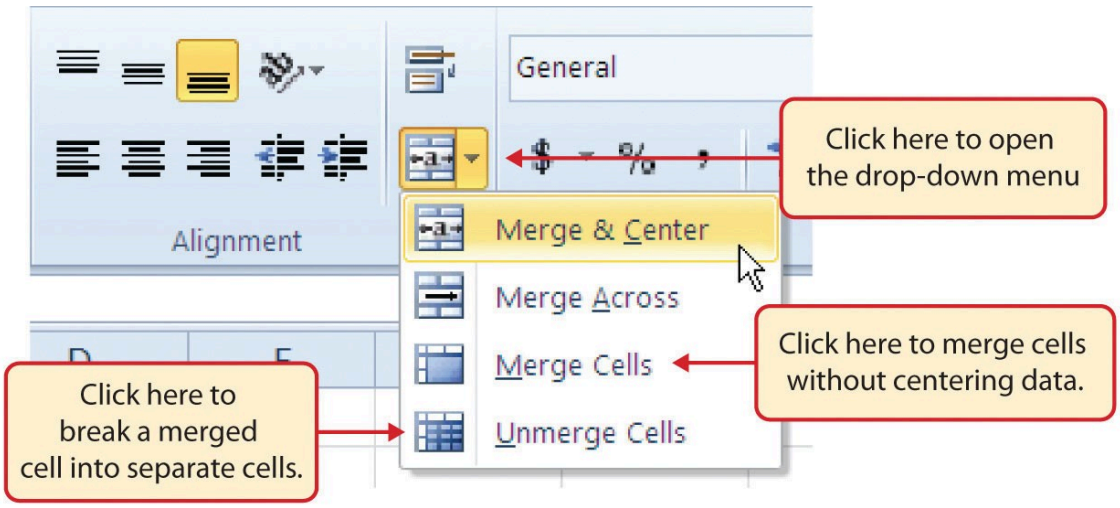


Figure 1.37 Merge Cell Drop-Down Menu

Why?

Merge & Center

One of the most common reasons the Merge & Center command is used is to center the title of a worksheet directly above the columns of data. Once the cells above the column headings are merged, a title can be centered above the columns of data. It is very difficult to center the title over the columns of data if the cells are not merged.

Figure 1.38 shows the Sheet1 worksheet with the data alignment commands applied. The reason for merging the cells in the range A1:D1 will become apparent in the next segment.

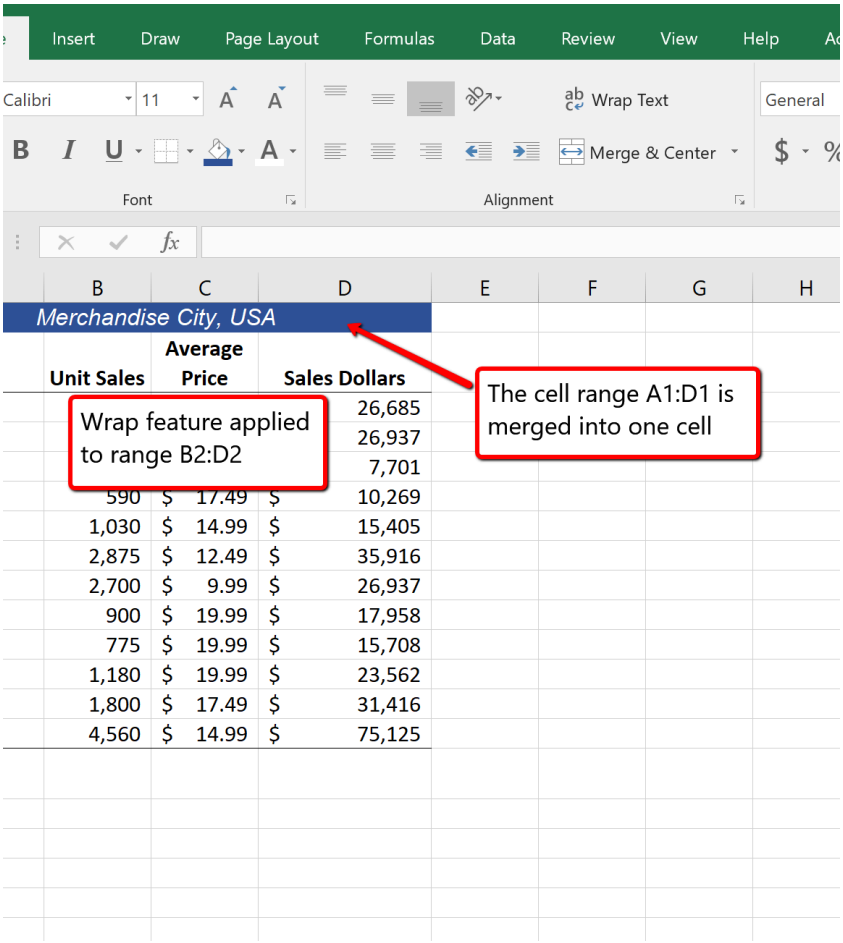


Figure 1.38 Data Alignment Features Added

Skill Refresher

Wrap Text

1. Activate the cell or range of cells that contain text data.
2. Click the Home tab of the Ribbon.
3. Click the Wrap Text button.

Skill Refresher

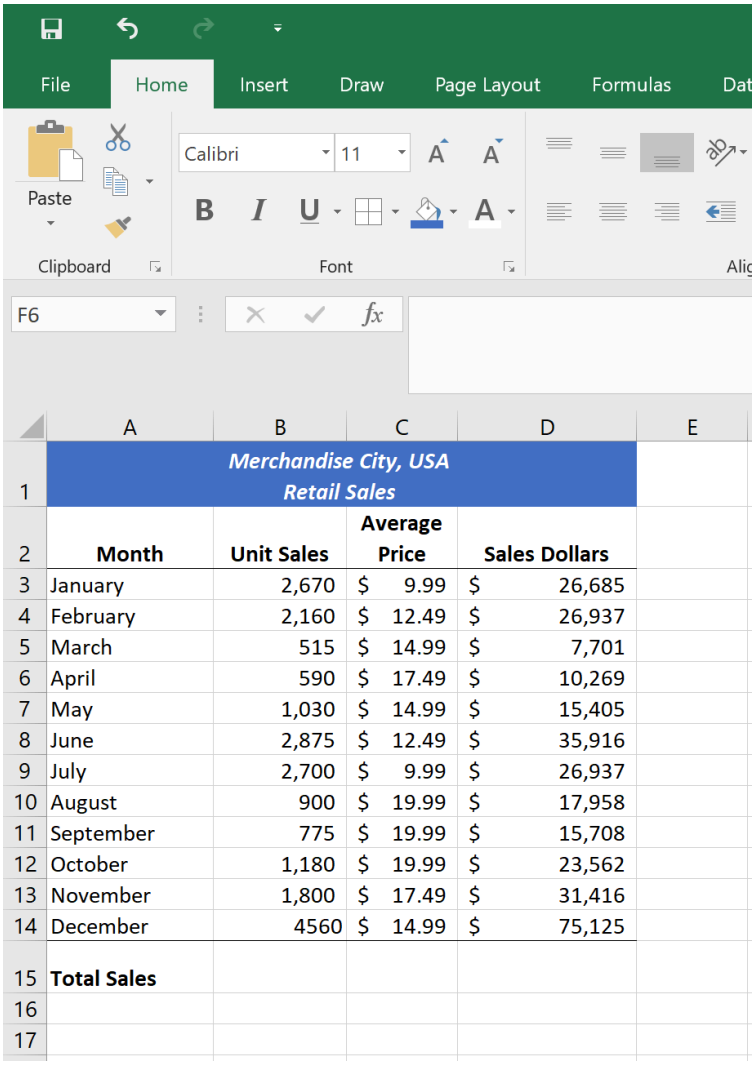
Merge Cells

1. Highlight a range of cells that will be merged.
2. Click the Home tab of the Ribbon.
3. Click the down arrow next to the Merge & Center button.
4. Select an option from the Merge & Center list.

ENTERING MULTIPLE LINES OF TEXT

In the Sheet1 worksheet, the cells in the range A1:D1 were merged for the purposes of adding a title to the worksheet. This worksheet will contain both a title and a subtitle. The following steps explain how you can enter text into a cell and determine where you want the second line of text to begin:

1. Click cell A1. Since the cells were merged, clicking cell A1 will automatically activate the range A1:D1. Position your mouse to the end of the title, directly after the "A" in the word "USA" and double-click to get a cursor (flashing I-beam).
2. Hold down the ALT key and press the ENTER key. This will start a new line of text in this cell location.
3. Type the text **Retail Sales** and press the ENTER key.
4. Select cell A1. Then click the Bold buttons in the Font group of commands in the Home tab of the Ribbon so that the titles are now in Bold and Italics.
5. Increase the height of Row 1 to 30 points. Once the row height is increased, all the text typed into the cell will be visible (see **Figure 1.39**).



	A	B	C	D	E
1	*Merchandise City, USA* *Retail Sales*				
2	**Month**	**Unit Sales**	**Average Price**	**Sales Dollars**	
3	January	2,670	$ 9.99	$ 26,685	
4	February	2,160	$ 12.49	$ 26,937	
5	March	515	$ 14.99	$ 7,701	
6	April	590	$ 17.49	$ 10,269	
7	May	1,030	$ 14.99	$ 15,405	
8	June	2,875	$ 12.49	$ 35,916	
9	July	2,700	$ 9.99	$ 26,937	
10	August	900	$ 19.99	$ 17,958	
11	September	775	$ 19.99	$ 15,708	
12	October	1,180	$ 19.99	$ 23,562	
13	November	1,800	$ 17.49	$ 31,416	
14	December	4560	$ 14.99	$ 75,125	
15	**Total Sales**				
16					
17					

Figure 1.39 Title & Subtitle Added to the Worksheet

Skill Refresher

Entering Multiple Lines of Text

1. Activate a cell location.
2. Type the first line of text.
3. Hold down the ALT key and press the ENTER key.
4. Type the second line of text and press the ENTER key.

BORDERS (ADDING LINES TO A WORKSHEET)

In Excel, adding custom lines to a worksheet is known as adding borders. Borders are different from the grid lines that appear on a worksheet and that define the perimeter of the cell locations. The Borders command lets you add a variety of line styles to a worksheet that can make reading the worksheet much easier. The following steps illustrate methods for adding preset borders and custom borders to a worksheet:

1. Click the down arrow to the right of the Borders button in the Font group of commands in the Home page of the Ribbon to view border options. (see **Figure 1.40**).

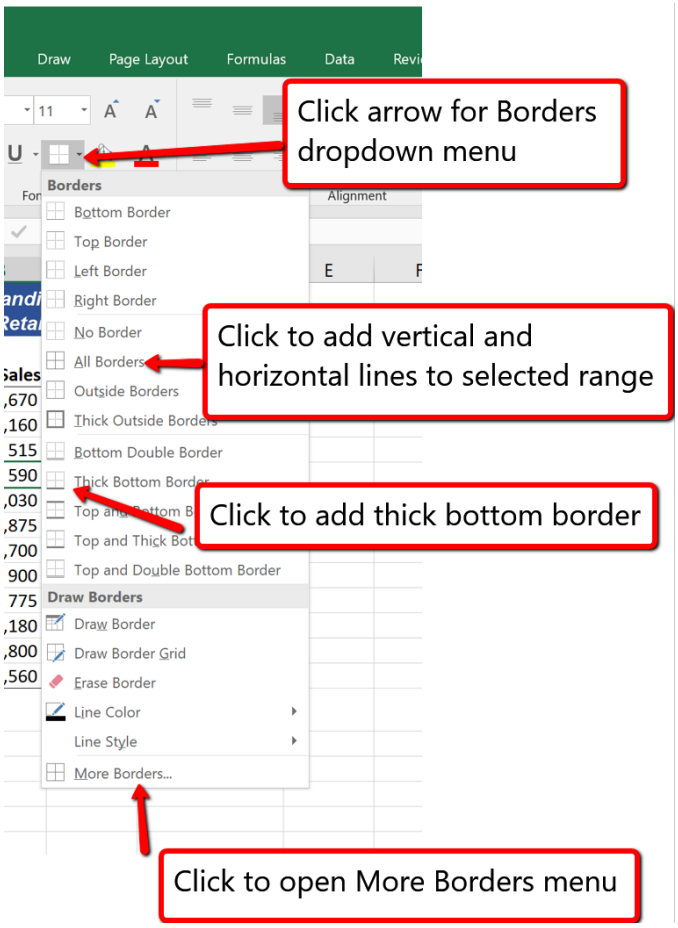


Figure 1.40 Borders Dropdown Menu

2. Select the range A1:D15. Left click the All Borders option from the Borders drop-down menu (see **Figure 1.40**). This will add vertical and horizontal lines to the range A1:D15.
3. Select the range A2:D2 .
4. Click the down arrow to the right of the Borders button.
5. Left click the Thick Bottom Border option from the Borders drop-down menu.
6. Select the range A14:D14 and apply a Thick Bottom Border from the drop-down menu. The thick border will help maintain the Excel Formatting Guidelines.

7. Select the range A1:D15.
8. Click the down arrow to the right of the Borders button.
9. Click More Borders... at the bottom of the List.
10. This will open the Format Cells dialog box (see **Figure 1.41**). You can access all formatting commands in Excel through this dialog box.
11. In the Style section of the Borders tab, click the thickest line style (see **Figure 1.41**).
12. Click the Outline button in the Presets section (see **Figure 1.41**).
13. Click the OK button at the bottom of the dialog box (see **Figure 1.41**).

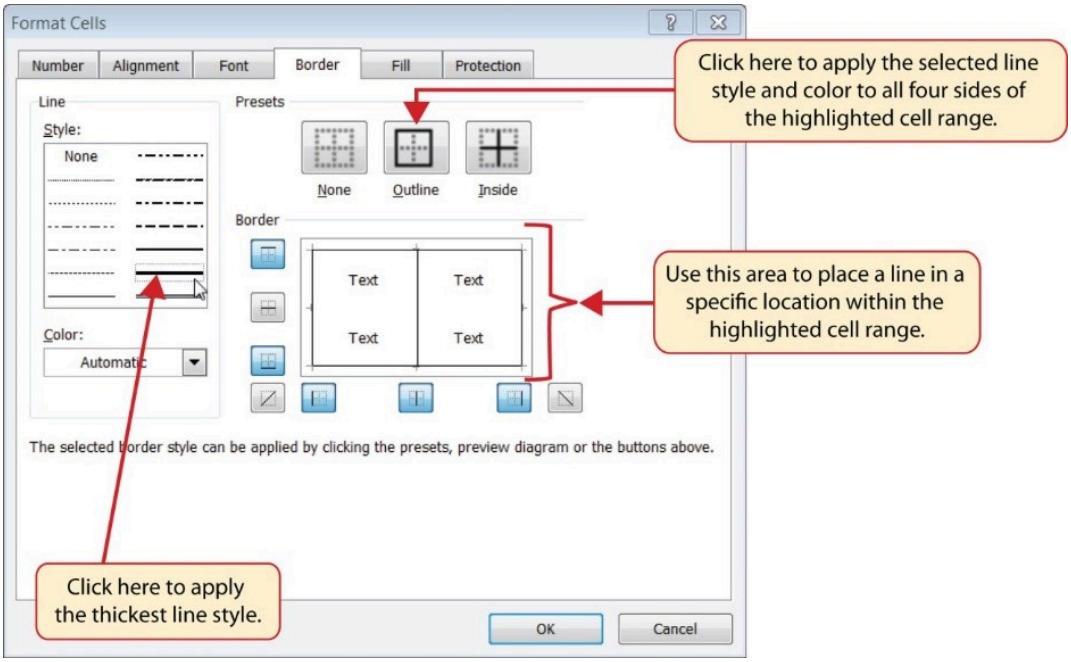
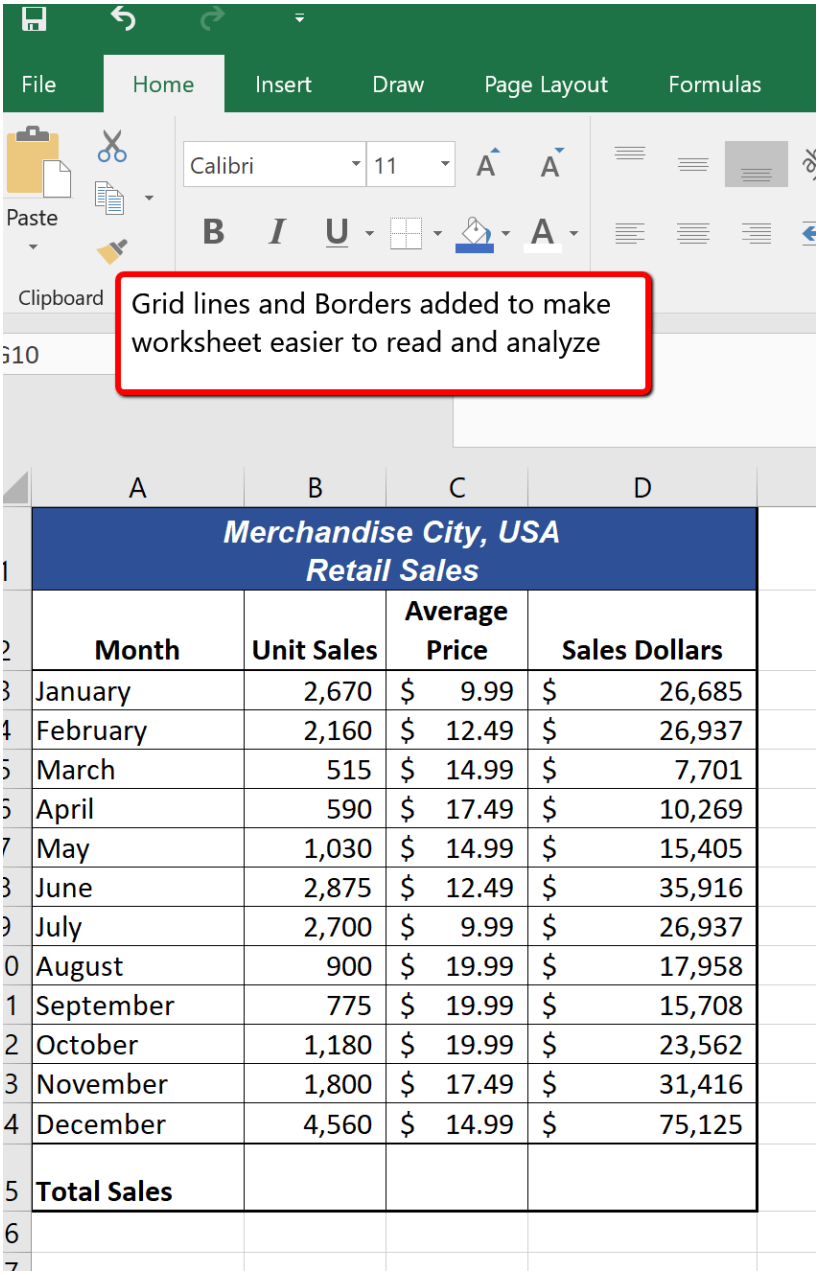


Figure 1.41 Borders Tab of the Format Cells Dialog Box



	A	B	C	D
1	Merchandise City, USA Retail Sales			
2	**Month**	**Unit Sales**	**Average Price**	**Sales Dollars**
3	January	2,670	$ 9.99	$ 26,685
4	February	2,160	$ 12.49	$ 26,937
5	March	515	$ 14.99	$ 7,701
6	April	590	$ 17.49	$ 10,269
7	May	1,030	$ 14.99	$ 15,405
8	June	2,875	$ 12.49	$ 35,916
9	July	2,700	$ 9.99	$ 26,937
10	August	900	$ 19.99	$ 17,958
11	September	775	$ 19.99	$ 15,708
12	October	1,180	$ 19.99	$ 23,562
13	November	1,800	$ 17.49	$ 31,416
14	December	4,560	$ 14.99	$ 75,125
15	**Total Sales**			
16				

Figure 1.42 Borders Added to the Worksheet

Skill Refresher

Preset Borders

1. Highlight a range of cells that require borders.

2. Click the Home tab of the Ribbon.
3. Click the down arrow next to the Borders button.
4. Select an option from the preset borders list.

Custom Borders

1. Highlight a range of cells that require borders.
2. Click the Home tab of the Ribbon.
3. Click the down arrow next to the Borders button.
4. Select the More Borders option at the bottom of the options list.
5. Select a line style and line color.
6. Select a placement option.
7. Click the OK button on the dialog box.

AUTOSUM

You will see at the bottom of Figure 1.42 that Row 15 is intended to show the totals for the data in this worksheet. Applying mathematical computations to a range of cells is accomplished through functions in Excel. Chapter 2 will review mathematical formulas and functions in detail. However, the following steps will demonstrate how you can quickly sum the values in a column of data using the AutoSum command:

1. Click cell B15 in the Sheet1 worksheet.
2. Click the Formulas tab of the Ribbon.
3. Click the down arrow below the AutoSum button in the Function Library group of commands (see **Figure 1.43**). *Note that the AutoSum button can also be found in the Editing group of commands in the Home tab of the Ribbon.*

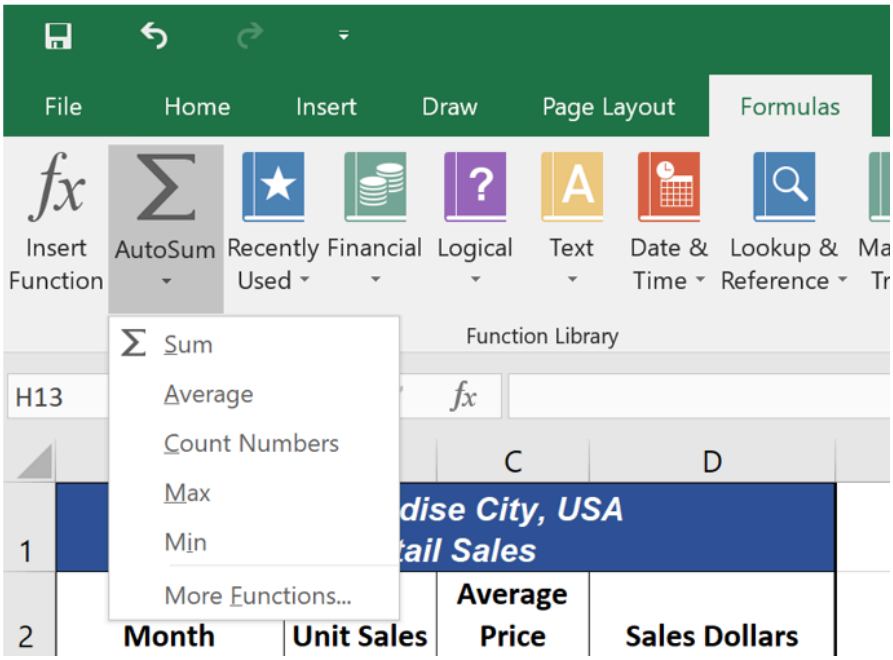


Figure 1.43 AutoSum List

4. Click the Sum option from the AutoSum drop down menu. The first click will display a flashing marquee around the range. Click the check mark next to the Formula bar to complete the function.
5. Excel will provide a total for the values in the Unit Sales column.
6. Click cell D15. It would not make sense to total the averages in column C so C15 will be left blank.
7. Repeat steps 3 through 5 to sum the values in the Sales Dollars column (see **Figure 1.44**).
8. Click cell C15 to explore other AutoSum selections. Select the COUNT function from the list; Excel will return "12" for the number of months (rows). Excel will also display indicators of a green arrow in the corner of C15 and an exclamation point in yellow. These indicate that the function in this cell varies from the other functions in row 15. They can be ignored and do not print.
9. Click cell C15 again; this time selecting the MAX option from the list. Excel will display $19.99. This reflects the Maximum Average Price in column C.
10. Click cell C15 and delete the contents in this cell.

	A	B	C	D
	Merchandise City, USA Retail Sales			
	Month	Unit Sales	Average Price	Sales Dollars
	January	2,670	$ 9.99	$ 26,685
	February	2,160	$ 12.49	$ 26,937
	March	515	$ 14.99	$ 7,701
	April	590	$ 17.49	$ 10,269
	May	1,030	$ 14.99	$ 15,405
	June	2,875	$ 12.49	$ 35,916
	July	2,700	$ 9.99	$ 26,937
0	August	900	$ 19.99	$ 17,958
1	September	775	$ 19.99	$ 15,708
2	October	1,180	$ 19.99	$ 23,562
3	November	1,800	$ 17.49	$ 31,416
4	December	4,560	$ 14.99	$ 75,125
5	**Total Sales**	21,755		$ 313,619
6				

Figure 1.44 Totals Added to the Sheet1 Worksheet

Skill Refresher

AutoSum

1. Highlight a cell location below or to the right of a range of cells that contain numeric values.
2. Click the Formulas tab of the Ribbon.
3. Click the down arrow below the AutoSum button.
4. Select a mathematical function from the list.

MOVING, RENAMING, INSERTING, AND DELETING WORKSHEETS

The default names for the worksheet tabs at the bottom of workbook are Sheet1, Sheet2, and so on. However, you can change the worksheet tab names to identify the data you are using in a

workbook. Additionally, you can change the order in which the worksheet tabs appear in the workbook. The following steps explain how to rename and move the worksheets in a workbook:

1. Double click the Sheet1 worksheet tab at the bottom of the workbook (see **Figure 1.45**). Type the name **Sales by Month**.
2. Press the ENTER key on your keyboard.
3. Click the + to the right of the newly named worksheet.
4. Type the name **Unit Sales Rank** to prepare the worksheet for future use.
5. Press the ENTER key on your keyboard.

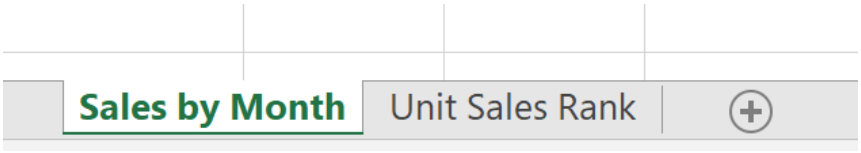


Figure 1.45 Renaming a Worksheet Tab

1. Click the + to add another worksheet tab.
2. Click the Home tab of the Ribbon.
3. Click the down arrow on the Delete button in the Cells group of commands.
4. Click the Delete Sheet option from the drop-down list. This removes the unneeded worksheet.
5. Click the Delete button on the Delete warning box (if a warning box appears).
6. Complete the steps above to delete the newly named **Unit Sales Rank** worksheet since it's decided that worksheet is also unnecessary so that you are left with just one worksheet.
7. Excel incorporates **Spell Check** which is located on the **Review** Ribbon. Clicking on the tool will allow Excel to check Spelling of alphabetic entries and allow for corrections. It's a good habit to always use Spell Check your work before saving/printing.

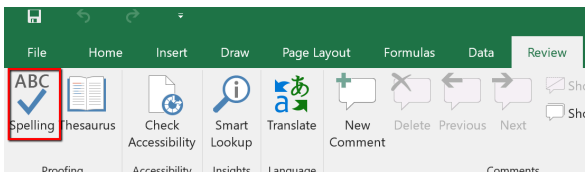


Figure 1.45a Spell Check Tool

8. Save the changes to your workbook by clicking either the **Save** button on the Home ribbon; or by selecting the **Save** option from the File menu.

Integrity Check

Deleting Worksheets

Be very cautious when deleting worksheets that contain data. Once a worksheet is deleted, you cannot use the Undo command to bring the sheet back. Deleting a worksheet is a permanent command.

Keyboard Shortcuts

Inserting New Worksheets

- Press the SHIFT key and then the F11 key on your keyboard. Same for Excel for Mac.

Figure 1.46 shows the final appearance of the Merchandise City, USA workbook.

	A	B	C	D
1	**Merchandise City, USA Retail Sales**			
2	**Month**	**Unit Sales**	**Average Price**	**Sales Dollars**
3	January	2,670	$ 9.99	$ 26,685
4	February	2,160	$ 12.49	$ 26,937
5	March	515	$ 14.99	$ 7,701
6	April	590	$ 17.49	$ 10,269
7	May	1,030	$ 14.99	$ 15,405
8	June	2,875	$ 12.49	$ 35,916
9	July	2,700	$ 9.99	$ 26,937
10	August	900	$ 19.99	$ 17,958
11	September	775	$ 19.99	$ 15,708
12	October	1,180	$ 19.99	$ 23,562
13	November	1,800	$ 17.49	$ 31,416
14	December	4,560	$ 14.99	$ 75,125
15	**Total Sales**	21,755		$ 313,619
16				
17				

Figure 1.46 Final Appearance of the Merchandise City, USA Workbook

Skill Refresher

Renaming Worksheets

1. Double click the worksheet tab.
2. Type the new name.
3. Press the ENTER key.

Moving Worksheets

1. Left click the worksheet tab.
2. Drag it to the desired position.

Deleting Worksheets

1. Open the worksheet to be deleted.
2. Click the Home tab of the Ribbon.
3. Click the down arrow on the Delete button.
4. Select the Delete Sheet option.
5. Click Delete on the warning box.

Key Takeaways

- Formatting skills are critical for creating worksheets that are easy to read and have a professional appearance.
- A series of pound signs (####) in a cell location indicates that the column is too narrow to display the number entered.
- Using the Wrap Text command allows you to stack multiword column headings vertically in a cell location, reducing the need to expand column widths.
- Use the Merge & Center command to center the title of a worksheet directly over the columns that contain data.
- Adding borders or lines will make your worksheet easier to read and helps to separate the data in each column and row.
- You cannot use the Undo command to bring back a worksheet that has been deleted.

ATTRIBUTION

1.4 Printing

Learning Objectives

- Use the Page Layout tab to prepare a worksheet for printing.
- Add headers and footers to a printed worksheet.
- Examine how to print worksheets and workbooks.

Once you have completed a workbook, it is good practice to select the appropriate settings for printing. These settings are in the Page Layout tab of the Ribbon and discussed in this section of the chapter.

PAGE SETUP

Before you can properly print the worksheets in a workbook, you must establish appropriate settings. The following steps explain several of the commands in the Page Layout tab of the Ribbon used to prepare a worksheet for printing:

1. Open the **CH1 Merchandise City Sales Data** workbook, if it is not already open.
2. Click the Page Layout tab of the Ribbon.
3. Click the Margins button in the Page Setup group of commands. This will open a drop-down list of options for setting the margins of your printed document.
4. Click the Wide option from the Margins drop-down list. (see **Figure 1.47**)
5. Click the Orientation button in the Page Setup and select Landscape.
6. Click on the arrow to the bottom right of the Page Setup category to launch the Page Setup options dialog box. Mac Users: there is no "arrow at the bottom right of the Page Setup category". Simply click the Page Setup button 

on the Page Layout tab.
7. Click the Margins tab and locate "Center on Page". Click the boxes to **Horizontally** and **Vertically** center the data on the worksheet. Click OK.

Why?

Use Print Settings

Because professionals often share Excel workbooks, it is a good practice to select the appropriate print settings in the Page Layout tab even if you do not intend to print the worksheets in a workbook. It can be extremely frustrating for recipients of a workbook who wish to print your worksheets to find that the necessary print settings have not been selected. This may reflect poorly on your attention to detail, especially if the recipient of the workbook is your boss.

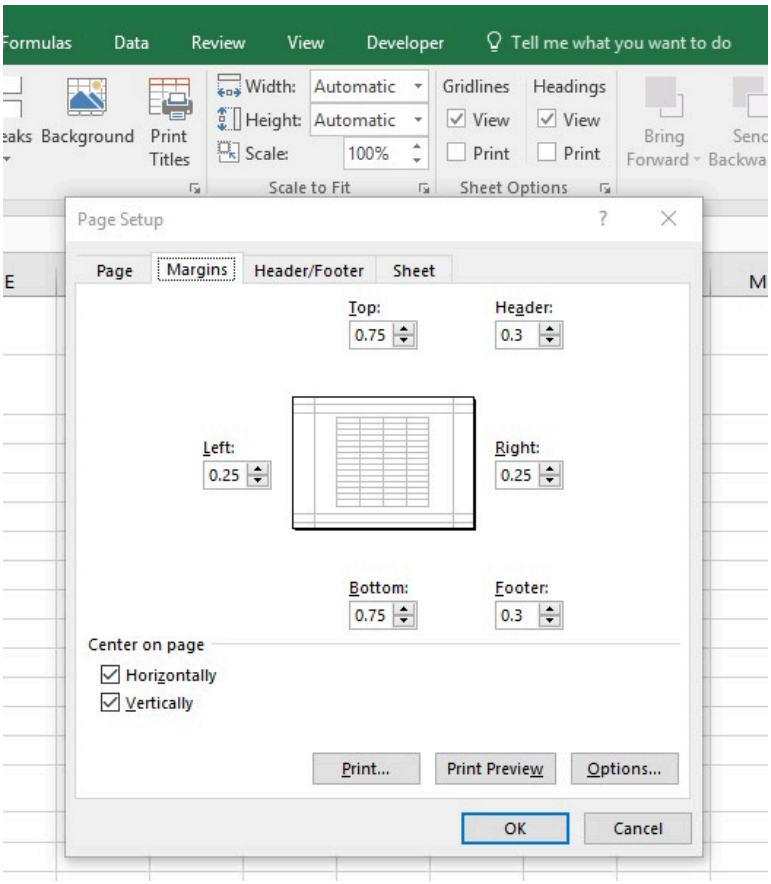


Figure 1.47 Page Layout Commands for Printing

Table 1.2 Printing Resources: Purpose and Use for Page Setup Commands

Command	Purpose	Use
Margins	Sets the top, bottom, right, and left margin space for the printed document	1. Click the Page Layout tab of the Ribbon. 2. Click the Margin button. 3. Click one of the preset margin options or click Custom Margins.
Orientation	Sets the orientation of the printed document to either portrait or landscape	1. Click the Page Layout tab of the Ribbon. 2. Click the Orientation button. 3. Click one of the preset orientation options.
Size	Sets the paper size for the printed document	1. Click the Page Layout tab of the Ribbon. 2. Click the Size button. 3. Click one of the preset paper size options or click More Paper Sizes.
Print Area	Used for printing only a specific area or range of cells on a worksheet	1. Highlight the range of cells on a worksheet that you wish to print. 2. Click the Page Layout tab of the Ribbon. 3. Click the Print Area button. 4. Click the Set Print Area option from the drop-down list.
Breaks	Allows you to manually set the page breaks on a worksheet	1. Activate a cell on the worksheet where the page break should be placed. Breaks are created above and to the left of the activated cell. 2. Click the Page Layout tab of the Ribbon. 3. Click the Breaks button. 4. Click the Insert Page Break option from the drop-down list.
Background	Adds a picture behind the cell locations in a worksheet	1. Click the Page Layout tab of the Ribbon. 2. Click the Background button. 3. Select a picture stored on your computer or network.
Print Titles	Used when printing large data sets that are several pages long. This command will repeat the column headings at the top of each printed page.	1. Click the Page Layout tab of the Ribbon. 2. Click the Print Titles button. 3. Click in the Rows to Repeat at Top input box in the Page Setup dialog box. 4. Click any cell in the row that contains the column headings for your worksheet. 5. Click the OK button at the bottom of the Page Setup dialog box.

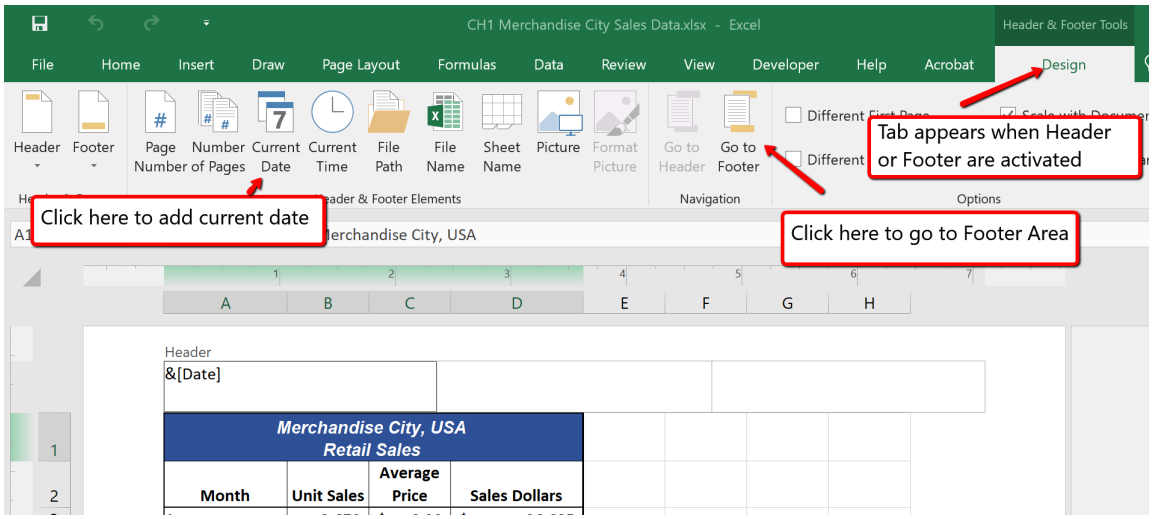
HEADERS AND FOOTERS

When printing worksheets from Excel, it is common to add headers and footers to the printed document. Information in the header or footer could include the date, page number, file name, company name, and so on. The following steps explain how to add headers and footers to the Merchandise City, USA Retail Sales worksheet.

1. Click the **Insert** Ribbon and click on **Header & Footer** at the right end of the ribbon

(located in the **Text** group). You will see the Design tab added to the Ribbon; this is used for creating the headers and footers for the printed worksheet. Also, this will convert the view of the worksheet from Normal to Page Layout (see **Figure 1.48**). This Page Layout view makes adding Headers & Footers easy and provides key features to incorporate.

2. Click on the Current Date icon to add the date to the left section of the worksheet Header. The &[Date] symbols which will toggle to a Date format when you click outside of this area.



1.48 Design Tab for Creating Headers and Footers

Figure 1.48 Design Tab for Creating Headers and Footers

3. Type your name in the center section of the Header.
4. Place the mouse pointer over the left section of the Header and left click (see **Figure 1.48**).
5. Click the Go to Footer button in the Navigation group of commands in the Design tab of the Ribbon.
6. Place the mouse pointer over the far right section of the footer and left click.
7. Click the Page Number button (you may need to click on the Design tab again) in the Header & Footer Elements group of commands in the Design tab of the Ribbon. This view will display as &[Page] until printed or until you return to normal view.
8. Click any cell location outside the header or footer area. The Design tab for creating headers and footers will disappear.
9. Click the Normal view button in the lower right side of the Status Bar (see **Figure 1.49**).

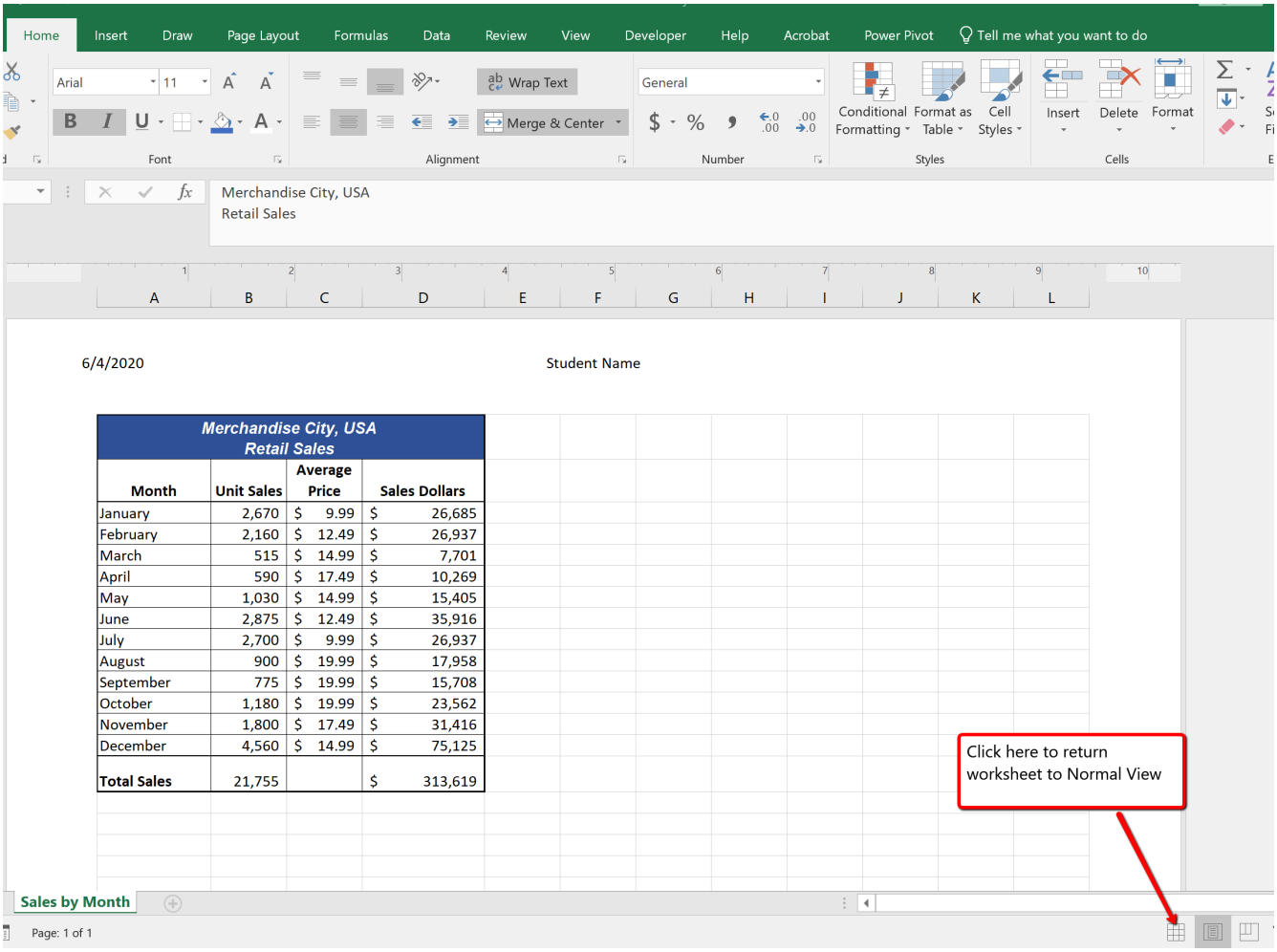


Figure 1.49 Worksheet in Page Layout View

PRINTING WORKSHEETS AND WORKBOOKS

Once you have established the print settings for the worksheets in a workbook and have added headers and footers, you are ready to print your worksheets. The following steps explain how to print the worksheets in the **Merchandise City, USA Sales** workbook:

1. Click the File tab on the Ribbon.
2. Click the Print option on the left side of the Backstage view (see **Figure 1.50**). On the right side of the Backstage view, you will be able to see a preview of your printed worksheet.

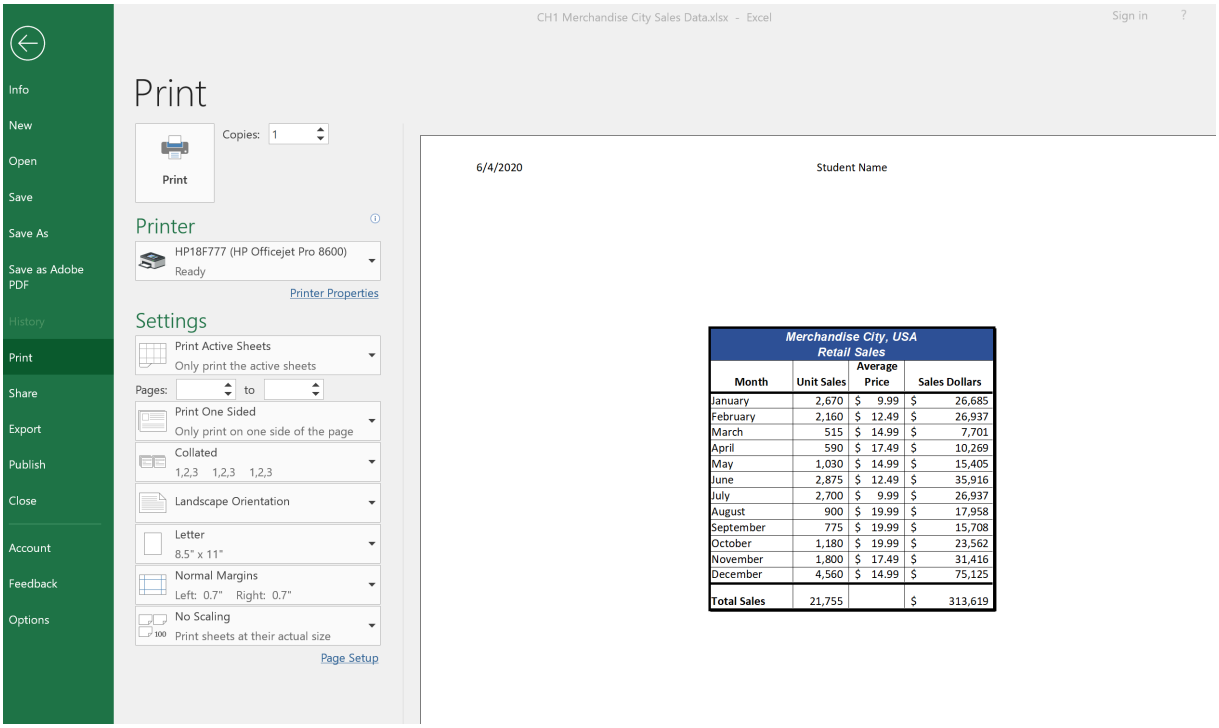


Figure 1.50 Backstage View Print option

3. Click the Print Active Sheets button in the Print section of the Backstage view (see **Figure 1.50**).
4. If your instructor has asked you to print your work, click the Print button.
5. Click the Home tab of the Ribbon.
6. Save and close the workbook.

Key Takeaways

- The commands in the Page Layout tab of the Ribbon are used to prepare a worksheet for printing.
- You can add headers and footers to a worksheet to show key information such as page numbers, the date, the file name, your name, and so on.
- The Print commands are in the File tab of the Ribbon.

ATTRIBUTION

1.5 Chapter Practice

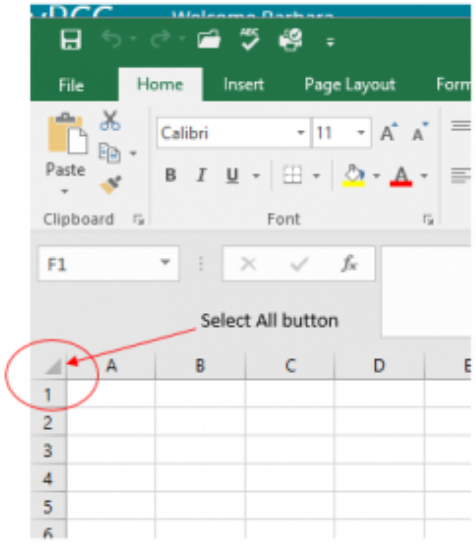
To assess your understanding of the material covered in the chapter, complete the following assignment.

BASIC MONTHLY BUDGET FOR MEDICAL OFFICE

Download Data File: PR1 Data

Creating and maintaining budgets are common practices in many careers. Budgets play a critical role in helping a business or household control expenditures. In this exercise you will create a budget for a hypothetical medical office while reviewing the skills covered in this chapter.

1. Open the file name **PR1 Data**, then Save As **PR1 Medical Office Budget**.
2. Activate all the cell locations in the Sheet1 worksheet by clicking the Select All button in



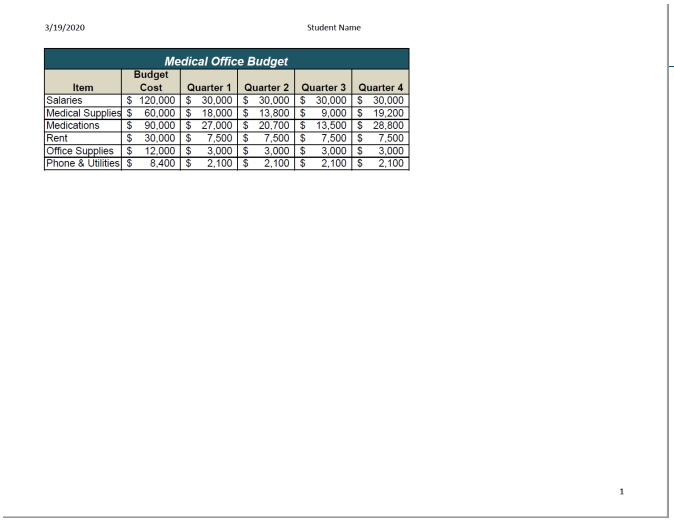
   the upper left corner of the worksheet.
3. In the Home tab of the Ribbon, set the font style to Arial and the font size to 12 points. Then click any cell to Deselect.
4. Increase the width of Column A so all the entries in the range A3:A8 are visible. Place the mouse pointer between the letter A and letter B of Column A and Column B. When the mouse pointer changes to a double arrow, left click and drag it to the right until the char-

acter width is approximately 18.00.

5. Enter **Quarter 1** in cell B2.
6. Use AutoFill to complete the headings in the range C2:E2. Activate cell B2 and place the mouse pointer over the Fill Handle.
7. Select the range B2:E2 and click the Format button in the Home tab of the Ribbon. Click the Column Width option, type 11.57 in the Column Width dialog box, and then click the OK button in the Column Width dialog box.
8. Enter the words **Medical Office Budget** in cell A1.
9. Insert a blank column between Columns A and B by clicking on any cell in Column B. Then, click the drop-down arrow of the Insert button in the Home tab of the Ribbon. Click the Insert Sheet Columns option.
10. Enter the words **Budget Cost** in cell B2.
11. Adjust the width of Column B to approximately 12.0 characters.
12. Select the range A1:F1 and click the Merge & Center button in the Home tab of the Ribbon to merge the cells in that range.
13. Make the following format adjustments to the range A1:F1: bold; italics; change the font size to 14 points; change the cell fill color to Aqua, Accent 5, Darker 50%; and change the font color to white.
14. Increase the height of Row 1 to approximately 24.75 points.
15. Make the following format adjustment to the range A2:F2: bold; and fill color to Tan, Background 2, Darker 10%. Center the column titles so that they are horizontally centered in each cell.
16. Select B2 and choose the Wrap Text button in the Home tab of the Ribbon. Increase the height of Row 2 to approximately 30 points.
17. Copy cell C3 and paste the contents into the range D3:F3.
18. Copy the contents in the range C6:C8 by highlighting the range and clicking the Copy button in the Home tab of the Ribbon. Then, highlight the range D6:F8 and click the Paste button in the Home tab of the Ribbon.
19. Calculate the total budget for all four quarters for the salaries. Click cell B3 and click the down arrow on the AutoSum button in the Formulas tab of the Ribbon. Click the Sum option from the drop-down list. Then, highlight the range C3:F3 and press the ENTER key on your keyboard.
20. Copy the formula in cell B3 and paste them into the range B4:B8.
21. Format the range B3:F8 with Accounting format and zero decimal places.
    If any of the cells display pound symbols (######), simply widen the column to display the values again.
22. Select the range A1:F8 and click the down arrow next to the Borders button in the Home

tab of the Ribbon. Select the All Borders option from the drop-down list.

23. Double click the Sheet1 worksheet tab to change the name of Sheet1 to the word **Budget**, and press the ENTER key. Delete any unnecessary worksheets.
24. Change the orientation of the Budget worksheet so it prints landscape instead of portrait.
25. Use Fit to 1 page so the Budget worksheet prints on one piece of paper, if it does not already.
26. Add a header to the Budget worksheet that shows the date in the upper left corner and your name in the center.
27. Add a footer to the Budget worksheet that shows the page number in the lower right corner.
28. Check the spelling on the worksheet and make any necessary changes. Save **PR1 Medical Office Budget** workbook.
29. Compare your work to the screenshot below and then submit the **PR1 Medical Office Budget** workbook as directed by your instructor.



3/19/2020 Student Name

Medical Office Budget					
Item	Budget Cost	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Salaries	$ 120,000	$ 30,000	$ 30,000	$ 30,000	$ 30,000
Medical Supplies	$ 60,000	$ 18,000	$ 13,800	$ 9,000	$ 19,200
Medications	$ 90,000	$ 27,000	$ 20,700	$ 13,500	$ 28,800
Rent	$ 30,000	$ 7,500	$ 7,500	$ 7,500	$ 7,500
Office Supplies	$ 12,000	$ 3,000	$ 3,000	$ 3,000	$ 3,000
Phone & Utilities	$ 8,400	$ 2,100	$ 2,100	$ 2,100	$ 2,100

1

PR 1 Medical Office Budget Solution Screenshot

ATTRIBUTION

1.6 Scored Assessment

SALES AND INVENTORY ITEMS

Download Data File: SC1 Data

A key activity for marketing professionals is to analyze projected sales and inventory information. This is especially important for retail environments. This exercise utilizes the skills covered in this chapter to analyze sales and inventory data.

1. Open the file named **SC1 Data** and then Save As **SC1 Sales and Inventory**
2. In the Sheet1 worksheet, enter the word Totals in cell C14.
3. Format all the cells in Sheet1 to Century font style and a 12-point font size.
4. Set the column width for Columns A through G to 13.5.
5. Edit the entry in cell B2 to read "**Item Number**."
6. Use AutoFill to fill the Item Numbers from B3 into the range B4:B13. The item numbers should increase by one as they are filled through the range.
7. Copy the contents of cell A3 and paste them into the range A4:A8.
8. Delete Column F.
9. Format the range A1:F2 so the text is Bold.
10. Set the alignment in the range A2:F2 to Wrap Text.
11. Prepare A1:F1 for the title text by changing the fill color of the cells in the range A1:F1 to Red, Accent 2, Darker 25%.
12. Make the following font changes to the range A1:F1: set the font color to white, add italics, and set the font size to 14.
13. Merge and center the cells in the range A1:F1.
14. Enter the title for this worksheet in the range A1:F1. The title should appear on two lines. The first line should read **Status Report**. The second line should read **Sales and Inventory by Item**.
15. Increase the height of Row 1 so the entire title is visible.
16. Format the values in the range C3:C13 with dollar signs and two decimal places.

17. Format the values in the range E3:F13 with comma style, zero decimal places.
18. In cell E14, use AutoSum to calculate the sum of the values in the range E3:E13.
19. In cell F14, use AutoSum to calculate the sum of the values in the range F3:F13.
20. Apply All Borders to the range A1:F14.
21. Add a thick bottom border to row 2; add a thick bottom border to row 13.
22. Add a thick line border around the perimeter of the range A1:F14.
23. Insert a new blank worksheet in the workbook (this will be Sheet4).
24. Delete Sheet3.
25. Move Sheet4 ahead of Sheet2 so the order of the worksheets is Sheet1, Sheet4, and Sheet2.
26. Rename the Sheet1 worksheet tab to "**Status Report**."
27. Change the orientation of the Status Report worksheet so it prints landscape instead of portrait.
28. Add a header to the Status Report worksheet that shows the date (needs to update) in the upper left corner and your name in the center.
29. Add a footer to the Status Report worksheet that shows the page number in the lower right corner with the word "**Page**" before the number.
30. Center the worksheet both horizontally and vertically on the sheet.
31. Check the spelling of the worksheet and make any necessary changes. Save the **SC1 Sales and Inventory** workbook.
32. Submit the **SC1 Sales and Inventory** workbook as directed by your instructor.

ATTRIBUTION

CHAPTER 2 – MATHEMATICAL COMPUTATIONS

Perhaps the most valuable feature of Excel is its ability to produce mathematical outputs using the data in a workbook. This chapter reviews several mathematical outputs that you can produce in Excel through the construction of formulas and functions. The chapter begins with the construction of formulas for basic and complex mathematical computations. The second section reviews statistical functions, such as SUM, AVERAGE, MIN, and MAX, which can be applied to a range of cells. The last section of the chapter addresses functions used to calculate mortgage and lease payments as well as the valuation of investments. This chapter also shows how you can use data from multiple worksheets to construct formulas and functions. These skills will be demonstrated in the context of a personal cash budget, which is a vital tool for managing your money for long-term financial security. The personal budget objective will also provide you with several opportunities to demonstrate Excel's what-if scenario capabilities, which highlight how formulas and functions automatically produce new outputs when one or more inputs are changed.

ATTRIBUTION

2.1 Formulas

Learning Objectives

- Learn how to create basic formulas.
- Understand relative referencing when copying and pasting formulas.
- Work with complex formulas by controlling the order of mathematical operations.
- Understand formula auditing tools.

This section reviews the fundamental skills for entering formulas into an Excel worksheet. The example used for this chapter is the construction of a personal budget. Most financial advisors recommend that all households construct and maintain a personal budget to achieve and maintain strong financial health. Organizing and maintaining a personal budget is a skill you can practice at any point in your life. Whether you are managing your expenses during college or maintaining the finances of a family of four, a personal budget can be a vital tool when making financial decisions. Excel can make managing your money a fun and rewarding exercise.

OPEN THE DATA FILE

Download Data File: CH2 Data

1. Open the Data file named **CH2 Data** and use the File/Save As command to save it with the new name **CH2 Personal Budget**.

Figure 2.1 shows the completed workbook that will be demonstrated in this chapter. Notice that this workbook contains four worksheets. The first worksheet, **Budget Summary**, serves as an overview of the data that was entered and calculated in the second and third worksheets, **Budget Detail** and **Loan Payments**. The second worksheet, **Budget Detail**, provides a detailed list of all the expenses and the third worksheet, **Loan Payments**, provides information regarding car payment and mortgage payment amounts. The last worksheet, **Prepare to Print**, has data that is unrelated to the budget worksheets but will be used in Section 2.4 – Preparing to Print.

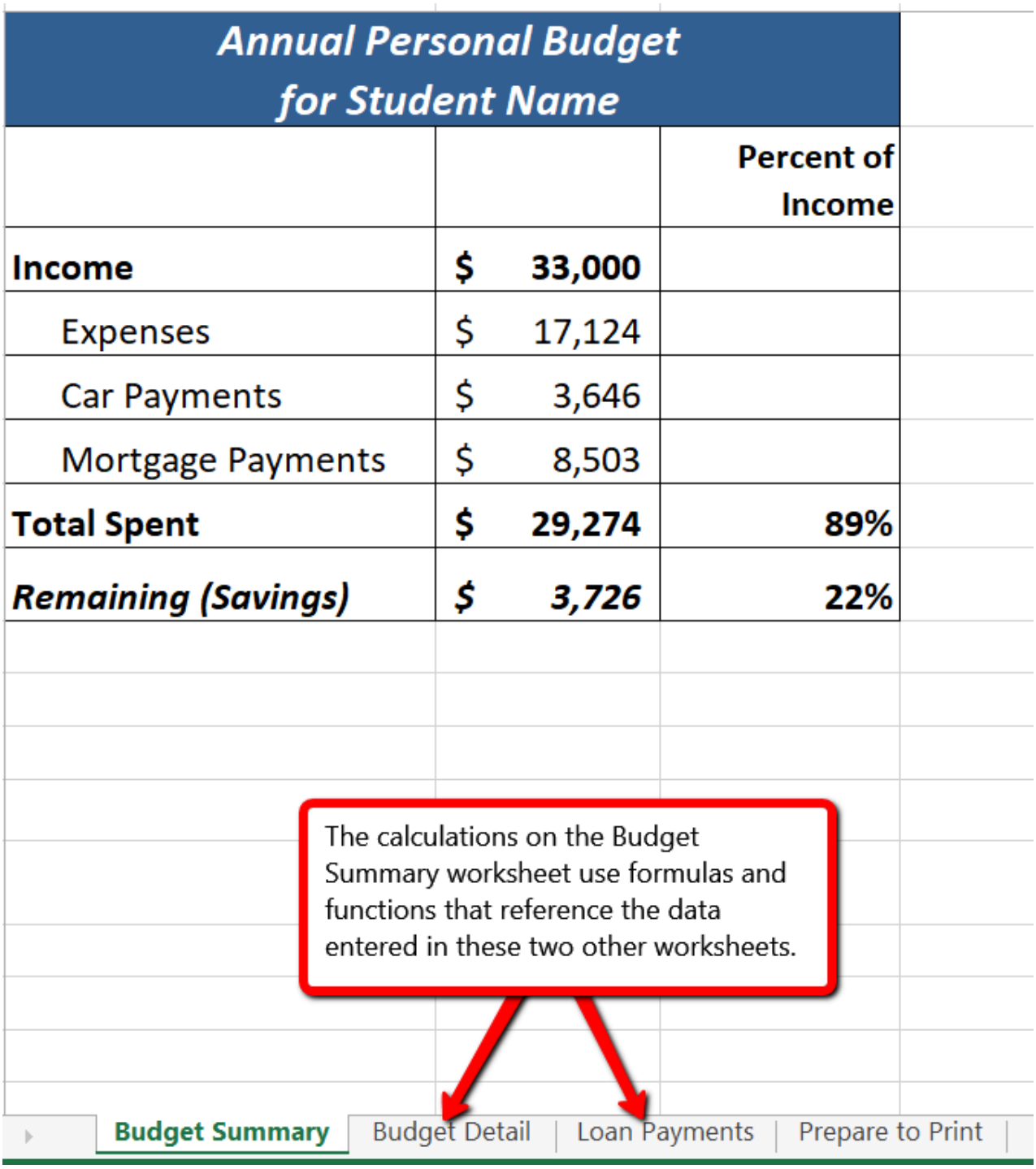


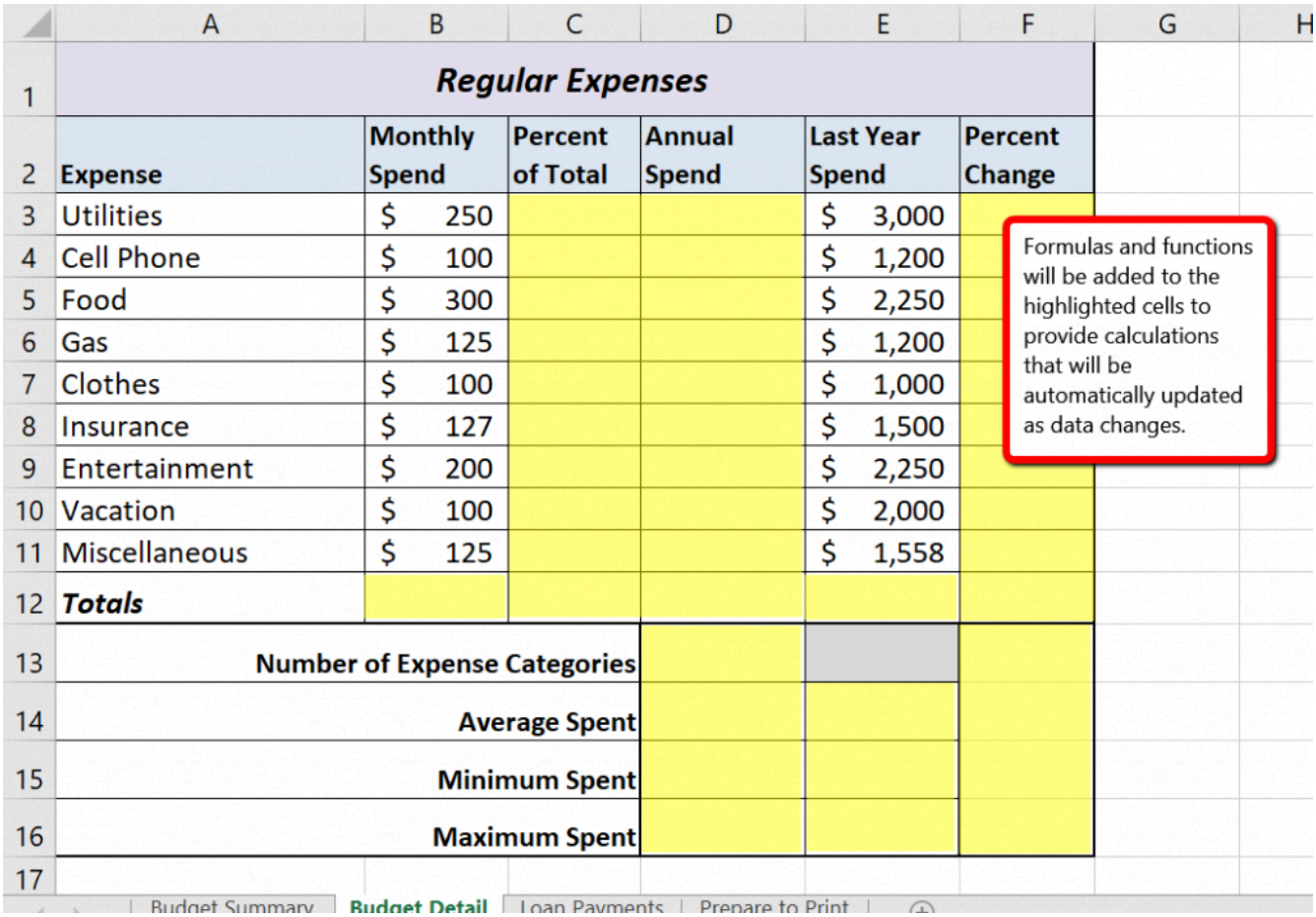
Figure 2.1 – The completed Budget Summary worksheet

CREATING A BASIC FORMULA

When formulas and cell references are used Excel will automatically recalculate when data is changed

Formulas are used to calculate a variety of mathematical outputs in Excel and can be used to create virtually any custom calculation required for your objective. Furthermore, when constructing a formula in Excel, you use cell addresses that, when added to a formula, become cell references. This means that Excel uses, or references, the number entered into the cell location when performing the calculation. As a result, when the numbers in the cells that are referenced are changed, Excel automatically recalculates the formula and produces a new result. This is what gives Excel the ability to create a variety of what-if scenarios, which will be explained later in the chapter.

To demonstrate the construction of a basic formula, we will begin working on the **Budget Detail** worksheet, which is shown in **Figure 2.2**. To complete this worksheet, we will enter some data, and then create several formulas and functions. **Table 2.1** provides definitions for each of the spend categories listed in the range A3:A11. When you develop a personal budget, these categories are defined on the basis of how you spend your money. It is likely that every person could have different categories or define the same categories differently. Therefore, it is important to review the definitions in **Table 2.1** to understand how we are defining these categories before proceeding.



	A	B	C	D	E	F	G	H
1	***Regular Expenses***							
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Year Spend**	**Percent Change**		
3	Utilities	$ 250			$ 3,000			
4	Cell Phone	$ 100			$ 1,200			
5	Food	$ 300			$ 2,250			
6	Gas	$ 125			$ 1,200			
7	Clothes	$ 100			$ 1,000			
8	Insurance	$ 127			$ 1,500			
9	Entertainment	$ 200			$ 2,250			
10	Vacation	$ 100			$ 2,000			
11	Miscellaneous	$ 125			$ 1,558			
12	***Totals***							
13	**Number of Expense Categories**							
14	**Average Spent**							
15	**Minimum Spent**							
16	**Maximum Spent**							
17								

Formulas and functions will be added to the highlighted cells to provide calculations that will be automatically updated as data changes.

Budget Summary | Budget Detail | Loan Payments | Prepare to Print

Figure 2.2 Budget Detail Worksheet

Table 2.1 Spend Category Definitions

Category	Definition
Utilities	Electricity, heat, water, home phone, cable, Internet access
Cell Phone	Cell phone plan and equipment charges
Food	Groceries
Gas	Cost of gas for vehicle
Clothes	Clothes, shoes, and accessories
Insurance	Renter, homeowner, and/or car insurance
Entertainment	Activities like dining out, movie and theater tickets, parties, and so on
Vacation	Vacation expenses
Miscellaneous	Any other spending categories

The amount of money spent each month for each category, as well as the amount of money spent last year, is already entered into the worksheet. We will write formulas that will calculate the annual (yearly) amount spent, the percent of the total spent each category represents, as well as the percent change from last year's spending to the current year.

The first formula will calculate the Annual Spend values. The formula will be constructed so that it

takes the values in the Monthly Spend column and multiplies them by 12 (the number of months in a year). This will show how much money will be spent per year for each of the categories listed in Column A. Since the first category is **Utilities**, we will start by creating the formula to multiply the Monthly Spend amount in B3 by 12. This formula will be created in D3 – the Annual Spend cell for the Utilities category. This formula will be written as: **=B3*12**

1. Switch to the **Budget Detail** worksheet if needed. Click cell **D3**.
2. Type an equal sign **=**
   When the first character entered into a cell is an equal sign, it signals Excel to perform a calculation.
3. Type **B3**. *This adds B3 to the formula, which is now a cell reference. Excel will use whatever value is entered into cell B3 in the calculation.*
4. Type the * . *This is the symbol for multiplication in Excel. As shown in **Table 2.2** the mathematical operators in Excel are slightly different from those found on a typical calculator.*
5. Type the number **12**. *This multiplies the value in cell B3 by 12. In this formula, a number, or constant, is used instead of a cell reference because it will not change. In other words, there will always be 12 months in a year.*
6. Press the **ENTER** key. *This enters the formula into the cell.*

Formulas always start with the equal sign. This signifies to Excel that the contents of the cell should be calculated, not just displayed as basic text or numbers.

Table 2.2 Excel Mathematical Operators (move up)

Symbol	Operation
+	Addition
–	Subtraction
/	Division
*	Multiplication
^	Power/Exponent

Why?

Use Cell References

Cell references enable Excel to automatically recalculate when one or more inputs in the referenced cells are

changed. Cell references also allow you to trace how results are being calculated in a formula. You should **never** use a calculator to determine a mathematical output and type it into the cell location of a worksheet. Doing so eliminates Excel's cell-referencing benefits as well as your ability to trace a formula to determine how results are being calculated.

Use Universal Constants

There will be times when you are writing formulas that you will need to use universal constants, or numbers that do not change, such as the number of days in a week, weeks or months in a year, and so on. For example, if you are calculating the monthly cost of an item when you know the yearly cost, you will always divide by 12 since there are 12 months in a year. In this case, you use the constant of 12 instead of a cell reference because the number of months in a year never changes.

Figure 2.3 shows how the formula appears in cell D3 before you press the ENTER key. **Figure 2.4** shows the result of the formula after you press the ENTER key, as well as the **formula bar** which displays the formula as it was entered in the cell.

The Annual Spend for Utilities is $3,000 because the formula is taking the Monthly Spend in cell B3 and multiplying it by 12. If the value in cell B3 is changed, the formula automatically produces a new result.

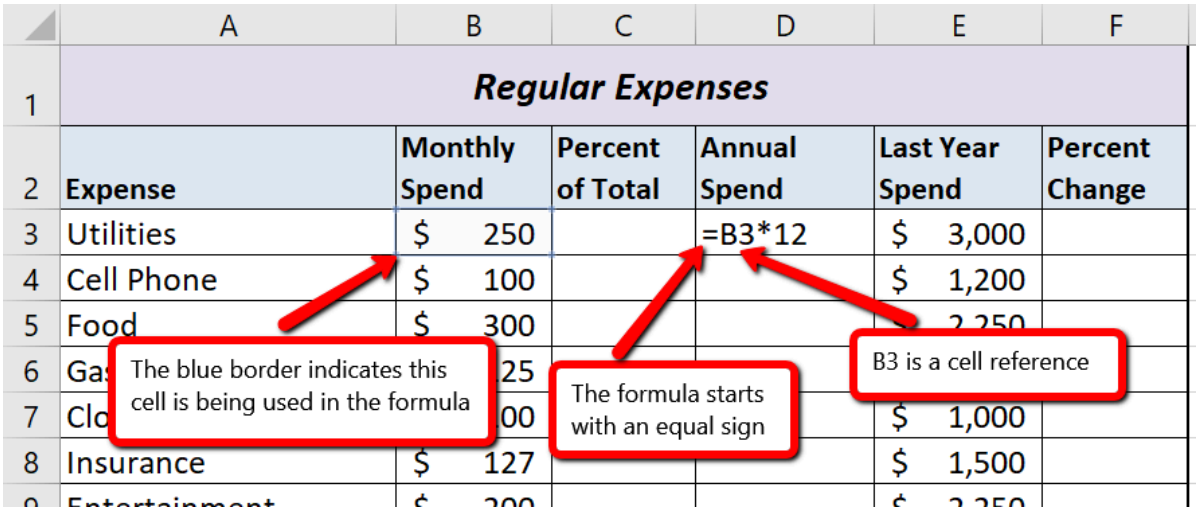
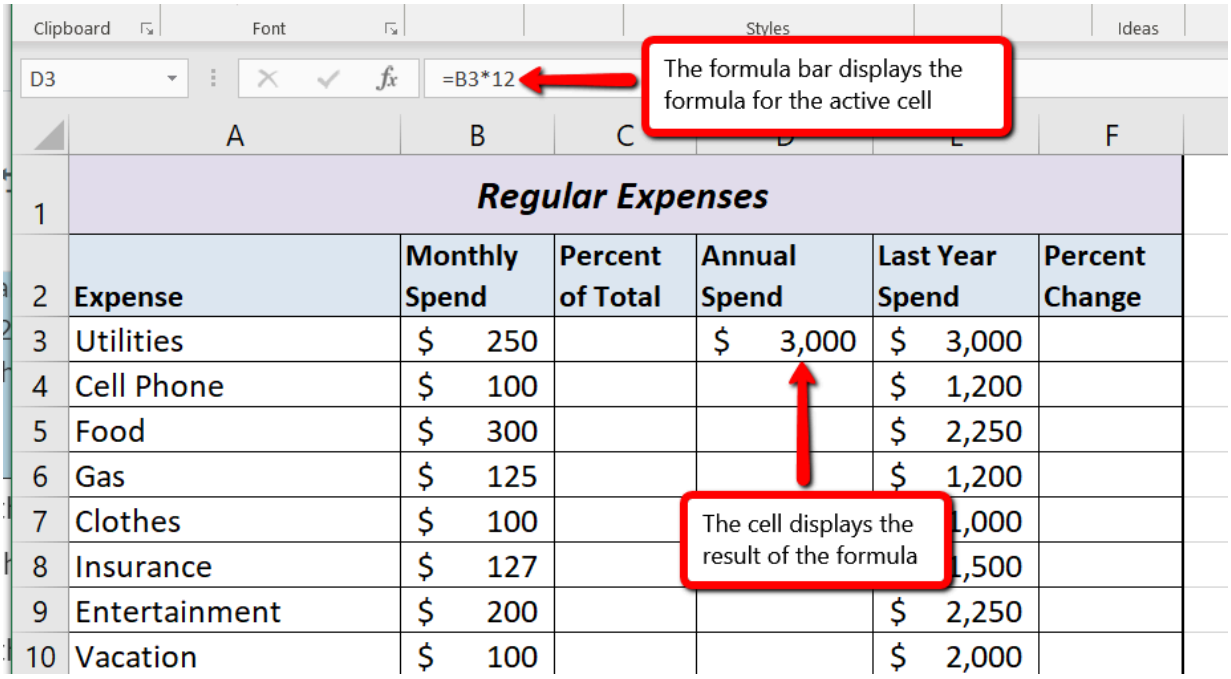


Figure 2.3 Adding a Formula to a Worksheet



	A	B	C	D	E	F
1	Regular Expenses					
2	Expense	Monthly Spend	Percent of Total	Annual Spend	Last Year Spend	Percent Change
3	Utilities	$ 250		$ 3,000	$ 3,000	
4	Cell Phone	$ 100			$ 1,200	
5	Food	$ 300			$ 2,250	
6	Gas	$ 125			$ 1,200	
7	Clothes	$ 100			1,000	
8	Insurance	$ 127			1,500	
9	Entertainment	$ 200			$ 2,250	
10	Vacation	$ 100			$ 2,000	

Figure 2.4 Formula Output for Annual Spend

RELATIVE REFERENCES (COPYING AND PASTING FORMULAS)

Once a formula is typed into a worksheet, it can be copied and pasted to other cell locations. For example, in cell D3 we have calculated the annual spend for the Utilities category, but this calculation needs to be performed for the rest of the cell locations in Column D. Since we used the B3 cell reference in the formula, Excel automatically adjusts that cell reference when the formula is copied and pasted into the rest of the cell locations in the column. This is called relative referencing and is demonstrated as follows:

1. Click cell D3.
2. Place the mouse pointer over the Auto Fill Handle in the bottom right corner of the cell.
3. When the mouse pointer turns from a white block plus sign to a black plus sign, click and drag down to cell D11. This pastes the formula into the range D4:D11.
4. Double click cell D6. Notice that the cell reference in the formula is automatically changed to B6.
5. Press the ENTER key.

Figure 2.5 shows the results added to the rest of the cell locations in the Annual Spend column. For each row, the formula takes the value in the Monthly Spend column and multiplies it by 12. You will also see that cell D6 has been double clicked to show the formula. Notice that Excel automatically changed the original cell reference of B3 to B6. This is the result of relative referencing, which means Excel automatically adjusts a cell reference relative to its original location when it is pasted into new cell locations. In this example, the formula was pasted into eight cell locations

below the original cell location. As a result, Excel increased the row number of the original cell reference by a value of one for each row it was pasted into.

	A	B	C	D	E
1	***Regular Expenses***				
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Year Spend**
3	Utilities	$ 250		$ 3,000	$ 3,000
4	Cell Phone	$ 100		$ 1,200	$ 1,200
5	Food	$ 300		$ 3,600	$ 2,250
6	Gas	$ 125		=B6*12	$ 1,200
7	Clothes	$ 100		$ 1,200	$ 1,000
8	Insurance	$ 12			1,500
9	Entertainment	$ 20			2,250
10	Vacation	$ 10			2,000
11	Miscellaneous	$ 125		$ 1,500	$ 1,558

This cell reference was automatically changed when the formula was pasted because of relative referencing

Figure 2.5 Relative Reference Example

Why?

Use Relative Referencing

Relative referencing is a convenient feature in Excel. When you use cell references in a formula, Excel automatically adjusts the cell references when the formula is pasted into new cell locations. If this feature were not available, you would have to manually retype the formula when you want the same calculation applied to other cell locations in a column or row.

CREATING COMPLEX FORMULAS (CONTROLLING THE ORDER OF OPERATIONS)

The next formula to be added to the Personal Budget workbook is the percent change over last year (Column F). This formula determines the difference between this year's Annual Spend values (Column D) and the values in the Last Year Spend column (Column E) and shows the difference in terms of a percentage. This requires that the order of mathematical operations be controlled to get an accurate result.

Excel uses the standard mathematical order of operations, as defined in Table 2.3. When writing complex formulas it is important to remember this **order of operations.** You want to be sure that your formulas will calculate in the order you intend. To help you remember which operations will be performed first, you can use the acronym PEMDAS.

P – parentheses
E – exponents
MD – multiplication and division
AS – addition and subtraction

Table 2.3 shows the standard order of operations (PEMDAS) for a typical formula. To change the order of operations shown in the table, you can use parentheses to process certain mathematical calculations first.

Table 2.3 Standard Order of Mathematical Operations (PEMDAS)

Symbol	Order
( )	Any calculation inside parentheses will be done first. If there are layers of parentheses used in a formula, Excel computes the innermost parentheses first and the outermost parentheses last.
^	Excel executes any exponential computations next.
* or /	Excel performs any multiplication or division computations next. When there are multiple instances of these computations in a formula, they are executed in order from left to right.
+ or –	Excel performs any addition or subtraction computations last. When there are multiple instances of these computations in a formula, they are executed in order from left to right.

To create the Percent Change formula, we will need to use parentheses to control the order of the calculations. We need the difference of the two values to be found before the division is done, so we will use parentheses around the subtraction portion of the formula to indicate that calculation needs to be done first. This formula is added to the worksheet as follows:

1. Click cell F3 in the **Budget Detail** worksheet.
2. Type an equal sign **=**.
3. Type an open parenthesis **(**.
4. Click cell D3. This will add a cell reference to cell D3 to the formula. *When building formulas, you can click cell locations instead of typing them.*

5. Type a minus sign **–**.
6. Click cell E3 to add this cell reference to the formula.
7. Type a closing parenthesis **)**.
8. Type the slash **/** symbol for division.
9. Click cell E3. This completes the formula that will calculate the percent change of last year's actual spent dollars vs. this year's budgeted spend dollars (**see Figure 2.6**).
10. Press the ENTER key.
11. Click cell F3 to activate it.
12. Place the mouse pointer over the Auto Fill Handle.
13. When the mouse pointer turns from a white block plus sign to a black plus sign, click and drag down to cell F11. This pastes the formula into the range F4:F11.

Figure 2.6 shows the formula that was added to the **Budget Detail** worksheet to calculate the percent change in spending. The parentheses were added to this formula to control the order of operations. Any mathematical computations placed in parentheses are executed first before the standard order of mathematical operations (see **Table 2.3)**. In this case, if parentheses were not used, Excel would produce an erroneous result for this worksheet.

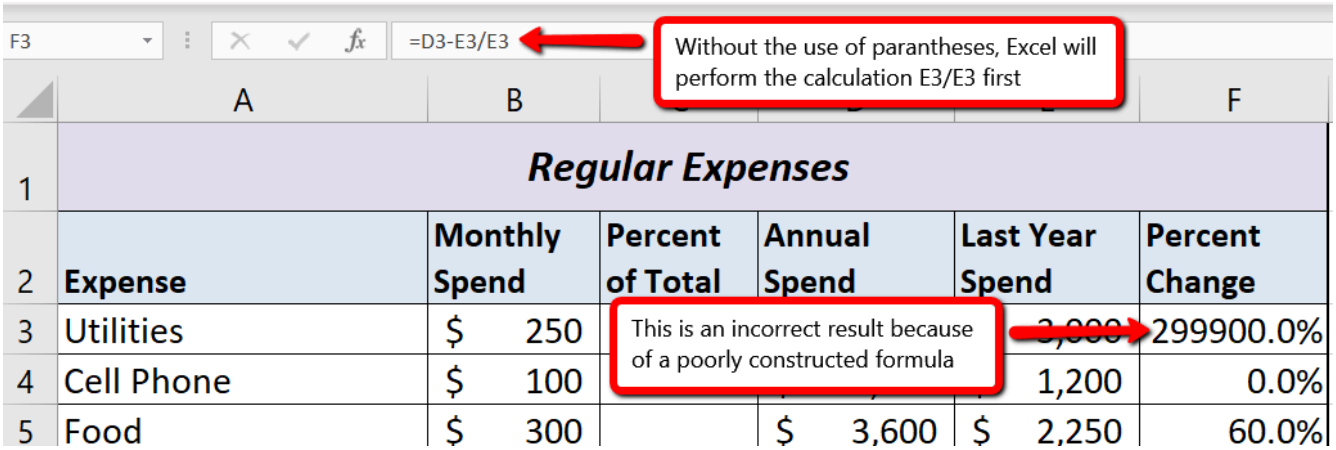
	A	B	C	D	E	F
1	***Regular Expenses***					
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Year Spend**	**Percent Change**
3	Utilities	$ 250		$ 3,000	$ 3,000	=(D3-E3)/E3
4	Cell Phone	$ 100		$ 1,200	$ 1,200	0.0%
5	Food	$ 300		$ 3,600	$ 2,250	60.0%
6	Gas	$ 125		$ 1,500	$ 1,200	25.0%
7	Clothes	$ 100		$ 1,200		
8	Insurance	$ 127		$ 1,524		
9	Entertainment	$ 200		$ 2,400	$ 2,250	6.7%
10	Vacation	$ 100		$ 1,200	$ 2,000	-40.0%
11	Miscellaneous	$ 125		$ 1,500	$ 1,558	-3.7%
12	***Totals***					

Mathematical computations in parantheses will be performed first

Figure 2.6 Adding the Percent Change Formula

Figure 2.7 shows the result of the percent change formula if the parentheses are removed. The formula produces a result of a 299900% increase. Since there is no change between the LY spend and the budget Annual Spend, the result should be 0%. However, without the parentheses, Excel is following the standard order of operations. This means the value in cell E3 will be divided by

E3 first (3,000/3,000), which is 1. Then, the value of 1 will be subtracted from the value in cell D3 (3,000−1), which is 2,999. Since cell F3 is formatted as a percentage, Excel expresses the output as an increase of 299900%.



	A	B	C	D	E	F
1	***Regular Expenses***					
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Year Spend**	**Percent Change**
3	Utilities	$ 250				299900.0%
4	Cell Phone	$ 100			1,200	0.0%
5	Food	$ 300		$ 3,600	$ 2,250	60.0%

Figure 2.7 Removing the Parentheses from the Percent Change Formula

Integrity Check<

Does the Output of Your Formula Make Sense?

It is important to note that the accuracy of the output produced by a formula depends on how it is constructed. Therefore, always check the result of your formula to see whether it makes sense with data in your worksheet. As shown in **Figure 2.7**, a poorly constructed formula can give you an inaccurate result. In other words, you can see that there is no change between the Annual Spend and LY Spend for Household Utilities. Therefore, the result of the formula should be 0%. However, since the parentheses were removed in this case, the formula is clearly producing an erroneous result.

Skill Refresher

Formulas

1. Type an equal sign **=**.
2. Click or type a cell location. If using constants, type a number.
3. Type a mathematical operator.
4. Click or type a cell location. If using constants, type a number.

5. Use parentheses where necessary to control the order of operations.
6. Press the ENTER key.

AUDITING FORMULAS

Excel provides a few tools that you can use to review the formulas entered into a worksheet. For example, instead of showing the outputs for the formulas used in a worksheet, you can have Excel show the formula as it was entered in the cell locations. This is demonstrated as follows:

1. With the **Budget Detail** worksheet open, click the Formulas tab of the Ribbon.
2. Click the Show Formulas button in the Formula Auditing group of commands. This displays the formulas in the worksheet instead of showing the mathematical outputs.
3. Click the Show Formulas button again. The worksheet returns to showing the output of the formulas.

You can also toggle Show Formulas on and off using the keyboard. Hold down the CTRL key while pressing the ` key.

Figure 2.8 shows the **Budget Detail** worksheet after activating the Show Formulas command in the Formulas tab of the Ribbon. As shown in the figure, this command allows you to view and check all the formulas in a worksheet without having to click each cell individually. After activating this command, the column widths in your worksheet increase significantly. The column widths were adjusted for the worksheet shown in **Figure 2.8** so all columns can be seen. The column widths return to their previous width when the Show Formulas command is deactivated.

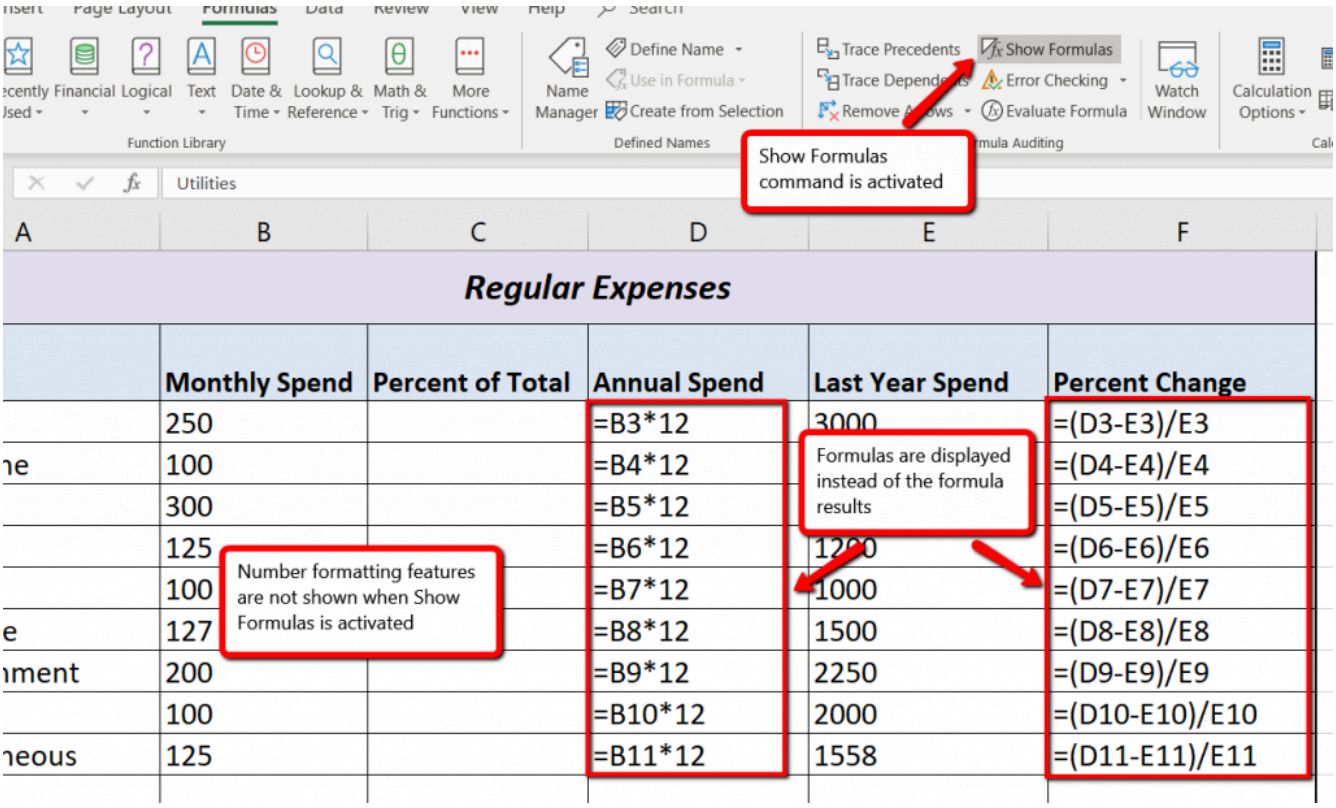


Figure 2.8 Show Formulas Command

Skill Refresher

Show Formulas

1. Click the Formulas tab on the Ribbon.
2. Click the Show Formulas button in the Formula Auditing group of commands.
3. Click the Show Formulas button again to show formula outputs.

Keyboard Shortcuts

Show Formulas

- Hold down the CTRL key while pressing the accent symbol `. Same for Excel for Mac.

Two other tools in the Formula Auditing group of commands are the **Trace Precedents** and **Trace Dependents** commands. These commands are used to trace the cell references used in a formula. A precedent cell is a cell whose value is used in other cells. The Trace Precedents command shows an arrow to indicate the cells or ranges (precedents) which affect the active cell's value. A depen-

dent cell is a cell whose value depends on the values of other cells in the workbook. The Trace Dependents command shows where any given cell is referenced in a formula. The following is a demonstration of these commands:

1. Click cell D3.
2. Click the Trace Dependents button in the Formula Auditing group of commands in the Formulas tab of the Ribbon. A blue arrow appears, pointing to cell F3 (see **Figure 2.9**). This indicates that cell D3 is referenced in a formula entered in cell F3.
3. Click the Remove Arrows command in the Formula Auditing group of commands in the Formulas tab of the Ribbon. This removes the Trace Dependents arrow.
4. Click cell F3.
5. Click the Trace Precedents button in the Formula Auditing group of commands in the Formulas tab of the Ribbon. A blue arrow with dots in cells D3 and E3, and pointing to cell F3 appears (see **Figure 2.10**). This indicates that cells D3 and E3 are references in a formula entered in cell F3.
6. Click the Remove Arrows command in the Formula Auditing group of commands in the Formulas tab of the Ribbon. This removes the Trace Precedents arrow.
7. Save the **CH2 Personal Budget** file.

Figure 2.9 shows the Trace Dependents arrow on the **Budget Detail** worksheet. The blue dot represents the activated cell. The arrows indicate where the cell is referenced in formulas.

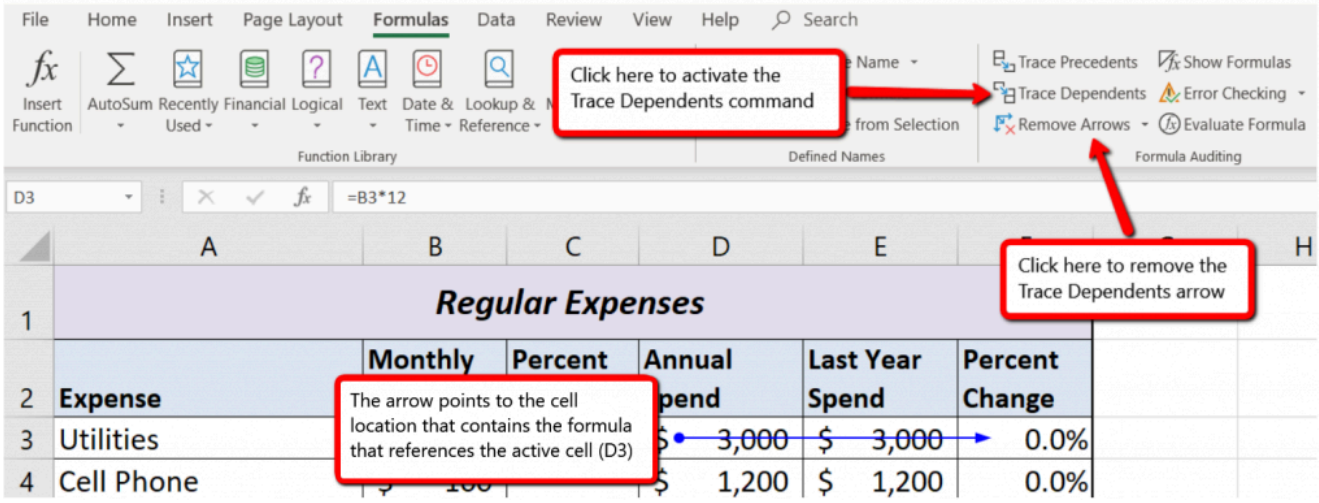


Figure 2.9 Trace Dependents Example

Figure 2.10 shows the Trace Precedents arrow on the **Budget Detail** worksheet. The blue dots on this arrow indicate the cells that are referenced in the formula contained in the activated cell. The arrow is pointing to the activated cell location that contains the formula.

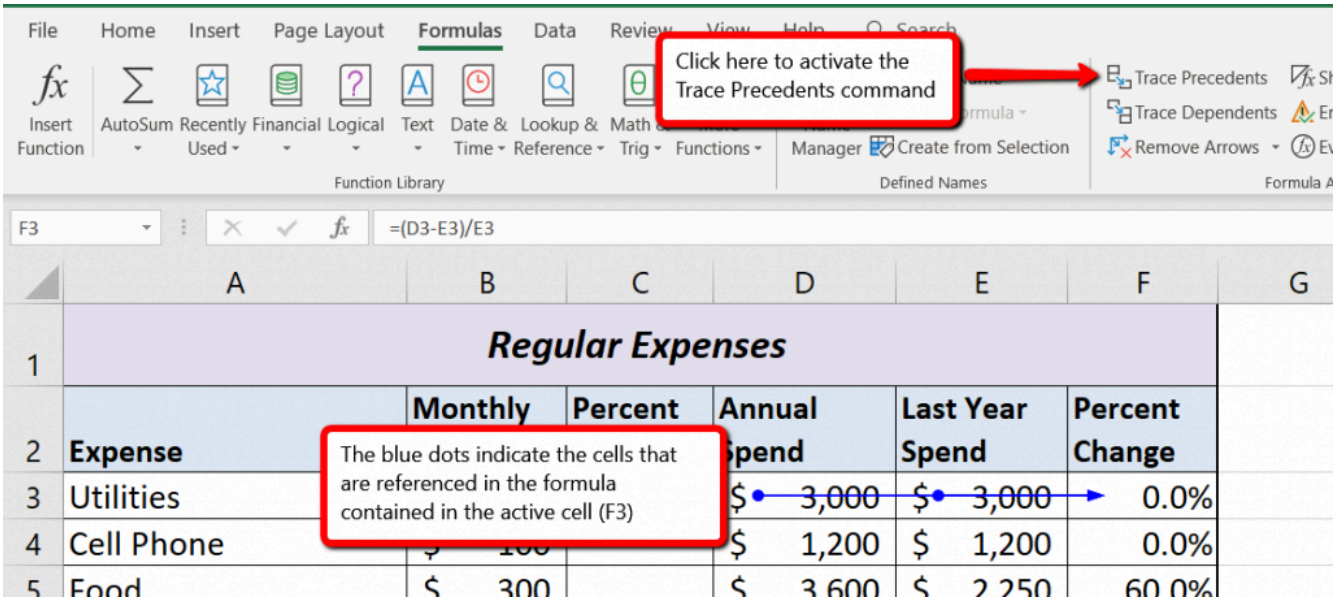


Figure 2.10 Trace Precedents Example

Skill Refresher

Trace Dependents

1. Click a cell location that contains a number or formula.
2. Click the Formulas tab on the Ribbon.
3. Click the Trace Dependents button in the Formula Auditing group of commands.
4. Use the arrow(s) to determine where the cell is referenced in formulas and functions.
5. Click the Remove Arrows button to remove the arrows from the worksheet.

Trace Precedents

1. Click a cell location that contains a formula or function.
2. Click the Formulas tab on the Ribbon.
3. Click the Trace Precedents button in the Formula Auditing group of commands.
4. Use the dot(s) along the line to determine what cells are referenced in the formula or function.
5. Click the Remove Arrows button to remove the line with the dots.

Key Takeaways

- Mathematical computations are conducted through formulas and functions.

- An equal sign **=** precedes all formulas and functions.
- Formulas and functions must be created with cell references to conduct what-if scenarios where mathematical outputs are recalculated when one or more inputs are changed.
- Mathematical operators on a typical calculator are different from those used in Excel. **Table 2.2** "Excel Mathematical Operators" lists Excel mathematical operators.
- When using numerical values in formulas and functions, only use universal constants that do not change, such as days in a week, months in a year, and so on.
- Relative referencing automatically adjusts the cell references in formulas and functions when they are pasted into new locations on a worksheet. This eliminates the need to retype formulas and functions when they are needed in multiple rows or columns on a worksheet.
- Parentheses must be used to control the order of operations when necessary for complex formulas.
- Formula auditing tools such as Trace Dependents, Trace Precedents, and Show Formulas should be used to check the integrity of formulas that have been entered into a worksheet.

ATTRIBUTION

2.2 Introductory Statistical Functions

Learning Objectives

1. Use the SUM function to calculate totals.
2. Use the COUNT function to count cell locations with numerical values.
3. Use the AVERAGE function to calculate the arithmetic mean.
4. Use the MAX and MIN functions to find the highest and lowest values in a range of cells.
5. Learn how to copy and paste formulas without formats applied to a cell location.
6. Use absolute references to calculate percent of totals.
7. Learn how to set a multiple level sort sequence for data sets that have duplicate values or outputs.

In addition to formulas, another way to conduct mathematical computations in Excel is through functions. Excel functions apply a mathematical process to a group of cells in a worksheet. For example, the SUM function is used to add the values contained in a range of cells. Functions are more efficient than formulas when you are applying a mathematical process to a group of cells. If you use a formula to add the values in a range of cells, you would have to add each cell location to the formula one at a time. This can be very time-consuming if you have to add the values in a few hundred cell locations. However, when you use a function, you can highlight all the cells that contain values you wish to sum in just one step.

The components of a function are as follows:

=FunctionName(Arguments)

Functions are a type of formula, therefore they start with an equal sign. The next component is the name of the function. A list of commonly used functions is shown in **Table 2.4**. After the function name comes the arguments for the function, which are always enclosed in parentheses. The arguments are the cell locations and/or values that will be used in the function. The number and type of arguments varies based on the the function being used, although in this section we will only work with a range of cells for the function arguments. Some examples of different functions with their arguments are:

=SUM(B2:B15) – adds the values in B2 through B15
=SQRT(A5) – finds the square root of the value in A5
=COUNTA(A1:A20) – finds the number of cells from A1 through A20 that contain text or a number

Throughout Section 2.2 we will add a variety of mathematical functions to the Personal Budget workbook. In addition to creating functions, this section also reviews percent of total calculations and the use of absolute references.

Table 2.4 Commonly Used Functions

Function	Output
ABS	The absolute value of a number
AVERAGE	The average or arithmetic mean for a group of numbers
COUNT	The number of cell locations in a range that contain a numeric value
COUNTA	The number of cell locations in a range that contain text or a numeric value
MAX	The highest numeric value in a group of numbers
MEDIAN	The middle number in a group of numbers (half the numbers in the group are higher than the median and half the numbers in the group are lower than the median)
MIN	The lowest numeric value in a group of numbers
MODE	The number that appears most frequently in a group of numbers
PRODUCT	The result of multiplying all the values in a range of cell locations
SQRT	The positive square root of a number
SUM	The total of all numeric values in a group

It is important to note that there are several methods for adding a function to a worksheet, and we will explore each of them throughout this section.

- Typing the function directly into a cell
- Selecting from the function list
- Using the Function Library on the ribbon
- Using the Insert Function button

THE SUM FUNCTION

The SUM function is used when you need to calculate totals for a range of cells or a group of selected cells on a worksheet. With regard to the **Budget Detail** worksheet, we will use the SUM function to calculate the totals in row 12, starting with the Monthly Spend total in B12. The following illustrates how a function can be added to a worksheet by typing it into a cell location:

1. Switch to the **Budget Detail** worksheet if needed.
2. Click cell B12.
3. Type an equal sign **=**.

4. Type the function name **SUM**.
5. Type an open parenthesis **(**.
6. Click cell B3 and drag down to cell B11. This places the range B3:B11 into the function.
7. Type a closing parenthesis **)**.
8. Press the ENTER key. The function calculates the total for the Monthly Spend column, which is $1,427.

Figure 2.11 shows the appearance of the SUM function added to the **Budget Detail** worksheet before pressing the ENTER key.

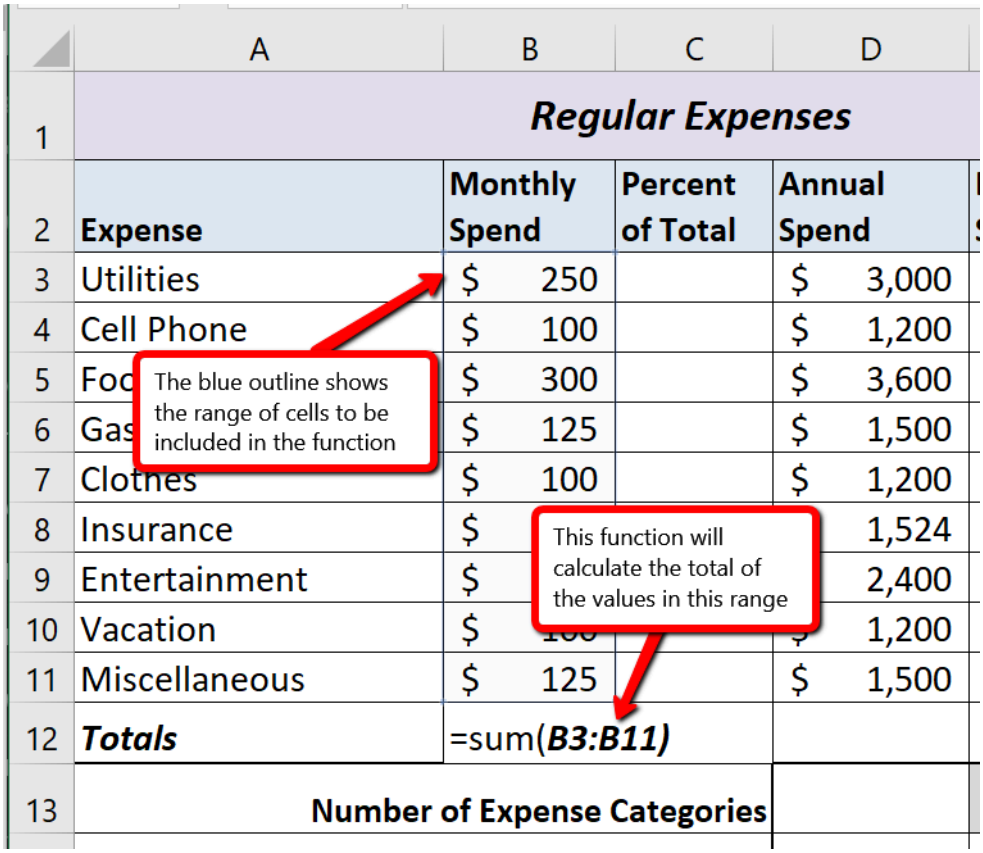


Figure 2.11 Adding the SUM Function to the Budget Detail Worksheet

As shown in **Figure 2.11**, the SUM function was added to cell B12. However, this function is also needed to calculate the totals in the Annual Spend and Last Year Spend columns. The function can be copied and pasted into these cell locations because of relative referencing. Relative referencing serves the same purpose for functions as it does for formulas. To complete the Totals in row 12, we need to copy and paste the SUM function into D12 and E12. Since we will then have totals in D12 and E12, we can paste the percent change formula into F12.

1. Click cell B12 in the **Budget Detail** worksheet.
2. Click the Copy button in the Home tab of the Ribbon.
3. Highlight cells D12 and E12.

4. Click the Paste button in the Home tab of the Ribbon. This pastes the SUM function into cells D12 and E12 and calculates the totals for these columns.
5. Click cell F11.
6. Click the Copy button in the Home tab of the Ribbon.
7. Click cell F12, then click the Paste button in the Home tab of the Ribbon.

Figure 2.12 shows the output of the SUM function that was added to cells B12, D12, and E12. In addition, the percent change formula was copied and pasted into cell F12. Notice that this version of the budget is planning an increase in spending compared to last year.

	A	B	C	D	E	F
1	***Regular Expenses***					
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Year Spend**	**Percent Change**
3	Utilities	$ 250		$ 3,000	$ 3,000	0.0%
4	Cell Phone	$ 100		$ 1,200	$ 1,200	0.0%
5	Food	$ 300		$ 3,600	$ 2,250	60.0%
6	Gas	$ 125		$ 1,500		
7	Clothes	$ 100		$ 1,200		
8	Insurance	$		524		
9	Entertainment	$		400	$ 2,250	6.7%
10	Vacation	$ 100		1,200	$ 2,000	-40.0%
11	Miscellaneous	$ 125		$ 1,500	$ 1,558	-3.7%
12	***Totals***	***$ 1,427***		***$ 17,124***	***$ 15,958***	7.3%
13	**Number of Expense Categories**					

Outputs created by SUM functions

Percent change formula pasted here since totals were added to D12 and E12

Figure 2.12 Results of the SUM Function in the Budget Detail worksheet

Integrity Check

Cell Ranges in Functions

When you intend to use a function on a range of cells in a worksheet, make sure there are two cell locations separated by a **colon** and not a comma. If you enter two cell locations separated by a comma, the function

will calculate only the two cell locations listed instead of an entire range of cells. For example, the SUM function shown in **Figure 2.13** will add only the values in cells C3 and C11, not the range C3:C11.

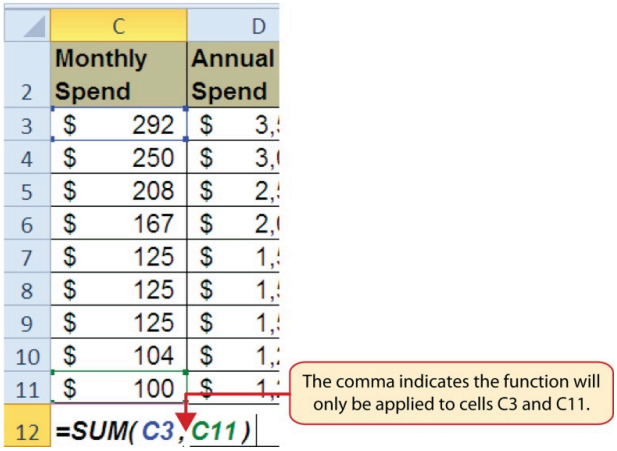


Figure 2.13 SUM Function Adding Two Cell Locations

THE COUNT FUNCTION

Data file: Continue with CH2 Personal Budget.

The next function that we will add to the **Budget Detail** worksheet is the COUNT function. The COUNT function is used to determine how many cells in a range contain a numeric entry. The COUNT function will not work for counting text or other non-numeric entries. If you want to count text instead of, or in addition to, numeric entries you use the COUNTA function. For the **Budget Detail** worksheet, we will use the COUNT function to count the number of items that are planned in the Annual Spend column (Column D). The following explains how the COUNT function is added to the worksheet by selecting from the function list:

1. Click cell D13.
2. Type an equal sign **=**.
3. Type the letter **C** (to start spelling the name of the function).
4. Click the down arrow on the scroll bar of the function list (see **Figure 2.14**) and find the word COUNT.

   Mac Users can scroll down with touchpad or mouse to find COUNT

5. Double click the word COUNT from the function list.
   Mac Users should single click the word “COUNT” do not double-click
6. Highlight the range D3:D11.
7. You can type a closing parenthesis **)** and then press the ENTER key, or simply press the ENTER key and Excel will close the function for you. The function produces an output of 9 since there are 9 items planned on the worksheet.

Figure 2.14 shows the function list box that appears after completing steps 2 and 3 for the COUNT function. The function list provides an alternative method for adding a function to a worksheet.

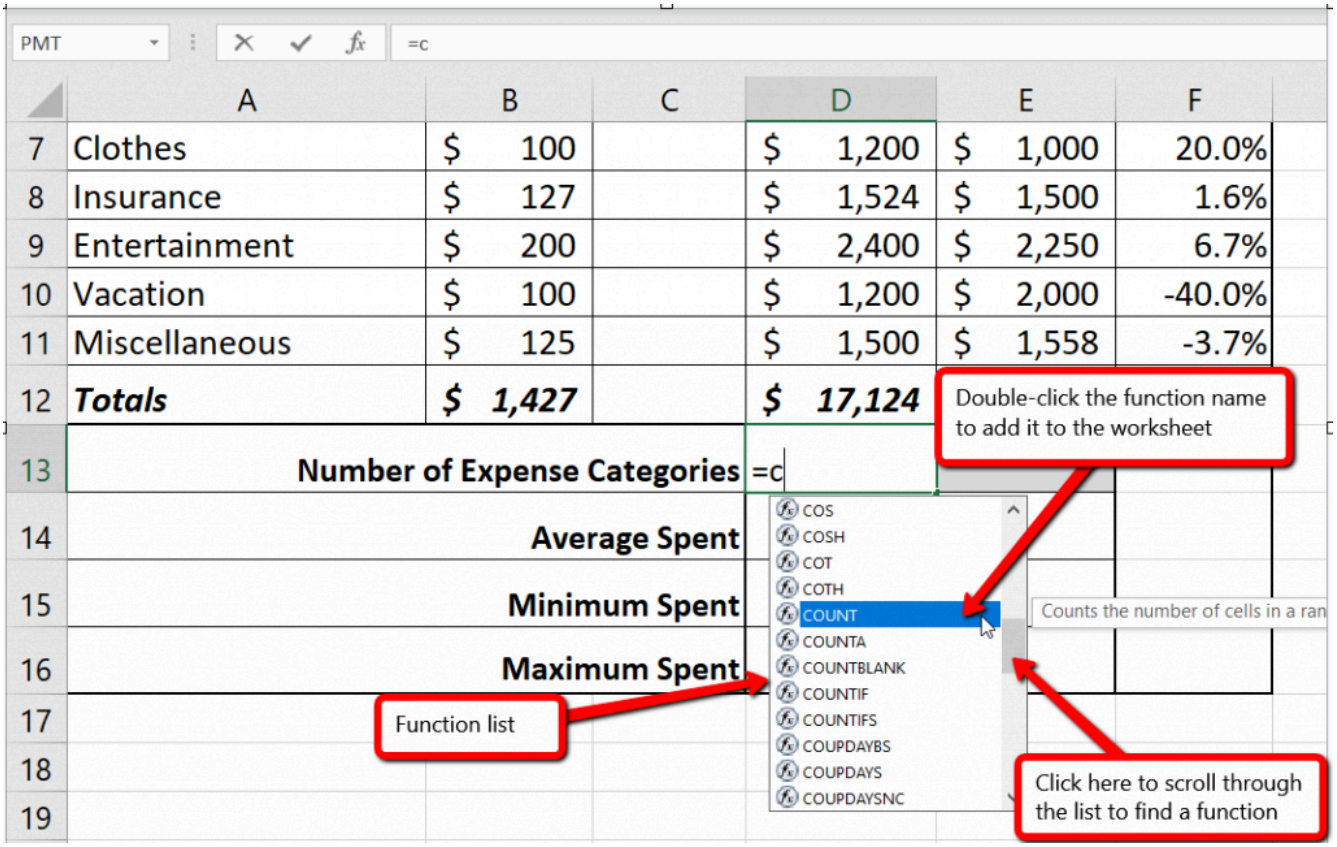
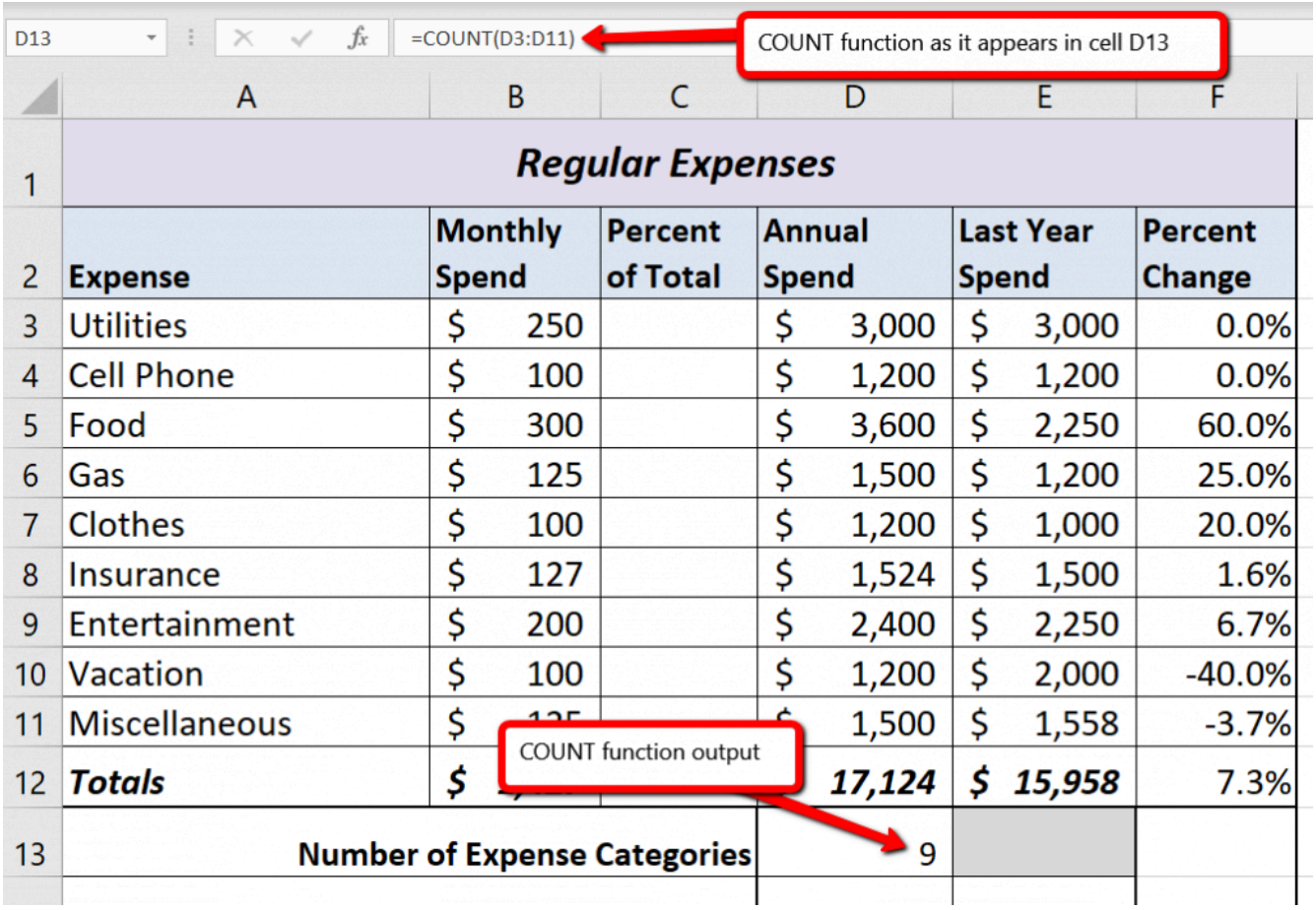


Figure 2.14 Using the Function List to Add the COUNT Function

Figure 2.15 shows the output of the COUNT function after pressing the ENTER key. The function counts the number of cells in the range D3:D11 that contain a numeric value. The result of 9 indicates that there are 9 categories planned for this budget.



	A	B	C	D	E	F
1	***Regular Expenses***					
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Year Spend**	**Percent Change**
3	Utilities	$ 250		$ 3,000	$ 3,000	0.0%
4	Cell Phone	$ 100		$ 1,200	$ 1,200	0.0%
5	Food	$ 300		$ 3,600	$ 2,250	60.0%
6	Gas	$ 125		$ 1,500	$ 1,200	25.0%
7	Clothes	$ 100		$ 1,200	$ 1,000	20.0%
8	Insurance	$ 127		$ 1,524	$ 1,500	1.6%
9	Entertainment	$ 200		$ 2,400	$ 2,250	6.7%
10	Vacation	$ 100		$ 1,200	$ 2,000	-40.0%
11	Miscellaneous	$		1,500	$ 1,558	-3.7%
12	***Totals***	***$***		***17,124***	***$ 15,958***	7.3%
13		**Number of Expense Categories**		9		

Figure 2.15 Completed COUNT Function in the Budget Detail Worksheet

THE AVERAGE FUNCTION

The next function we will add to the **Budget Detail** worksheet is the AVERAGE function. This function is used to calculate the arithmetic mean for a group of numbers. For the **Budget Detail** worksheet, we will use the function to calculate the average of the values in the Annual Spend column. We will add this to the worksheet by using the Function Library on the Formulas ribbon. The following steps explain how this is accomplished:

1. Click cell D14 in the **Budget Detail** worksheet.
2. Click the Formulas tab on the Ribbon.
3. Click the More Functions button in the Function Library group of commands.
4. Place the mouse pointer over the Statistical option from the drop-down list of options.
5. Click the AVERAGE function name from the list of functions that appear in the menu (see **Figure 2.16**). This opens the Function Arguments dialog box.
6. Click the Collapse Dialog button in the Function Arguments dialog box (see **Figure 2.17**).
   For Mac Users, the Collapse Dialog button may not collapse. Just continue with Step 7

and press Enter after selecting the range.

7. Highlight the range D3:D11.
8. Click the Expand Dialog button in the Function Arguments dialog box (see **Figure 2.18**). You can also press the ENTER key to get the same result.
9. Click the OK button on the Function Arguments dialog box. This adds the AVERAGE function to the worksheet.

   Mac Users should click the **DONE** button

Figure 2.16 illustrates how a function is selected from the Function Library in the Formulas tab of the Ribbon.

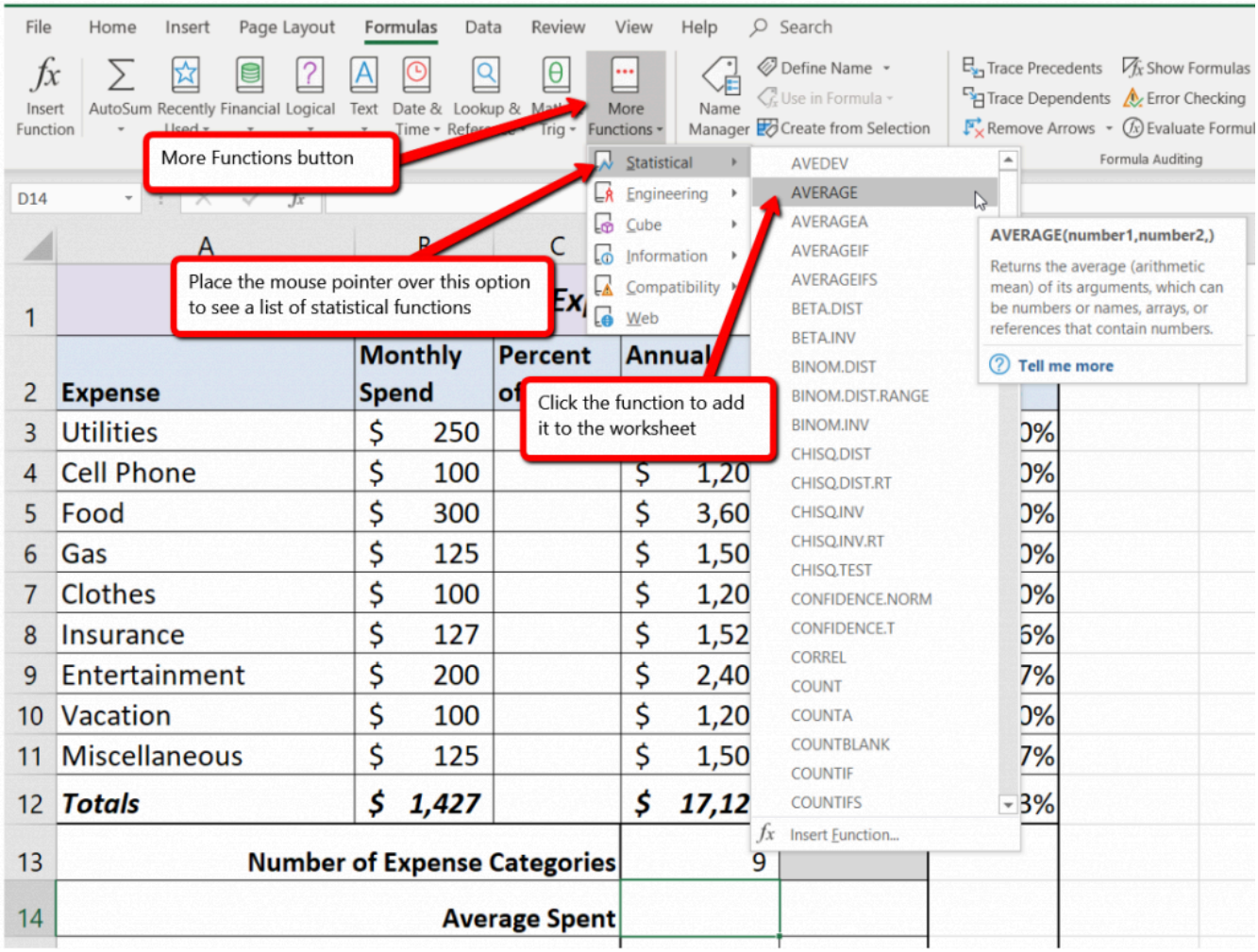


Figure 2.16 Selecting the AVERAGE function from the Function Library

Figure 2.17 shows the Function Arguments dialog box. This appears after a function is selected from the Function Library. The Collapse Dialog button is used to hide the dialog box so a range of cells can be highlighted on the worksheet and then added to the function.

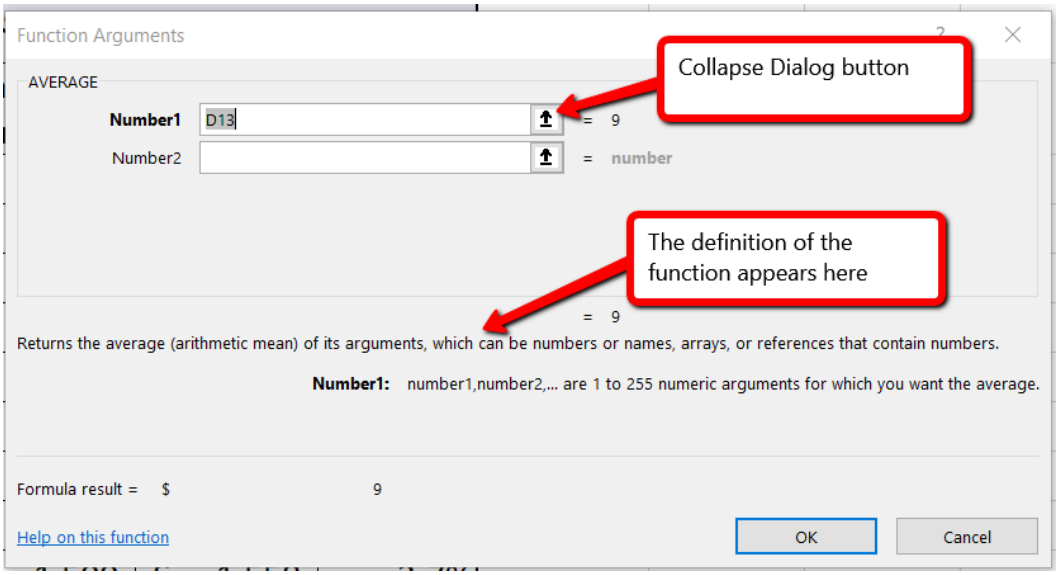


Figure 2.17 Function Arguments Dialog Box

Figure 2.18 shows how a range of cells can be selected from the Function Arguments dialog box once it has been collapsed.

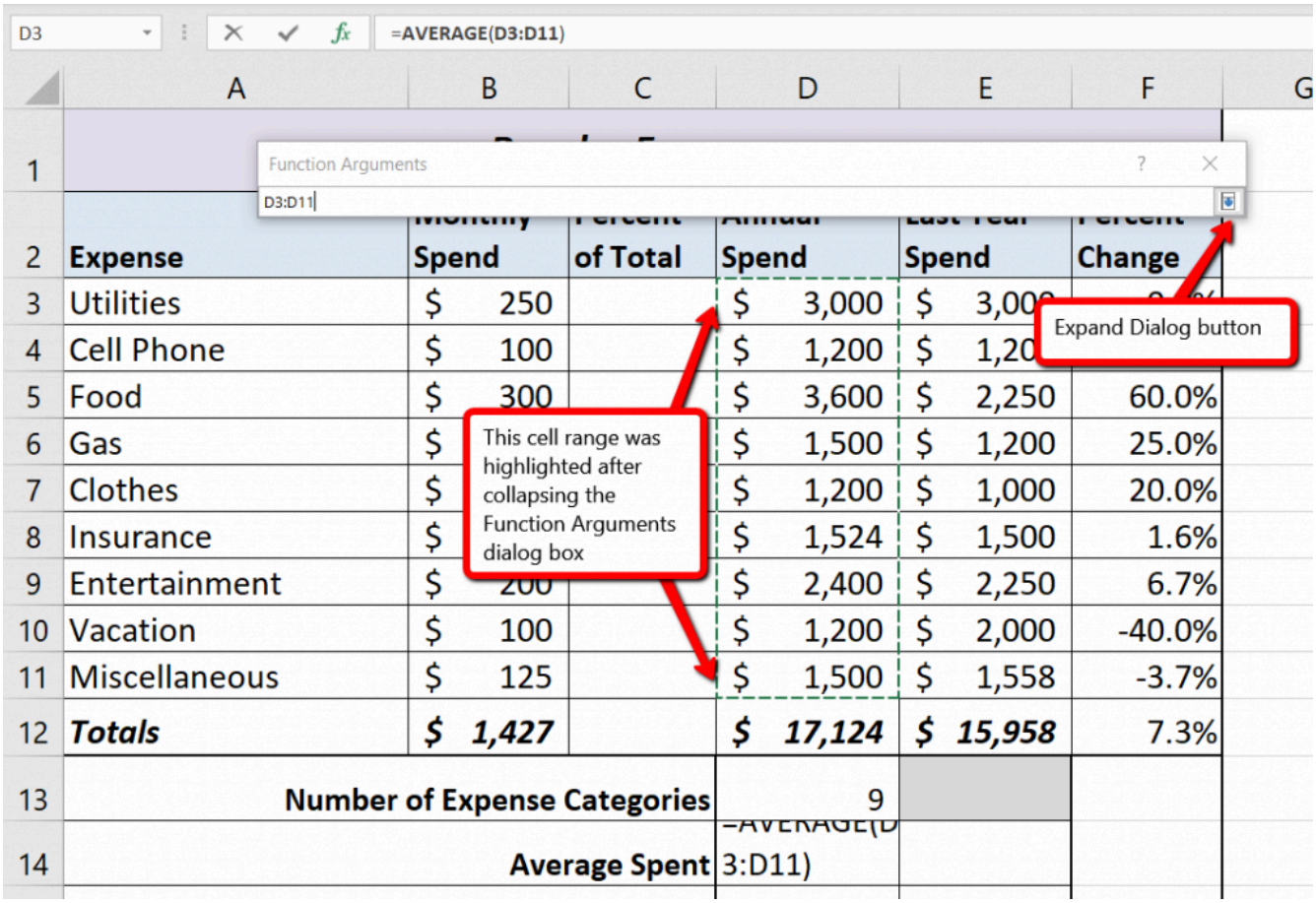


Figure 2.18 Selecting a range from the Function Arguments Dialog Box

Figure 2.19 shows the Function Arguments dialog box after the cell range is defined for the AVER-

AGE function. The dialog box shows the result of the function before it is added to the cell location. This allows you to assess the function output to determine whether it makes sense before adding it to the worksheet.

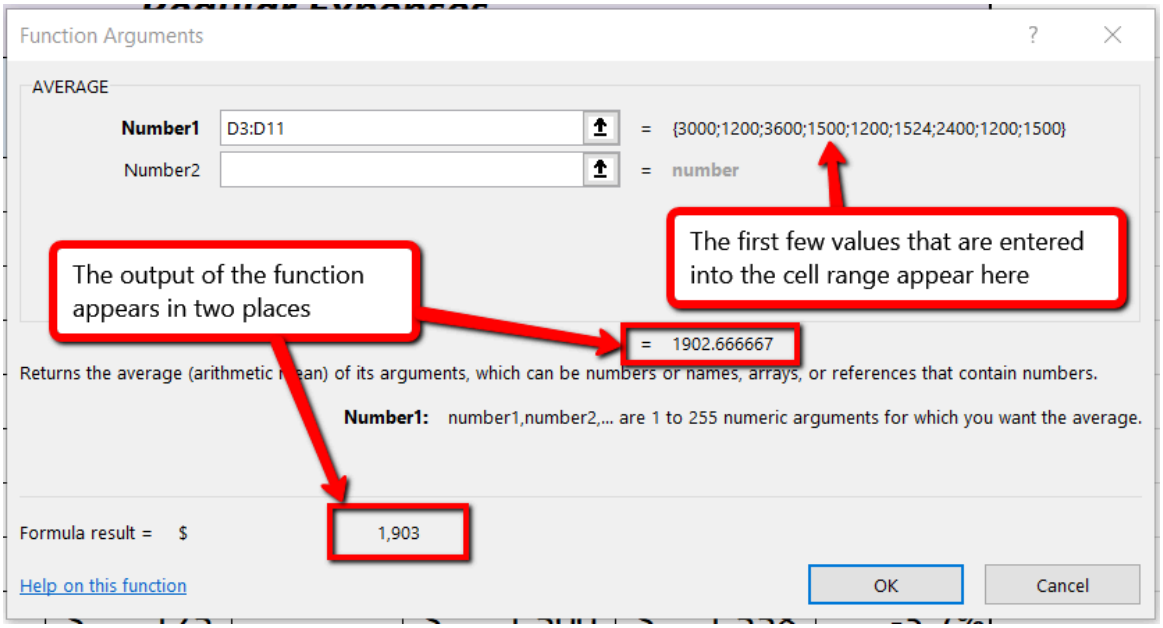
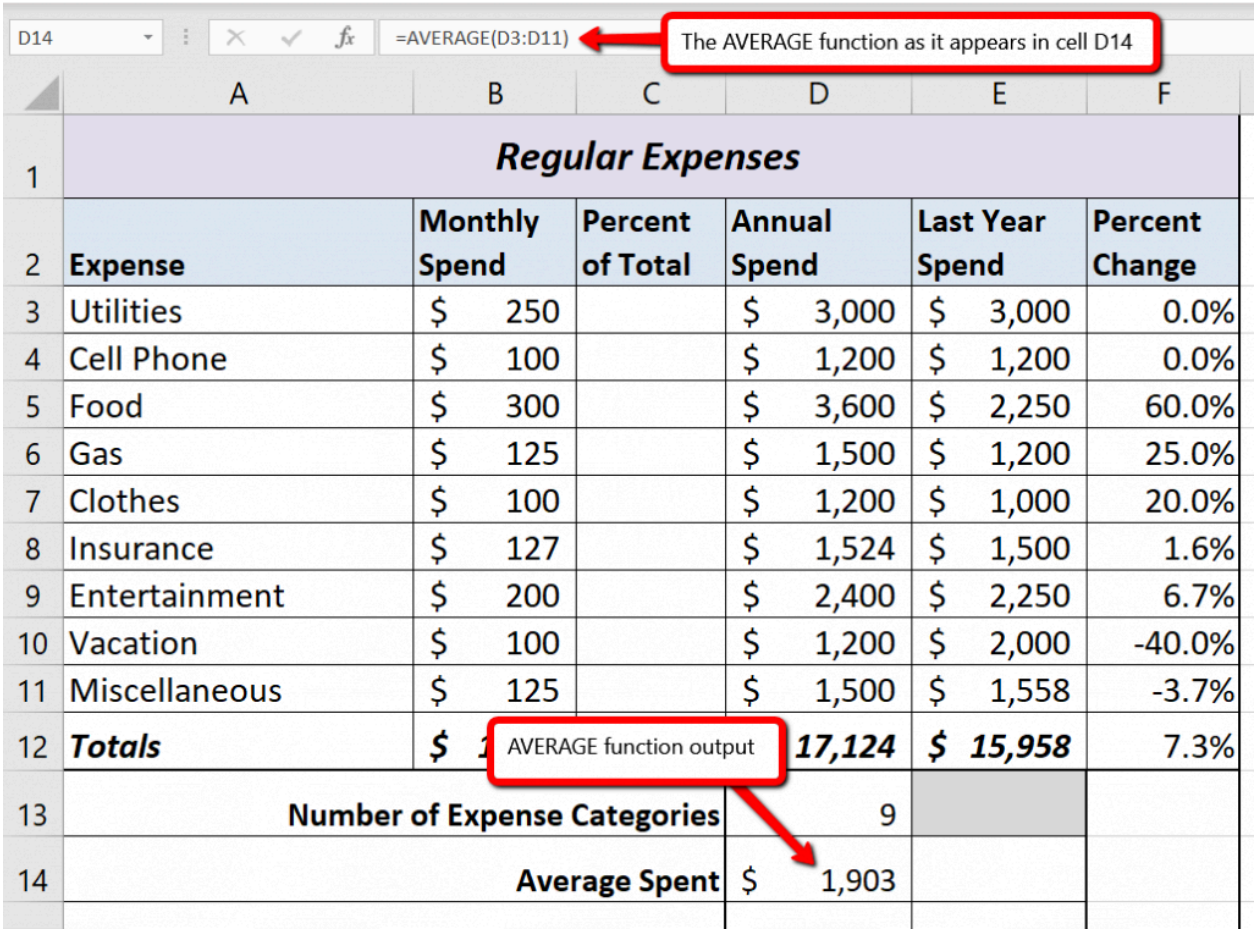


Figure 2.19 Function Arguments Dialog Box after a Cell Range Is Defined for a Function

Figure 2.20 shows the completed AVERAGE function in the **Budget Detail** worksheet. The output of the function shows that on average we expect to spend $1,903 for each of the categories listed in Column A of the budget. This average spend calculation per category can be used as an indicator to determine which categories are costing more or less than the average budgeted spend dollars.



	A	B	C	D	E	F
1	***Regular Expenses***					
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Year Spend**	**Percent Change**
3	Utilities	$ 250		$ 3,000	$ 3,000	0.0%
4	Cell Phone	$ 100		$ 1,200	$ 1,200	0.0%
5	Food	$ 300		$ 3,600	$ 2,250	60.0%
6	Gas	$ 125		$ 1,500	$ 1,200	25.0%
7	Clothes	$ 100		$ 1,200	$ 1,000	20.0%
8	Insurance	$ 127		$ 1,524	$ 1,500	1.6%
9	Entertainment	$ 200		$ 2,400	$ 2,250	6.7%
10	Vacation	$ 100		$ 1,200	$ 2,000	-40.0%
11	Miscellaneous	$ 125		$ 1,500	$ 1,558	-3.7%
12	***Totals***	***$ 1***		***17,124***	***$ 15,958***	7.3%
13			**Number of Expense Categories**	9		
14			**Average Spent**	$ 1,903		

Figure 2.20 Completed AVERAGE function

THE MAX AND MIN FUNCTIONS

Data file: Continue with CH2 Personal Budget.

The final two statistical functions that we will add to the **Budget Detail** worksheet are the MAX and MIN functions. These functions identify the highest and lowest values in a range of cells. The following steps explain how to add these functions to the **Budget Detail** worksheet using the Insert Function button:

1. Click cell D15 in the **Budget Det**ail worksheet.
2. Click the Insert Function button on the Formulas ribbon. (see **Figure 2.21**)
3. This brings up the Insert Function dialog box. Type the word **MIN** in the search box and then click the Go button. (see **Figure 2.22**)
4. Double-click MIN in the list. This opens the Function Arguments dialog box.
5. Click the Collapse Dialog button in the Function Arguments dialog box.
6. Highlight the range D3:D11.

7. Click the Expand Dialog button in the Function Arguments dialog box.
8. Click the OK button on the Function Arguments dialog box. This adds the MIN function to the worksheet. (see **Figure 2.23)**
9. Click cell D16.
10. Repeat steps 2-8 (using MAX instead of MIN) to add the MAX function to the worksheet. (see **Figure 2.24**)

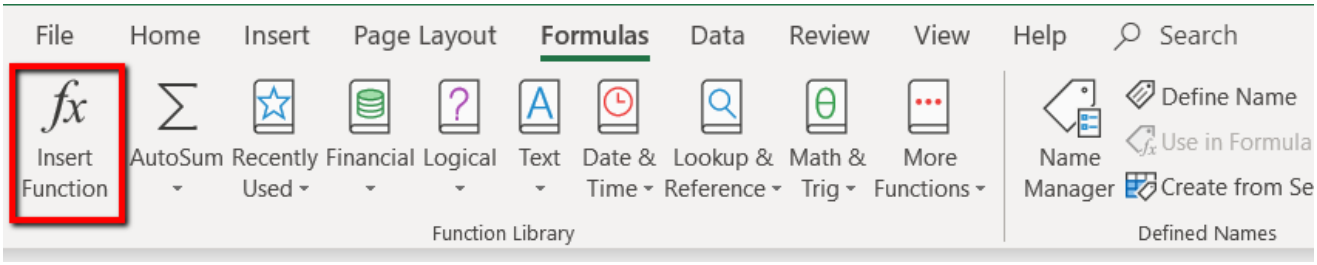


Figure 2.21 Insert Function button on the Formulas Ribbon

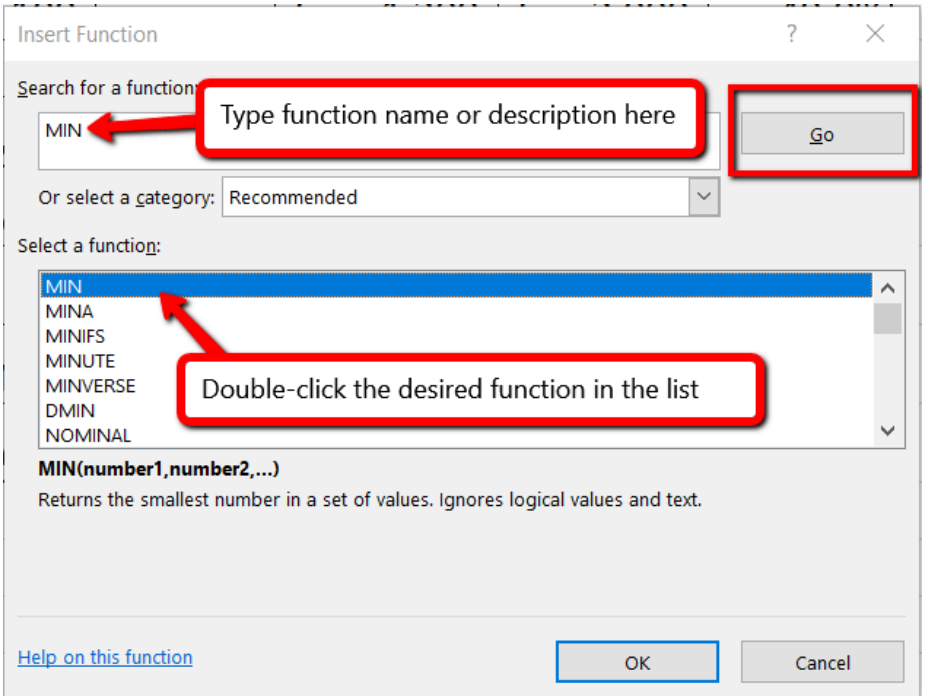
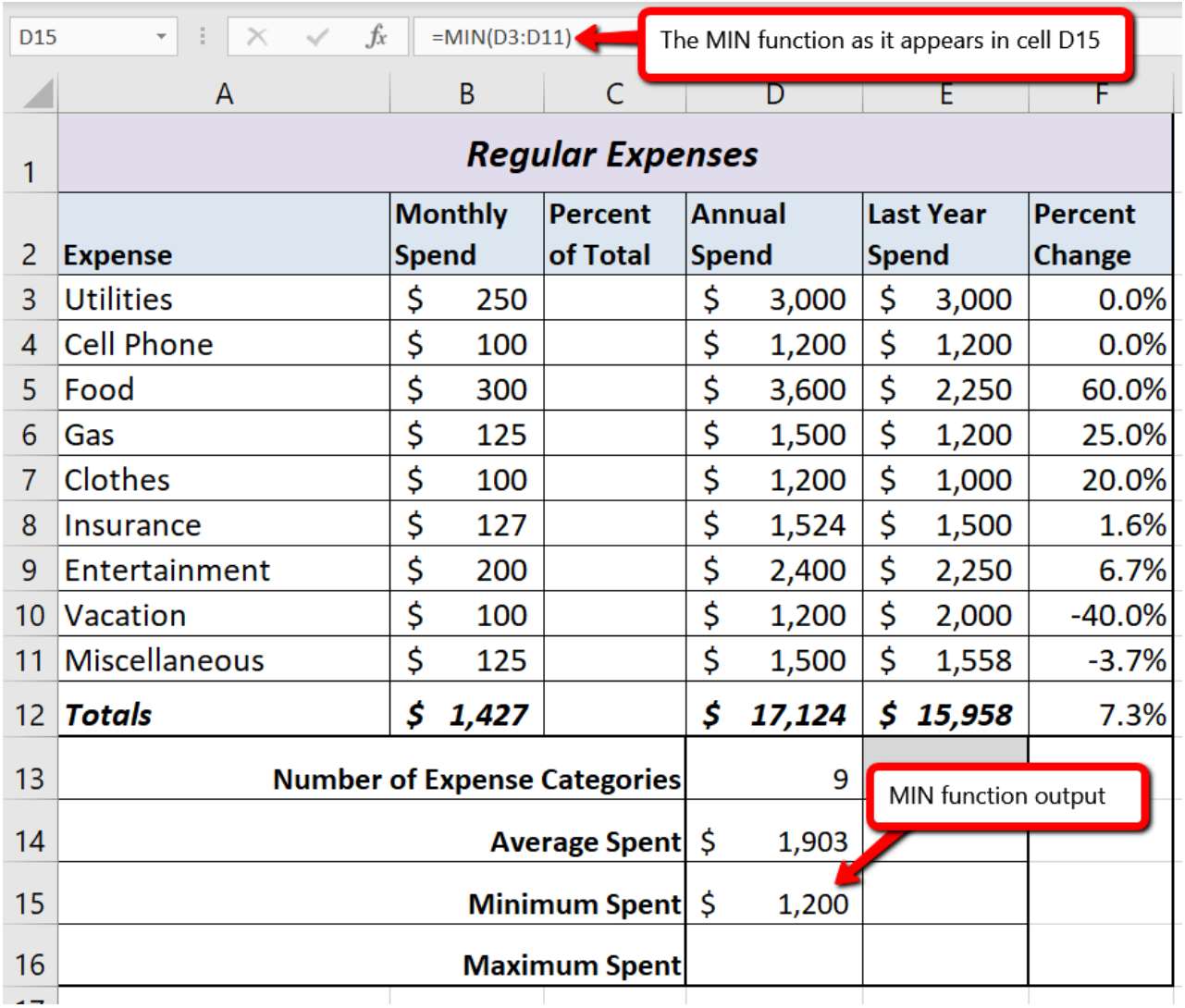
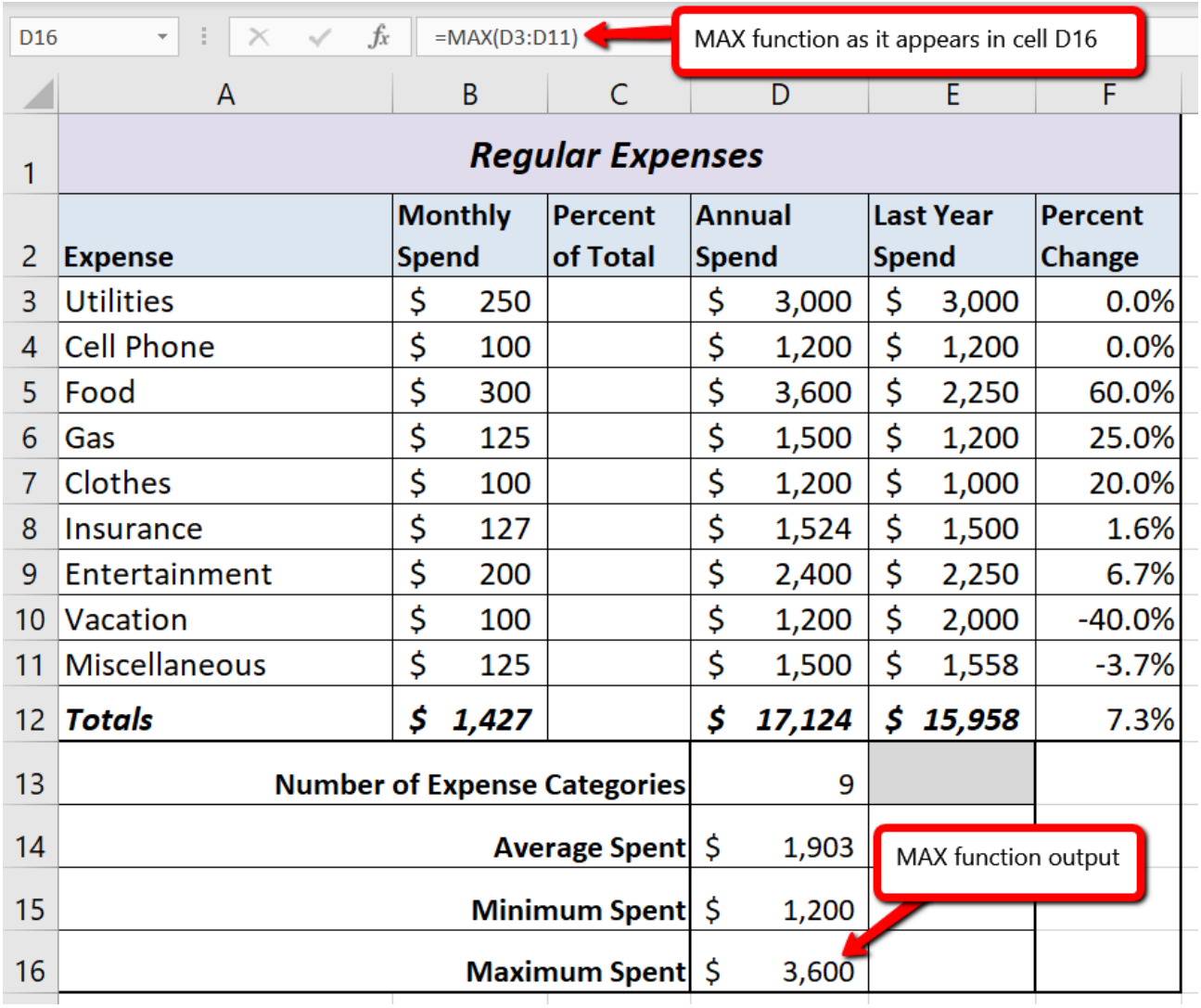


Figure 2.22 Insert Function Dialog Box



	A	B	C	D	E	F
1	***Regular Expenses***					
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Year Spend**	**Percent Change**
3	Utilities	$ 250		$ 3,000	$ 3,000	0.0%
4	Cell Phone	$ 100		$ 1,200	$ 1,200	0.0%
5	Food	$ 300		$ 3,600	$ 2,250	60.0%
6	Gas	$ 125		$ 1,500	$ 1,200	25.0%
7	Clothes	$ 100		$ 1,200	$ 1,000	20.0%
8	Insurance	$ 127		$ 1,524	$ 1,500	1.6%
9	Entertainment	$ 200		$ 2,400	$ 2,250	6.7%
10	Vacation	$ 100		$ 1,200	$ 2,000	-40.0%
11	Miscellaneous	$ 125		$ 1,500	$ 1,558	-3.7%
12	***Totals***	***$ 1,427***		***$ 17,124***	***$ 15,958***	7.3%
13	**Number of Expense Categories**			9		
14	**Average Spent**			$ 1,903		
15	**Minimum Spent**			$ 1,200		
16	**Maximum Spent**					

2.23 MIN function added to the Budget Detail worksheet



	A	B	C	D	E	F
1	***Regular Expenses***					
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Year Spend**	**Percent Change**
3	Utilities	$ 250		$ 3,000	$ 3,000	0.0%
4	Cell Phone	$ 100		$ 1,200	$ 1,200	0.0%
5	Food	$ 300		$ 3,600	$ 2,250	60.0%
6	Gas	$ 125		$ 1,500	$ 1,200	25.0%
7	Clothes	$ 100		$ 1,200	$ 1,000	20.0%
8	Insurance	$ 127		$ 1,524	$ 1,500	1.6%
9	Entertainment	$ 200		$ 2,400	$ 2,250	6.7%
10	Vacation	$ 100		$ 1,200	$ 2,000	-40.0%
11	Miscellaneous	$ 125		$ 1,500	$ 1,558	-3.7%
12	***Totals***	***$ 1,427***		***$ 17,124***	***$ 15,958***	7.3%
13	**Number of Expense Categories**			9		
14	**Average Spent**			$ 1,903		
15	**Minimum Spent**			$ 1,200		
16	**Maximum Spent**			$ 3,600		

Figure 2.24 MAX function added to the Budget Detail worksheet

Skill Refresher

Typing a function or selecting from the function list

1. Type an equal sign **=**.
2. Type the function name followed by an open parenthesis **(** or double click the function name from the function list.
3. Highlight the range of cells to use or click individual cell locations followed by commas.
4. Type a closing parenthesis **)** and press the ENTER key or press the ENTER key to close the function.

Inserting a function using the ribbon

1. On the Formulas ribbon, select the correct category in the Function Library. Click the desired function in the list.
2. In the Function Dialog box, click the Collapse Dialog button and highlight the range of cells to use.
3. Click the Expand Dialog button and then click the OK button in the Function Arguments dialog box.

Inserting (and searching for) a function using the Insert Function button

1. On the Formulas ribbon, click the Insert Function button and search for the function to use. Double-click on the desired function in the list.
2. In the Function Dialog box, click the Collapse Dialog button and highlight the range of cells to use.
3. Click the Expand Dialog button and then click the OK button in the Function Arguments dialog box.

COPY AND PASTE FORMULAS (PASTING WITHOUT FORMATS)

Data file: Continue with CH2 Personal Budget.

As shown in **Figure 2.24**, the COUNT, AVERAGE, MIN, and MAX functions are summarizing the data in the Annual Spend column. You will also notice that there is space to copy and paste these functions under the Last Year Spend column. This allows us to compare what we spent last year and what we are planning to spend this year. Normally, we would simply copy and paste these functions into the range E14:E16. However, you may have noticed the thicker style border that was used around the perimeter of the range D13:E16. If we used the regular Paste command, the thick line on the right side of the range D13:E16 would be replaced with a single line. Therefore, we are going to use one of the Paste Special commands to paste only the functions without any of the formatting treatments. This is accomplished through the following steps:

1. Highlight the range D14:D16 in the **Budget Detail** worksheet.
2. Click the Copy button in the Home tab of the Ribbon.
3. Click cell E14.
4. Click the down arrow below the Paste button in the Home tab of the Ribbon.
5. Click the Formulas option from the drop-down list of buttons (see **Figure 2.25**).

Figure 2.25 shows the list of buttons that appear when you click the down arrow below the Paste button in the Home tab of the Ribbon. One thing to note about these options is that you can preview them before you make a selection by dragging the mouse pointer over the options. When

the mouse pointer is placed over the Formulas button, you can see how the functions will appear before making a selection. Notice that the thick line border does not change when this option is previewed. That is why this selection is made instead of the regular Paste option.

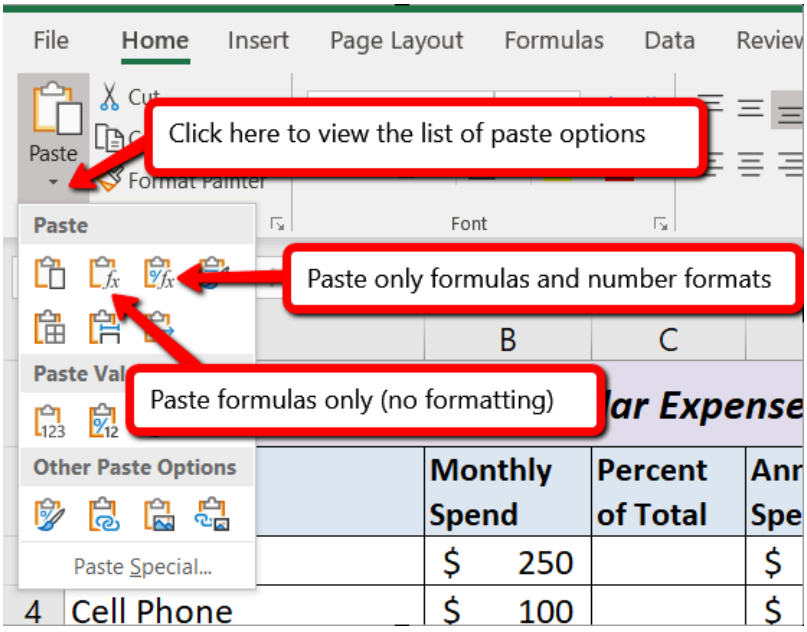


Figure 2.25 Paste Formulas Option

Skill Refresher

Paste Formulas without formatting

1. Click a cell location containing a formula or function.
2. Click the Copy button in the Home tab of the Ribbon.
3. Click the cell location or cell range where the formula or function will be pasted.
4. Click the down arrow below the Paste button in the Home tab of the Ribbon.
5. Click the Formulas button under the Paste group of buttons.

ABSOLUTE REFERENCES (CALCULATING PERCENT OF TOTALS)

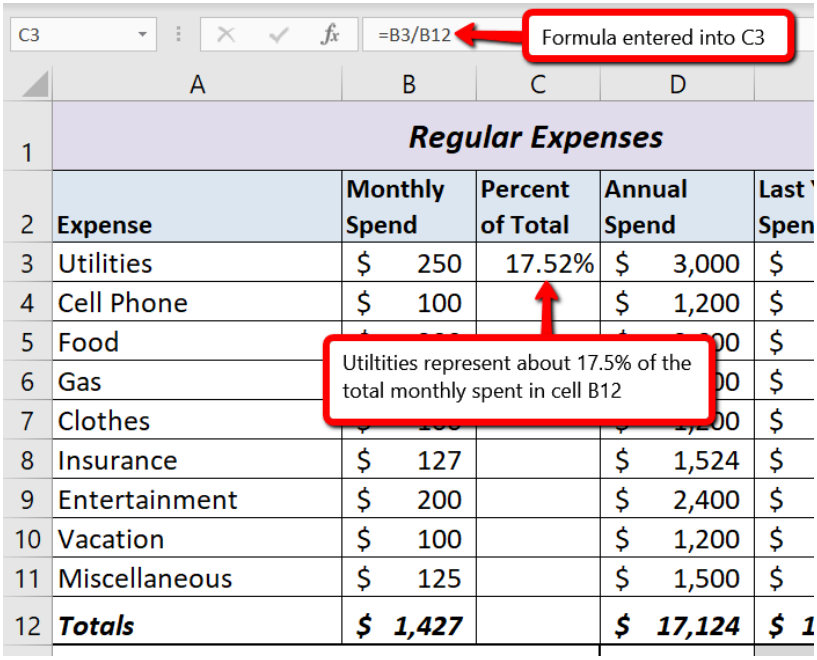
Data file: Continue with CH2 Personal Budget.

To further analyze your budget, you want to see what percentage of your total monthly spending is spent in each category. Since totals were added to row 12 of the **Budget Detail** worksheet, a percent of total calculation can be added to Column C beginning in cell C3. The percent of total calculation shows the percentage for each value in the Monthly Spend column with respect to the total in cell B12. However, after the formula is created, it will be necessary to turn off Excel's rela-

tive referencing feature before copying and pasting the formula to the rest of the cell locations in the column. Turning off Excel's relative referencing feature is accomplished through an absolute reference.

First we will create the formula, which needs needs to divide the amount in B3 by the total monthly spend in B12.

1. Click cell C3 in the **Budget Detail** worksheet.
2. Type an equal sign **=**.
3. Click cell B3.
4. Type a forward slash **/**.
5. Click cell B12.
6. Press the ENTER key. You will see that Utilities represent about 17.5% of the Monthly Spend budget (see **Figure 2.26**).



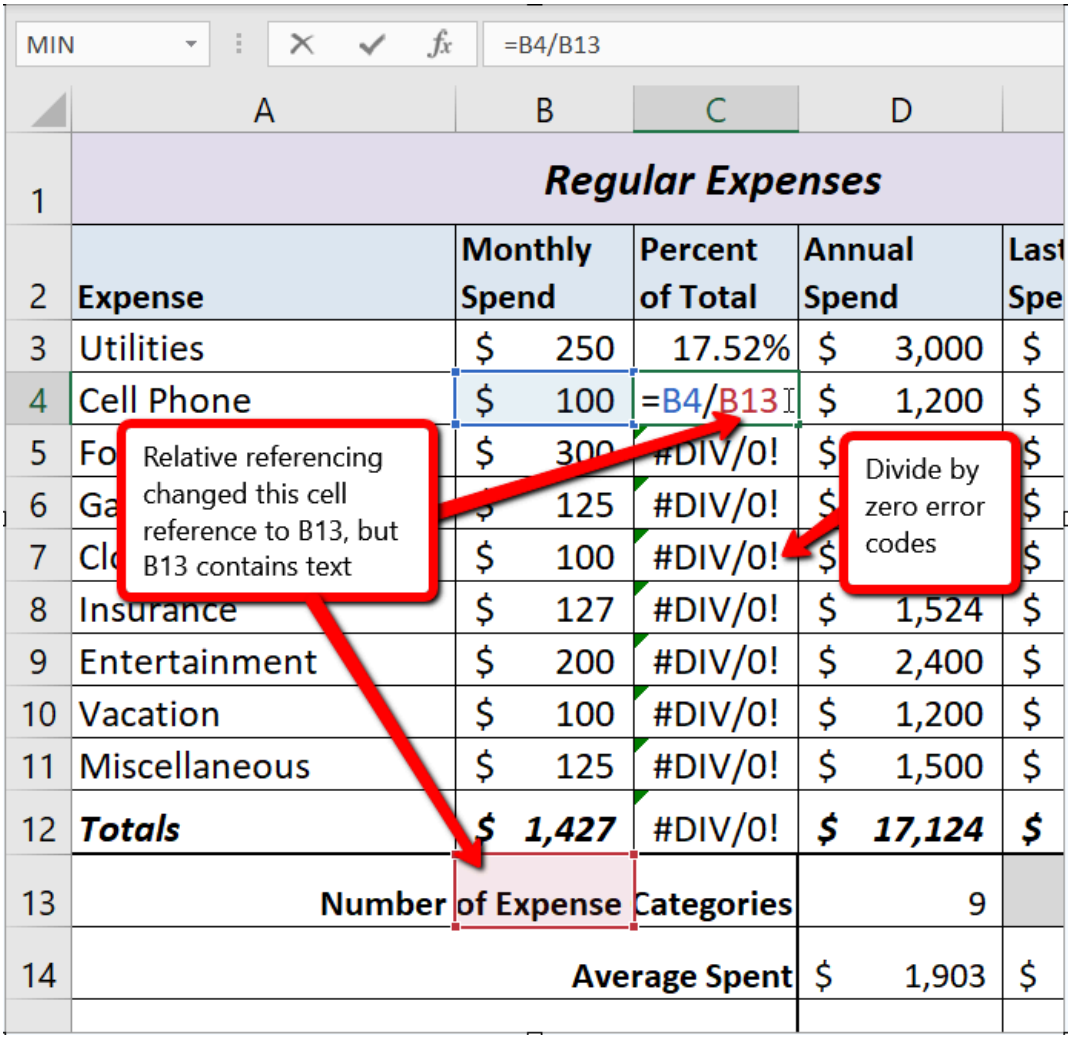
	A	B	C	D	
1	***Regular Expenses***				
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Spen**
3	Utilities	$ 250	17.52%	$ 3,000	$
4	Cell Phone	$ 100		$ 1,200	$
5	Food				$
6	Gas				$
7	Clothes				$
8	Insurance	$ 127		$ 1,524	$
9	Entertainment	$ 200		$ 2,400	$
10	Vacation	$ 100		$ 1,200	$
11	Miscellaneous	$ 125		$ 1,500	$
12	***Totals***	***$ 1,427***		***$ 17,124***	***$ 1***

Figure 2.26 Adding a Formula to Calculate the Percent of Total

Figure 2.26 shows the completed formula that is calculating the percentage that Utilities represents to the total Monthly Spend for the budget (see cell C3). Normally, we would copy this formula and paste it into the range C4:C11. However, because of relative referencing, both cell references will increase by one row as the formula is pasted into the cells below C3. This is fine for the first cell reference in the formula (C3) but not for the second cell reference (C12).

Figure 2.27 illustrates what happens if we paste the formula into the range C4:C12 in its current state. Notice that Excel produces the **#DIV/0** error code. This means that Excel is trying to divide a number by zero, which is impossible. Looking at the formula in cell C4, you see that the first cell reference was changed from B3 to B4. This is fine because we now want to divide the Monthly

Spend for Cell Phone (cell B4) by the total Monthly Spend in cell B12. However, Excel has also changed the B12 cell reference to B13. Because cell location B13 does not contain a number, the formula produces the #DIV/0 error code.



	A	B	C	D	
1	***Regular Expenses***				
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Spe**
3	Utilities	$ 250	17.52%	$ 3,000	$
4	Cell Phone	$ 100	=B4/B13	$ 1,200	$
5	Fo	$ 300	#DIV/0!	$	$
6	Ga	125	#DIV/0!	$	$
7	Cl	$ 100	#DIV/0!	$	$
8	Insurance	$ 127	#DIV/0!	$ 1,524	$
9	Entertainment	$ 200	#DIV/0!	$ 2,400	$
10	Vacation	$ 100	#DIV/0!	$ 1,200	$
11	Miscellaneous	$ 125	#DIV/0!	$ 1,500	$
12	***Totals***	***$ 1,427***	#DIV/0!	***$ 17,124***	***$***
13		**Number of Expense Categories**		9	
14			**Average Spent**	$ 1,903	$

Figure 2.27 #DIV/0 Error from Relative Referencing

To eliminate the divide-by-zero error shown in **Figure 2.27** we must add an absolute reference to cell B12 in the formula. An absolute reference prevents relative referencing from changing a cell reference in a formula. This is also referred to as locking a cell. No matter where you copy a formula with an absolute reference, it will always refer back to the locked cell. An absolute reference is indicated by a $ sign in front of both the column letter and the row number. For example, **$A$15** is an absolute reference to cell A15.

$A$15 is an example of an absolute reference

We are going to modify the existing formula in C3 to make the reference to cell B12 an absolute reference. The following explains how this is accomplished:

1. Double click cell C3.

2. Place the mouse pointer in front of B12 and click. The blinking cursor should be in front of the B in the cell reference B12.
3. Press the F4 key. You will see a dollar sign ($) added in front of the column letter B and the row number 12. *You can also type the dollar signs in front of the column letter and row number if you prefer. The formula should appear as =B3/$B$12. The **F4** key is a cool shortcut for adding the dollar signs.*

   Mac Users: If the **F4** key does not insert the $ symbols, check the keyboard settings: click black Apple icon at top left of the screen, choose "**System Preferences**", click the **Keyboard icon**, make sure the checkbox is checked for the item that says: "Use F1, F2, etc. as standard function keys".
4. Press the ENTER key.
5. Click cell C3.
6. Use the AutoFill Handle or Copy and Paste to copy the formula from C3 to the range C4:C11.

Figure 2.28 shows the percent of total formula with an absolute reference added to B12. Notice that in cell C4, the cell reference remains B12 instead of changing to B13. Also, you will see that the percentages are being calculated in the rest of the cells in the column, and the divide-by-zero error is now eliminated.

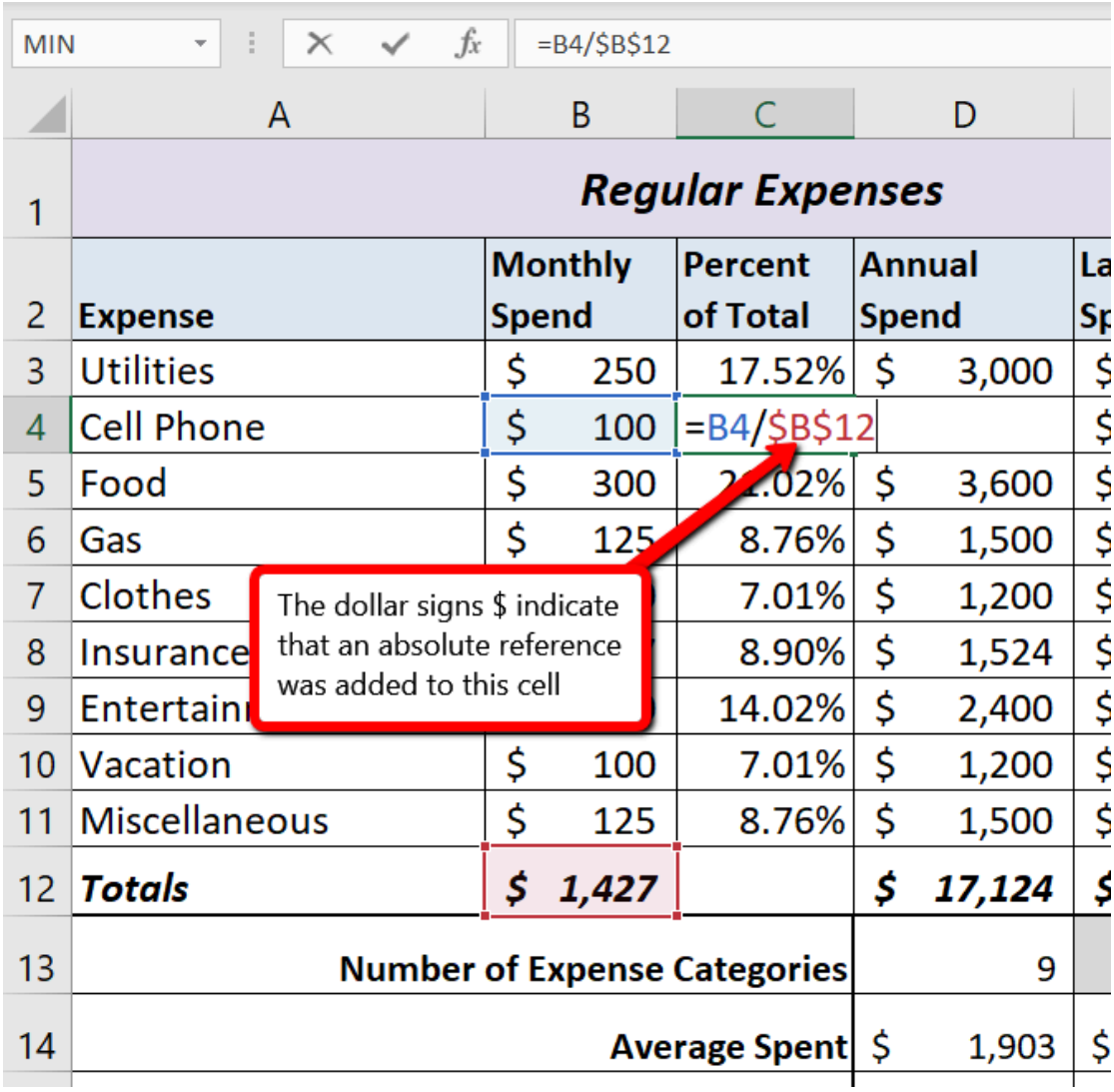


Figure 2.28 Adding an Absolute Reference to a Cell Reference in a Formula

Skill Refresher

Absolute References

1. Click in front of the column letter of a cell reference in a formula or function that you do not want altered when the formula or function is pasted into a new cell location.
2. Press the F4 key or type a dollar sign $ in front of the column letter and row number of the cell reference.

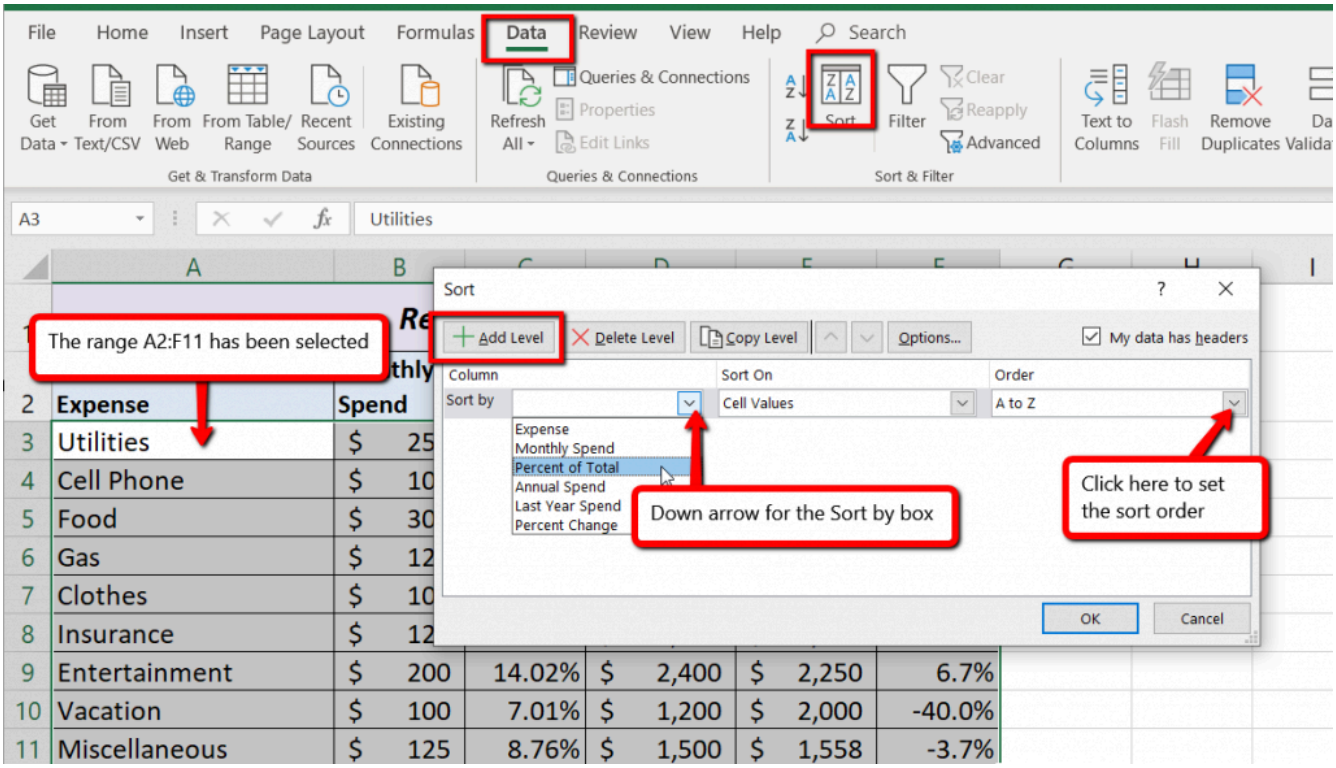
SORTING DATA (MULTIPLE LEVELS)

Data file: Continue with CH2 Personal Budget.

The **Budget Detail** worksheet shown in **Figure 2.28** is now producing several mathematical outputs through formulas and functions. The outputs allow you to analyze the details and identify trends as to how money is being budgeted and spent. Before we draw some conclusions from this worksheet, we will sort the data based on the Percent of Total column. Sorting is a powerful tool that enables you to analyze key trends in any data set. Sorting will be covered thoroughly in a later chapter, but will be briefly introduced here.

For the purposes of the **Budget Detail** worksheet, we want to set multiple levels for the sort order. We are going to sort first by the Percent of Total, and then by the Last Year Spend amount. Excel will first sort the items by the Percent of Total, and any items with the same Percent of Total will then be sorted by Last Year Spend. This is accomplished through the following steps:

1. Highlight the range A2:F11.
2. Click the Data tab in the Ribbon.
3. Click the Sort button in the Sort & Filter group of commands. This opens the Sort dialog box, as shown in **Figure 2.29**.
4. Click the down arrow next to the "Sort by" box.
5. Click the Percent of Total option from the drop-down list.
6. Click the down arrow next to the sort Order box.
7. Click the Largest to Smallest option.
8. Click the Add Level button. This allows you to set a second level for any duplicate values in the Percent of Total column.
   the + symbol at bottom left corner is the "Add Level" button for Excel for Mac
9. Click the down arrow next to the "Then by" box.
10. Select the Last Year Spend option. Leave the Sort Order as Smallest to Largest
11. Click the OK button at the bottom of the Sort dialog box.
12. Save the **CH2 Personal Budget** file.



2.29 Sort Dialog Box

Figure 2.30 shows the **Budget Detail** worksheet after it has been sorted. Notice that there are three identical values in the Percent of Total column. This is why a second sort level had to be created for this worksheet. The second sort level arranges the values of 7.01% based on the values in the Last Year Spend column in ascending order. Excel gives you the option to set as many sort levels as necessary for the data contained in a worksheet.

	A	B	C	D	E	F
1	***Regular Expenses***					
2		**nthly nd**	**Percent of Total**	**Annual Spend**	**Last Year Spend**	**Percent Change**
3	Food	$ 300	21.02%	$ 3,600	$ 2,250	60.0%
4	Utilities	$ 250	17.52%			%
5	Entertainment	$ 200	14.02%			%
6	Insurance	$ 127	8.90%			%
7	Gas	$ 125	8.76%	$ 1,500	$ 1,200	25.0%
8	Miscellaneous	$ 125	8.76%	$ 1,500	$ 1,558	-3.7%
9	Clothes	$ 100	7.01%	$ 1,200	$ 1,000	20.0%
10	Cell Phone	$ 100	7.01%	$ 1,200	$ 1,200	0.0%
11	Vacation	$ 100	7.01%	$ 1,200	$ 2,000	-40.0%
12	***Totals***	***$ 1,427***		***$ 17,124***	***$ 15,958***	7.3%
13	**Number of Expense Categories**			9		
14	**Average Spent**			$ 1,903	$ 1,773	
15	**Minimum Spent**			$ 1,200	$ 1,000	
16	**Maximum Spent**			$ 3,600	$ 3,000	

The primary sort level is based on the values in this column

These duplicate Percent of Total values are then sorted based on the values in the Last Year Spend column

Figure 2.30 Budget Detail Worksheet after Sorting

Skill Refresher

Sorting Data (Multiple Levels)

1. Highlight a range of cells to be sorted.
2. Click the Data tab of the Ribbon.
3. Click the Sort button in the Sort & Filter group.
4. Select a column from the "Sort by" drop-down list in the Sort dialog box.
5. Select a sort order from the Order drop-down list in the Sort dialog box.
6. Click the Add Level button in the Sort dialog box.
7. Repeat Steps 4 and 5.
8. Click the OK button on the Sort dialog box.

Key Takeaways

- Statistical functions are used when a mathematical process is required for a range of cells, such as summing the values in several cell locations. For these computations, functions are preferable to formulas because adding many cell locations one at a time to a formula can be very time-consuming.
- Statistical functions can be created using cell ranges or selected cell locations separated by commas. Make sure you use a cell range (two cell locations separated by a colon) when applying a statistical function to a contiguous range of cells.
- To prevent Excel from changing the cell references in a formula or function when they are pasted to a new cell location, you must use an absolute reference. You can do this by placing a dollar sign ($) in front of the column letter and row number of a cell reference.
- The #DIV/0 error appears if you create a formula that attempts to divide a constant or the value in a cell reference by zero.
- The Paste Formulas option is used when you need to paste formulas without any formatting treatments into cell locations that have already been formatted.
- You need to set multiple levels, or columns, in the Sort dialog box when sorting data that contains several duplicate values.

ATTRIBUTION

2.3 Functions for Personal Finance

Learning Objectives

1. Understand the fundamentals of loans.
2. Use the PMT function to calculate monthly car loan payments.
3. Use the PMT function to calculate monthly mortgage payments on a house using a down payment.
4. Learn how to summarize data in a workbook by using worksheet links to create a summary worksheet.

In this section, we continue to develop the **Personal Budget** workbook. Notable items that are missing from the **Budget Detail** worksheet are the payments you might make for a car or a home. This section demonstrates Excel functions used to calculate loan payments for a car and to calculate mortgage payments for a house.

THE FUNDAMENTALS OF LOANS AND LEASES

One of the functions we will add to the Personal Budget workbook is the PMT function. This function calculates the payments required for loan repayment. However, before demonstrating this function, it is important to cover a few fundamental concepts on loans.

A loan is a contractual agreement in which money is borrowed from a lender and paid back over a specific period of time. The amount of money that is borrowed from the lender is called the **principal** of the loan. The borrower is usually required to pay the principal of the loan plus interest. When you borrow money to buy a house, the loan is referred to as a mortgage. This is because the house being purchased also serves as collateral to ensure payment. In other words, the bank can take possession of your house if you fail to make loan payments. As shown in **Table 2.5**, there are several key terms related to loans.

Table 2.5 Key Terms for Loans

Term	Definition
Collateral	Any item of value that is used to secure a loan to ensure payments to the lender
Down Payment	The amount of cash paid toward the purchase of a house. If you are paying 20% down, you are paying 20% of the cost of the house in cash and are borrowing the rest from a lender.
Interest Rate	The interest that is charged to the borrower as a cost for borrowing money
Mortgage	A loan where property is put up for collateral
Principal	The amount of money that has been borrowed
Residual Value	The estimated selling price of a vehicle at a future point in time
Length	The amount of time you have to repay a loan

Figure 2.31 shows an example of an amortization table for a loan. A lender is required by law to provide borrowers with an amortization table when a loan contract is offered. The table in the figure shows how the payments of a loan would work if you borrowed $100,000 from a lender and agreed to pay it back over 10 years at an interest rate of 5%. You will notice that each time you make a payment, you are paying the bank an interest fee plus some of the loan principal. Each year the amount of interest paid to the bank decreases and the amount of money used to pay off the principal increases. This is because the bank is charging you interest on the amount of principal that has not been paid. As you pay off the principal, the interest rate is applied to a lower number, which reduces your interest charges. Finally, the figure shows that the sum of the values in the Interest Payment column is $29,505. This is how much it costs you to borrow this money over 10 years. Indeed, borrowing money is not free. It is important to note that to simplify this example, the payments were calculated on an annual basis. However, most loan payments are made on a monthly basis.

	A	B	C	D
1	**Loan Details**			
2	Annual Interest Rate		5.0%	
3	Terms in Years		10	
4	Loan Principal		$ 100,000	
5	**Annual Payments**		**$12,950**	
6				
7	***Amortization Table for Loan***			
8	**Year**	**Interest Payment**	**Principal Payment**	**Beginning Principal Balance**
9	1	$ 5,000	$ 7,950	$ 100,000
10	2	$ 4,602	$ 8,348	$ 92,050
11	3	$ 4,185	$ 8,765	$ 83,702
12	4	$ 3,747	$ 9,204	$ 74,936
13	5	$ 3,287	$ 9,664	$ 65,733
14	6	$ 2,803	$ 10,147	$ 56,069
15	7	$ 2,296	$ 10,654	$ 45,922
16	8	$ 1,763	$ 11,187	$ 35,267
17	9	$ 1,204	$ 11,746	$ 24,080
18	10	$ 617	$ 12,334	$ 12,334

For each year, the Interest Payment plus the Principle Payment is $12,950.

Total for this column is $29,505.

At the end of year 10, the loan is paid in full.

Figure 2.31 Example of an Amortization Table

THE PMT (PAYMENT) FUNCTION FOR LOANS

Data file: Continue with CH2 Personal Budget.

If you own a home, your mortgage payments are a major component of your household budget. If you are planning to buy a home, having a clear understanding of your monthly payments is critical for maintaining strong financial health. In Excel, mortgage payments are conveniently calculated through the PMT (payment) function. This function is more complex than the statistical functions

covered in Section 2.2 "Statistical Functions". With statistical functions, you are required to add only a range of cells or selected cells within the parentheses of the function, also known as the argument. With the PMT function, you must accurately define a series of arguments in order for the function to produce a reliable output. **Table 2.6** lists the arguments for the PMT function. It is helpful to review the key loan terms in **Table 2.5** before reviewing the PMT function arguments.

Table 2.6 Arguments for the PMT Function

Argument	Definition
Rate	This is the interest rate the lender is charging the borrower. The interest rate is usually quoted in annual terms, so you have to divide this rate by 12 if you are calculating monthly payments.
Nper	The argument letters stand for number of periods. This is the term of the loan, which is the amount of time you have to repay the bank. This is usually quoted in years, so you have to multiply the years by 12 if you are calculating monthly payments.
Pv	The argument letters stand for present value. This is the principal of the loan or the amount of money that is borrowed.
[Fv]	The argument letters stand for future value. The brackets around the argument indicate that it is not always necessary to define it. It is used if there is a lump-sum payment that will be made at the end of the loan terms. This is also used for the residual value of a lease. If it is not defined, Excel will assume that it is zero.
[Type]	This argument can be defined with either a 1 or a 0. The number 1 is used if payments are made at the beginning of each period. A 0 is used if payments are made at the end of each period. The argument is in brackets because it does not have to be defined if payments are made at the end of each period. Excel assumes that this argument is 0 if it is not defined.

By default, the result of the PMT function in Excel is shown as a negative number. This is because it represents an outgoing payment. When making a mortgage or car payment, you are paying money out of your pocket or bank account. Depending on the type of work that you do, your employer may want you to leave your payments negative or they may ask you to format them as positive numbers. In the following assignments, the payments calculated using the PMT function will be made positive to make them easier to work with. To do this, you will place a negative sign between the equal sign and the function name PMT.

We will first use the PMT function in the Personal Budget workbook to calculate the monthly loan payments for a car. These calculations will be made in the **Loan Payments** worksheet and then displayed in the **Budget Summary** worksheet through a cell reference link. So far we have demonstrated several methods for adding functions to a worksheet. When working with more complex functions such as the PMT, it is easiest to use the Function Dialog box.

Remember to use cell references for the arguments of the PMT function whenever possible. This will allow you the flexibility to change aspects of the loan, such as a lower interest rate or more expensive car, and have the payment automatically recalculate.

The following steps use the Insert Function command covered in Section 2.2 to add the PMT function:

1. Switch to the **Loan Payments** worksheet.
2. Click cell B5.

Using cell references for the arguments provides greater flexibility in trying different scenarios.

3. Click the Formulas tab on the Ribbon.
4. Click the Insert Function button to bring up the Insert Function dialog box.
5. Type loan **payment** in the search box and click Go.
   the Excel for Mac search box does is not the same as the "Search for a function: input box". Mac Users must type: **PMT** in the search box instead. Then press Enter.
6. Double-click the PMT option in the "Select a function:" box. This will open the Function Arguments dialog box.
7. Drag the Function Arguments dialog box out of the way so that you can see the worksheet cells you want to use in the function. Refer to **Figure 2.31** for the completed Function Arguments dialog box as you complete the next steps.
8. Click in the Rate argument box in the dialog box, then click cell B3 in the worksheet. This will add B3 (the annual interest rate) to the Rate argument.
9. Type a forward slash **/** for division.
10. Type the number **12**. *Since our goal is to calculate the monthly payments for the loan, we need to divide the rate, which is stated in annual terms, by 12. This converts the annual rate to a monthly rate.*
11. Click the Nper argument box (or use the Tab key) and then click cell B4 in the worksheet. This will add B4 (the number of years to repay the loan) to the Nper argument.
12. Type an **asterisk** * for multiplication.
13. Type the number **12**. *Since our goal is to calculate the monthly payments for the loan, we need to multiply the terms of the loan by 12. This converts the terms of the loan from years to months.*
14. Click the Pv argument box (or use the Tab key) and then click cell B2 in the worksheet. This will add B2 (the amount of the loan) to the Pv argument.
15. You will now see the Rate, Nper, and Pv arguments defined for the function. (**see Figure 2.31**)
16. Click the OK button at the bottom of the Function Arguments dialog box. The function will now be placed into the worksheet. Since we are not paying any lump sums of money at the end of the loan, there is no need to define the Fv argument. Also, we will assume that the monthly payments will be made at the end of each month. Therefore, there is no need to define the Type argument.
17. Notice that the result of the formula in cell B5 is showing as a negative number (see **Figure 2.32).** To fix this, double-click on cell B5 and type a negative sign between the equal sign and the letters PMT in the formula (see **Figure 2.33**).
18. The finished formula in cell B5 should be **=-PMT(B3/12,B4*12,B2)**

Figure 2.31 shows the completed Function Arguments dialog box for the PMT function. Notice that the dialog box shows the values for the Rate and Nper arguments. The Rate is divided by 12 to convert the annual interest rate to a monthly interest rate. The Nper argument is multiplied by 12 to convert the terms of the loan from years to months. Finally, the dialog box provides you with a definition for each argument. The definition appears when you click in the input box for the argument.

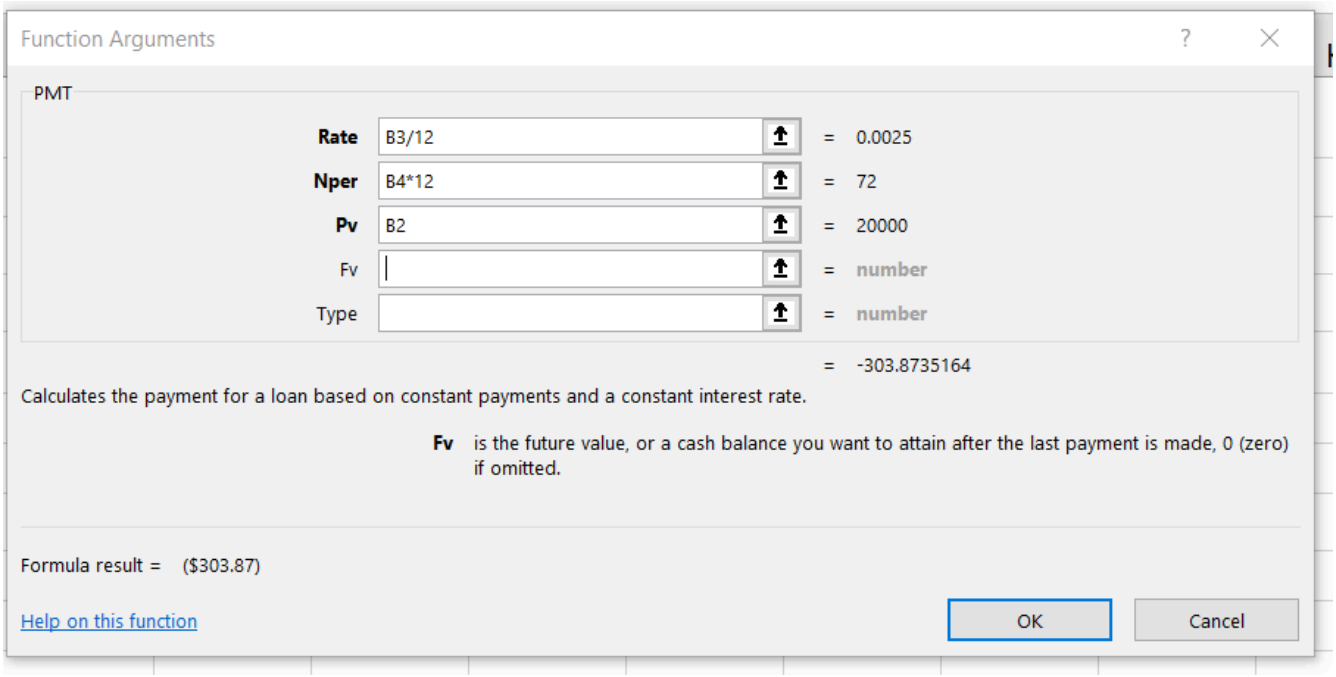


Figure 2.31 Function Arguments Dialog Box for the PMT function

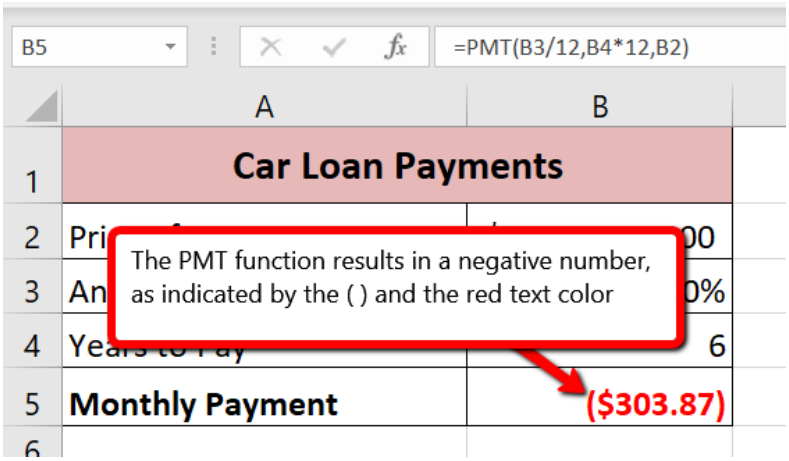


Figure 2.32 Result of the PMT Function as a Negative Number

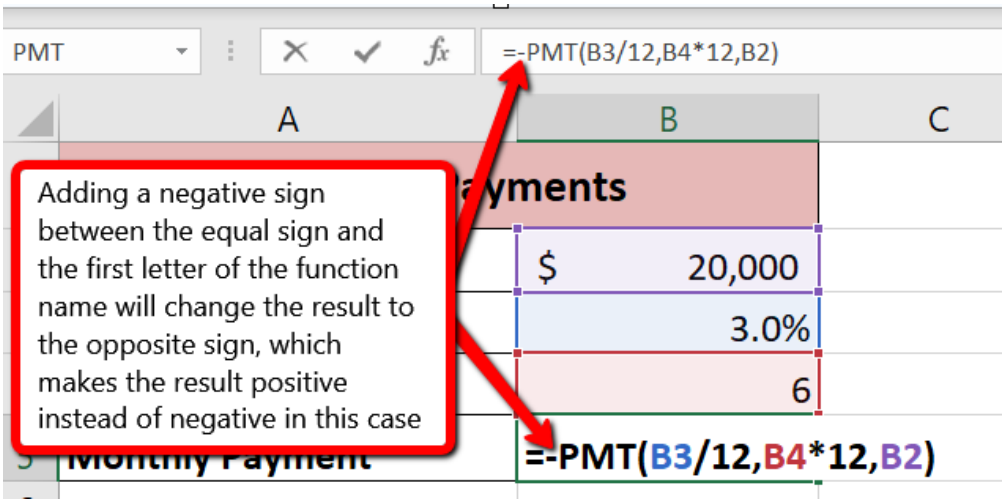


Figure 2.33 The PMT Function Modified to Result in a Positive Number

Keyboard Shortcuts

Insert Function

- Hold the SHIFT key while pressing the F3 key.

Function Arguments Dialog Box

- After the equal sign **=** and function name are typed into cell a location, hold down the CTRL key and press the letter A on your keyboard.

Integrity Check

Comparable Arguments for PMT Function

When using functions such as PMT, make sure the arguments are defined in comparable terms. For example, if you are calculating the monthly payments of a loan, make sure both the Rate and Nper argument are expressed in terms of months. The function will produce an erroneous result if one argument is expressed in years while the other is expressed in months.

THE PMT FUNCTION WHEN THERE IS A DOWN PAYMENT

In addition to calculating the loan payments for a car, the PMT function will be used in the Personal Budget workbook to calculate the mortgage payments for a home. The details for the mortgage payments are also found in the **Loan Payments** worksheet. Unlike the car loan, there is a down payment with the mortgage. A down payment on a mortgage is usually a percentage of the price of the home, which is paid up front and reduces the amount of the loan itself. The down payment amount and amount of the loan will both need to be calculated using formulas. While we did not use a down payment in the car loan example, it is fairly common to have a down payment when purchasing a car too.

Write the formulas to calculate the Down Payment Amount and new Loan Amount by following these steps:

1. Click cell B11.
2. Write the formula **=B9*B10**. *This will calculate 20% of the price of the house.*
3. Click cell B12. Write the formula **=B9-B11**. *This will subtract the down payment amount from the price of the house* (see **Figure 2.34** for the Show Formulas View and **Figure 2.35** for the formula results).

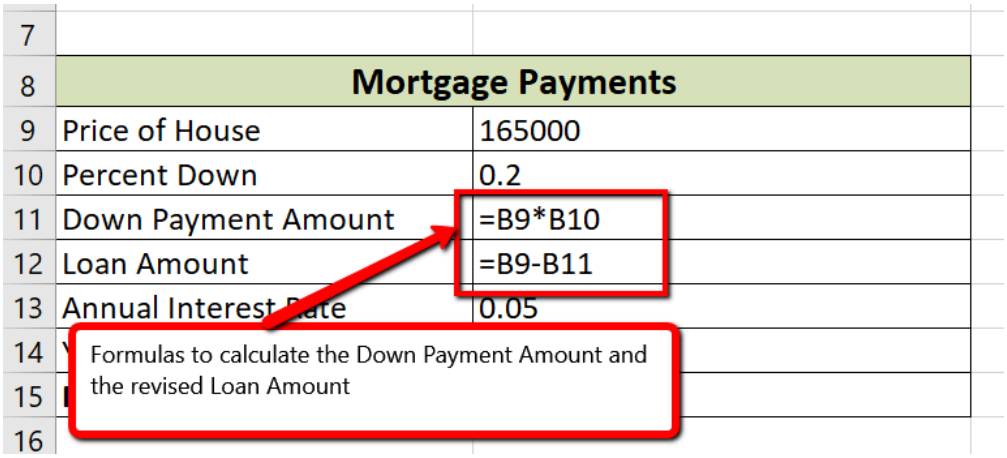


Figure 2.34 Show Formulas View

8	**Mortgage Payments**		
9	Price of House	$	165,000
10	Percent Down		20%
11	Down Payment Amount	$	33,000
12	Loan Amount	$	132,000
13	Annual Interest Rate		5.0%
14	Years to Pay		30
15	**Monthly Payment**		

Figure 2.35 Results of the Down Payment Amount and Revised Loan Amount Formulas

Now that we have the revised Loan Amount in cell B12, we can write the PMT function following the same process we did for the car loan.

1. Click cell B15.
2. Click the Formulas tab on the Ribbon.
3. Click the Insert Function button to bring up the Insert Function dialog box.
4. Type **PMT** in the search box and click Go.
5. Double-click the PMT option in the "Select a function:" box. This will open the Function Arguments dialog box.
6. Enter the following arguments (see **Figure 2.36**)
    - Rate: **B13/12** –> divide by 12 to convert the annual rate to a monthly one
    - Nper: **B14*12** –> multiply by 12 to convert the number of years into number of months
    - Pv: **B12** –> this is the cell with the actual loan amount, not the price of the house
7. Click OK in the Function Arguments dialog box.
8. Modify the formula in cell B15 to display the result as a positive number. *Remember to type a negative sign between the equal sign and the letters PMT.*
9. Cell B15 should contain the function: **=-PMT(B13/12,B14*12,B12)** and the result should be $708.60 (see **Figure 2.37**).

Figure 2.36 shows how the the completed Function Arguments dialog box for the PMT function for the mortgage should appear before pressing the OK button.

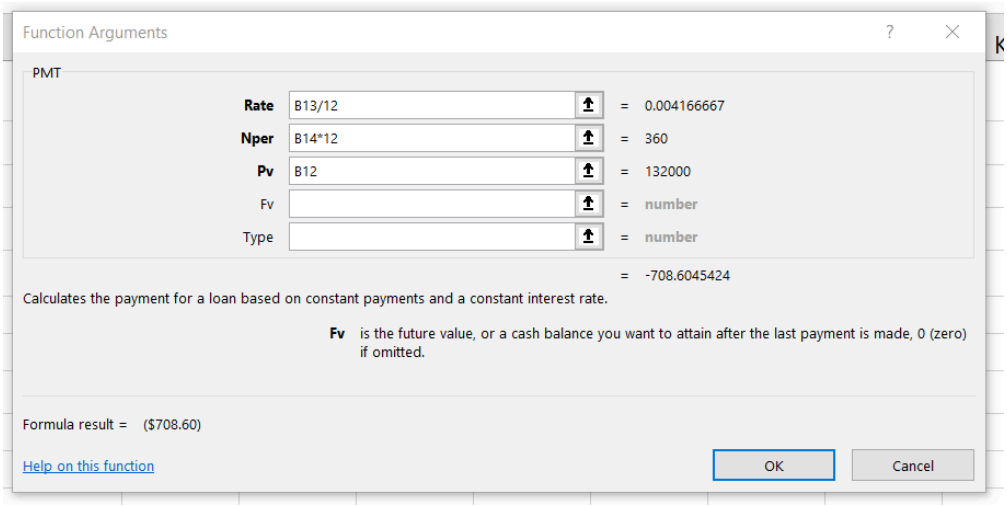


Figure 2.36 Function Arguments Dialog Box for the Mortgage Payment PMT Function

Figure 2.37 shows the result of the PMT function for the mortgage. The monthly payments for this mortgage are $708.60. This monthly payment will be displayed in the **Budget Summary** worksheet.

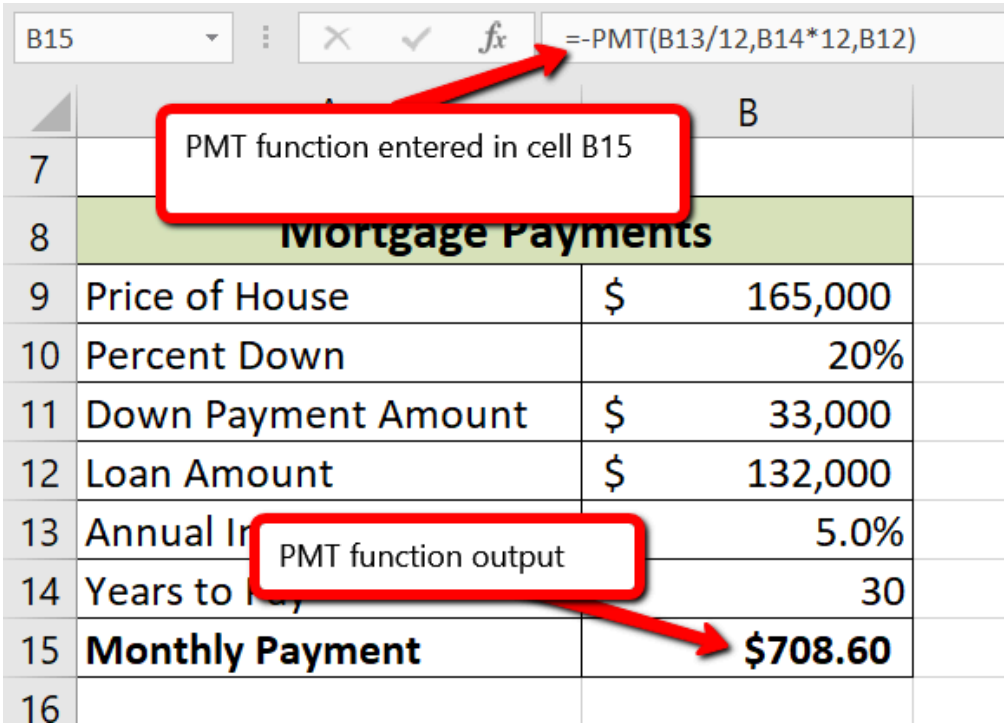


Figure 2.37 Mortgage Monthly Payment Calculation

Skill Refresher

PMT Function

1. Type an equal sign **=**.
2. Type the letters **PMT** followed by an open parenthesis, or double click the function name from the function list.
3. Define the Rate argument with a cell location that contains the rate being charged by the lender for the loan or lease. If the interest rate given is an annual rate, divide it by 12 to convert it to a monthly rate.
4. Define the Nper argument with a cell location that contains the amount of time to repay the loan or lease. If the amount of time is in years, multiply it by 12 to convert it to number of months.
5. Define the Pv argument with a cell location that contains the principal of the loan or the price of the item being leased.
6. Type a closing parenthesis **)**.
7. Press the ENTER key.
8. If the result needs to be shown as a positive number, add a negative sign between the equal sign and the letters PMT.

LINKING WORKSHEETS (CREATING A SUMMARY WORKSHEET)

So far we have used cell references in formulas and functions, which allow Excel to produce new outputs when the values in the cell references are changed. Cell references can also be used to display values or the outputs of formulas and functions in cell locations on other worksheets. This is how we will complete the Budget Summary worksheet using values from both the Budget Detail and Loan Payments worksheets.

Outputs from the formulas and functions that were entered into the **Budget Detail** will be displayed on the **Budget Summary** worksheet through the use of cell references.

1. Switch to the Budget Summary worksheet and select cell B4. *This cell needs to reference the Total Annual Spend (D12) from the Budget Detail worksheet.*
2. Type an =
3. Click the **Budget Detail** worksheet tab.
4. Click cell D12.
5. Press the ENTER key on your keyboard.
6. The formula bar will display the formula **='Budget Detail'!D12** and the cell will display $17,124. (**see Figure 2.38)**

Figure 2.38 shows how the cell reference appears in the **Budget Summary** worksheet. Notice that the cell reference D12 is preceded by the **Budget Detail** worksheet name enclosed in apostrophes followed by an exclamation point ('Budget Detail'!) This indicates that the value displayed in the cell is referencing a cell location in the **Budget Detail** worksheet.

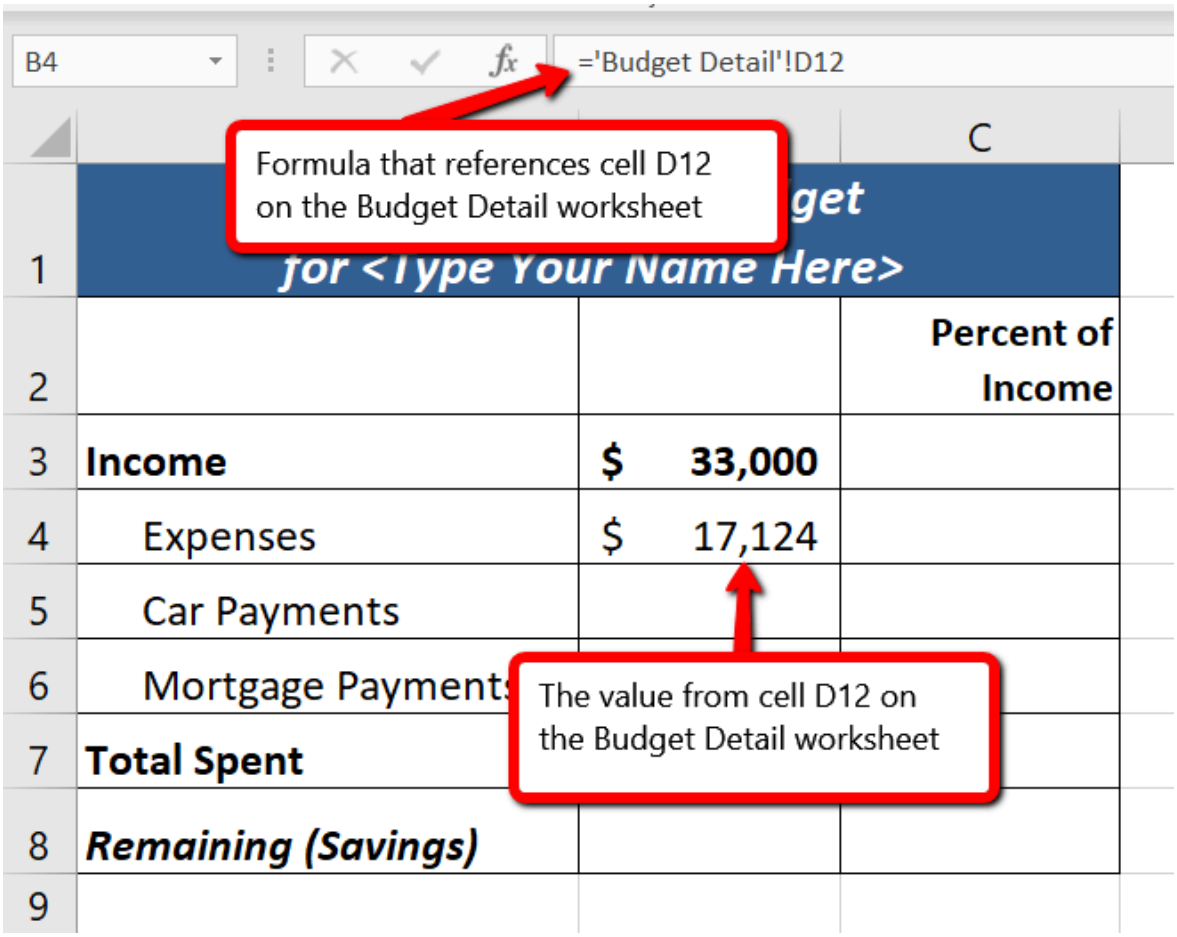


Figure 2.38 Cell Reference Showing the Total Annual Spend from the Budget Detail Worksheet

We will use a similar process to enter in the annual car payments and mortgage payments from the Loan Payments worksheet. The payments on the Loan Payments worksheet are monthly payments though, so we will need to multiply each one by 12 to get the **annual** amount to display in the Budget Summary worksheet.

1. Click on cell B5. *This cell needs to contain a formula that references the monthly car payment cell (B5) on the Loan Payments worksheet and multiplies by 12.*
2. Type an =
3. Click the **Loan Payments** worksheet tab.
4. Click cell B5 on the Loan Payments worksheet.
5. The formula bar will display the formula **='Loan Payments'!B5**
6. Type an asterisk ***** for multiplication.
7. Type the number **12**. The formula in the formula bar should read: **='Loan Pay-**

ments'!B5*12

8. Press the ENTER key on your keyboard.
9. Click on cell B6. *This cell needs to contain a formula that references the monthly mortgage payment cell (B15) on the Loan Payments worksheet and multiplies by 12.*
10. Type an =
11. Click the **Loan Payments** worksheet tab.
12. Click cell B15 on the Loan Payments worksheet.
13. The formula bar will display the formula **='Loan Payments'!B15**
14. Type an asterisk ***** for multiplication.
15. Type the number **12**. The formula in the formula bar should read: **='Loan Payments'!B15*12**
16. Press the ENTER key on your keyboard.

Figure 2.39 shows the results of creating formulas that reference cell locations in the **Loan Payments** worksheet.

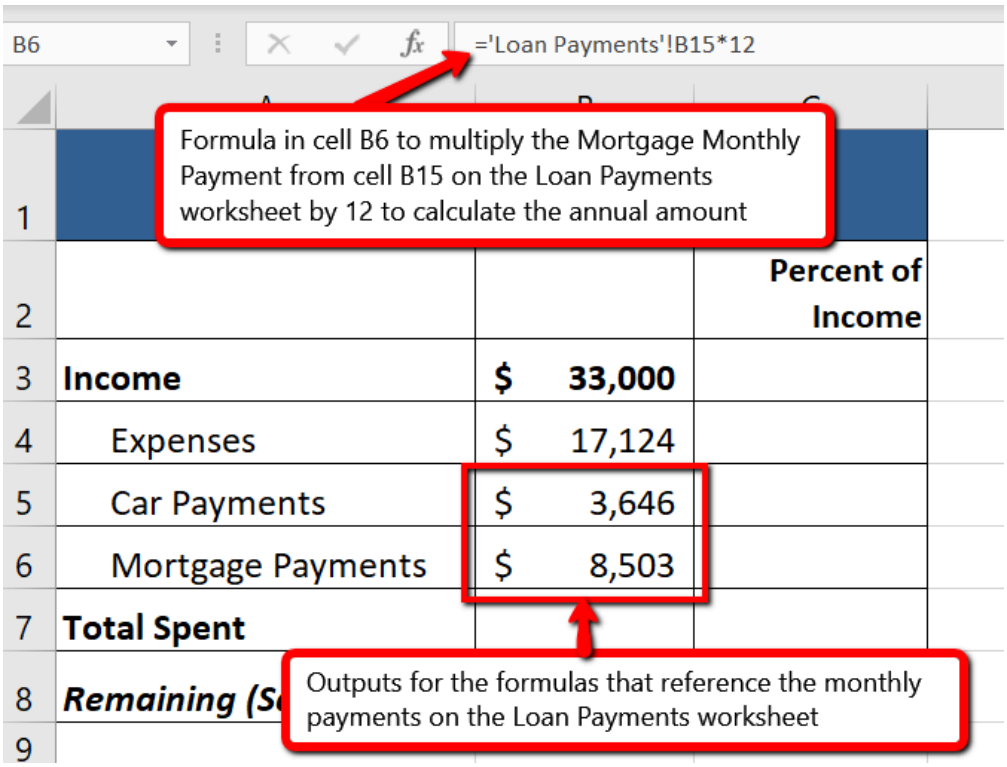


Figure 2.39 Results of the Formulas for the Annual Loan Payments

We can now add other formulas and functions to the **Budget Summary** worksheet that can calculate the difference between the total spend dollars vs. the total net income in cell B3. The following steps explain how this is accomplished:

1. Click cell B7 in the **Budget Summary** worksheet.
2. Type an equal sign **=**.
3. Type the function name **SUM** followed by an open parenthesis **(**.
4. Highlight the range B4:B6.
5. Type a closing parenthesis **)** and press the ENTER key on your keyboard or simply press the ENTER key to close the function. *The total for all annual expenses now appears on the worksheet.*
6. Click cell B8 on the **Budget Summary** worksheet. You will enter a formula to calculate Remaining (Savings) amount in this cell.
7. Type an equal sign **=**.
8. Click cell B3.
9. Type a minus sign **–** and then click cell B7.
10. Press the ENTER key on your keyboard. This formula produces a positive number, indicating our income is greater than our total expenses.

Figure 2.40 shows the results of the formulas that were added to the **Budget Summary** worksheet. Overall, having your income exceed your total expenses is a good thing because it allows you to save money for future spending needs or unexpected events.

	A	B	C
1	***Annual Personal Budget for <Type Your Name Here>***		
2			**Percent of Income**
3	**Income**	**$ 33,000**	
4	Expenses	$ 17,124	
5	Car Payments	$ 3,646	
6	Mortgage Payments	$ 8,503	
7	**Total Spent**	**$ 29,274**	
8	***Remaining (Savings)***	***$ 3,726***	
9			

Figure 2.40 Formulas Added to Calculate Amount Remaining for Savings

We can now add a few formulas that calculate both the spending rate and the savings rate as a percentage of net income. These formulas require the use of absolute references, which we covered earlier in this chapter. The following steps explain how to add these formulas:

1. Click cell C7 in the **Budget Summary** worksheet.
2. Type an equal sign **=**.
3. Click cell B7.
4. Type a forward slash **/** for division and then click B3.
5. Press the F4 key on your keyboard. This adds an absolute reference to cell B3.
6. Press the ENTER key. The result of the formula shows that total expenses consume 89% of our net income.
7. Click cell C7.
8. Place the mouse pointer over the Auto Fill Handle.
9. When the mouse pointer turns to a black plus sign, left click and drag down to cell C8. This copies and pastes the formula into cell C8.
10. Compare your worksheets with Figures 2.41a-c below. Make any necessary changes before moving on to the next section.
11. Save the **CH2 Personal Budget** file.

Figure 2.41a shows the completed **Budget Summary** worksheet

	A	B	C	D
1	***Annual Personal Budget for <Type Your Name Here>***			
2			**Percent of Income**	
3	**Income**	**$ 33,000**		
4	Expenses	$ 17,124		
5	Car Payments	$ 3,646		
6	Mortgage Payments	$ 8,503		
7	**Total Spent**	**$ 29,274**	**89%**	
8	***Remaining (Savings)***	***$ 3,726***	**11%**	
9				

Figure 2.41a Completed Budget Summary worksheet

Figure 2.41b shows the completed **Budget Detail** worksheet

	A	B	C	D	E	F
1	***Regular Expenses***					
2	**Expense**	**Monthly Spend**	**Percent of Total**	**Annual Spend**	**Last Year Spend**	**Percent Change**
3	Food	$ 300	21.02%	$ 3,600	$ 2,250	60.0%
4	Utilities	$ 250	17.52%	$ 3,000	$ 3,000	0.0%
5	Entertainment	$ 200	14.02%	$ 2,400	$ 2,250	6.7%
6	Insurance	$ 127	8.90%	$ 1,524	$ 1,500	1.6%
7	Gas	$ 125	8.76%	$ 1,500	$ 1,200	25.0%
8	Miscellaneous	$ 125	8.76%	$ 1,500	$ 1,558	-3.7%
9	Clothes	$ 100	7.01%	$ 1,200	$ 1,000	20.0%
10	Cell Phone	$ 100	7.01%	$ 1,200	$ 1,200	0.0%
11	Vacation	$ 100	7.01%	$ 1,200	$ 2,000	-40.0%
12	***Totals***	***$ 1,427***		***$ 17,124***	***$ 15,958***	7.3%
13	**Number of Expense Categories**			9		
14	**Average Spent**			$ 1,903	$ 1,773	
15	**Minimum Spent**			$ 1,200	$ 1,000	
16	**Maximum Spent**			$ 3,600	$ 3,000	
17						

Figure 2.41b Completed Budget Detail worksheet

Figure 2.41c shows the completed **Loan Payments** worksheet

	A	B
1	**Car Loan Payments**	
2	Price of Car	$ 20,000
3	Annual Interest Rate	3.0%
4	Years to Pay	6
5	**Monthly Payment**	**$303.87**
6		
7		
8	**Mortgage Payments**	
9	Price of House	$ 165,000
10	Percent Down	20%
11	Down Payment Amount	$ 33,000
12	Loan Amount	$ 132,000
13	Annual Interest Rate	5.0%
14	Years to Pay	30
15	**Monthly Payment**	**$708.60**
16		

Figure 2.41c Completed Loan Payments worksheet

Key Takeaways

- The PMT function can be used to calculate the monthly mortgage payments for a house or the monthly lease payments for a car.
- When using the PMT function, each argument must be separated by a comma.
- To calculate the monthly payment for a loan using the PMT function, the Rate and Nper arguments must be defined in terms of months. The Rate should be divided by 12 to convert it from an annual rate to a monthly rate. The Nper should be multiplied by 12 to convert the term of the loan from years to months.
- The PMT function produces a negative output if the Pv argument is not preceded by a minus sign. For the purposes of this textbook, a minus sign will be entered before the PV argument

in the PMT dialog box.

ATTRIBUTION

2.4 Preparing to Print

Learning Objectives

1. Review and learn new cell formatting techniques.
2. Understand how to modify page scaling and margins.
3. Create custom headers and footers to automatically update information.

In this section, we will review some of the formatting techniques covered in Chapter 1, as well as learn some new techniques. We will also preview a two-page worksheet and set page setup options to present the data in a professional manner. A new data file will be used in this section.

FORMATTING WORKSHEET DATA

Data File: Continue working with CH2 Personal Budget

You have been given sales data that needs to be formatted in a professional manner. This worksheet will be printed and presented to investors, so it needs to be prepared for printing as well. **Figure 2.42** shows how the finished worksheet will appear in Print Preview.

Juliet's Bakery Supply
Monthly Sales Figures

Salesperson	Sales ID	January	February	March	April	May	June
Brown, John	BrownJ	$ 24,878	$ 19,227	$ 18,069	$ 13,553	$ 13,765	$ 19,042
Harris, Marc	HarrisM	18,381	19,762	16,539	5,635	10,640	18,877
Hodgson, Karen	HodgsonK	26,899	4,308	12,202	15,818	18,760	12,014
Johnson, Frank	JohnsonF	13,661	23,156	18,781	8,228	22,143	10,083
Martinez, Sarah	MartinezS	22,514	18,530	25,365	11,235	24,024	15,409
Miller, Brett	MillerB	19,889	1,919	2,656	27,110	17,294	20,678
Moore, Steve	MooreS	19,299	13,798	14,267	23,624	28,271	20,949
Smith, Mary	SmithM	7,866	20,043	29,699	15,629	23,391	8,926
Wilson, Diane	WilsonD	661	19,278	13,398	1,546	29,600	24,677
Totals		**$ 154,047**	**$ 140,023**	**$ 150,975**	**$ 122,379**	**$ 187,888**	**$ 150,655**

Printed on 2/17/2020 Filename: CH2 Personal Budget.xlsx

Figure 2.42 Completed Prepare to Print worksheet

1. Switch to the **Prepare to Print** worksheet.

1. To change the font of the entire worksheet, click the Select All button in the top left corner of the worksheet grid (see **Figure 2.43**).

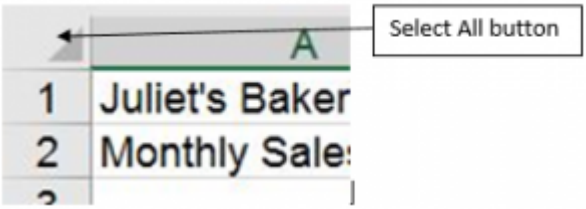


Figure 2.43 Select All button

1. Change the font to Calibri, Size 12.
2. Using the skills learned in Chapter 1, make the following formatting changes:
    1. A1:H1 – Merge and Center; format text as bold and apply a font color and size of your choice
    2. A2:H2 – Merge and Center; format text as bold and italic, apply a font color of your choice
    3. A5:H5 – Apply a dark fill color; format text as white and bold
    4. C5:H5 – Center align
    5. A15:H15 – Apply Top Border to the cells; format text as bold
    6. C6:H6 and C15:H15 – Apply Accounting Number format with 0 decimal places
    7. C7:H14 – Apply Comma style with 0 decimal places
    8. Highlight A6:A14 (salespeople's names) and click the Increase Indent button in the Alignment group on the Home ribbon (see **Figure 2.44**). This will indent the text from the cell border.

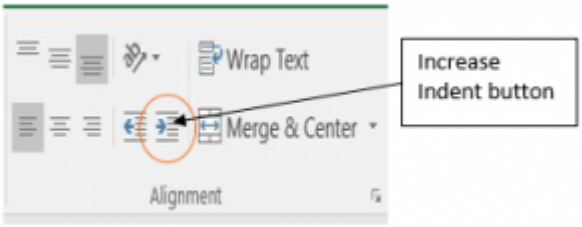


Figure 2.44 Increase Indent button

USING PAGE SETUP OPTIONS

Once the worksheet is professionally formatted, you need to look in Print Preview to see how the pages will print.

1. Go to Backstage View by clicking the File tab on the ribbon. Select Print from the menu. Notice that the worksheet is currently printing on two pages, with the page breaking between the April and May columns. To fix this problem, you will first change the left and right margins while still in Print Preview

   Mac Users should click the **File menu option** and select **Print** from the menu
2. Click the Margins drop-down arrow in the Settings section (see **Figure 2.45**)
3. Select Custom Margins... at the bottom of the list.

   Mac Users should select **"Manage Custom Margins"**
4. Type in **0.5** for the Left Margin and **0.5** for the Right Margin.
5. Click OK. Changing the margins brought the May column onto the same page, but the June column is still on a separate page. Next you will use Page Scaling to fix this while still in Print Preview.
6. Click the Scaling drop-down arrow in the Settings section (**Figure 2.46**).

   Mac Users: there is no "Scaling drop-down arrow". Just click the checkbox for **"Scale to fit"**
7. Select Fit All Columns on One Page.
8. Exit Backstage View.

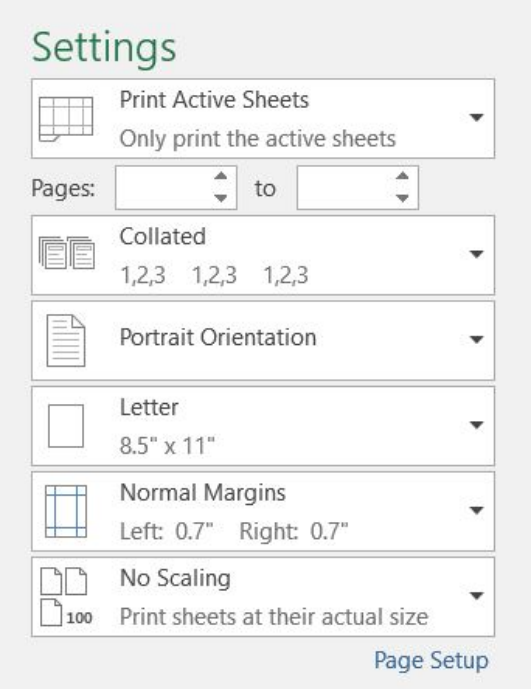


Figure 2.46 Settings section of Print Preview

CREATING A FOOTER USING PAGE SETUP

Now that the entire worksheet is printing on one page, you need to add a footer with information about the date the file was printed along with the filename. In Chapter 1 you learned how to create headers and footers using the Insert ribbon. You can also create headers and footers using the Custom Header/Footer dialog box.

1. Click the **Page Layout** tab on the ribbon.
2. Click the dialog box launcher in the Page Setup group. A window similar to **Figure 2.47** should appear.

Mac Users: there is no "dialog box launcher". Just click the **Page Setup button** and continue with Step 3 below.

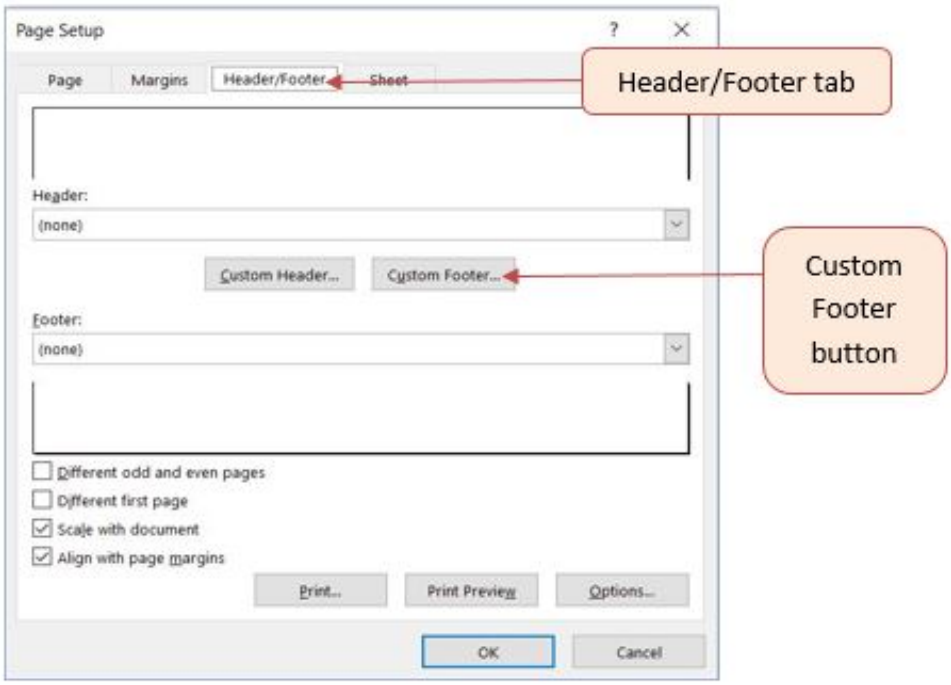


Figure 2.47 Page Setup Dialog Box

3. Click the Header/Footer tab in the Page Setup dialog box.
4. Click the Custom Footer button. The Footer dialog box should appear (see **Figure 2.48**).

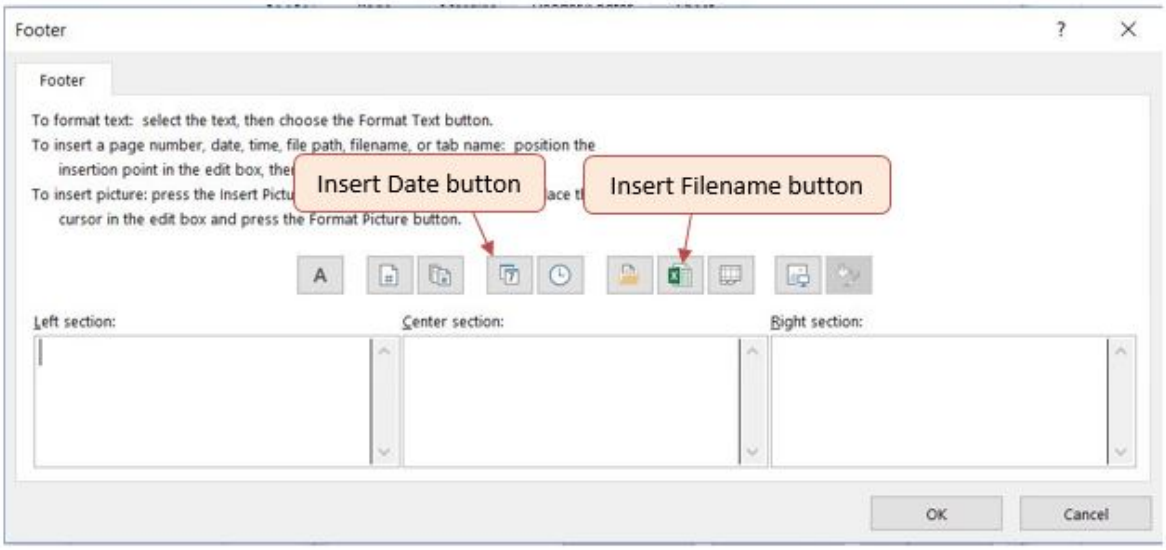


Figure 2.48 Footer Dialog Box

5. Click in the Left section: box and type **Printed on.**
6. Making sure to leave a space after the word on, click the Insert Date button.
7. Click in the Right section: box and type **Filename:.**
8. Making sure to leave a space after the colon, click the Insert File Name button.
9. The Footer dialog box should look like **Figure 2.49**.
10. Click the OK button. Click OK again to close the Page Setup dialog box.
11. Go to Print Preview to see that the current date and file name are displayed in the footer.
12. Exit Backstage View. Check the spelling on all of the worksheets and make any necessary changes.
13. Save the **CH2 Personal Budget** file.
14. Compare your work with the completed worksheet shown in **Figure 2.42** and then submit the **CH2 Personal Budget** workbook as directed by your instructor.

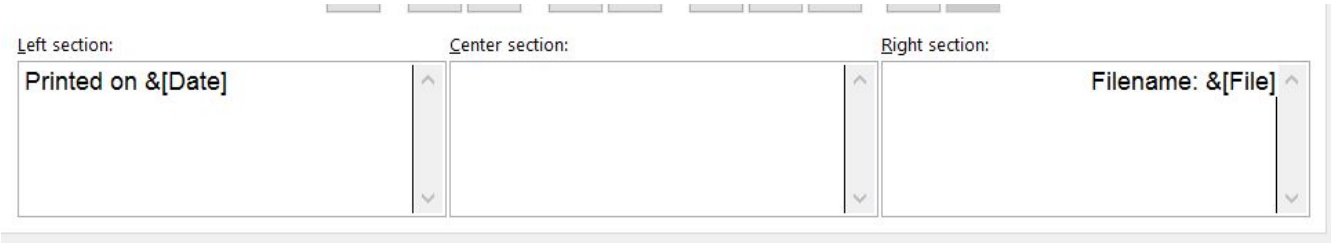


Figure 2.49 Completed Custom Footer Dialog Box

Key Takeaways

- It is important to always check your workbooks in Print Preview to ensure that the data is printed in a professional and easy to read manner.
- Adjust margins and page scaling as needed to keep columns of data together on one page if possible.
- Use headers and footers to display information in the top and bottom margins of the printed worksheet. Use the Insert buttons to insert changing information, such as dates and file names, instead of typing them in directly.

ATTRIBUTION

2.5 Chapter Practice

FINANCIAL PLAN FOR A LAWN CARE BUSINESS

Download Data File: PR2-Data

Running your own lawn care business can be an excellent way to make money over the summer while on break from college. It can also be a way to supplement your existing income for the purpose of saving money for retirement or for a college fund. However, managing the costs of the business will be critical in order for it to be a profitable venture. In this exercise you will create a simple financial plan for a lawn care business by using the skills covered in this chapter.

There are two worksheets in the workbook you will be using.

- **Annual Plan** – provides calculations to determine how much money the lawn care business brings in for one year, based on the average price per lawn cut and the number cut per year, as well as the expenses for the year.
- **Equipment Loans** – calculates the monthly payments for the various lawn care equipment loans.

Annual Plan Worksheet

1. Open the file named **PR2 Data** and then Save As **PR2 Lawn Care**.
2. Switch to the Annual Plan worksheet if needed.
3. Enter the following data into cells B14, B15, and B16:
    - Gasoline cost (per cut) = $10
    - Number of customers = 30
    - Annual lawn cuts per customer = 20
4. In cell B3, enter the average price per lawn cut of $50.
5. In cell B4, write a formula that calculates the total number of lawns cut in the year. *This is the number of customers multiplied by the annual lawn cuts per customer.*

6. In cell B5, write a formula that calculates the total annual sales. *This is found by multiplying the average price per lawn by the total number of lawn cuts.*
7. In cell B8, write a formula to calculate the total cost of gasoline for the year. *This is found by multiplying the gasoline cost per cut by the total number of lawns cut.*
8. You will finish the rest of this worksheet after completing the Equipment Loans worksheet.

Equipment Loans Worksheet

1. Switch to the Equipment Loans worksheet.
2. In cell E3, write a PMT function to calculate the monthly payment for the Commercial Lawn Mower. *Don't forget the negative sign in between the equal sign and the PMT! Remember to convert the interest rate and years to monthly terms and to use cell references.* The arguments of the PMT function should be as follows:
    - RATE: B3/12
    - NPER: C3*12
    - PV: D3
3. Copy the PMT function from cell E3 to the other equipment items.
4. In cell E10, use the SUM function to calculate the total for the monthly loan payments. Make sure that the blank rows (7 through 9) were included in the range for the SUM function so that you can add more equipment items later if needed.
5. In cell E11, write a formula that calculates the total **annual** loan payments. *This will be the monthly total multiplied by 12 (the number of months in a year).*
6. If needed, apply Accounting format to all of the monetary values so that the placement of the dollar sign is consistent throughout the worksheet.
7. Sort the data in the range A3:E6 first by **Interest Rate** and then by **Loan Amount** using the following steps:
    - Select the range A3:E6.
    - Click the Sort button in the Data tab of the Ribbon.
    - In the Sort dialog box, select the Interest Rate option in the "Sort by" drop-down box. Select Largest to Smallest for the sort order.
    - Click the Add Level button in the Sort dialog box.
    - Select the Loan Amount option in the "Then by" drop-down box. Select Largest to Smallest for the sort order.
    - Click the OK button in the Sort dialog box.
8. Add a header with the date on the left and the worksheet name on the right. Be sure to

insert the date and worksheet name so that they will automatically update.

9. Check Print Preview and make any other changes necessary for professional printing.

Complete the Annual Plan Worksheet

1. Switch back to the Annual Plan worksheet.
2. In cell B9, write a formula that displays the annual monthly payments total from cell E11 in the Equipment Loans worksheet using the following steps:
    - Type an equal sign **=**
    - Click the **Equipment Loans** worksheet
    - Click cell E11
    - Press the ENTER key
3. In cell B10, calculate the Total Expenses by adding the Gasoline Cost and the Annual Equipment Payments.
4. In cell B12, calculate the Annual Profit by finding the difference between the Total Annual Sales and the Total Expenses. *Hint: This will hopefully be a positive number which shows that your business is making money instead of losing money.*
5. Format all cells that contain monetary amounts in the Annual Plan worksheet for Accounting Number Format ($) with no decimal places. Format all other numerical values as Comma format with no decimal places.
6. Add a header with the date on the left and the worksheet name on the right. Be sure to insert the date and worksheet name so that they will automatically update.
7. Check Print Preview and make any changes necessary for professional printing.
8. Check the spelling on all of the worksheets and make any necessary changes.

Compare both worksheets with the answer keys below.

10/3/2020 Annual Plan

Lawn Care Annual Financial Plan	
Annual Sales Plan	
Average Price per Lawn Cut	$ 50
Total Number of Lawns Cut	600
Total Annual Sales	$ 30,000
Annual Expenses	
Gasoline	$ 6,000
Annual Equipment Payments	$ 2,321
Total Expenses	$ 8,321
Annual Profit	$ 21,679
Gasoline Cost (per cut)	$ 10
Number of Customers	30
Annual Lawn Cuts per Customer	20

1/30/2020 Equipment Loans

Equipment Purchasing Plan				
Item	Interest Rate	Years	Loan Amount	Monthly Payment
Blower	6.0%	3	$ 700	$ 21.30
Commercial Lawn Mower	5.5%	4	$ 6,000	$ 139.54
Edger	4.0%	2	$ 400	$ 17.37
Trimmer	4.0%	2	$ 350	$ 15.20
			Monthly Total	$ 193.40
			Annual Total	$ 2,320.83

ATTRIBUTION

2.6 Chapter Scored

HOTEL OCCUPANCY AND EXPENSES

Download Data File: SC2-Data

The hotel management industry presents a wide variety of career opportunities. These range from running a bed and breakfast to a management position at a large hotel. No matter what hotel management career you choose to pursue, understanding hotel occupancy and costs are critical to running a successful operation. This exercise examines the occupancy rate and expenses of a small hotel.

There are three worksheets in the workbook for this assignment.

- **Occupancy** – calculates and displays the maximum **hotel capacity** for each month (based on the number of rooms, the capacity of each room, and the number of days in the specific month), the **actual occupancy** (how many actually stayed in the hotel that month), and the **occupancy percentage** (what percentage of capacity was the hotel each month).
- **Statistics** – calculates and displays the highest, lowest, and average actual occupancy and occupancy percentages form the Occupancy worksheet.
- **Shuttle Purchase** – calculates three different down payment options for a loan to purchase a shuttle for the hotel.

Occupancy Worksheet

1. Open the file named **SC2 Data** and then Save As **SC2 Hotel**.
2. Switch to the Occupancy worksheet if needed.
3. Replace the [Insert Year] in A1 with the year number for last year.
4. You need to calculate the January capacity for the hotel in C5. The capacity shows how many people the hotel can hold during the month. It is calculated by first multiplying the *occupants per room* by the *number of rooms* in the hotel. This **result** is then multiplied by the number of days in the month (cell B5 for January). Create this formula using **absolute references** so that the appropriate cells do not change when the formula is

pasted throughout column C. *Hint: two of the cells in the formula need to be absolute references.*

5. Copy the formula in cell C5 and paste it into the range C6:C16. Use a paste method that does not remove the border at the bottom of cell C16.
6. Format the numbers in columns C and D for comma format with zero decimal places.
7. In cell C17, enter a function that finds the sum of the monthly hotel capacity values. Do the same in cell D17 to find the sum of the monthly actual occupancy values.
8. Enter a formula in cell E5 to calculate the Percent Occupied of the hotel (this statistic shows what percentage of the hotel is full or occupied). Your formula should divide the Actual Occupancy by the Hotel Capacity. Then copy and paste the formula into the range E6:E17. Use a paste method that does not remove the borders at the bottom of cell E16 and E17. Format the results in E5:E17 as *percentages with two decimal places*.
9. Format the Totals (C17:E17) as bold.
10. Apply any number formatting that aids in the readability and professionalism of the worksheet.
11. Check Print Preview and make any changes necessary for professional printing.

Statistics Worksheet

1. Replace the [Insert Year] in A1 with the year number for last year.
2. Enter a **function** in cell B3 that finds the highest value in the Actual Occupancy column from the Occupancy worksheet.
3. Enter a **function** in cell B4 that finds the lowest value in the Actual Occupancy column from the Occupancy worksheet.
4. Enter a **function** in cell B5 that shows the average value of the Actual Occupancy column on the Occupancy worksheet.
5. Use the Auto Fill handle to copy the formulas in the range B3:B5 to the range C3:C5.
6. Apply any number formatting that aids in the readability and professionalism of the worksheet. The numbers should be formatted similarly to the Occupancy worksheet.
7. Check Print Preview and make any changes necessary for professional printing.

Shuttle Purchase Worksheet

The hotel is considering buying a car to shuttle customers to and from the airport. You need to decide how much of a down payment to make, so you are going to calculate the monthly payment based on three different down payment percentages. The number of years to pay off the loan will vary for each of the down payment percentage options. Remember, the down payment amount

is found by multiplying the price of the car by the down payment percentage. This amount is then subtracted from the price of the car to find the amount of the loan.

1. In cell B5 write a formula that will calculate the **amount of the down payment**. *Be sure to use cell references as much as possible.* Copy the formula to the other down payment options.
2. In cell B6 write a formula to calculate the **amount of the loan**. *Be sure to use cell references as much as possible.*Copy the formula to the other down payment options.
3. In cell B9 create a PMT function to calculate the **monthly payment.** Make sure the arguments in the PMT function are converted into months and that the monthly payment is a positive number. *Be sure to use cell references as much as possible.* Copy the function to the other down payment options.
4. In cell B10 create a formula that calculates **how much will be paid in total** for the vehicle, including the down payment and the total amount paid on the loan in the given number of years. Copy the formula to the other down payment options.
5. In cell A12, write an explanation of which down payment option is the best and why.
6. Apply any number formatting that aids in the readability and professionalism of the worksheet.
7. Make the following page setup changes to the worksheet:
    - Center horizontally on the page
    - Create a footer with the date on the left and the file name on the right. Make sure that both the date and the file name will update automatically.
8. Check the spelling on all of the worksheets and make any necessary changes.
9. Save the **SC2 Hotel** workbook and submit the workbook as directed by your instructor.

ATTRIBUTION

CHAPTER 3 – FORMULAS, FUNCTIONS, LOGICAL AND LOOKUP FUNCTIONS

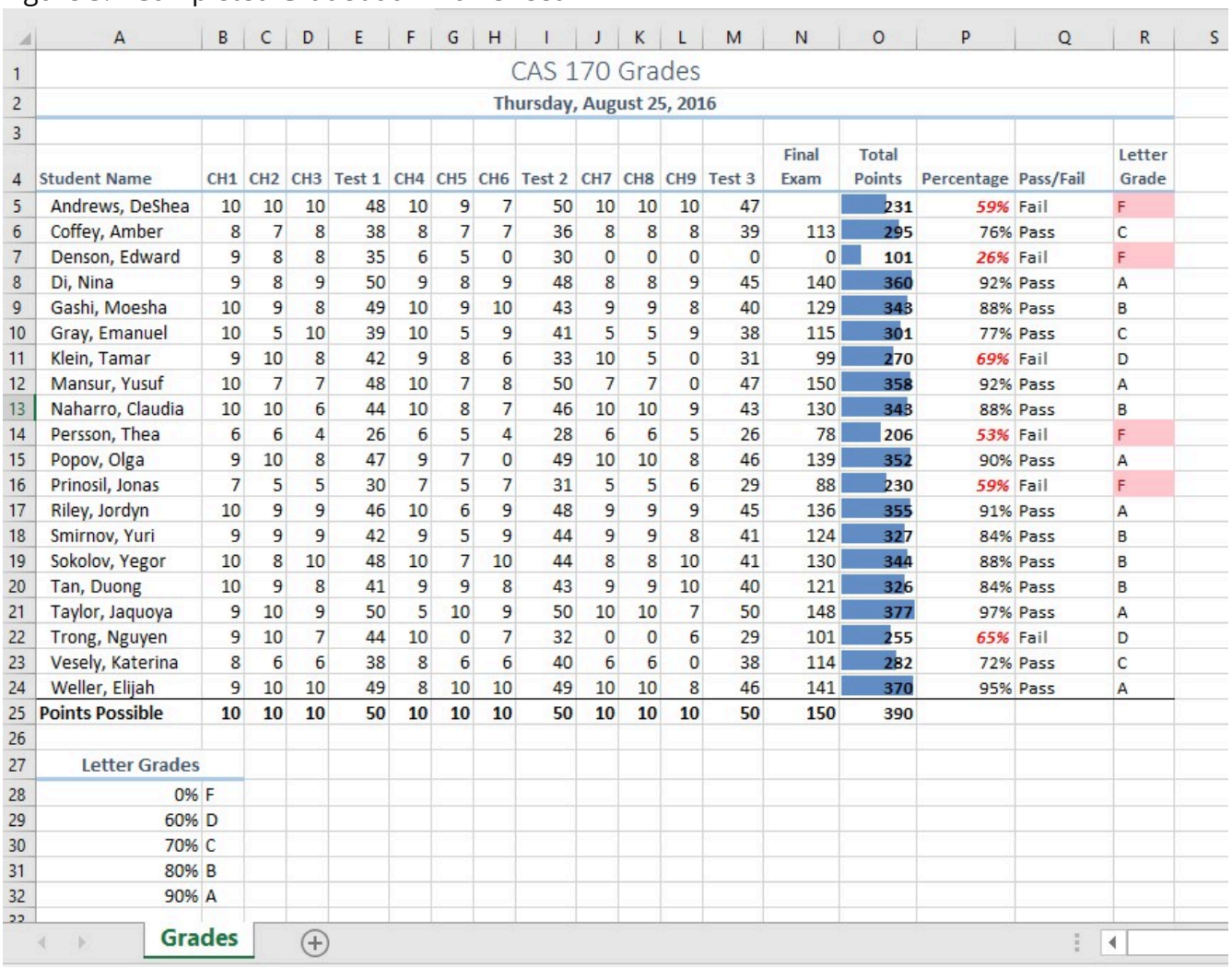
Excel workbooks are designed to allow you to create useful and complex calculations. In addition to doing arithmetic, you can use Excel to look up data, and to display results based on logical conditions. We will also look at ways to highlight specific results. These skills will be demonstrated in the context of a typical gradebook spreadsheet that contains the results for an imaginary Excel class.

In this chapter, we will:

- Use the **Quick Analysis Tool** to find the Total Points for all students and Points Possible. (**Note for Mac Users**: the Quick Analysis Tool is not available with Excel for Mac. We have alternate steps for Mac Users)
- Write a division formula to find the Percentage for each student, using an absolute reference to the Total Points Possible.
- Write an **IF Function** to determine Pass/Fail – passing is 70% or higher.
- Write a **VLOOKUP** to determine the Letter Grade using the Letter Grades scale.
- Use the **TODAY** function to insert the current date.
- Review common **Error Messages** using Smart Lookup to get definitions of some of the terms in your spreadsheet.
- Apply **Data Bars** to the Total Points values.
- Apply **Conditional Formatting** to the Percentage, Pass/Fail, and Letter Grade columns.
- **Printing Review** – Change to Landscape, Scale to Fit Columns on One Page and Set Print Area.

Figure 3-1 shows the completed workbook that will be demonstrated in this chapter. Notice the techniques used in columns O and R that highlight the results of your calculations. Notice, also that there are more numbers on this version of the file than you will see in your original data file. These are all completed using Excel calculations.

Figure 3.1 Completed Gradebook Worksheet



CAS 170 Grades

Thursday, August 25, 2016

Student Name	CH1	CH2	CH3	Test 1	CH4	CH5	CH6	Test 2	CH7	CH8	CH9	Test 3	Final Exam	Total Points	Percentage	Pass/Fail	Letter Grade
Andrews, DeShea	10	10	10	48	10	9	7	50	10	10	10	47		231	59%	Fail	F
Coffey, Amber	8	7	8	38	8	7	7	36	8	8	8	39	113	295	76%	Pass	C
Denson, Edward	9	8	8	35	6	5	0	30	0	0	0	0	0	101	26%	Fail	F
Di, Nina	9	8	9	50	9	8	9	48	8	8	9	45	140	360	92%	Pass	A
Gashi, Moesha	10	9	8	49	10	9	10	43	9	9	8	40	129	343	88%	Pass	B
Gray, Emanuel	10	5	10	39	10	5	9	41	5	5	9	38	115	301	77%	Pass	C
Klein, Tamar	9	10	8	42	9	8	6	33	10	5	0	31	99	270	69%	Fail	D
Mansur, Yusuf	10	7	7	48	10	7	8	50	7	7	0	47	150	358	92%	Pass	A
Naharro, Claudia	10	10	6	44	10	8	7	46	10	10	9	43	130	343	88%	Pass	B
Persson, Thea	6	6	4	26	6	5	4	28	6	6	5	26	78	206	53%	Fail	F
Popov, Olga	9	10	8	47	9	7	0	49	10	10	8	46	139	352	90%	Pass	A
Prinosil, Jonas	7	5	5	30	7	5	7	31	5	5	6	29	88	230	59%	Fail	F
Riley, Jordyn	10	9	9	46	10	6	9	48	9	9	9	45	136	355	91%	Pass	A
Smirnov, Yuri	9	9	9	42	9	5	9	44	9	9	8	41	124	327	84%	Pass	B
Sokolov, Yegor	10	8	10	48	10	7	10	44	8	8	10	41	130	344	88%	Pass	B
Tan, Duong	10	9	8	41	9	9	8	43	9	9	10	40	121	326	84%	Pass	B
Taylor, Jaquoya	9	10	9	50	5	10	9	50	10	10	7	50	148	377	97%	Pass	A
Trong, Nguyen	9	10	7	44	10	0	7	32	0	0	6	29	101	255	65%	Fail	D
Vesely, Katerina	8	6	6	38	8	6	6	40	6	6	0	38	114	282	72%	Pass	C
Weller, Elijah	9	10	10	49	8	10	10	49	10	10	8	46	141	370	95%	Pass	A
Points Possible	**10**	**10**	**10**	**50**	**10**	**10**	**10**	**50**	**10**	**10**	**10**	**50**	**150**	390			

Letter Grades	
0%	F
60%	D
70%	C
80%	B
90%	A

Grades

ATTRIBUTION

3.1 More on Formulas and Functions

Learning Objectives

1. Review the use of the =MAX function.
2. Examine the Quick Analysis Tool to create standard calculations, formatting, and charts very quickly.
3. Create Percentage calculation.
   – Use the Smart Lookup tool to acquire additional information about percentage calculations.
   – Review the use of Absolute cell reference in a division formula.

ANOTHER USE FOR =MAX

Before we move on to the more interesting calculations we will be discussing in this chapter, we need to determine how many points it is possible for each student to earn for each of the assignments. This information will go into Row 25. The **=MAX** function is our tool of choice.

Download Data File: CH3 Data

1. Open the data file **CH3 Data** and save the file to your computer as **CH3 Gradebook and Parks**.
2. Make B25 your active cell.
3. Start typing **=MAX** (See **Figure 3.2**) Note the explanation you see on the offered list of functions. You can either keep typing **(** or double click MAX from the list.

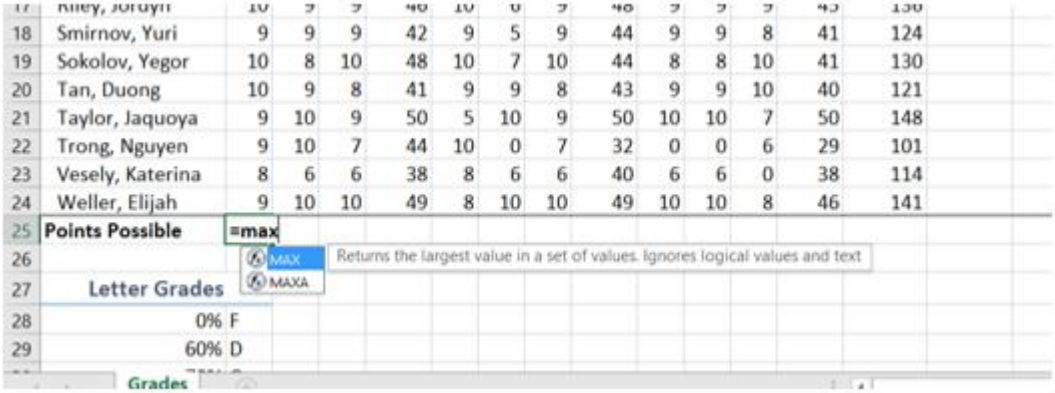


Figure 3.2 Entering a function

4. Select the range of numbers above row 25. Your calculation will be: **=MAX(B5:B24).**
5. Press Enter after selecting the range.
6. Now, use the Fill Handle to copy the calculation from Column B through Column N. Note that as you copy the calculation from one column to the next, the cell references change. The calculation in column B reads: **=MAX(B5:B24)**. The one in column N reads: **=MAX(N5:N24)**. These cell references are relative references.

By default, the calculations that Excel copies change their cell references **relative** to the row or column you copy them to. That makes sense. You wouldn't want column N to display an answer that uses the values in column L.

Want to see all the calculations you have just created? Press **Ctrl ~** (See **Figure 3.3**.) **Ctrl ~** displays your calculations (formulas). Pressing **Ctrl ~** a second time will display your calculations in the default view – as values.

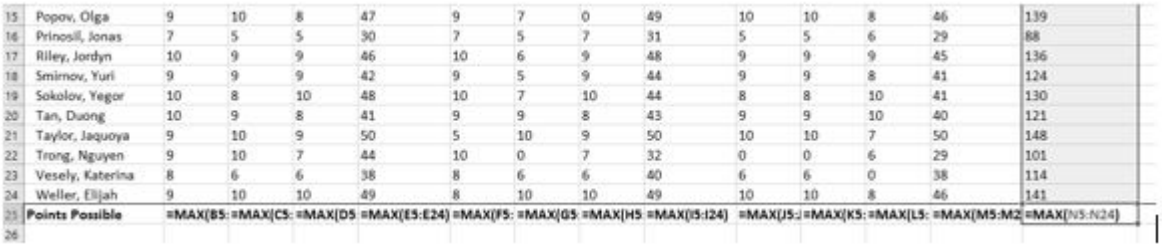


Figure 3.3 Relative References – Displayed as calculations.

QUICK ANALYSIS TOOL

The Quick Analysis Tool allows you to create standard calculations, formatting, and charts very quickly. In this exercise we will use it to insert the Total Points for each student in Column O.

Mac Users: the Quick Analysis Tool is not available with Excel for Mac. We

have alternate steps for Mac Users below. Skip down below Figure 3.5 to continue.)

Be sure to press **Ctrl ~** to return your spreadsheet to the normal view (the formula results should display, not the formulas themselves).

1. Select the range of cells **B5:N25**
2. In the lower right corner of your selection, you will see the Quick Analysis tool (see **Figure 3.4**).

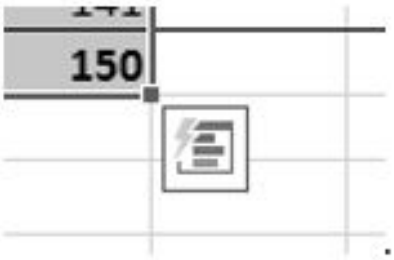


Figure 3.4 Quick Analysis Tool

3. When you click on it, you will see that there are a number of different options. This time we will be using the **Totals** option. In future exercises, we will use other options.
4. Select **Totals**, and then the **SUM** option that highlights the right column (see **Figure 3.5**). Selecting that SUM option places =SUM() calculations in column O.

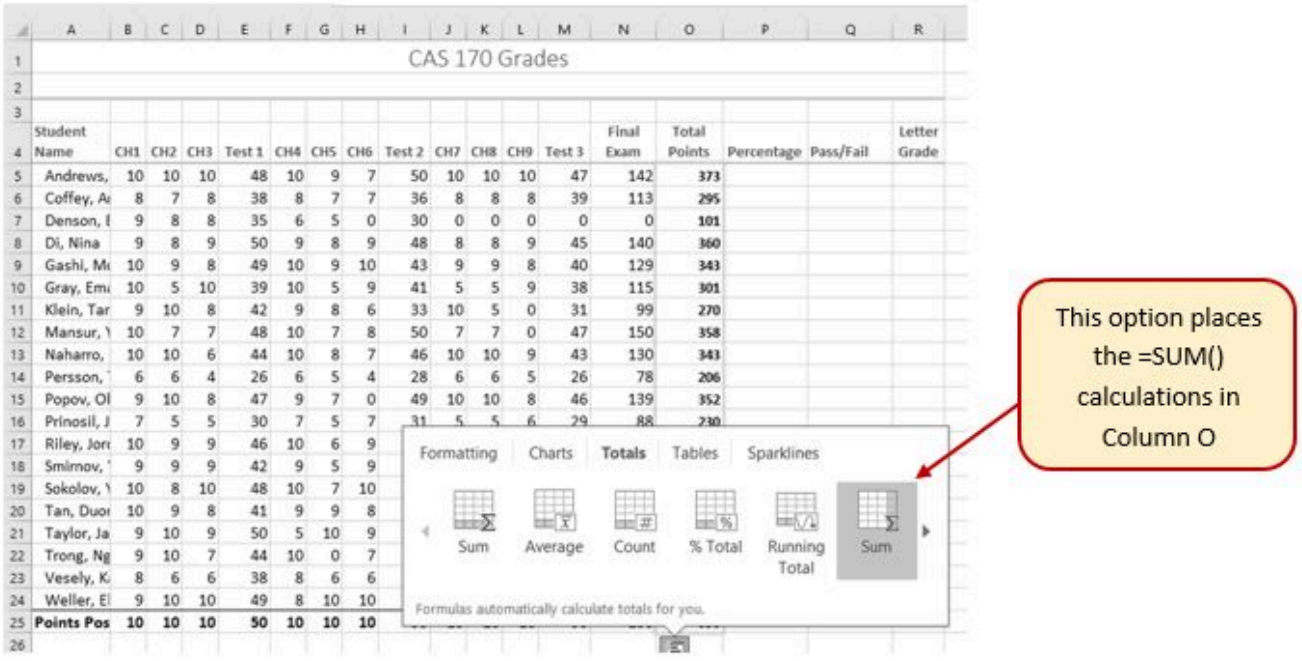


Figure 3.5 Quick Analysis Tool – Totals, Sum Column

Alternate steps for Mac Users:

1. Select the range B5:O25 then click the AutoSum button on the Ribbon (Home tab or Formulas tab)
2. Select the range O5:O25 and click the Bold button.

PERCENTAGE CALCULATION

Column P requires a Percentage calculation. Before we launch into creating a calculation for this, it might be handy to know precisely what it is we are looking for. If you are connected to the internet and are using Excel 365, you can use the **Smart Lookup** tool to get some more information about calculating percentages.

In general, the Smart Lookup tool allows you to get more information and definitions about unfamiliar terms or features. This tool is available in all of the Microsoft Office applications.

1. Select cell P4.
2. Find the **Smart Lookup** tool on the **Review** tab (see **Figure 3.6**) and click it. You can also "Right-click" the specific cell and choose **Smart Lookup.**

   Mac Users: The **Smart Lookup** tool is only on the **Review** tab in the latest versions of Excel for Mac. If you can't find the **Smart Lookup** tool on the **Review** tab, you will find it by clicking on the "**Tools**" menu bar option.
   Note for all users: there is a keyboard shortcut for using the Smart Lookup tool. You can hold down the Control key and click in the specific cell (in this case, P4)
3. If this is the first time you have used the Smart Lookup tool, you may need to respond to a statement about your privacy. Press the **Got it** button. We think the Wikipedia article does a pretty good job explaining the calculation, don't you?
4. Close the Smart Lookup pane after reading through the definitions.

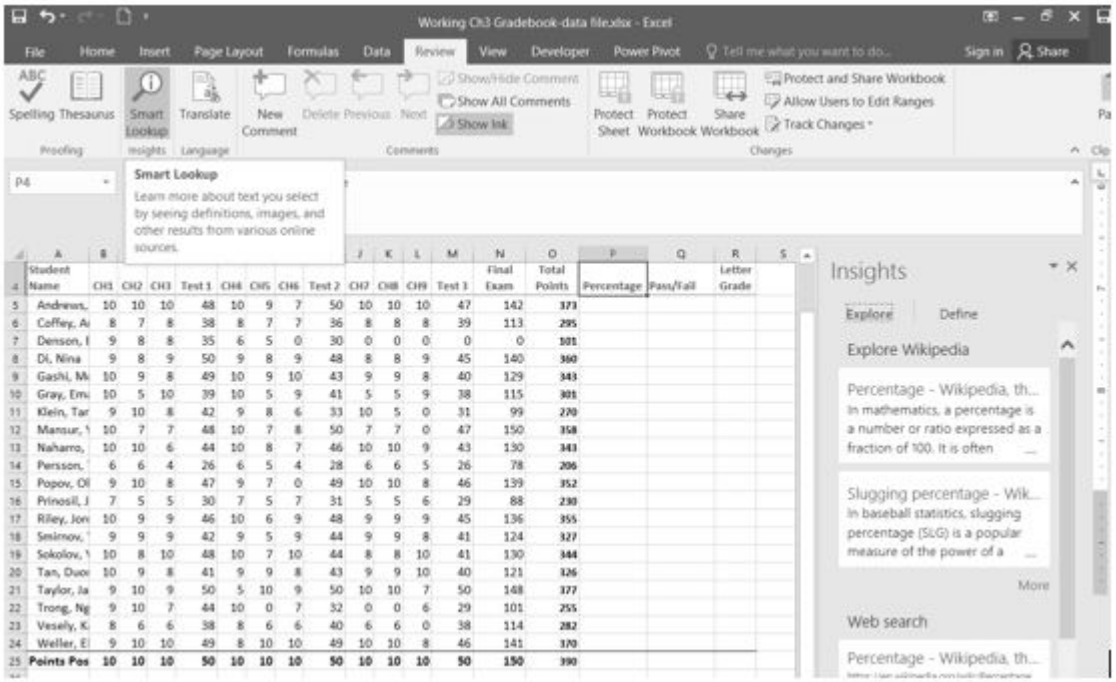


Figure 3.6 Smart Lookup tool

Now that we know what is needed for the Percentage calculation, we can have Excel do the calculation for us. We need to divide the **Total Points** for each student by the **Total Points** of all the **Points Possible**. Notice that there is a different number on each row – for each student. But, there is only one **Total Points Possible** – the value that is in cell **O25**.

1. Make sure that P5 is your active cell.
2. Press **=** then select cell **O5**. Press **/**, then cell **O25**. Your calculation should look like this: **=O5/O25**. The result of the formula should be **0.95641026**. (So far, so good. DeShea Andrews is doing well in this class – with a percentage grade of almost 96%. Definitely an "A"!)
3. Next use the Fill handle to copy the calculation down through row 24 to calculate the other students' grades. You should get the error message **#DIV/0!**. This error message reminds us that you can't divide a number by 0 (zero). And that is just what is happening. If you look at the calculation in P9, the calculation reads: =O9/O29. The first cell reference is correct – it points to Moesha Gashi's total points for the class. But the second reference is wrong. It points to an empty cell – O29.

Before copying the calculation, we have to make the second reference (O25) an **absolute cell reference**. That way, when we copy the formula down, the cell reference for O25 will be locked and will not change.

1. Make P5 your active cell. In the Formula Bar click on O25 (see **Figure 3.7**).
2. Press F4 (on the function keys at the top of your keyboard). That will make the O25 reference absolute. It will not change when you copy the calculation (see **Figure 3.8**). (If you

are working on a laptop and do not have an F4 function key, you can type in a $ before the O and another one before the 25.)

3. The calculation now looks like this: **=O5/$O$25.**
4. Use the Fill Handle to copy the formula down through P24 again. Now, when you copy the formula, you will get correct values for all of the students.

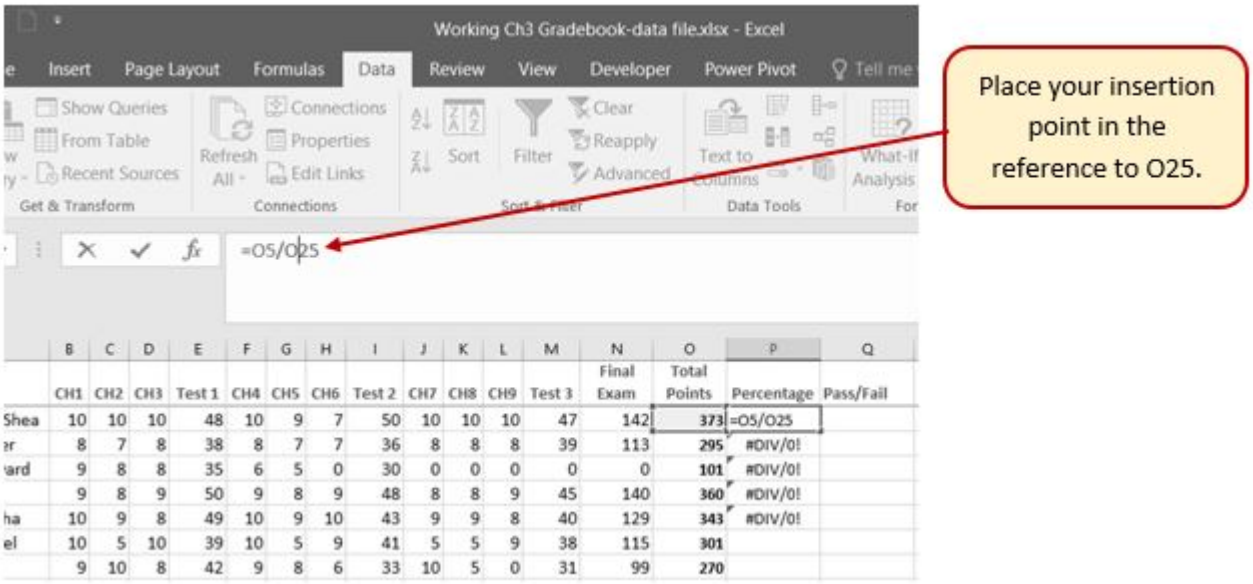


Figure 3.7 Editing a formula

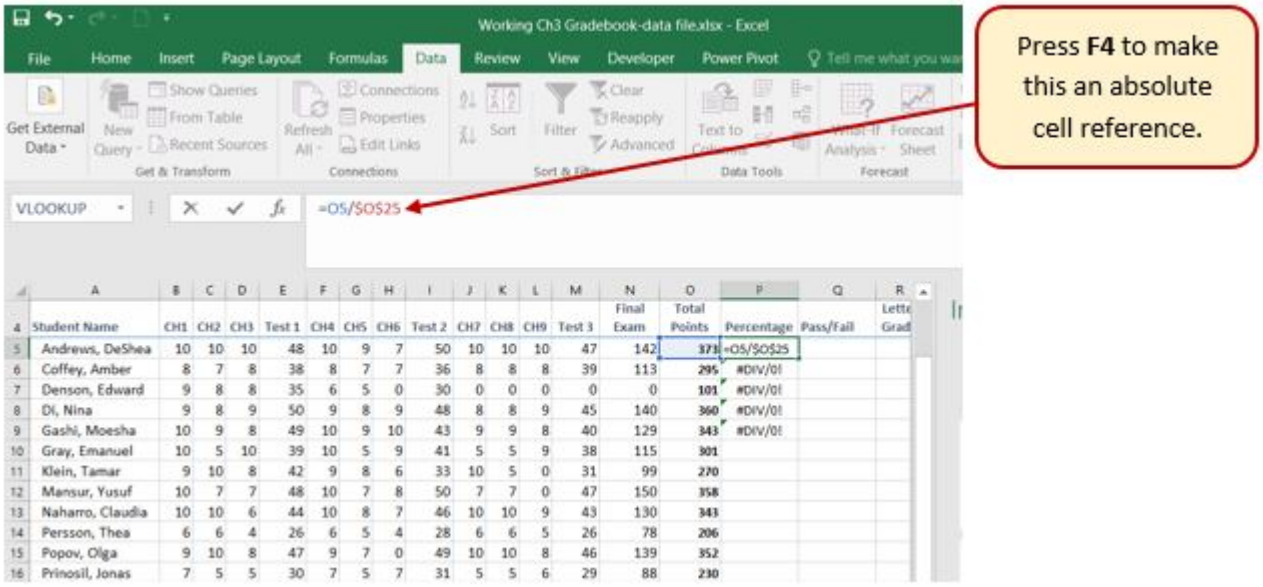


Figure 3.8 Absolute Cell reference – press F4

Those long decimals are a bit nonstandard. Let's change them to % by applying cell formatting.

1. Select the range P5:P24.

2. On the Home tab, in the Number Group, select the % (Percent Style) button.

Skill Refresher

Absolute References

1. Click in front of the column letter of a cell reference in a formula or function that you do not want altered when the formula or function is pasted into a new cell location.
2. Press the F4 key or type a dollar sign ($) in front of the column letter and row number of the cell reference.

Keyboard Shortcuts

Smart Lookup Tool

- Hold down the CTRL key and click the specific cell that you are working with. Then choose "**Smart Lookup**"
- **Mac Users**: Same as above

Key Takeaways

- Functions can be created using cell ranges or selected cell locations separated by commas. Make sure you use a cell range (two cell locations separated by a colon) when applying a statistical function to a contiguous range of cells.
- To prevent Excel from changing the cell references in a formula or function when they are pasted to a new cell location, you must use an absolute reference. You can do this by placing a dollar sign ($) in front of the column letter and row number of a cell reference or by using the F4 function key.
- The #DIV/0 error appears if you create a formula that attempts to divide a constant or the value in a cell reference by zero.

ATTRIBUTION

3.2 Logical and Lookup Functions

Learning Objectives

- Use an IF Function to make logical comparisons between a value and what you expect.
- Create a VLOOKUP calculation to look up information in a table.
- Understand error messages.
- Understand how to enter and format Date/Time Functions.

In addition to doing arithmetic, Excel can do other kinds of functions based on the data in your spreadsheet. In this section, we will use an **=IF** function to determine whether a student is passing or failing the class. Then, we will use a **=VLOOKUP** function to determine what grade each student has earned.

IF FUNCTION

The IF function is one of the most popular functions in Excel. It allows you to make logical comparisons between a value and what you expect. In its simplest form, the IF function says something like:
If the value in a cell is what you expect (true) – do this. If not – do that.

The IF function has three arguments:

- **Logical test –** Here, we can test to see if the value in a selected cell is what we expect. You could use something like "B7=14" or "B7>12" or "B7<6"
- **Value_if_true –** If the requirements in the logical test are met – if B7 is equal to 14 – then it is said to be true. For this argument, you can type text – "True", or "On budget!" Or you could insert a calculation, like B7*2 (If B7 does equal 14, multiply it by 2). Or, if you want Excel to put nothing at all in the cell, type "" (two quotes).
- **Value_if_false** – If the requirements in the logical test are not met – if B7 does not equal 14 – then it is said to be false. You can enter the same instructions here as you did above. Let's say that you type the double quotes here. Then, if B7 does not equal 14,

nothing will be displayed in this cell.

In column Q we would like Excel to tell us whether a student is passing – or failing the class. If the student scores **70%** or better, he/she will pass the class. But, if he/she scores less than 70%, he/she is failing.

1. Make sure that Q5 is your active cell.
2. On the Formulas tab, in the Function Library group, find the IF function on the Logical pulldown menu (see **Figure 3.9**).

   Mac Users: There is no "Function Library" group for Excel for Mac. Mac Users should click on the Formulas tab, then click the "Logical" tool 

list arrow, and choose IF (see **Figure 3.9).**

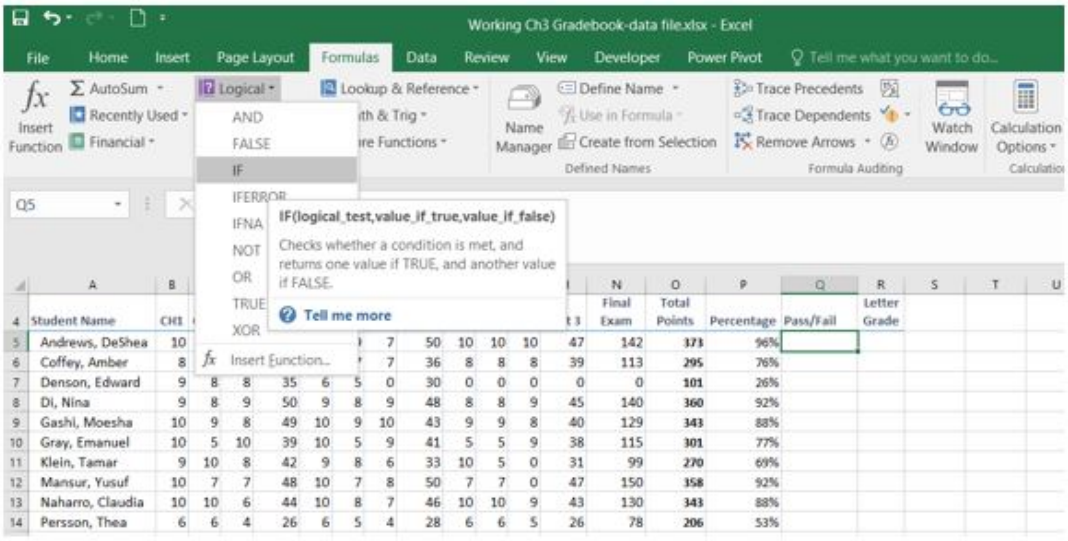


Figure 3.9 IF Function

Now you will see the IF Function dialog box, with a place to enter each of the three arguments.

Mac Users: There is no "dialog box". The "Formula Builder" pane will display at the right side of the Excel window. It has the same layout as Figure 3.10 below.

1. Click in the box for **Logical Test**. We need to test whether a student's score is less than **.7**. So, in this box, type **P5<.7**
2. Click in the box for **Value_if_true**. If the student's score is less than .7, then they are failing the class. In this box, type **Fail**.
3. Click in the box for **Value_if_false**. If the student's score is NOT less than .7, then they are passing the class. In this box, type **Pass**.
4. Make sure that your dialog box matches **Figure 3.10**.

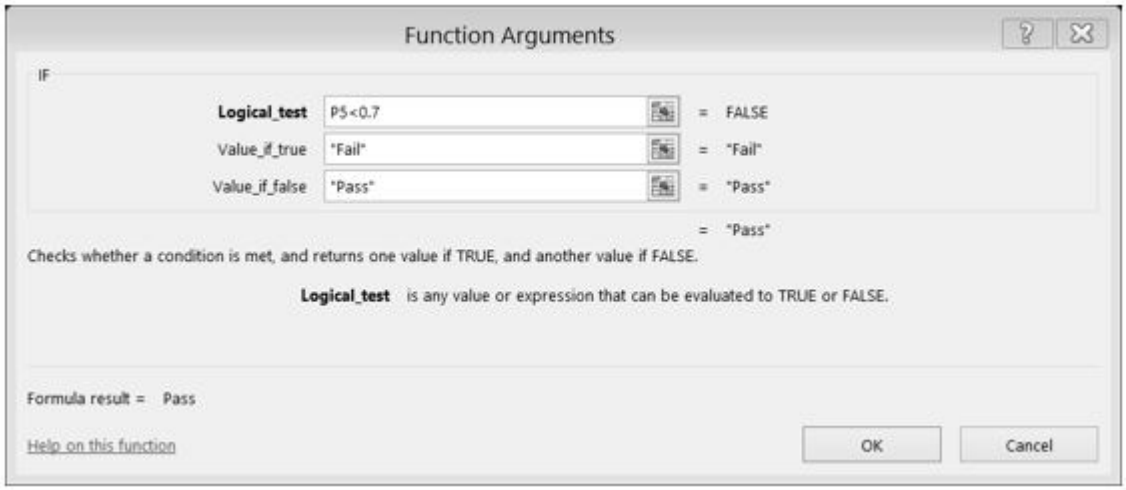


Figure 3.10 IF Function Dialog Box

While we are here, let's take a look at the dialog box. Notice that as you click in each box, Excel gives you a brief explanation of the contents (in the middle below the boxes.) In the lower left-hand corner, you can see the results of the calculation. In this case, DeShae is passing the class. Below that is a link to **Help on this function**. Selecting this link will take you to the Excel help for this function – with detailed information on how it works.

5. Once you have typed in the required arguments and reviewed to make sure they are correct, press OK.

   Mac Users should click the "Done" button, then close the Formula Builder pane. (The text Pass should be displayed in Q5 because DeShae is passing the class.)

6. Use the Fill handle to copy the IF function down through row 24.

7. Click on Q5. When you look in the formula bar, you will see the IF calculation: **=IF(P5<0.7,"Fail","Pass")** (see **Figure 3.11**).

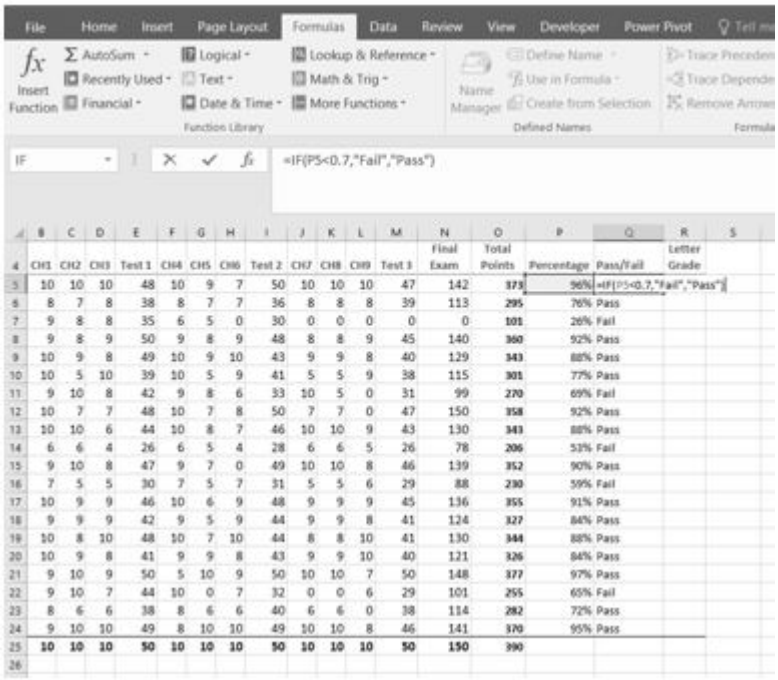


Figure 3.11 IF Function Results

VLOOKUP FUNCTION

You need to use a VLOOKUP function to look up information in a table. Sometimes that table is on a different sheet in your workbook. Sometimes it is in another file entirely. In this case, we need to know what grade each student is getting based on their percentage score. You will find the table that defines the scores and the grades in **A28:B32**.

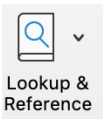
There are four pieces of information that you will need in order to build the VLOOKUP syntax. These are the four arguments of a VLOOKUP function:

- The value you want to lookup, also called the **Lookup_value**. In our example, the lookup value will be the student's percentage score in column P.
- The **Table_array** is the range (table) where the lookup values and the values you want returned by the function are located. In our example, this is the table of percentages and corresponding letter grades in the range A28:B32. The lookup value should always be in the first column in the table array for VLOOKUP to work correctly. For example, in our table_array the lookup value is in cell A28, so the range should start with A.
- The **Col_index_num** is the column number in the range that contains the value to return. In our example, when you specify A28:B32 as the Table_array range, you should count A as the first column (1), B as the second column (2), and so on. You will enter the appropriate column number in this box as 1, 2, or 3 and so on.
- In the **Range_lookup**, you can optionally specify TRUE if you want an approximate match

or FALSE if you want an exact match of the return value. If you leave this blank, the default value will always be TRUE, or approximate match.

Let's create the VLOOKUP to display the correct Letter Grade in column R.

1. Make sure that R5 is your active cell.
2. On the Formulas tab, in the Function Library, find the **VLOOKUP** function on the Lookup & Reference pull-down menu (see **Figure 3.12**).

Mac Users should click the Lookup and Reference tool list arrow 

to find the **VLOOKUP** function.

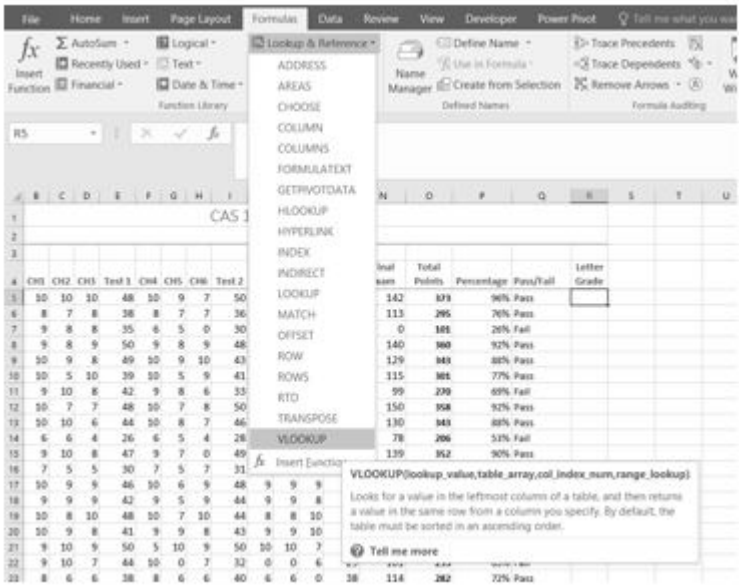


Figure 3.12 VLOOKUP Function

3. Fill in the dialog box so that it looks like the image in **Figure 3.13**.

Mac Users will use the "Formula Builder" pane at the right side of the Excel Window.

- **Lookup_value –** In this case, we will use the Percentage score. So, **P5** for the first lookup value.
- **Table_array** – This is the range that contains the value you want returned by the function. In this case, that range is A28:B32. Note that this range does NOT include the label in row 27; just the actual data. The cell references for the Table_array need to be absolute – $A$28:$B$32. When we copy this function to the other cells, we do not want these cell references to change. It should always be $A$28:$B$32. **This is very important! They must have the absolute reference symbols or the calculations will not work.**
- **Col_index_number** – This is the column in the table array range that includes

the information that we are looking up. In our case, the actual grades are in the 2nd column of the range. So, the column index will be 2.

- **Range_lookup** – In some cases, you will need something in the Range_lookup box. Since we are looking for an approximate match for the percentages, we want the default value of TRUE, so we do not need to enter anything for this argument.

2. While you are in the dialog box, be sure to look at all the helpful definitions that Excel offers.
3. When you have filled in the dialog box, press OK.

   Mac Users should click the "Done" button, then close the Formula Builder pane.
4. The calculation you will see in the formula bar is: =VLOOKUP(P5,$A$28:$B$32,2)
5. Use the fill handle to copy the function down through row 24. The results displayed should match **Figure 3.14**.

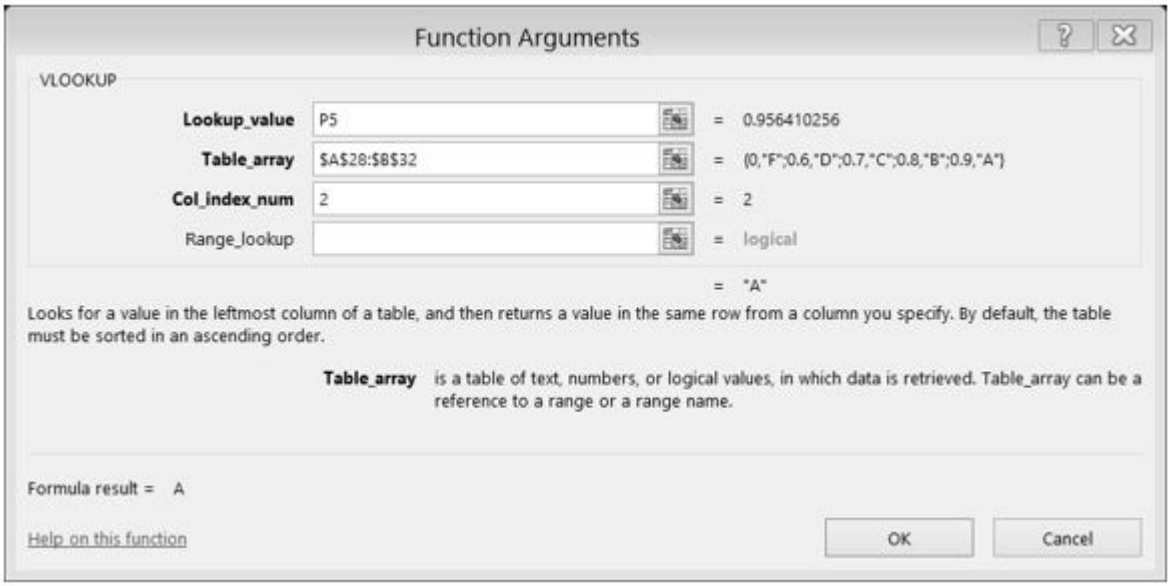


Figure 3.13 VLOOKUP completed dialog box

=VLOOKUP(P5,$A$28:$B$32,2)

CAS 170 Grades

CH4	CH5	CH6	Test 2	CH7	CH8	CH9	Test 3	Final Exam	Total Points	Percentage	Pass/Fail	Letter Grade
10	9	7	50	10	10	10	47	142	373	96%	Pass	A
8	7	7	36	8	8	8	39	113	295	76%	Pass	C
6	5	0	30	0	0	0	0	0	101	26%	Fail	F
9	8	9	48	8	8	9	45	140	360	92%	Pass	A
10	9	10	43	9	9	8	40	129	343	88%	Pass	B
10	5	9	41	5	5	9	38	115	301	77%	Pass	C
9	8	6	33	10	5	0	31	99	270	69%	Fail	D
10	7	8	50	7	7	0	47	150	358	92%	Pass	A
10	8	7	46	10	10	9	43	130	343	88%	Pass	B
6	5	4	28	6	6	5	26	78	206	53%	Fail	F
9	7	0	49	10	10	8	46	139	352	90%	Pass	A
7	5	7	31	5	5	6	29	88	230	59%	Fail	F
10	6	9	48	9	9	9	45	136	355	91%	Pass	A
9	5	9	44	9	9	8	41	124	327	84%	Pass	B
10	7	10	44	8	8	10	41	130	344	88%	Pass	B
9	9	8	43	9	9	10	40	121	326	84%	Pass	B
5	10	9	50	10	10	7	50	148	377	97%	Pass	A
10	0	7	32	0	0	6	29	101	255	65%	Fail	D
8	6	6	40	6	6	0	38	114	282	72%	Pass	C
8	10	10	49	10	10	8	46	141	370	95%	Pass	A
10	**10**	**10**	**50**	**10**	**10**	**10**	**50**	**150**	390			

Figure 3.14 VLOOKUP Complete

Note: What if it didn't work? What if you get a result different from the one predicted? In this case, either you have made a previous error, resulting in different % scores than this exercise anticipated, or you made a mistake entering your VLOOKUP function.

To make repairs in the function, make sure that R5 is your active cell. On the Formula bar, press the Insert Function button (see **Figure 3.15**). That will reopen the dialog box so you can make your repairs. Did you forget to make the cell references for the Table_array absolute? Did you use the wrong cell for the Lookup_value? Press OK when you are done and recopy the corrected function.

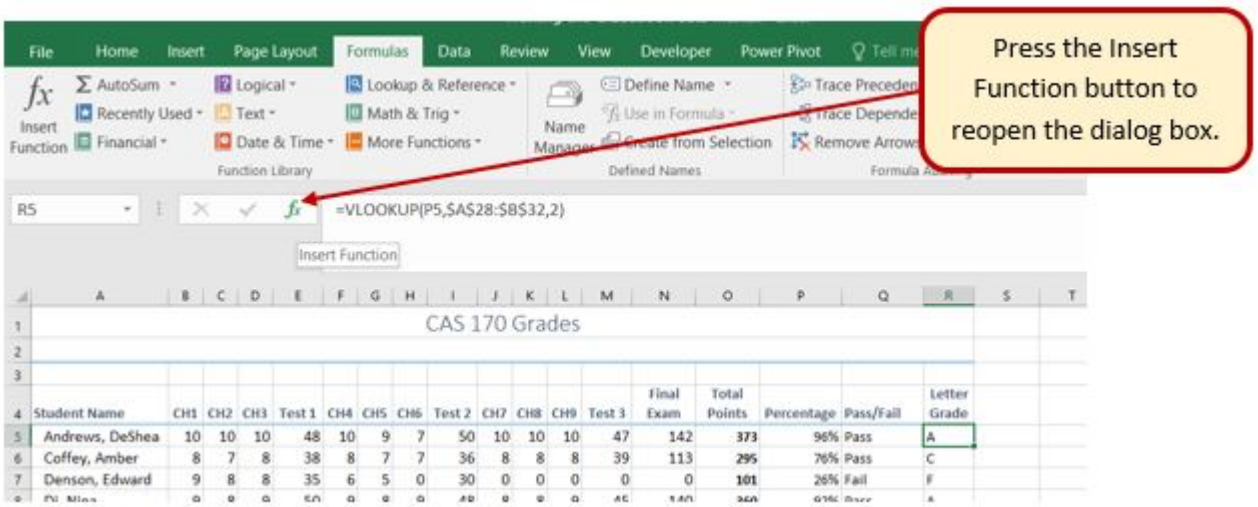


Figure 3.15 Insert Function

ERROR MESSAGES

Sometimes Excel notices that you have made errors in your calculations before you do. In those cases Excel alerts you with some slightly mysterious error messages. A list of common error messages can be found in **Table 3.1** below.

Table 3.1 – Common Error Messages

Message	What Went Wrong
#DIV/0!	You tried to divide a number by a zero (0) or an empty cell.
#NAME	You used a cell range name in the formula, but the name isn't defined. Sometimes this error occurs because you type the name incorrectly.
#N/A	The formula refers to an empty cell, so no data is available for computing the formula. Sometimes people enter N/A in a cell as a placeholder to signal the fact that data isn't entered yet. Revise the formula or enter a number or formula in the empty cells.
#NULL	The formula refers to a cell range that Excel can't understand. Make sure that the range is entered correctly.
#NUM	An argument you use in your formula is invalid.
#REF	The cell or range of cells that the formula refers to aren't there.
#VALUE	The formula includes a function that was used incorrectly, takes an invalid argument, or is misspelled. Make sure that the function uses the right argument and is spelled correctly.

This table was copied from the internet. Look here for additional information.
http://www.dummies.com/software/microsoft-office/excel/how-to-detect-and-correct-formula-errors-in-excel-2016/

DATE FUNCTIONS

Very often dates and times are an important part of Excel data. Numbers that are correct today may not be accurate tomorrow. So, it is frequently useful to include dates and times on your spreadsheets.

These dates and times fall into two categories – ones that:

- **Remain the same**. For instance, if a spreadsheet includes data for May 15th, you don't want the date to change each time you re-open the spreadsheet.
- **Change to reflect the current date/time**. When it is important to have the current date or time on a spreadsheet, you want Excel to update the information regularly.

Take a look at the list of Date and Time functions offered in the Function Library on the Formulas tab (see **Figure 3.16**).

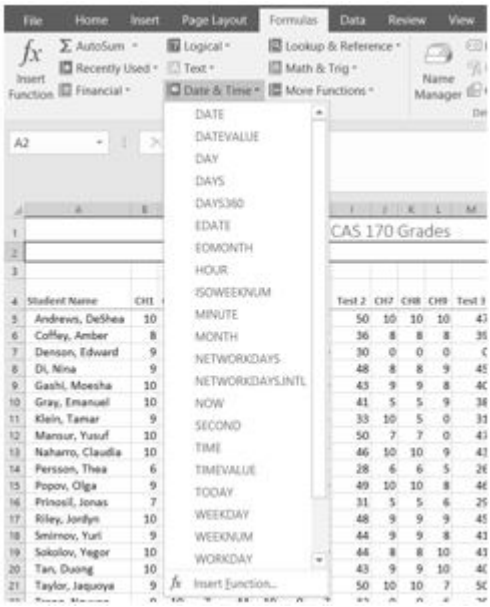


Figure 3.16 Date & Time Functions

For our gradebook, we want the date and time to be displayed in A2, and it needs to update whenever the workbook file is opened.

1. Make A2 your active cell. Notice that A2 extends all the way from column A to Column R. Previously, someone has used the Merge & Center tool on this cell to make it match the title above.
2. On the Formulas tab, in the Function Library, select **NOW** from the Date & Time drop-down list and then click OK.

   Mac Users click the "Done" button in the "Formula Builder" pane at the right side of the Excel window; then close the pane.
3. The result you will see in the formula bar is: =NOW(). The result you will see in A2

depends on the current date and time. The NOW function is a very handy function. It takes no arguments and is Volatile! That is not as alarming as it may seem. This just means that you don't need to give it any more information to do its job and that your results will change frequently. You can update the date and time whenever you want – you don't have to wait until you open the workbook again.

4. Make sure that A1 is your active cell and press the **F9** function key (along the top of your keyboard.) The time will update.

Excel will update this field independently whenever you save and re-open the file, or print it. It may happen more frequently than that – depending on how you have set this up in your installation of Excel.

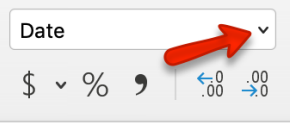
Another variation of the current date is the **TODAY** function. Let's try that one next.

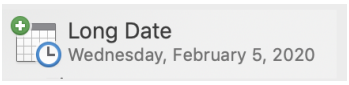
1. Make sure A2 is your active cell. Press Delete to remove the NOW function.
2. From the Date & Time drop-down list in the Function Library on the Formulas tab (see **Figure 3.16**), select TODAY and then click OK.

   Mac Users click the "Done" button in the "Formula Builder" pane; then close the pane.
3. The result you will see in the formula bar is: =TODAY(). The result you will see in A2 depends on the current date. Since we haven't asked for the time, the time you are seeing is likely 12:00. That is not very helpful so we need to change the format of the date.
4. On the Home tab, in the Number group, press the Number Format Launcher button (see **Figure 3.17**).
5. In the **Format Cells** dialog box, click the Number tab. Choose the **Date** category and select **Wednesday, March 14, 2012** (this format is called **Long Date**).

   Mac Users: there is no Number Format Launcher button or "Format Cells" dialog box.

   Click the list arrow next to "Date" and choose **"Long Date"**





6. The current day and date will display in A2.

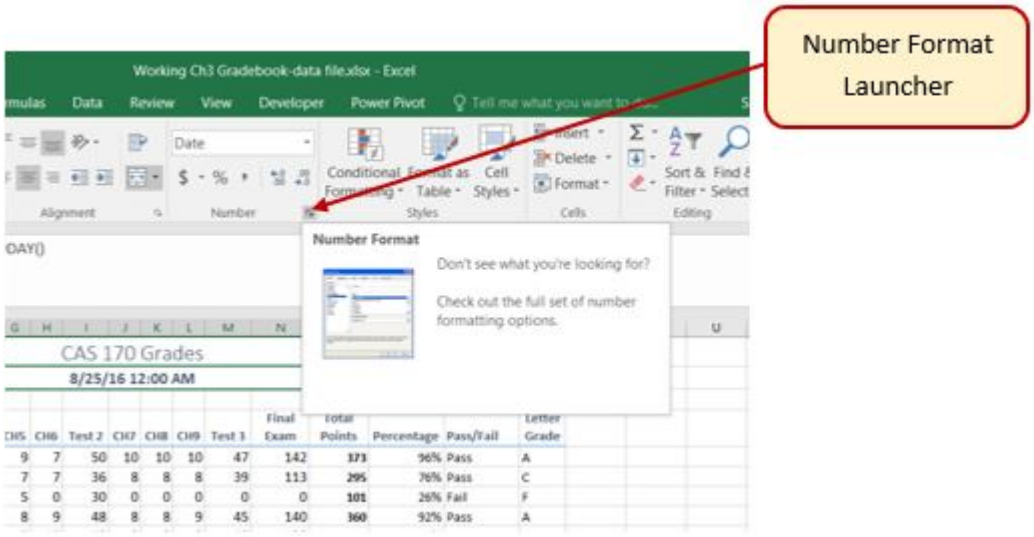


Figure 3.17 Number Format Launcher

Keyboard Shortcuts

Sometimes you want the date or the time to show up in your spreadsheet, but you don't want it to change. You can simply type in the date or time. Or, you can use shortcut keys.

- CTRL ; (semi colon) will bring you the current date

  Mac Users: same as above

- CTRL : (colon or CTRL SHIFT ;) will bring you the current time.

  Mac Users: SHIFT COMMAND :

Key Takeaways

- Functions don't always have to be about arithmetic. Excel provides functions that will help you perform logical evaluations, look things up, and work with dates and times.
- Excel displays error messages when your formulas and functions are not constructed properly.

ATTRIBUTION

3.3 Conditional Formatting

Learning Objectives

- Use Conditional Formatting techniques to provide flexible highlighting, applying specified formatting only when certain conditions are met. Techniques include:
    - Data bars — to make it easy to visualize values in a range of cells.
    - Cells Rules — to highlight values that match the requirements you specify.

You now have all the calculations you need in your CAS 170 Grades spreadsheet. There is a lot of data here. To make it easier to pick out the most important pieces of data, Excel provides **Conditional Formatting**. The best thing about Conditional Formatting is that it is flexible, applying specified formatting only when certain conditions are met.

1. Select the values in the Total Points column (**O5:O24**).
2. At the bottom of your selection, click on the Quick Analysis Tool. On the Formatting tab, select Data Bars (see **Figure 3.18**).

   Mac Users: as stated previously, there is no Quick Analysis Tool for Excel for Mac. Use the alternate steps as shown below.

Excel places blue bars on top of your values; long blue bars for larger numbers, shorter ones for smaller numbers. This makes it easier to see how well each student did in the class – without having to look at the specific numbers.

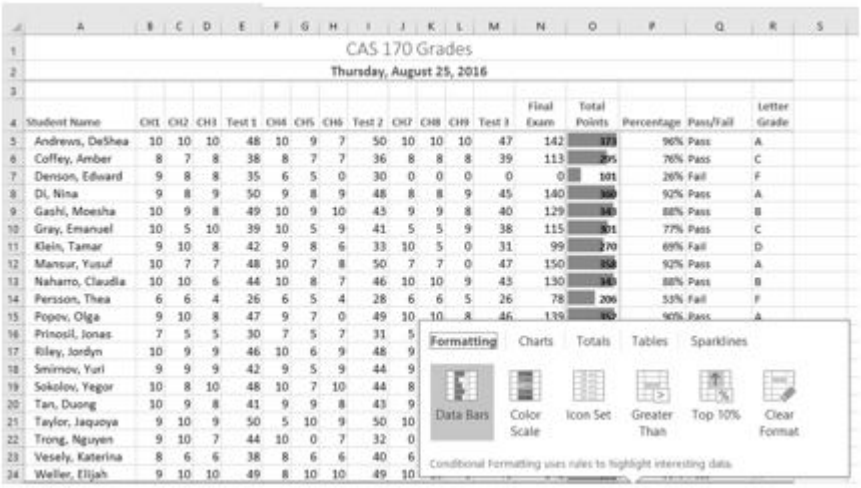
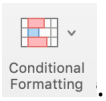


Figure 3.18 Data Bars on the Quick Analysis tool

Another way to apply Data Bars is to:

- Select the range that needs data bars
- On the Home tab, in the Styles group, select Data Bars from the Conditional Formatting tool.
- From there you can select data bars of different colors and opacities (see **Figure 3.19**).

Mac Users: Alternate Steps:

- On the Home tab select Data Bars from the Conditional Formatting tool 

.
- From there you can select data bars of different colors and opacities (see **Figure 3.19**).