Excel 2016: Part 2

Microsoft® Office Excel® 2016: Part 2

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COURSE PREREQUISITES

This manual assumes that the user understands the basics of using a Windows-based computer. Students should be comfortable using the keyboard, mouse, and Start menu. Understanding and experience with printing and using a web browser is an asset, but not required. No previous experience with other versions of Excel is necessary.

COURSE OBJECTIVES

By the end of this course, users should be comfortable with creating a new spreadsheet, working with basic formulae, making a spreadsheet look professional and presentable, and saving and printing a spreadsheet.

HOW TO USE THIS BOOK

This course is broken up into seven lessons. Each lesson focuses on several key topics, each of which are broken down into easy-to-follow concepts. At the end of each topic, you will be given an activity to complete. At the end of each lesson, we will summarize what has been covered and provide a few review questions for you to answer. Supplemental learning for selected topics is provided in the form of Lesson Labs at the end of this book.

Before you begin, download the course's Exercise Files to a convenient location. They will be referenced throughout this course and are a key part of your learning experience.

LESSON 1:
CREATING ADVANCED FORMULAS

Lesson Objectives

In this lesson you will learn how to:

- Apply range names

- Use specialized functions

TOPIC A: Apply Range Names

To help ensure that everyone who works on the same workbook can understand what formulas and calculations are doing, it is important to use cell and range names. While cell references can be used to identify where formulas are getting information to calculate data, it is not always obvious. Excel allows you to give individual cells and cell ranges names, and then use those names in formulas and functions. Then, you can tell at just a glance what the data is and it is being used.

Topic Objectives
In this topic, you will learn:
- About cell and range names
- How to add range names using the Name box and the New Name dialog box
- How to edit and delete range names
- How cell and range names are used in formulas

RANGE NAMES

Range names are meaningful labels that you can assign to individual cells or cell ranges. You can use a range name anywhere you would use a cell reference or cell range reference. This means you can use a name like "Employees" to describe a range of cells rather than their reference (such as C2:C55).

For example, consider the following worksheet. Cells A2 and B2 have been given names (TotalSales and TotalExpenses, respectively) and those names have been used in a formula in cell C2 (=TotalSales-TotalExpenses):
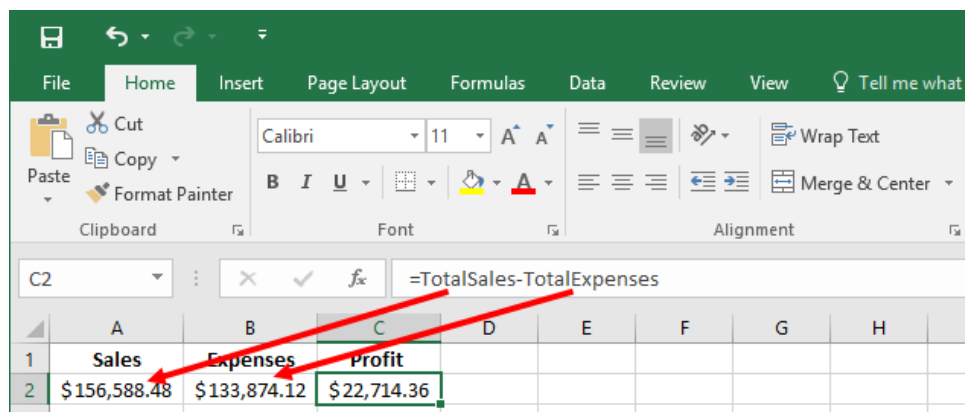
As an added bonus, range names use absolute cell references. This means that if you copy a formula or use AutoFill while using named ranges, the formula will maintain its original cell references:
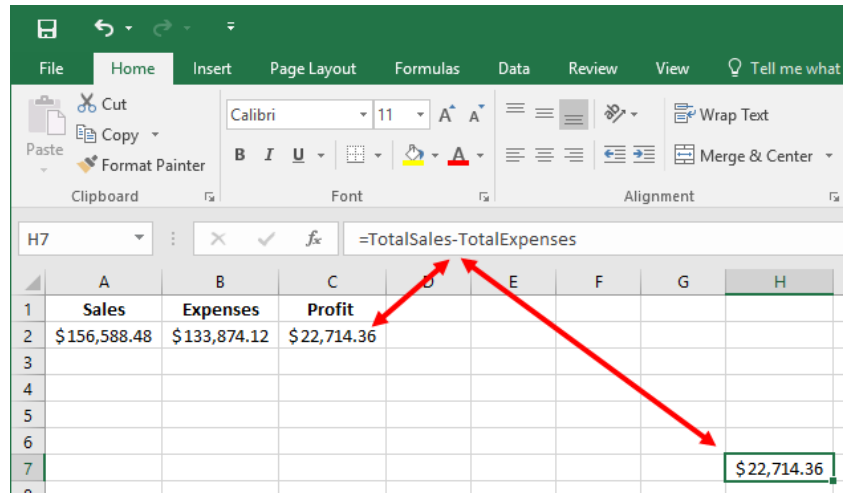
Range names make formulas much more readable, improve worksheet clarity, and greatly improve worksheet organization. Range names can even help in overall design of your worksheet.

Most small worksheets are usually constructed by filling a sheet with data and then performing calculations. However, range names enable you to create a worksheet by doing the opposite: constructing formulas and then adding the data. When you are designing your worksheet, you can create formulas using names instead of traditional cell references, and then define the names for the corresponding ranges as data becomes available.

For example, below is an empty worksheet with a defined formula but no defined names, which results in a #NAME error. This error will remain visible until both "Value1" and "Value2" have been defined:
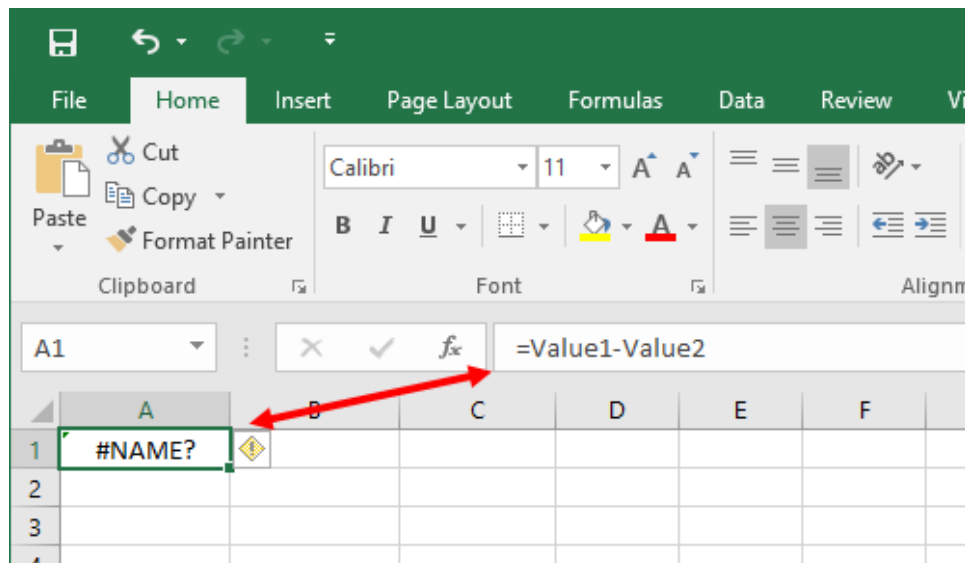
Keep in mind when choosing cell or range names that all names must start with a letter, underscore, or backslash. Beyond the first character, you can add any letter or number or you wish. Additionally, names cannot contain any spaces, nor can they contain cell references. Finally, it is important to know that cell and range names are **not** case-sensitive.

ADDING RANGE NAMES USING THE NAME BOX

To apply a cell name or range name, first use your cursor to select the cell(s) that you want to name. Next, type the name that you would like to use into the Name Box:
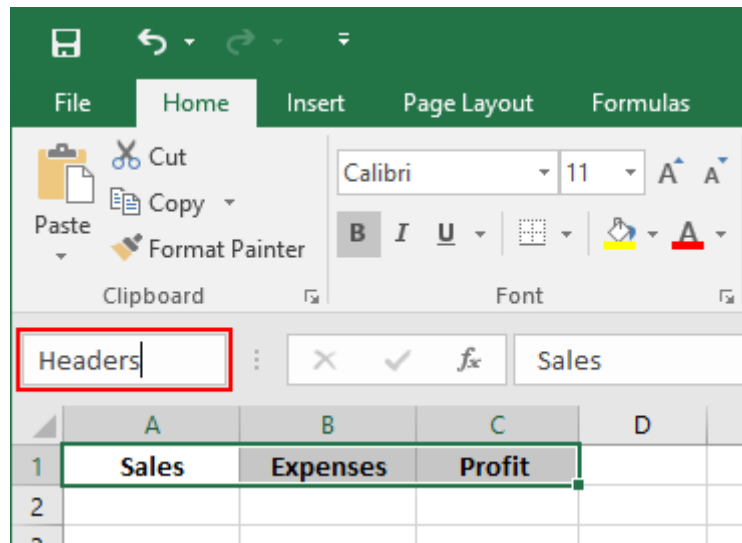
Pressing Enter will apply this name. From then on, you will be able to select this range by clicking the Name Box drop-down menu and clicking on the range name that you set:
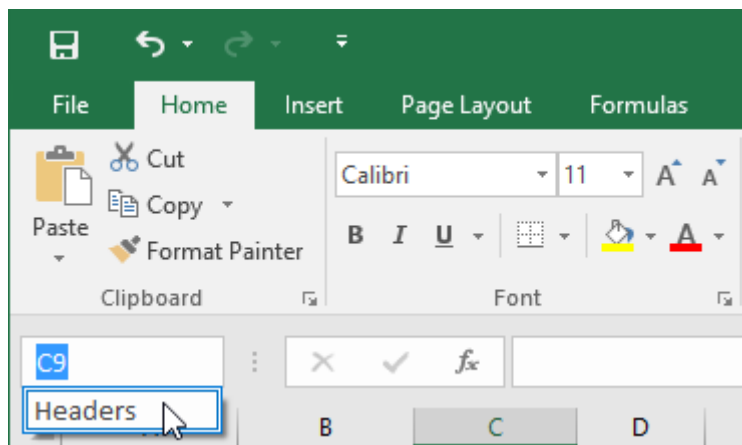
ADDING RANGE NAMES USING THE NEW NAME DIALOG BOX

Cells and cell ranges can also be named using the New Name dialog box. While this technique takes a little bit longer, you have more control over what cells the name refers to. To open the New Name dialog box, click Formulas → Define Name:
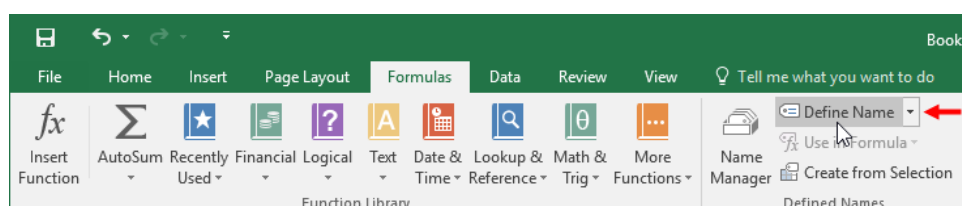
When the New Name dialog box is displayed, you will see that the Name field appears at the top. The Scope drop-down menu allows you to choose if this new name will be applied to only the current worksheet or the entire workbook. Inside the Comment text area you can enter a brief description of the named cell or range. By default, the cells that were selected when the Define Name command was clicked will already be filled into the "Refers to" field. If you wish, you can change this selection by clicking on the cell selector ():
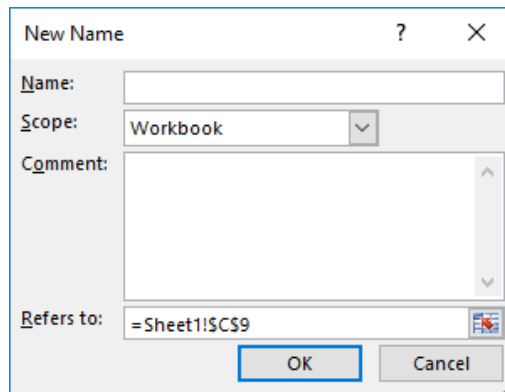
Once you enter your options and click OK, the named range will be created.

EDITING A RANGE NAME AND DELETING A RANGE NAME

As workbooks are typically dynamic in nature, the ability to manage named cells and ranges can become very important. The Name Manager dialog box allows you to view and manage all named objects within your workbook. This dialog box is accessed by clicking Formulas → Name Manager:
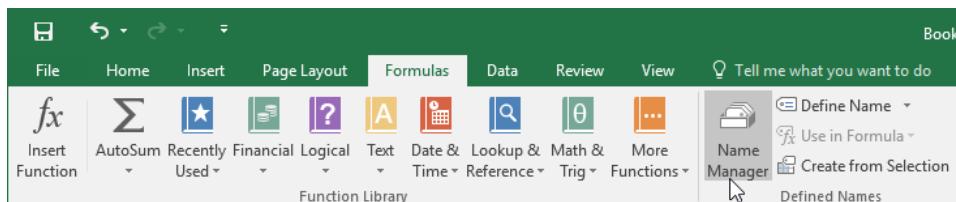
When open, the Name Manager dialog box will list any named objects within the current workbook:
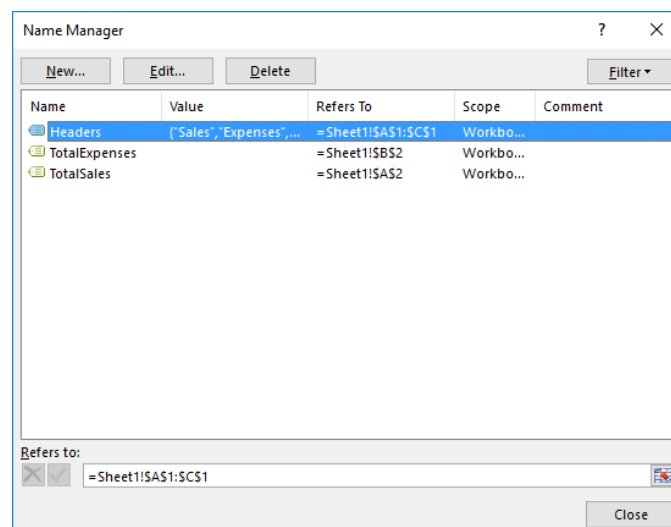
Clicking the New button will open the New Name dialog box, which you can use to create a new range name:
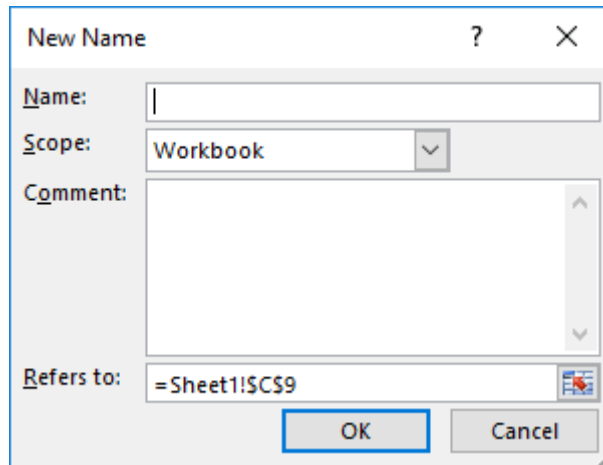
If you select a name from the list in the Name Manager dialog box and then click the Edit button, the Edit Name dialog box will be shown:
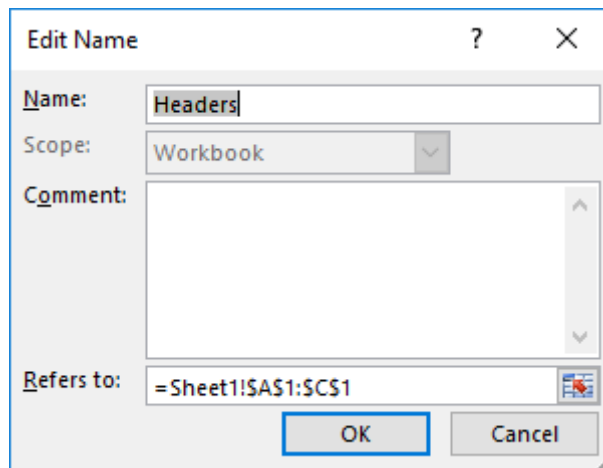
This dialog box is identical to the New Name dialog box; the only difference is that it will be prepopulated with information from the selected range name.

To delete a range name, click to select the range name in question and then click the Delete button:
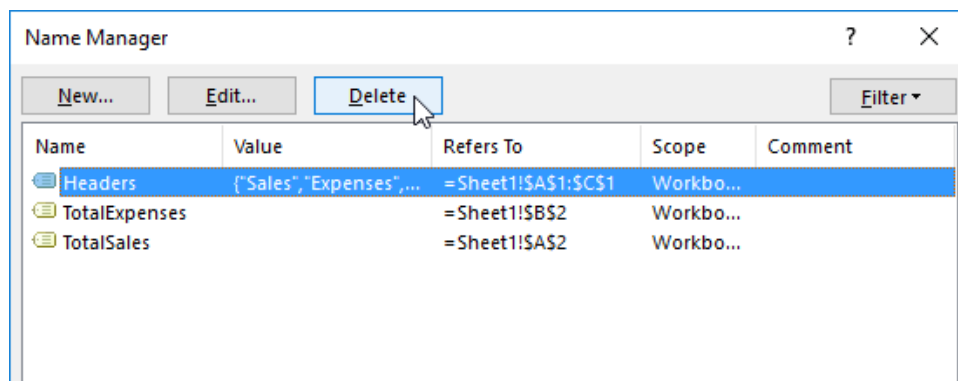
A dialog will then open to ask you to confirm this action. Click OK to complete the deletion process.

Finally, the Filter command is used to show only certain ranges based on specified criteria:
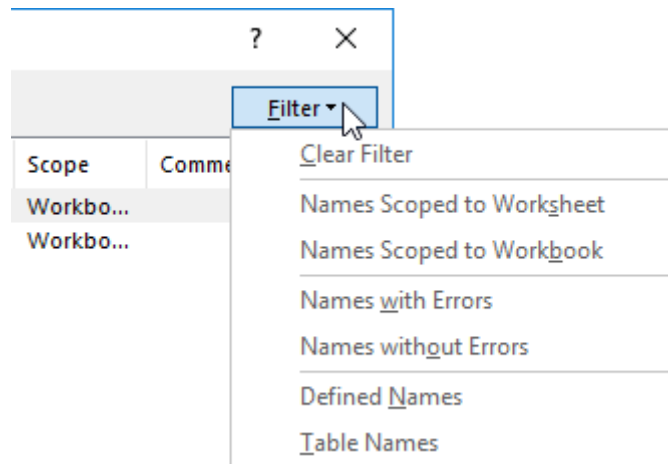
This is particularly useful when working with a workbook that contains a large amount of range names, as you can quickly narrow down the list to only those ranges that you would like to work with.

USING RANGE NAMES IN FORMULAS

Cell and range names are not just useful in keeping your workbooks more organized; they can also help immensely in the creation of formulas. This is because after you have defined a cell or range name, you are able to use that name in place of the usual cell reference. This makes formulas much more readable.

For example, below you can clearly and quickly see what this formula does. If it used standard cell references, it would be much harder to tell:

Perhaps one of the easiest methods to enter cell and range names into a formula is to use the Formula AutoComplete feature. Just like how the AutoComplete feature suggests function names based on the first few characters that you type into the Formula Bar, it will also suggest cell and range names in a small menu. Double-clicking on a suggestion in this menu will insert it into the formula:
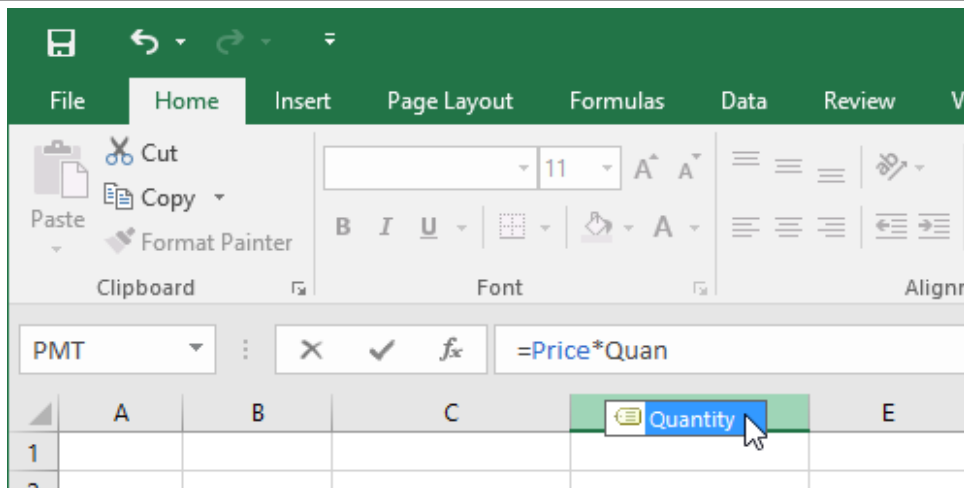
You can differentiate names from functions and other objects suggested by the small tag icon that appears by each name ( ).

In addition to manually entering cell and range names, you can also use the Use in Formula command to insert existing cell and range names into formulas. To access this command, click Formulas → Use in Formula:
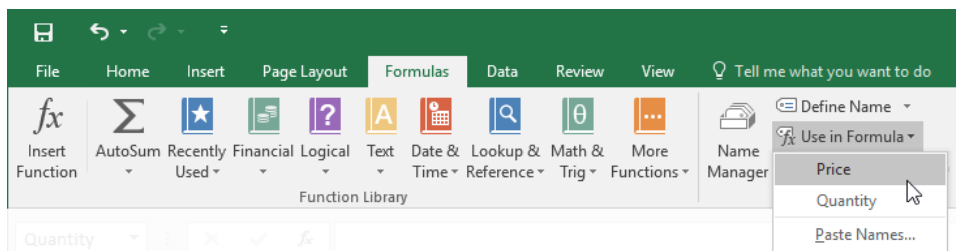
This action will display a drop-down menu listing all of the existing cell and range names. Clicking on an option will insert its reference into the Formula Bar.

ACTIVITY 1-1

Using Range Names in Formulas

Using the features that you learned about in this topic, you will complete a small sales worksheet that you have been working on.

1. To begin, open Activity 1-1 from your Exercise Files folder:
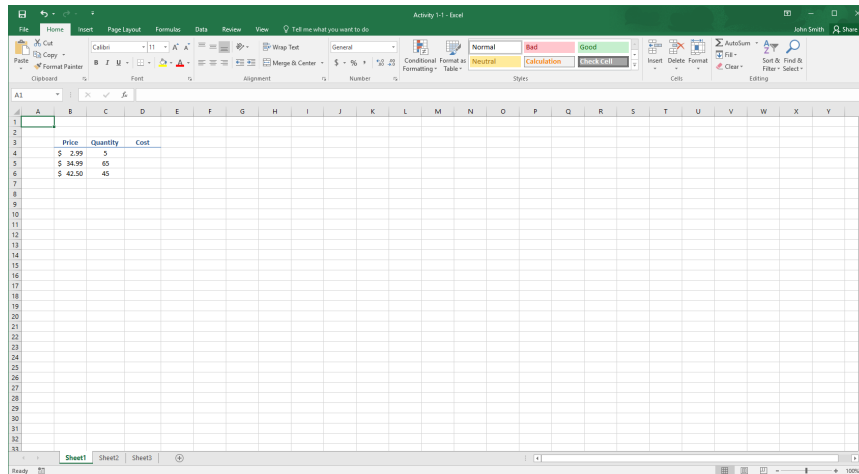
2. To create the first range name, use your cursor to select cells B4:B6:
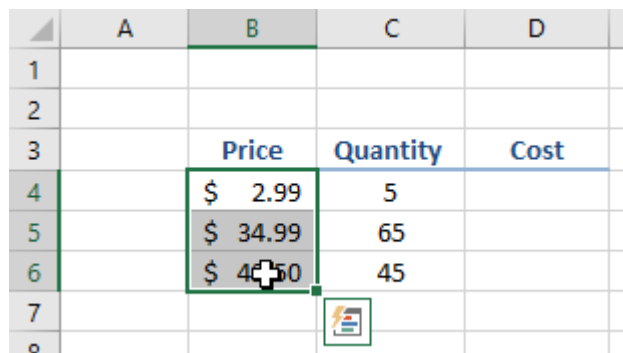
3. Next, type "Prices" inside the Name Box. Press Enter:
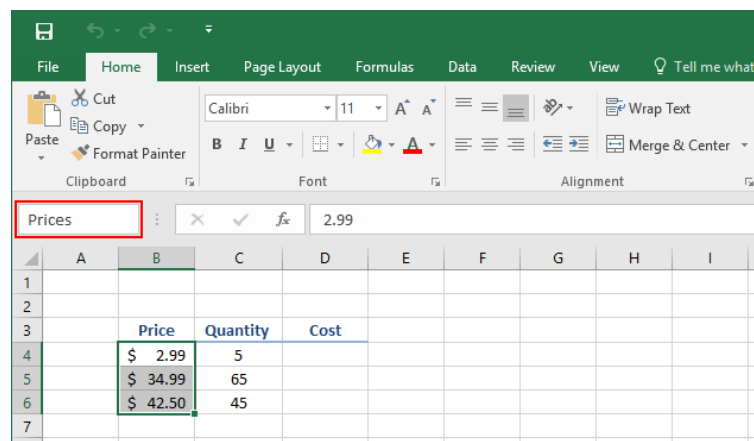
4.   The selected range will now have "Prices" as a range name:
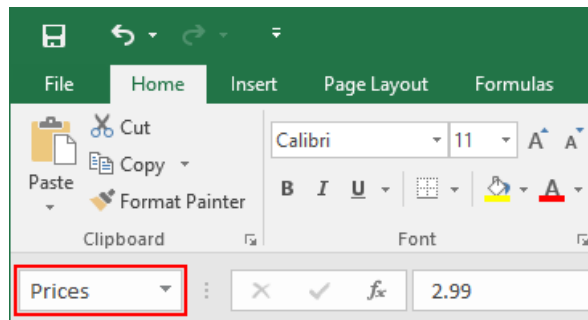
5.   Now, let's try another method to create another range name. First, use your cursor to select cells C4:C6:

6.   Next, click Formulas → Define Name:
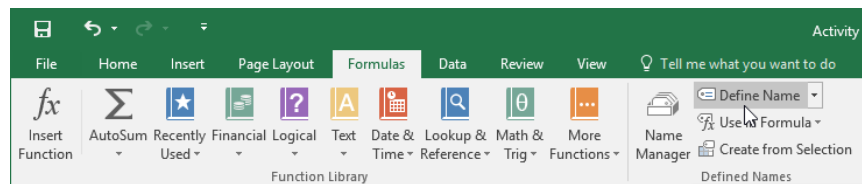
7.   The New Name dialog box will now be displayed. Ensure that "Quantity" appears inside the Name text box and that the Scope drop-down menu is set to Workbook. Click OK:
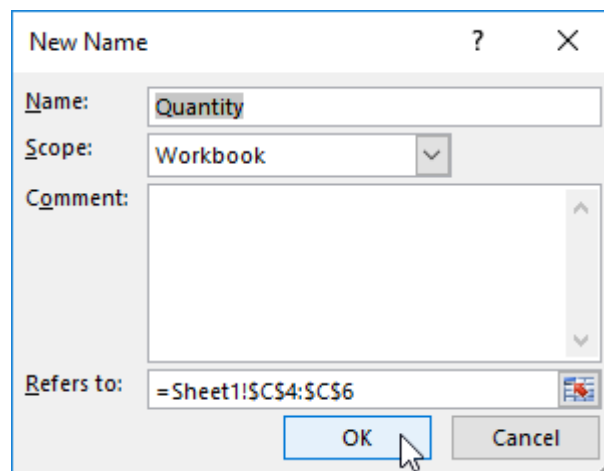
8. The selected range now has "Quantity" as a range name:
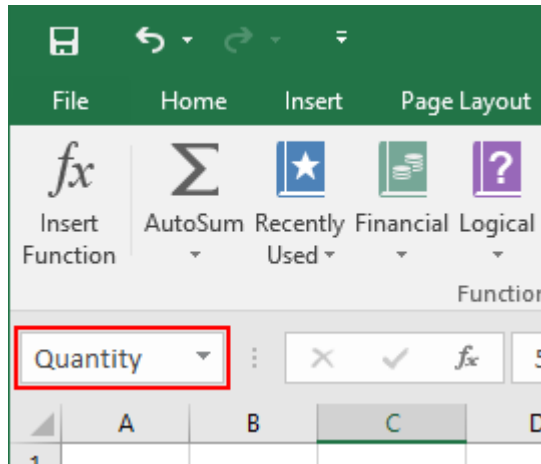
9. You have one more range name to create. Use your cursor to select cells D3:D6:

10. Click Formulas → Create from Selection:
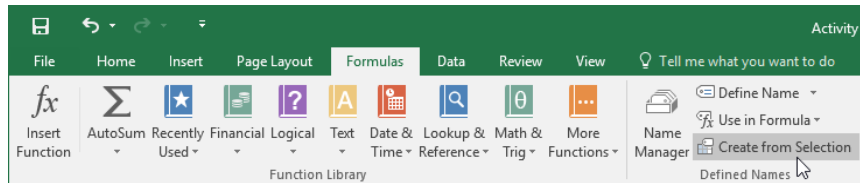
11. In the Create Names from Selection dialog box, ensure that the "Top row" checkbox is selected and click OK:
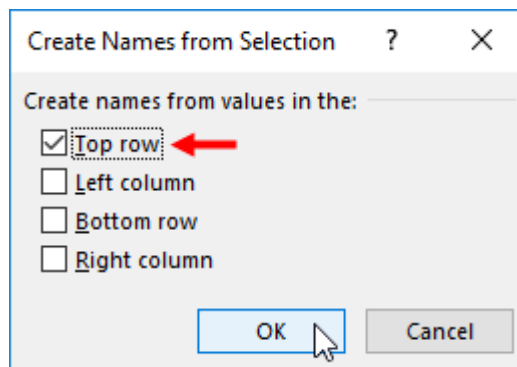
12.   Next, you need to create a formula that will calculate the cost of the items (Quantity*Price). Select cell D4:

13.   Click inside the Formula Bar and type "=":
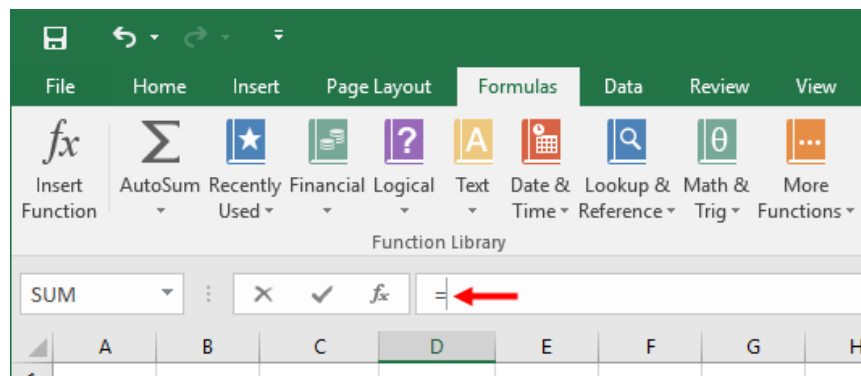
14.   Next, type "Prices" followed by an asterisk:
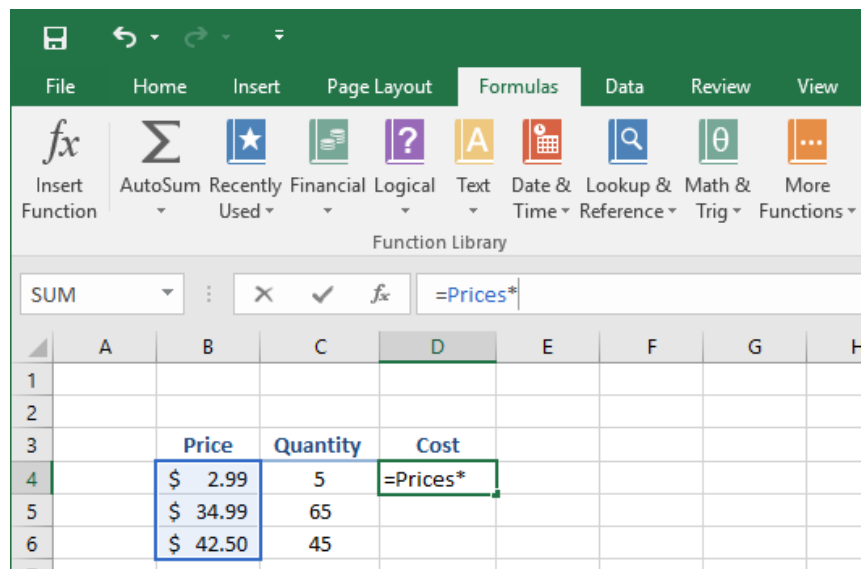
Note that because Prices is a range name, its text will appear blue in the Formula Bar and blue shading will appear around that range of data on the worksheet.

15. Still inside the Formula Bar, type "Q" and then double-click the Quantity result from the small menu that appears:
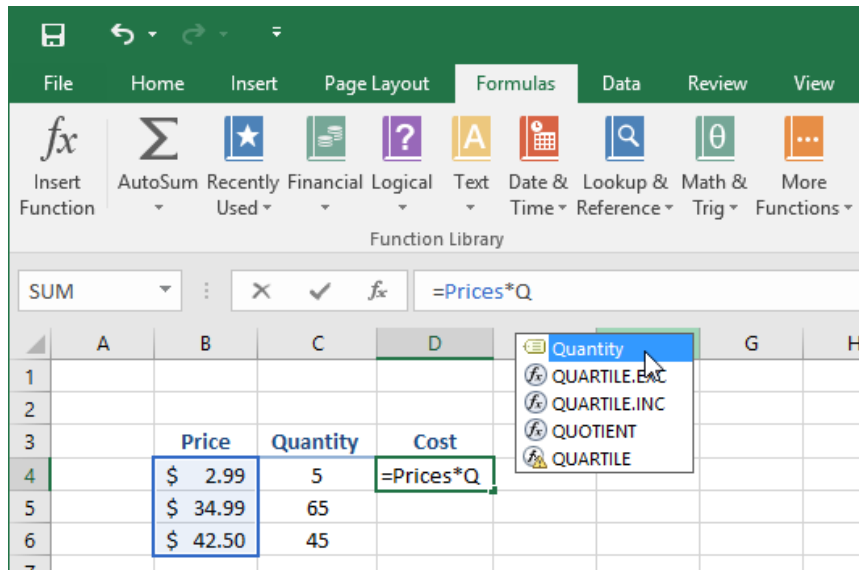
16. The Quantity name will now appear within the Formula Bar in red text, with its associated range shaded in red in the worksheet:
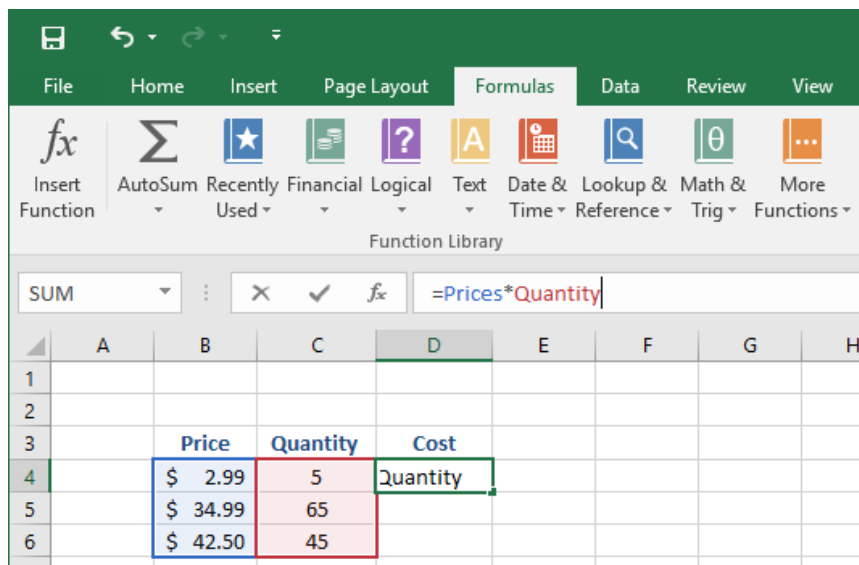
17. Press Enter to apply the formula. You will see the result appear in D4:

18. Save the current workbook as Activity 1-1 Complete and then close Microsoft Excel 2016.

TOPIC B: Use Specialized Functions

While the basic functions in Excel cover the majority of use cases, there are some situations where a specialized function is more appropriate. In order to find and use specialized functions, you must be familiar with their syntax and understand how they work on a fundamental level.

Topic Objectives
In this topic, you will learn:
- About function categories
- About the Excel function reference
- About function syntax
- About function entry dialog boxes
- Using nested functions
- About automatic workbook calculations
- How to show and hide formulas
- How to enable iterative calculations

FUNCTION CATEGORIES

Every built-in function that is available in Excel has been categorized into one of 12 standard categories. These categories are available on the Formulas tab, with some categories available under the More Functions drop-down menu:
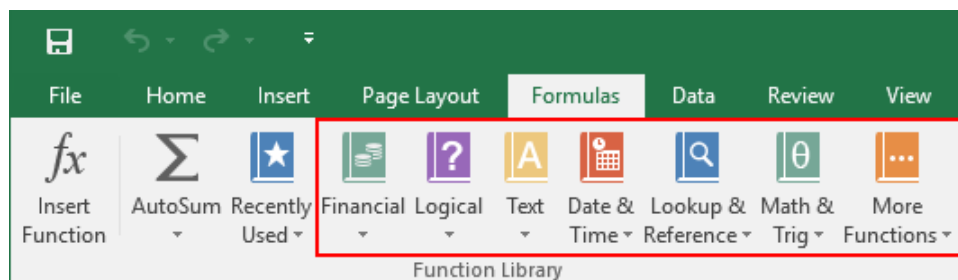
(Note that you can expand the number of standard categories using add-ons.)

Here is a breakdown of what types of functions each of the available categories contains:

Financial	This category contains dozens of functions that can be used to calculate financial data like compound interest, rates of return, and depreciation.
Logical	The functions in this category are used to return values that are either true or false. Typically these functions are used in conjunction with other formulas.
Text	Functions in this category are used to manipulate text. For example, you will find functions that will replace text or convert text to uppercase.
Date & Time	These functions can be as simple as calculating the current date to calculating the number of workdays in a year.
Lookup & Reference	The functions in this category are used to find specific values in a specified range or table.
Math & Trig	This category includes a variety of common mathematical functions.
Statistical	The functions in this group are used to perform a variety of statistical analysis tasks. For example, you will find functions to calculate mean and median data.
Engineering	This category includes functions that are commonly used in engineering settings.
Cube	The functions in this category are used to perform complex data analysis using OLAP (Online Analytical Processing) cubes.
Information	Functions in this category give you information about the worksheets in your workbook and the data that they contain. For example, one function has the ability to determine the type of data in a cell.
Compatibility	The functions in this category are unique in that they are actually older versions of functions that are still available. Such functions are useful if you are working with workbooks that were created in older versions of Excel.
Web	The functions found in this category are used to return data from web services, return data from XML content, and return URL-encoded string data.

THE EXCEL FUNCTION REFERENCE

While you become familiar with many of Excel's functions, there may be a few that elude you. In such cases you will need to identify which function serves which purpose. This is where the Excel function reference can be invaluable.

The Excel function reference is a Help resource that will list all of the functions that are available in Excel 2016, what they do, their syntax, and examples of their use. To access the Excel function

reference, open the Excel Help window by pressing F1. Next, type "Excel functions by category" into the search field and press Enter:
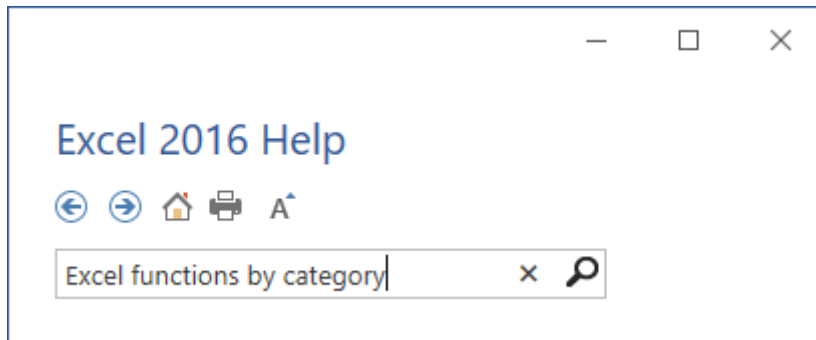
From the list of results, click the "Excel functions (by category)" option:
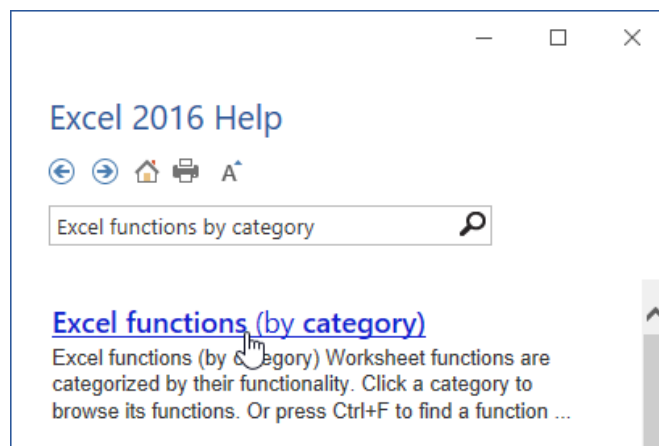
You will then be able to view all of the functions that Excel 2016 has to offer:
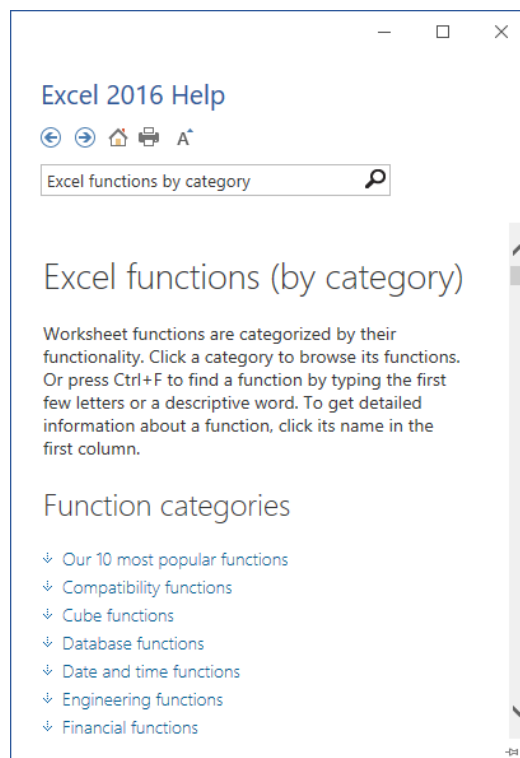
Clicking on any function that is listed here will provide you with much more detail about it:
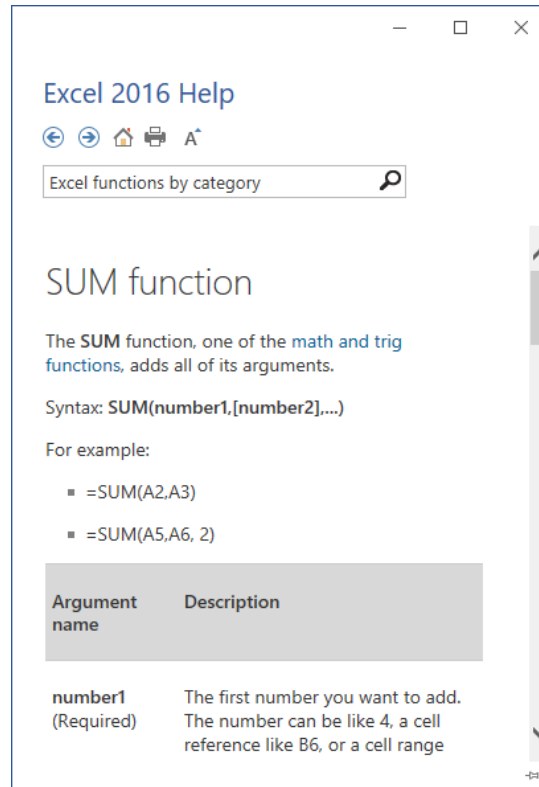
FUNCTION SYNTAX

Functions are a major part of what makes Excel so popular, so now you will explore some different types of functions and learn some tricks that you can use to perform complex calculations. Just keep in mind that even the most complex of formulas can be broken down into simple parts. Remember to pay attention to the order of precedence (using the BEDMAS acronym) and the number of parentheses you use.

The SUMIF Function

=SUMIF(range, criteria, [sum_range])

The SUMIF function is used to calculate the sum of values in a specified **range** if they meet a specified **criteria**. For example, you could calculate total sales figures and only include numbers that are less than a specified value. The **sum_range** argument is optional; you can use it if you want to add cells to the sum other than those specified in the argument. If you choose to leave out this argument, the function will only calculate the sum of the values from the previous **range** argument.

Below are some example of the SUMIF function in action:

Function	Description
=SUMIF(A1:C10, "<5")	Only numbers in the range A1:C10 that are under 5 will be added together.
=SUMIF(A1:C10, "December", D1:D10)	Only numbers in the range D1:D10 will be added together where they correspond with the text entry of "December" in the range A1:C10.
=SUMIF(A1:A10, 5)	All numbers with the value of 5 that fall within the A1:A10 range will be added together.

The AVERAGEIF Function

=AVERAGEIF(range, criteria, [average_range])

The AVERAGEIF function will return the average of every cell within a **range** if the specified **criteria** is met. For example, if you wanted to calculate the average sale amount in a set range of sales data only for sales below a certain amount you could use this function. The **average_range** argument is optional; it can be used if you want to add cells to the sum other than those specified by the **range** argument. If you choose to leave out this argument, the function will only calculate the average of the values from the **range** argument.

Below are some AVERAGEIF functions in action:

Function	Description
=AVERAGEIF(A1:C10, "<5")	The average of all numbers in the range A1:C10 that are under 5 will be calculated.
=AVERAGEIF(A1:C10, "December", D1:D10)	The average for the numbers in the range D1:D10 will be calculated where they correspond with the text entry of "December" in the range A1:C10.

The COUNTIF Function

=COUNTIF(range, criteria)

The COUNTIF function will count the number of cells in a specified **range** if the **criteria** is met. For example, this function could be used to count the number of sales associates who have sold X number of products.

Function	Description
=COUNTIF(A1:C10, "<5")	This function will count all cells within the A1:C10 range where the value is 5 or lower.
=COUNTIF(A1:A10, 5)	This function will count all cells within the A1:A10 range only where the value is 5.

IFS Functions

The functions that have been covered so far (AVERAGEIF, COUNTIF, and SUMIF) all have an equivalent IFS function that allow you to perform those respective calculations on data that requires more than just one specified criteria.

With a few exceptions, such functions have very similar syntax:

=SUMIFS(sum_range, criteria_range1, criteria1, [criteria_range2], [criteria2], …)

=AVERAGEIFS(average_range, criteria_range1, criteria1, [criteria_range2], [criteria2], …)

=COUNTIFS(criteria_range, criteria1, [criteria_range2], [criteria2], …)

The COUNTA Function

=COUNTA(value1, [value2],…)

The COUNTA function is used to count the number of cells specified by the argument (**value1**, **value2**, etc.) that are not empty.

Function	Description
=COUNTA(A1:A10)	All cells that contain data within the A1:A10 cell range will be counted.
=COUNTA(A1:A10, B1, C1)	All cells that contain data within the A1:A10 range, as well as cells B1 and C1, will be counted.

FUNCTION ENTRY DIALOG BOXES

Functions can be entered into a worksheet using a number of different methods. Perhaps the most straightforward is to type the function directly into the Formula Bar – just like a regular formula. For example, if we wanted to use the SUM function to calculate the sum total of the values inside the A1:A6 range, we would select the cell where the result will be displayed and type "=SUM(A1:A6)" into the formula bar:
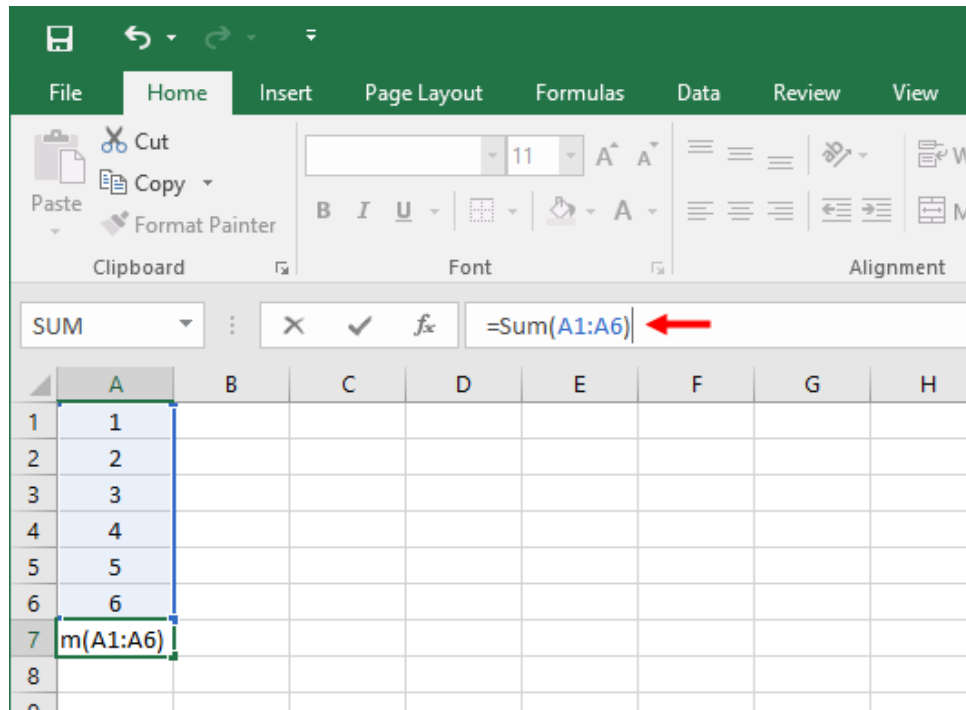
Pressing Enter or clicking the Enter button will then enter the function into your worksheet and then produce the result:
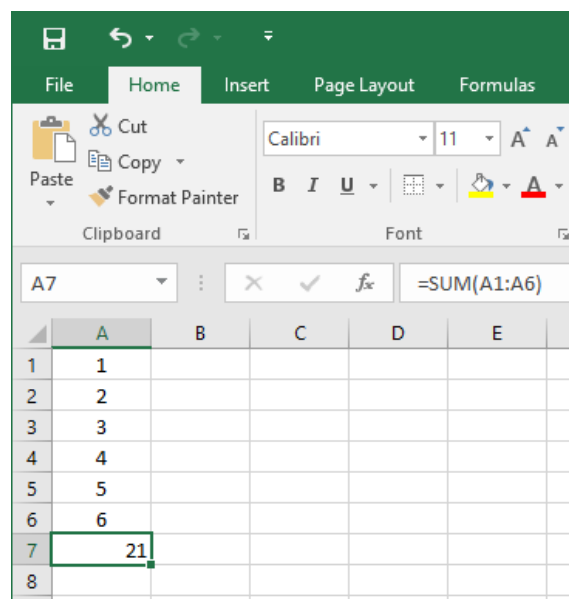
While manually entering a function into the Formula Bar can often be the fastest way to enter a function, it is sometimes a difficult method to take advantage of when you are unsure of a function's syntax. In such cases, you want to open the Insert Function dialog box. To open this

dialog box, first select the cell in which you want the result of the function entered and then click Formulas → Insert Function, or click the Insert Function button that is beside the Formula Bar:
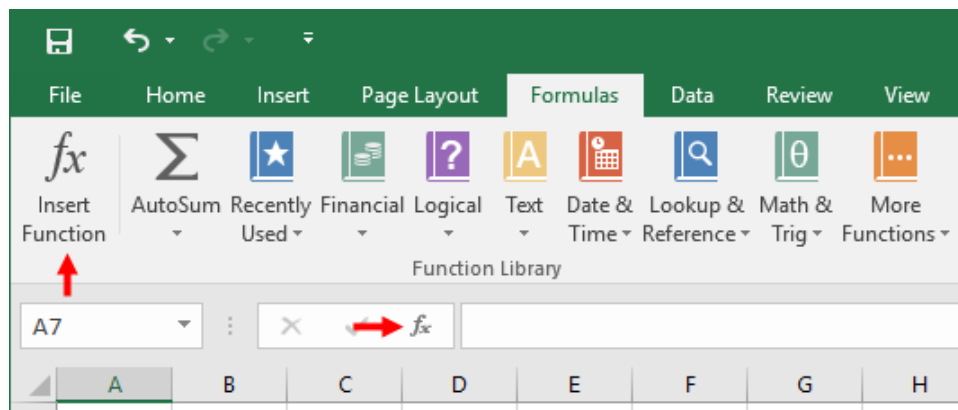
The Insert Function dialog box provides you with a **search area (1)** that you can use to find a particular function that you need, as well as a **category drop-down menu (2)** that will display all of the functions that belong to a specified category:
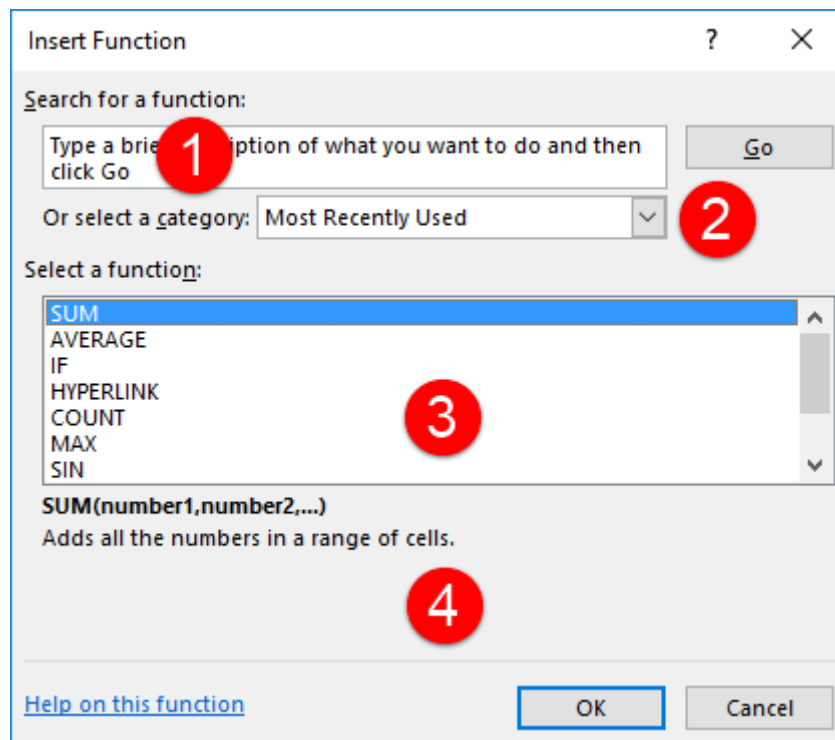
Lower in this dialog box you will see a **list of functions (3)** that are shown based on your search or the category that you selected. Clicking any of the functions that are listed here will show you a **preview (4)** of what the syntax for the selected function is and a brief description of what that function is used for.

Once you find and select a function, click OK to enter it into your worksheet. This action will typically display the Function Arguments dialog box:
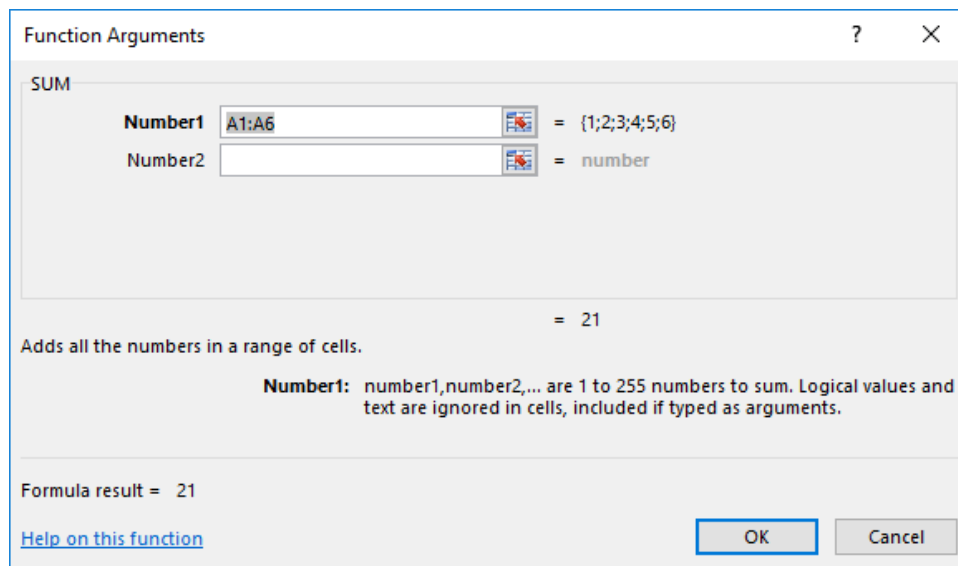
Using the controls in this dialog box, you are able to add arguments to the function that you selected. For this example, as we are working with the SUM function, we are able to choose data ranges that will be entered into the function for us. You will also see the result of the formula shown near the bottom and the middle of this dialog box.

Clicking the OK button will enter the function into the worksheet using the arguments that you selected.

USING NESTED FUNCTIONS

Some situations require for a function to be nested inside of another function. This means that you are using the results of the nested function as arguments. For example, here is an example of a nested function:

=IF(SUM(A1:A5)>10, SUM(A6:A10), 0)

In this example a two SUM functions have been nested inside of a single IF function. The way this example works is that IF the SUM of data in cells A1:A5 is greater than 10, then this formula will SUM the values of cells A6:A10 and display that result. IF the SUM of data in cells A1:A5 is less than 10, then "0" will be displayed instead.

AUTOMATIC WORKBOOK CALCULATIONS

By default Excel workbooks with automatically calculate the results of formulas automatically. Occasionally, you may want to switch your workbook calculations to manual recalculation so that you have more control over when formulas are calculated in your workbook. Typically you would do this if you are working with a particularly large workbook and the response times in Excel are slowed when you change a value and numerous formulas calculate the results of this change at the same time.

To change the calculation options, click Formulas → Calculate Options. This drop-down command includes the Automatic (default), Automatic Except for Data Tables, and Manual options:
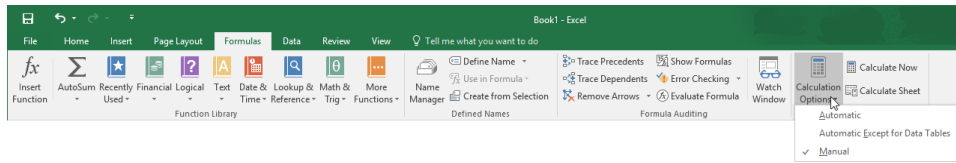
If you switch to the Manual option, you can then calculate formulas in your workbook manually by clicking Formulas → Calculate Now:
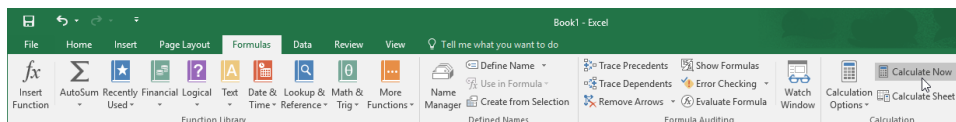
Alternatively, you can also choose to calculate only those formulas on the current worksheet by clicking Formulas → Calculate Sheet:
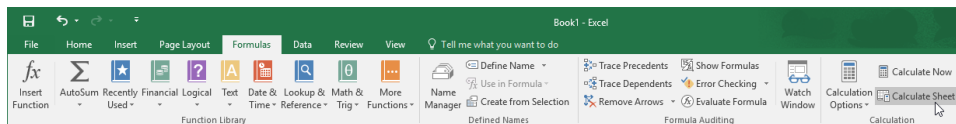
SHOWING AND HIDING FORMULAS

To make creating and reviewing worksheets a bit easier, you can show the formulas (instead of the result) on the worksheet and the printed page. To do this, click Formulas → Show Formulas:
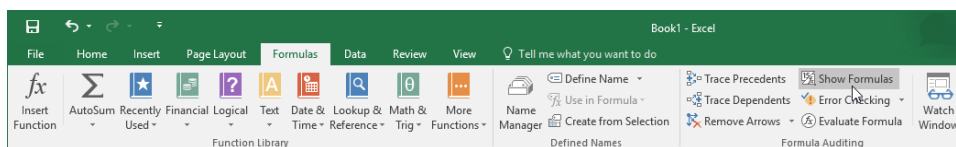
This action will show formulas within the sheet instead of the calculated results:

	A	B	C	D
1	100			
2	200			=A1+A2+A3
3	300			

ENABLING ITERATIVE CALCULATIONS

While you would typically want to avoid circular references (formulas that refer to cells that contain the same formula), there are situations where this is desirable. In Excel, you are able to accommodate such situations by enabling **iterative calculations** and choosing the exact number of iterations required. Iterative calculations are those calculations that repeat until a desired condition is reached. Typically these are used when building more complex calculations, such as those used to calculate tax accrual.

To enable iterative calculations, first open the Excel Options dialog box by clicking File → Options. Next, display the Formulas category. Finally, check the "Enable iterative calculation" check box:
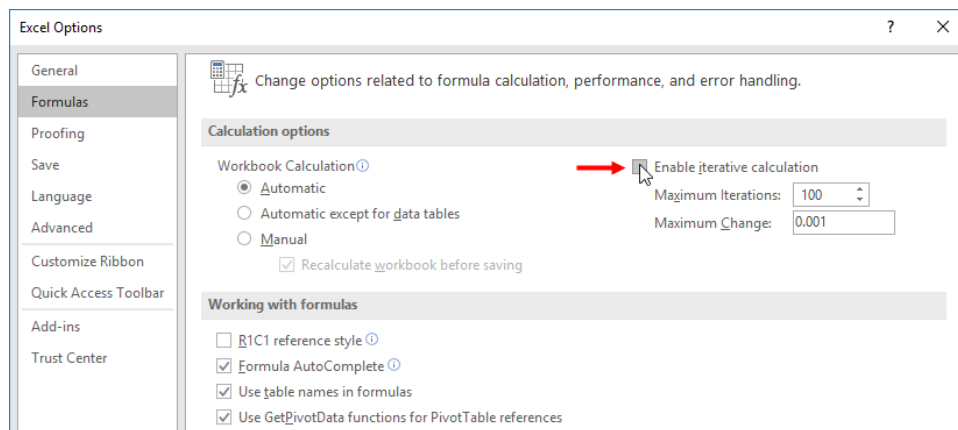
With iterative calculation enabled, any formulas that contain circular references will calculate up to the value found in the Maximum Iterations increment box (100 by default). The Maximum Change text box contains the maximum change value (.001 by default) to control how much the results change.

ACTIVITY 1-2

Using Specialized Functions

You have a large worksheet that contains the details of dozens of loans. A payment rate for each loan must be calculated according to the terms that have been provided for each. You will use the PMT function to complete this task.

1. To begin, open Activity 1-2 from your Exercise Files folder:

2. First, click to select cell G3:

3. Next, click Formulas → Financial → PMT:
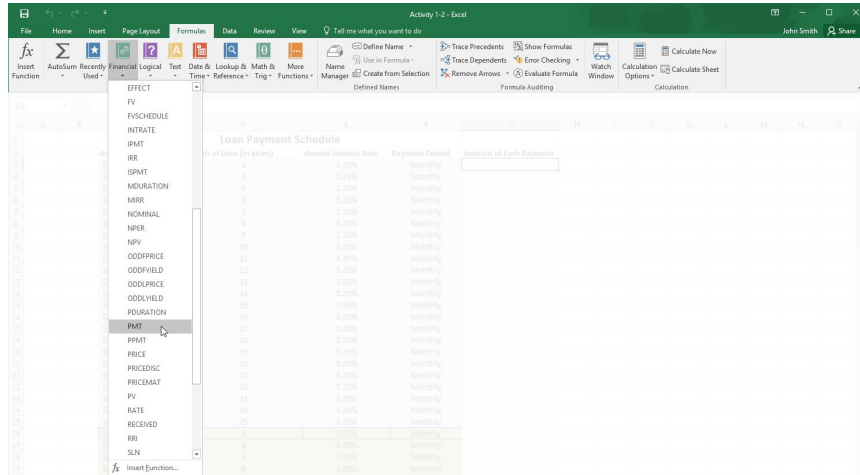
4. The Function Arguments dialog will appear. Within this dialog you need to enter all of the arguments. As the interest rate is stored in cell E3, type "E3" into the Rate text box:
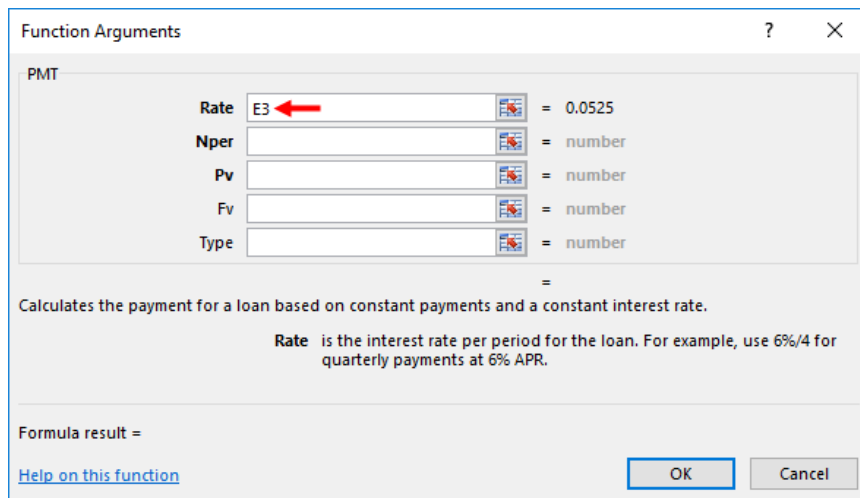
5. As these are annual interest rates and the payments will be monthly, you need to divide this value by 12. Type "/12" following the cell reference in the Rate text box:
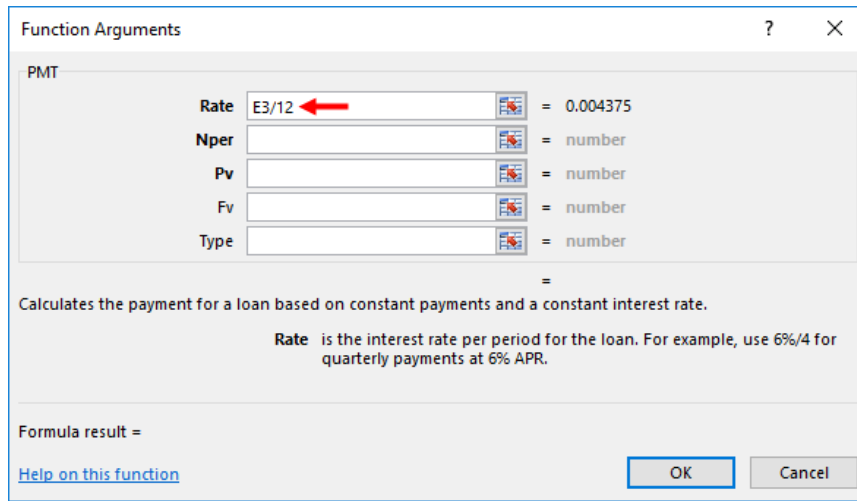
6. The next argument is Nper, or the number of payment periods over the life of the loan. This information is in cell D3, but it is given in years. Because you need to enter it as months, type "D3*12" into the Nper text box:
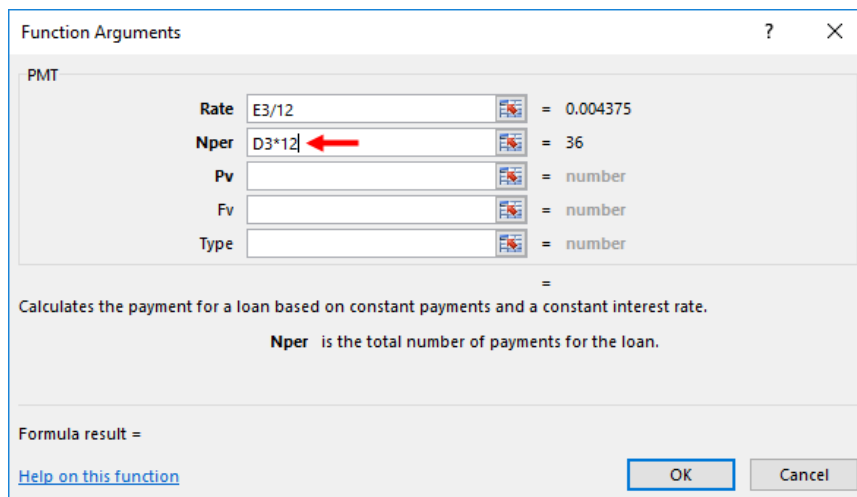
7. The next argument is Pv, or present value. This is the amount of money that is being borrowed. This information is in cell C3, so type "C3" into the Pv text box:
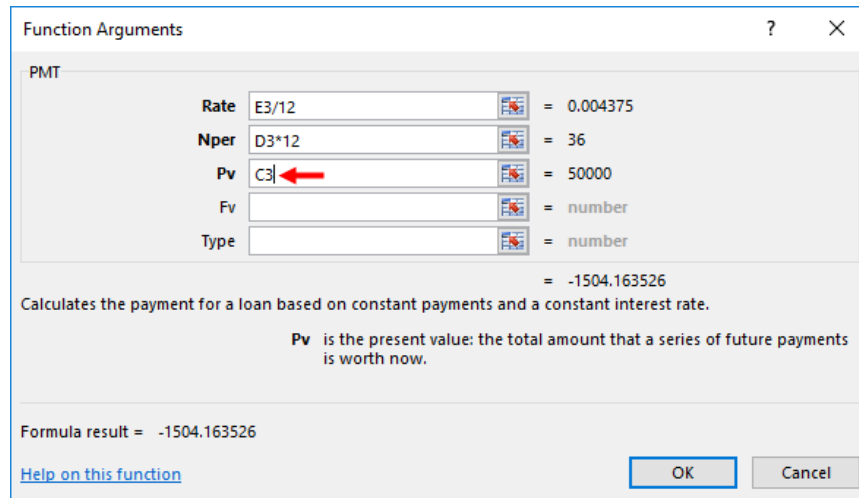
8. Leave the Fv (Future Value) argument field empty. This argument will default to 0, which is what we want. (This means there will be no part of the loan left outstanding at the end of the payments.) We will also let the Type field default to 0, meaning payments will be due at the end of the payment period. Click OK to create the function:
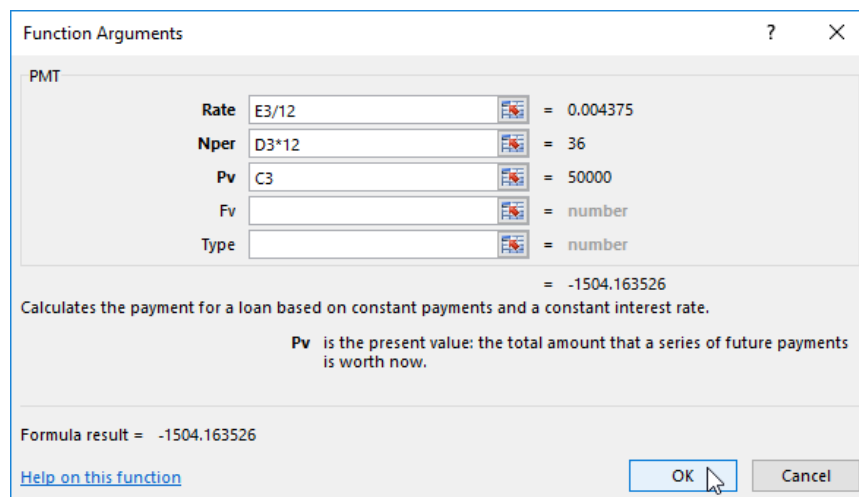
9. Now you will now have a result in the cell G3. You will also see the PMT function in the Formula Bar:
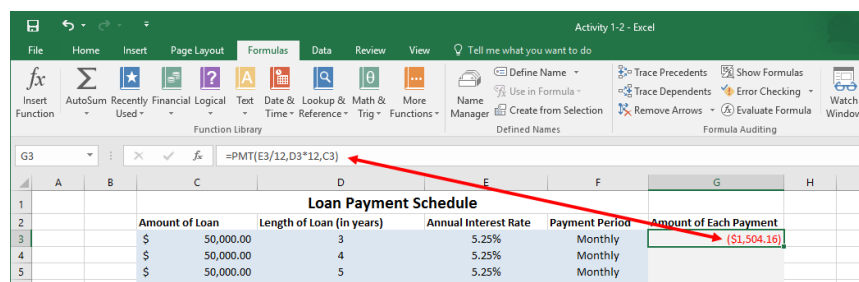
10. Now it is time to enter this formula for the rest of the data rows. To do this, click cell G3 to make it active, and then drag the AutoFill handle in the lower right corner of the cell down to G94:
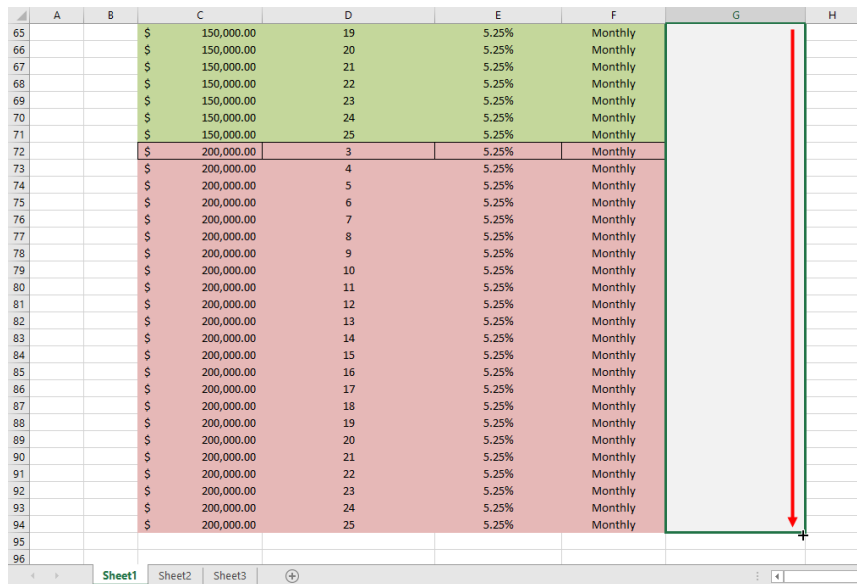
11. Release the mouse button. You will see that the loan payments for each entry have been calculated:
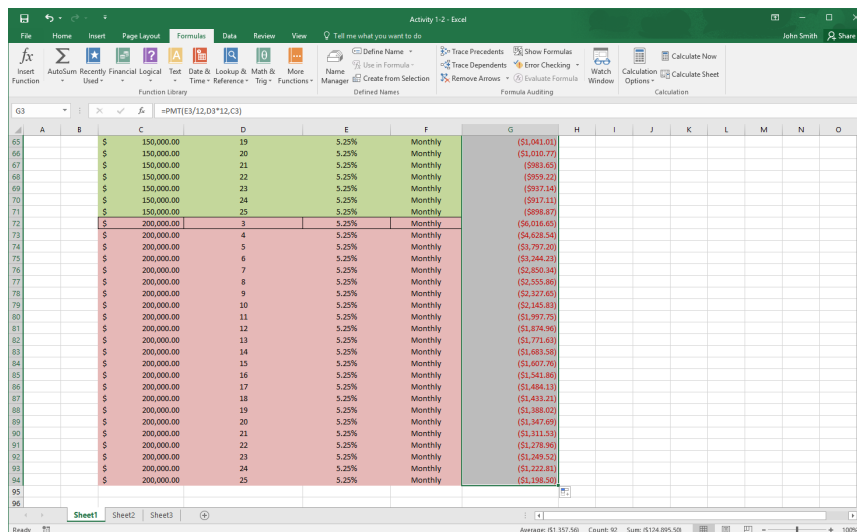
12. Save your work as Activity 1-2 Complete and then close Microsoft Excel 2016.

Summary

Over the course of this lesson you learned about range names and how to apply them. Additionally, you learned about the different function categories and specialized functions that are available. You should also now be familiar with function syntax, nested functions, automatic workbook calculations, and iterative calculations.

LESSON 2: ANALYZING DATA WITH LOGICAL AND LOOKUP FUNCTIONS

Lesson Objectives

In this lesson you will learn how to:

- Use text functions

- Use logical functions

- Use lookup functions

- Use date functions

- Use financial functions

TOPIC A: Use Text Functions

While you are now familiar with Excel's more commonly used functions, you still need to learn about some of its more specialized ones. In this topic you will learn about functions that are specific to text analysis.

Topic Objectives
In this topic, you will learn:
- About text functions
- About LEFT and RIGHT functions
- About the MID function
- About the LEN function
- About the TRIM function
- About the UPPER, LOWER, and PROPER functions
- About the CONCATENATE function
- About the TRANSPOSE function

TEXT FUNCTIONS

Text functions are used in Excel to analyze text-based worksheet data. While such functions can be used for data analysis, they are typically used instead to prepare data for analysis. This is because they allow you to format textual data for use in other areas. For example, you can use text functions to import textual data from another workbook and format it so that it meets the formatting requirements for the destination workbook.

THE LEFT AND RIGHT FUNCTIONS

=LEFT(text, [num_chars])

=RIGHT(text, [num_chars])

The LEFT and RIGHT functions are used to return a specific number of characters from either the left or the right side of a text string. Typically these functions are used in situations where you need to transfer text to a destination where there is a limit on the number of characters each entry may have. The **text** argument is used to declare which text you would like to transfer, while the **[num_chars]** argument is used to declare how many characters you would like transferred.

Suppose that A1 contains "John Smith" as a text string in a worksheet. Examine the possible examples of how the LEFT and RIGHT functions would work with this data:

Function	Description
=RIGHT(A1)	As the num_chars argument was not set in this function it will default to one character. This means that the output for this function would be "h" – the last letter on the far right of the text string.
=RIGHT(A1, 5)	With the num_chars argument set to 5, this function would result in "Smith" as an output – the last five letters on the far right of the text string.
=LEFT(A1, 5)	With the num_chars argument set to 5, this function would result in "John " (including the space) as an output – the first five letters on the far left of the text string.
=LEFT("John")	This function would return only "J" as an output because the num_chars argument wasn't set.

THE MID FUNCTION

=MID(text, start_num, num_chars)

Similar in use and design to the LEFT and RIGHT functions, the MID function will return characters from the middle of a text string. As with the LEFT and RIGHT functions, the **text** argument is used to reference the cell(s) with the text string in question or to enter a text string directly into the function surrounded by double quotation marks. The **start_num** argument is unique to the MID function as it tells the function which character in the text string to start with. The **num_chars** argument then allows you to set the number of characters that you would like to return from the starting point that you set in the previous argument. Keep in mind that while the **num_chars** arguments behaves the same as it does in the LEFT and RIGHT functions, it is required in order for the MID function to operate correctly.

Suppose that A1 contains "John Smith" as a text string in a worksheet. Examine the possible examples of how the MID function would work with this text string:

Function	Description
=MID(A1, 5, 5)	In this case, the text is contained within cell A1. The start_num argument is set to 5, so the function will start five characters (including spaces) into the text string. The num_chars argument is set to five so the five characters after the starting position will be returned. This means that "Smith" would be the output for this formula.
=MID(A1, 1, 4)	In this case, the text is contained within cell A1. The start_num function is set to 1, so the function will start at the beginning of the text string. The num_chars argument is set to 4 so the four characters after the starting position will be returned. This means that "John" would be the output for this formula.

THE LEN FUNCTION

=LEN(text)

The LEN (short for length) function's sole purpose is to return the number of characters that appear within a text string. While there can be many uses for this function, it is typically used to ensure that text strings are of the correct length. For example, you could use this function to make sure that all of the text data within a row is under a specified length. The only argument in this function, **text**, is used to specify where the text data that you would like to count is stored.

Suppose that A1 contains "John Smith" as a text string and B1 contains "Jane Doe" as a text string. Examine the possible examples of how the LEN function would work with this information in mind:

Function	Description
=LEN(A1)	In this case the LEN function has the text argument set to A1. This means that a count of the text string within this cell will be returned. The output of this function would then be 10.
=LEN(B1)	In this case the LEN function has the text argument set to B1. This means that a count of the text string within this cell will be returned. The output of this function would then be 8.

THE TRIM FUNCTION

=TRIM(text)

The TRIM function is used to remove any empty spaces from text strings, excluding spaces between words. This function can be very useful in solving data compatibility issues. For example, a frequent problem in data entry is random spaces at the beginning or end of a text string. Such problems can greatly affect your ability to work with text-based data.

Note that the only argument in this function, **text**, is used to specify where the text data that you would like to work with is stored.

Suppose that A1 contains " John Smith" as a text string and B1 contains "Jane " as a text string. Examine the possible examples of how the TRIM function would work with this information in mind:

Function	Description
=TRIM(A1)	In this case the TRIM function has the text argument set to A1. "John Smith" will be returned with all of the spaces at the beginning of this text string removed.
=TRIM(B1)	In this case the TRIM function has the text argument set to B1. "Jane" will be returned with all of the spaces at the end of this text string removed.

THE UPPER, LOWER, AND PROPER FUNCTIONS

=UPPER(text)

=LOWER(text)

=PROPER(text)

The UPPER, LOWER, and PROPER functions are used to change the casing of text-based data. The UPPER function will convert all lowercase characters into uppercase, while the LOWER function will do the opposite. The PROPER function will only capitalize the first character of each word in a text string. For all of these functions, the only argument is **text**. This used to indicate the text-based data that you would like this function to work with.

Suppose that A1 contains "John Smith" as a text string and B1 contains "jANe smiTh" as a text string. Examine the possible examples of how the UPPER, LOWER, and PROPER functions would work with this information in mind:

Function	Description
=UPPER(A1)	In this example, the UPPER function will convert all of the text within cell A1 to uppercase. This means that the output would be "JOHN SMITH".
=LOWER(A1)	In this example, the LOWER function will convert all of the text within cell A1 to lowercase. This means that the output would be "john smith".
=PROPER(B1)	In this example, the PROPER function ensures that only the first character in each word in cell B1 is capitalized. This means that "Jane Smith" would be the resulting output.

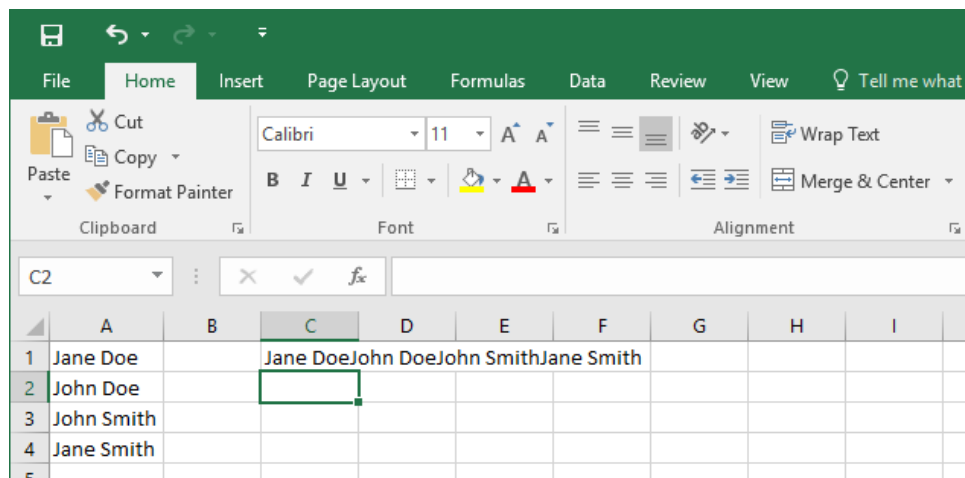## THE CONCATENATE FUNCTION

=CONCATENATE(text1, [text2], …)

The CONCATENATE function is perhaps one of the most powerful text functions available in Excel. Using this function you can combine (concatenate) text strings together from multiple cells into a single cell. This function can save you an enormous amount of time if you need to combine data from multiple sources into one cell.

This function's only required argument is **text1**. This is where you need to declare the first string of text that you want to include in the new cell. Subsequent strings can be added using more arguments, with each separated by a comma. Keep in mind that you are limited to 254 arguments when using this function.

Suppose that you want to combine all of the text data from the A1:A4 range of the example worksheet into the C1 cell:

With the C1 cell selected, you would type "=CONCATENATE(A1, A2, A3, A4)" into the Formula Bar. After pressing Enter, the output of that result will display the text from all the arguments into cell C1 with no spaces in between:

Spaces (or other symbols) can be added between each text string by adding a space surrounded by double quotation marks between each argument. In this case, you would type =CONCATENATE(A1, " ", A2, " ", A3, " ", A4):
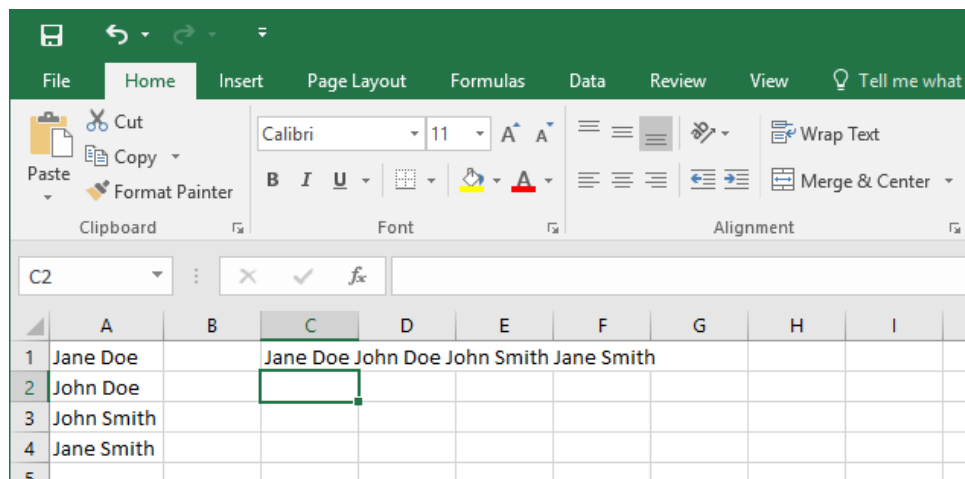

Text Concatenation with the Ampersand

While the CONCATENATE function can be extremely useful, you can also use a somewhat simpler method to join multiple text strings together. Using just the ampersand operator (&) in the Formula Bar you can achieve the same result as if you used the CONCATENATE function. For

example, suppose that you wanted to combine text data from the A1 and A2 cells and display the output in cell C1:

By typing "=A1&A2" into the Formula Bar, the output will result in the text strings from these two cells being combined together:
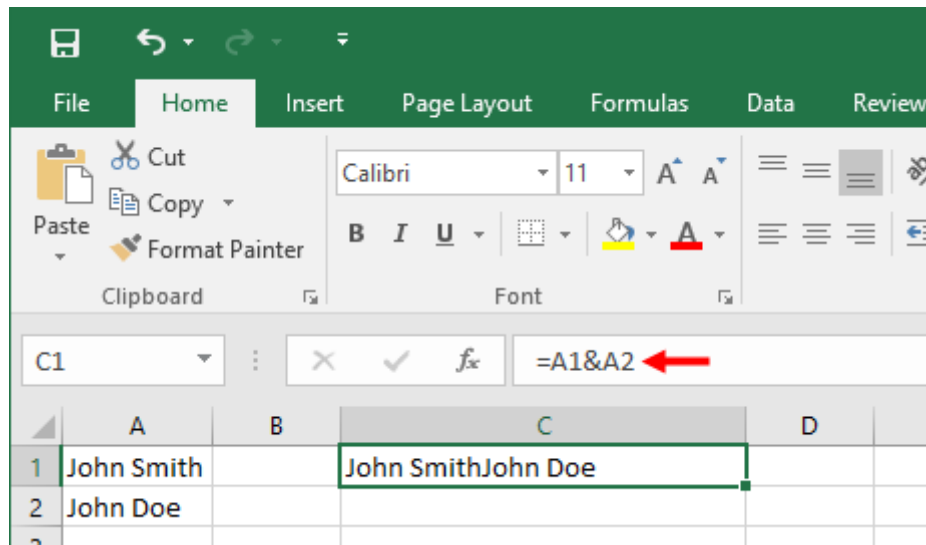
Just like with the CONCATENATE function, you can also add spaces or other characters. In this case, if you wanted to add a space between these two combined strings, you could type the following into the Formula Bar: =A1&" "&A2:
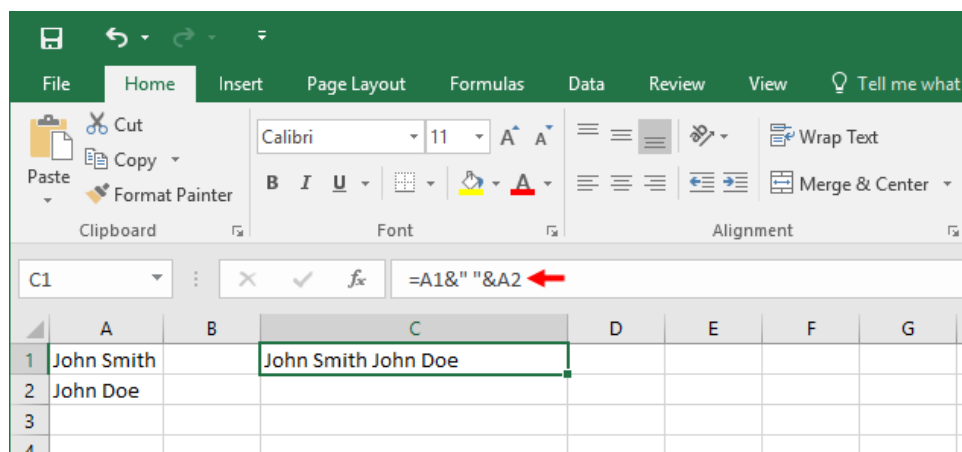

(Note that if you wanted to add a third string, you would have to add another ampersand character after the A2 cell reference.)
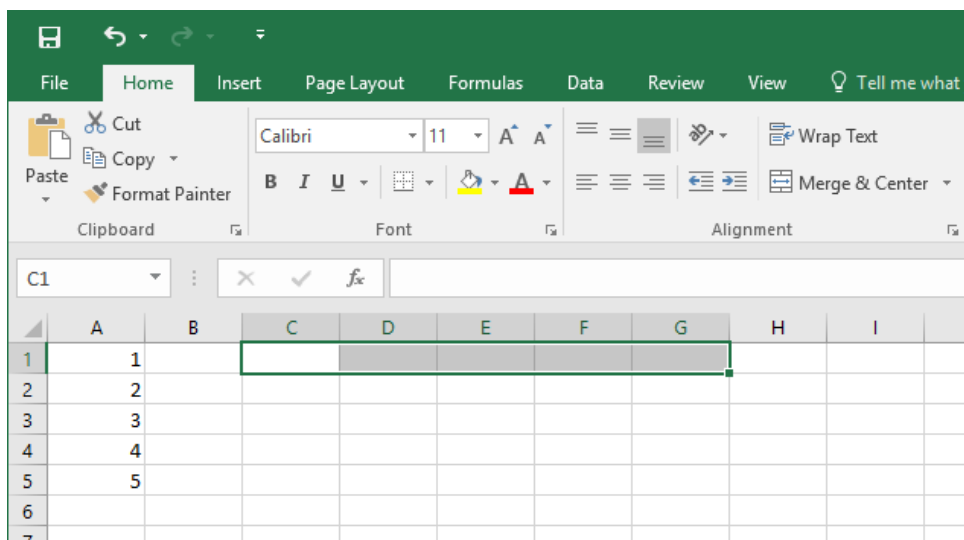
THE TRANSPOSE FUNCTION

The Transpose function will shift a vertical range of cells to a horizontal range and the reverse. To operate correctly, this function needs to be entered as an array formula in a range that has the same number of rows and columns.
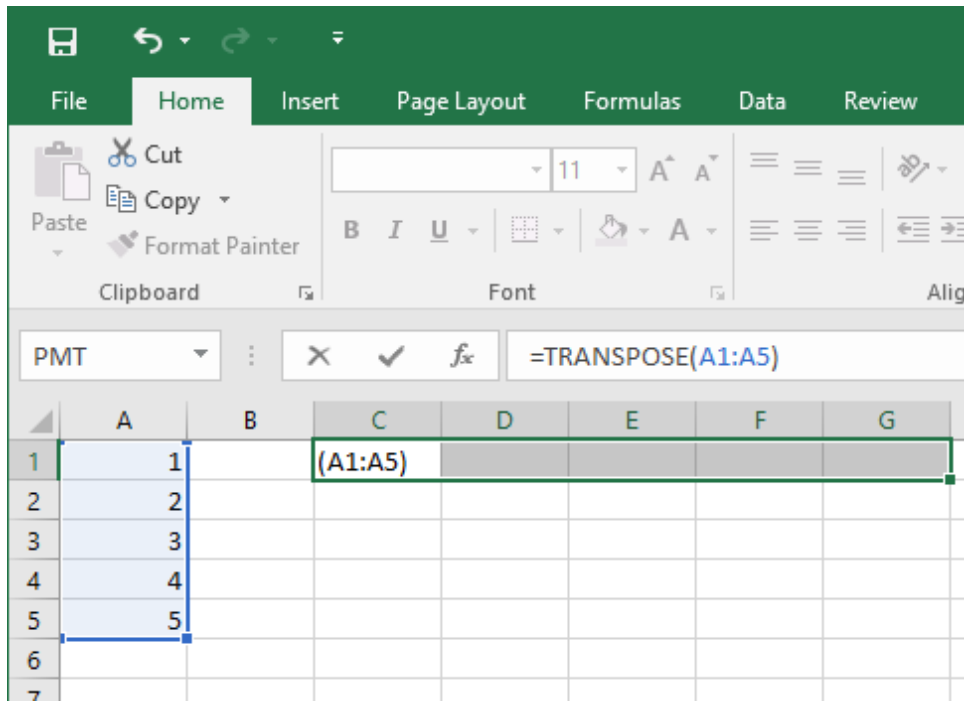
For example, suppose that you wanted to transpose the values in column A so that they appear horizontally on row 1:
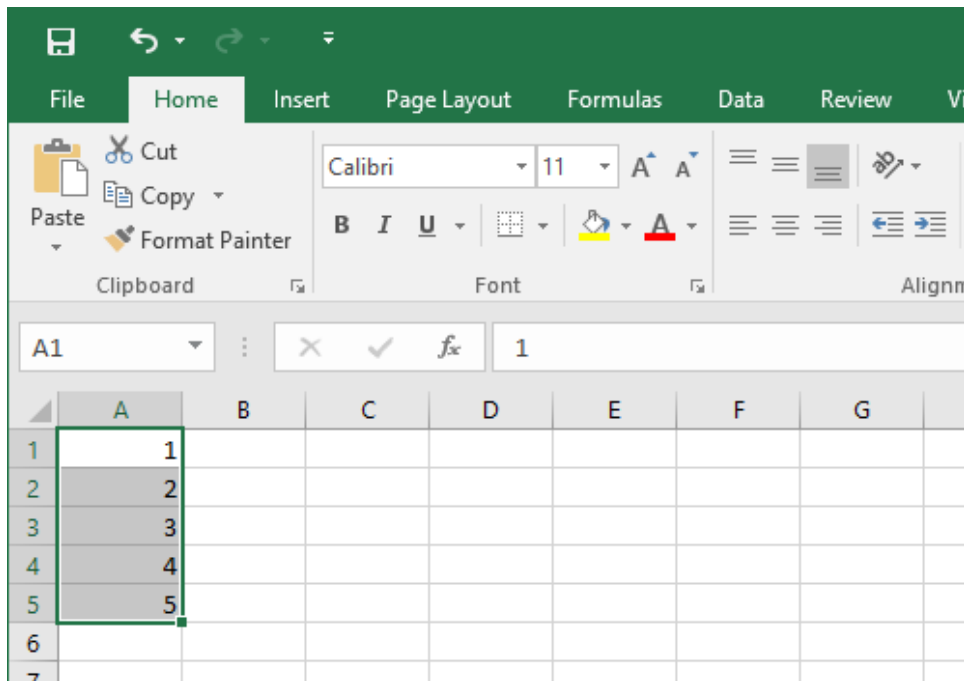

To do this, first select the destination cells that you would like the results to be shown in:

Next, you would enter the transpose function into the Formula Bar with the original cell range as the argument – in this case it would be "=TRANSPOSE(A1:A5):

Press Ctrl + Shift + Enter to enter this function as an array formula and the results will be displayed within the selected cells:
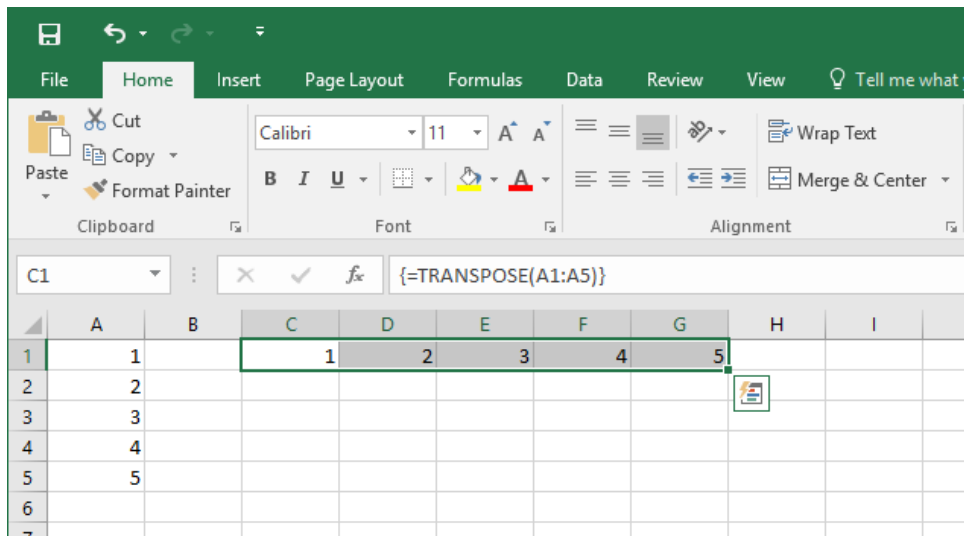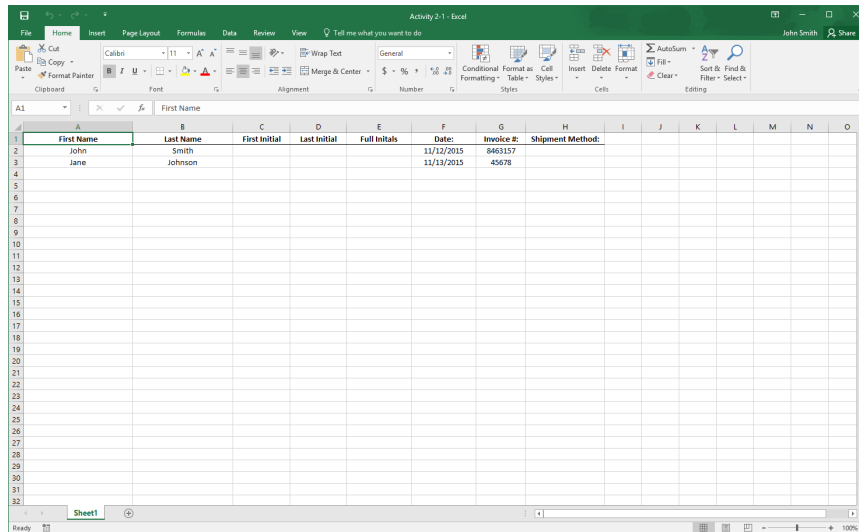
ACTIVITY 2-1

Analyzing Data Using Text Functions

Using some of the text functions that you have learned about in this topic, you would like to automate portions of an invoice form to decrease the time needed for data entry.
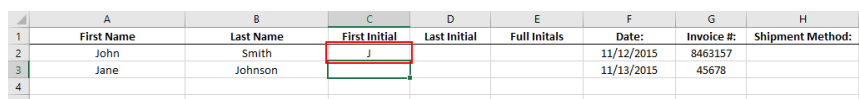
**1.** To begin, open Activity 2-1 from your Exercise Files folder:

2. First you would like to find the first initial from the first name that is entered into column A. Click to select cell C2 and type "=LEFT(A2)" into the Formula Bar:
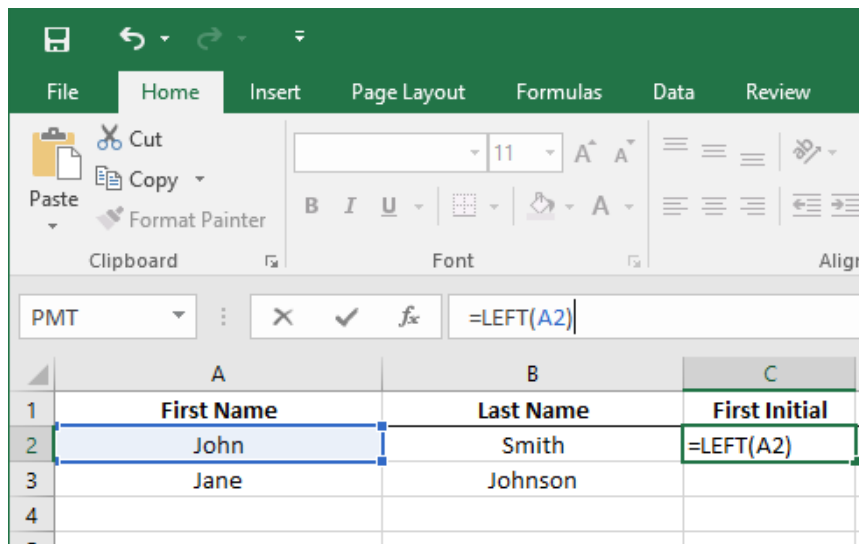
3. Press the Enter key on your keyboard and you will see that the previously selected cell now displays the initial from the first name ("J" in this case):

4. Next, you need to do the same thing and find first initial from the last name that is entered into column B. Click to select cell D2 and type "=LEFT(B2)" into the Formula Bar:
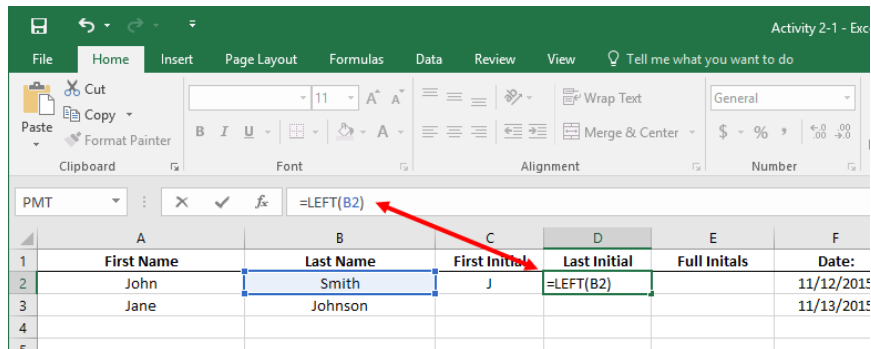
5. Press the Enter key on your keyboard and you will see that the previously selected cell now displays the initial from the last name ("S" in this case):

6. Now you need to use the CONCATENATE function to fill in the Full Initials column. Click to select the E2 cell and then type "=CONCATENATE(C2, D2)" into the Formula Bar:
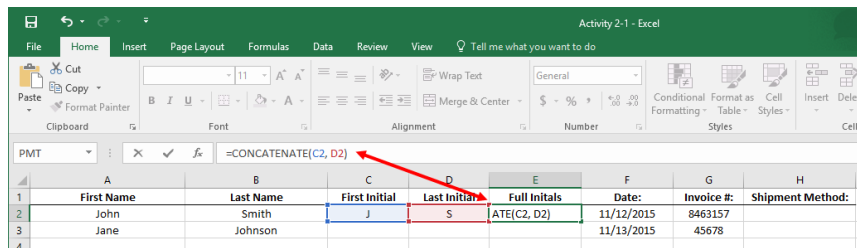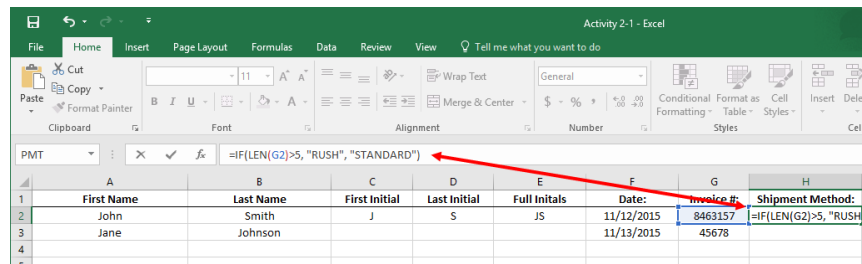

7. Press the Enter key and you will see that the values from cells C2 and D2 have been combined to show the full initials:


8. Finally, you would like to automatically fill in the shipment method based on the number of characters that appear in the invoice number. If the invoice has more than five character, then it is a rush order while if it is five character or less it is a standard order. Select H2:

9. Type "=IF(LEN(G3)>5, "RUSH", "STANDARD")" into the Formula Bar:

10. Press the Enter key on your keyboard and you will see that this particular order is a rush order because its invoice number is over five characters:
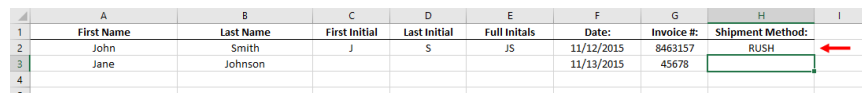
11. Use the Auto Fill feature to copy the formulas that you entered over the course of this activity into the adjacent cells in row 3:
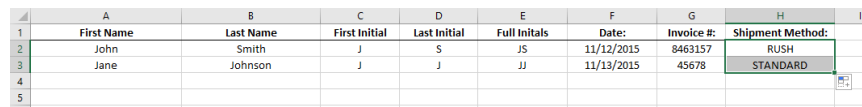
12. Save the current workbook as Activity 2-1 Complete and then close Microsoft Excel 2016.

TOPIC B: Use Logical Functions

Logical functions are used to ask yes or no questions of your data. Over the course of this topic you will learn all about the logical functions that are available in Excel 2016, including the AND, OR, and IF functions.

Topic Objectives
In this topic, you will learn:
- About logical functions
- About logical operators
- About the AND function
- About the OR function
- About the IF function

LOGICAL FUNCTIONS

Excel contains a collection of logical functions that allow you to essentially ask yes or no questions of your data. Such questions return a positive (TRUE) or negative (FALSE) response. Logical functions also allow you to perform calculations when certain conditions are met. For example, logical functions could be used to ask your data if the sales department met its goals for this quarter.

LOGICAL OPERATORS

Logical operators are used to compare two values against one another to see if they meet a specified logical condition. Should the values meet the logical condition (2 > 1) then the output would be the logical value of TRUE. If the values do not meet the logical condition (2 < 1), then the output would instead be FALSE. Due to this behavior, logical operators are instrumental in constructing conditions for functions and calculations to run correctly. Below you will find a table with all of the logical operators that are available in Excel 2016 and what they do:

Operator	Symbol	Examples with TRUE Result
Equal to	=	1 = 1
Greater than	>	2 > 1
Less than	<	1 < 2
Greater than or equal to	>=	2 >= 2 3 >=2
Less than or equal to	<=	2 <= 2 1 <=2
Not equal to	<>	1 <> 2

THE AND FUNCTION

=AND(logical1, [logical2], …)

This function will return a TRUE value when all of the arguments are true. On the flipside, it will return a FALSE value when all arguments in this function are false. While there can be a varied amount of use cases for this function, you would typically use it for conditional purposes. For example, you could use this function to check if all of the departments in an organization have met all of their goals for the current quarter.

The first argument that is required in this function is **logical1.** You can have up to 30 of these arguments in one AND function with each argument separated by a comma. These arguments are where you enter the logical values and operators that you would like to test for (e.g. A1>B2). Additionally, you also have the option of entering a formula as a single argument.

Suppose that A1 contains the value of 15, while cell B1 holds the value 20, and C1 contains 25. Additionally, assume that D1 holds the logical value of FALSE:

	A	B	C	D
1	15	20	25	FALSE
2				
3				

Function	Description
=AND(A1<B1, B1>C1)	While the value of A1 is less than the value in B1, B1 is actually less than C1. As not all of the arguments in this function are true, the AND function will output **FALSE**.
=AND(A1<B1, B1<C1)	The value of A1 is less than B1, and similarly the value of B1 is less than C1. As all of the arguments in this AND function have returned as true, the output for this function would be **TRUE**.
=AND(D1)	The value of D1 holds the logical value of FALSE so the output of this AND function would also be **FALSE**.
=AND(2*2=4)	In this function a simple equation has been added as an argument. As this equation is correct (2X2=4) the output from this AND function would be **TRUE**.

THE OR FUNCTION

=OR(logical1, [logical2], …)

The OR function is similar to the AND function with one key difference: the OR function will return a TRUE value if **any** of the arguments evaluate to TRUE. With the same 30 arguments limit as the AND function, the OR function is constructed in the same manner and supports the same items (formulas, cell references, etc.). Typically this function would be used to determine if there is a TRUE value in a group of data. For example, you could use it to quickly see if anyone in your sales department has made sales over a particular dollar amount this quarter.

Suppose that A1 contains the value of 15, while cell B1 holds the value 20, and C1 contains 25. Additionally assume that D1 holds the logical value of FALSE:

|	A	B	C	D
1	15	20	25	FALSE
2				
3				

Function	Description
=OR(A1<B1, B1>C1)	While the value of A1 is less than the value in B1, B1 is actually less than C1. Even though only one of the arguments in this function has returned as TRUE, the OR function will still output **TRUE**.
=OR(A1<B1, B1<C1)	The value of A1 is less than B1, and similarly the value of B1 is less than C1. As all of the arguments in this OR function have returned as true, the output for this function would be **TRUE**.
=OR(D1, A1<5)	The value of D1 holds the logical value of FALSE and the data in A1 is not less than 5, so both of these arguments resolve to FALSE. This means that the output for this OR function would also be **FALSE**.

THE IF FUNCTION

=IF(logical_test, value_if_true, value_if_false)

The IF function is one of the most commonly used logical functions. It will set a cell value based upon if a logical test resolves to true or false. For example, you could use this function to test if a salesperson in your organization exceeded a sales goal. If that resolves to true then you could have this function output a bonus amount. If it resolves to false, then you could have this function output a zero amount.

The IF function has three arguments: **logical_test**, **value_if_true**, and **value_if_false**. The **logical_test** argument is where you create the condition that you would like to test. The **value_if_true** argument will be the output of this function if the condition is found to be true.

Similarly, the **value_if_false** argument will be the output if the condition is found to be false. Keep in mind that the value arguments in this function can not only hold text and numerical data; however, all text data must be enclosed in double quotation marks.

Suppose that A1 contains the value of 15, while cell B1 holds the value 20, and C1 contains 25. Additionally assume that D1 holds the logical value of FALSE:

	A	B	C	D
1	15	20	25	FALSE
2				
3				

Function	Description
=IF(A1<B1, "Yes", "No")	In this example, A1 is in fact less than B1 so this function would output **Yes**.
=IF(A1<B1, B1*C1, "No")	In this example, A1 is less than B1 so this function would output the result of the B1*C1 formula - **500** in this case.
=IF(A1>B1, "Yes", "No")	In this example, A1 is less than B1 so this function will result in **No** as the output.

ACTIVITY 2-2

Analyzing Data Using Logical Functions

You have been tasked with maintaining a worksheet that is used to determine if an employee qualifies for a bonus. Use the functions you learned about in this lesson to determine which employees will receive a bonus and complete the data in the ID column.

1. To begin, open Activity 2-2 from your Exercise Files folder:
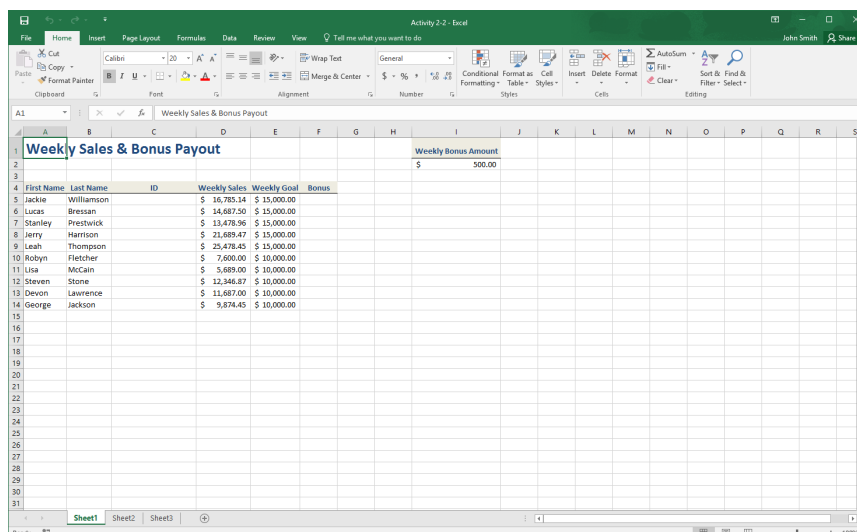
2.   First you need to fill in the ID column. This data is the first name and last name separated by an underscore (_). While you can do this manually, the CONCATENATE function is built for exactly this type of work. Use your cursor to select cells C5:C14 on the worksheet:

3.   Next, in the Formula Bar, type "=CONCATENATE(A5:A14, "_", B5:B14)":

4.   This is also an array formula so press Ctrl + Shift + Enter to apply it. You will now see that the formula is complete and the contents of the ID column have been filled in correctly:
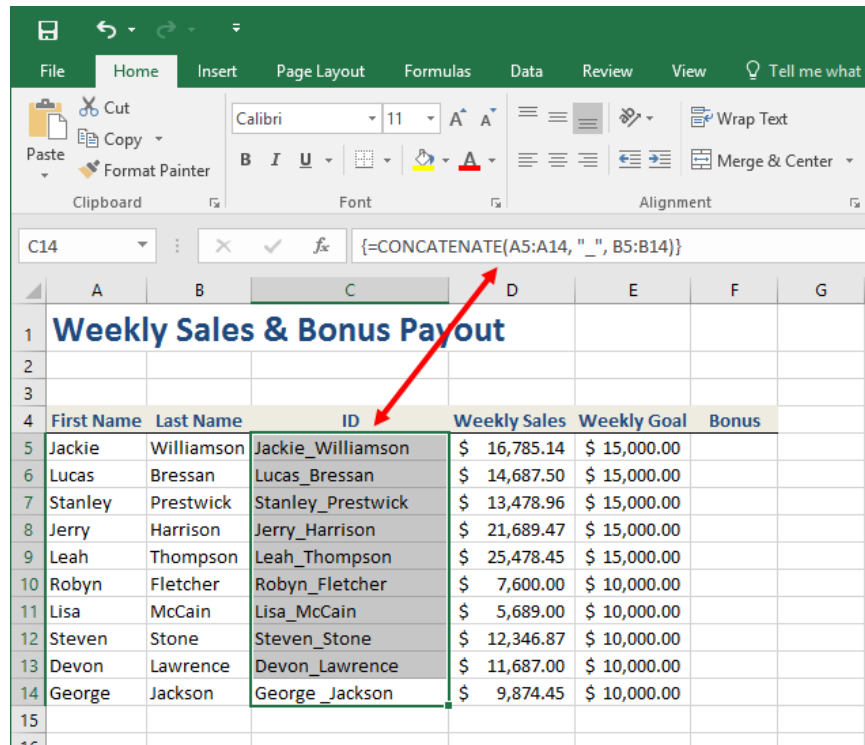
5.   Next, you need to determine which salespeople are going to receive a bonus. Bonuses are dispensed if they exceed their weekly sales goal. For this purpose you can use the IF function. Use your cursor to select cells F5:F9 on the worksheet:
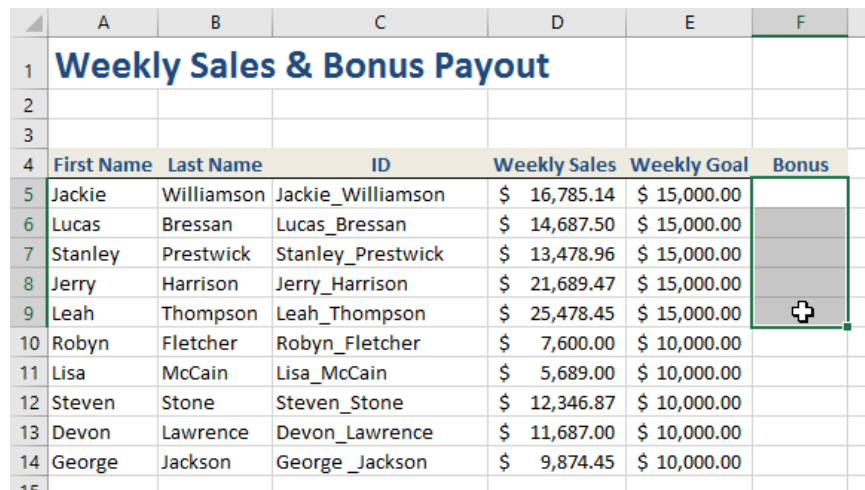
6. Inside the Formula Bar, type "=IF(D5:D9>E5:E9, I2, 0)" and then press Ctrl + Shift + Enter:
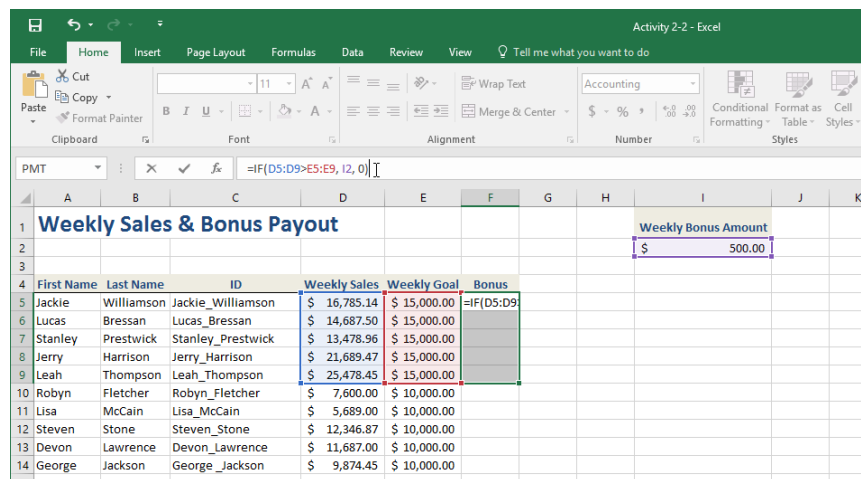
7. The new IF function will then be applied to the selected cells as an array. You will immediately see that two of the selected employees qualify for a $500 bonus:
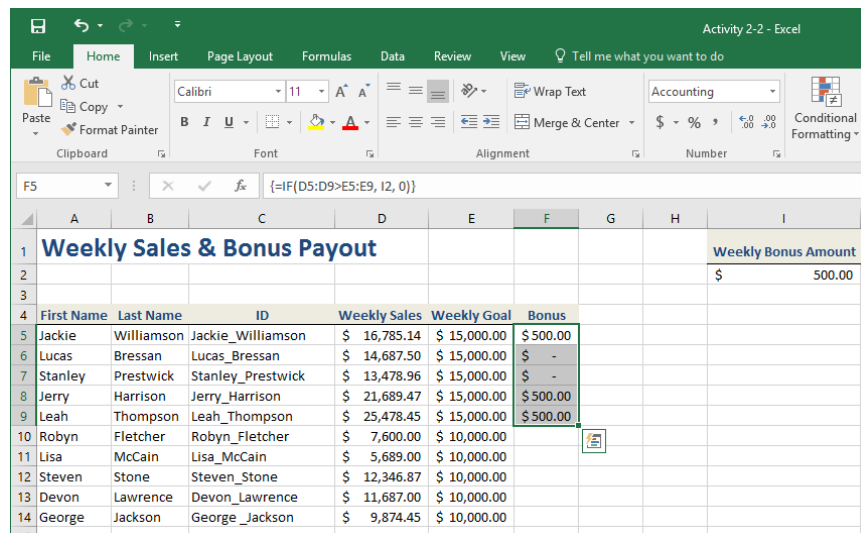
8. Next, you need to construct a similar function that will be applied to the remainder of the salespeople on the worksheet. Use your cursor to select cells F10:F14:
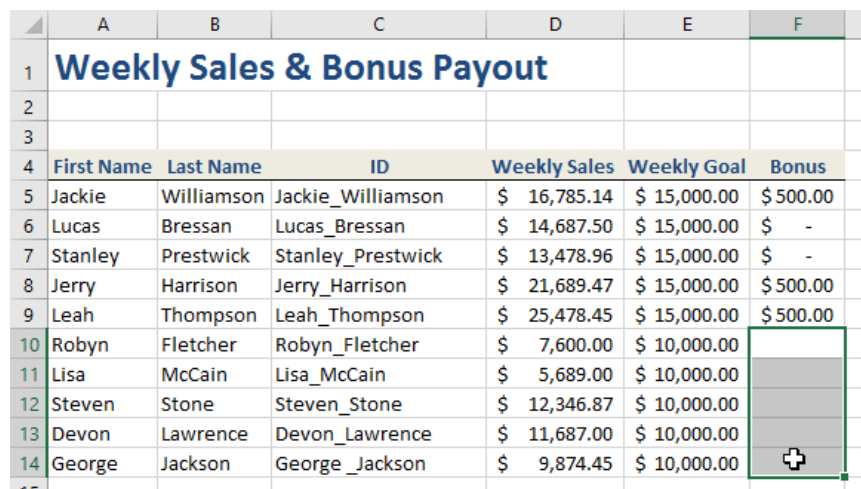
9. Inside the Formula Bar, type "=IF(D10:D14>E10:E14, I2, 0)". Because this is an array function, press Ctrl + Shift + Enter:
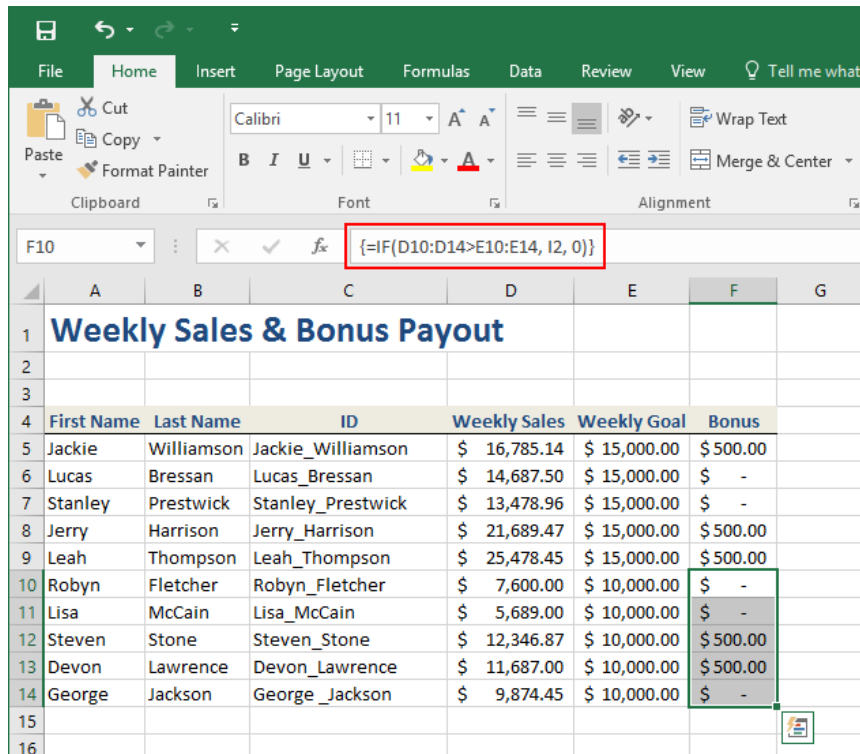
10. The bonus information has now been calculated for all employees in this worksheet:

11. Save your work as Activity 2-2 Complete and then close Microsoft Excel 2016.

TOPIC C: Use Lookup Functions

While you are now familiar with Excel's more commonly used functions, you still need to learn about some of its more specialized ones. In this topic you will learn about functions that are specific to data analysis.

Topic Objectives
In this topic, you will learn:
- About lookup functions
- About the LOOKUP function
- About the HLOOKUP function
- About the VLOOKUP function
- About the MATCH function
- About the INDEX function

LOOKUP FUNCTIONS

Lookup functions are used to find and return a value by searching a corresponding row or column. For example, suppose that you are trying to find a product name that corresponds to a product number. You could use the LOOKUP function to search for the product number and then return the value from an adjacent column (Product Name in this case):
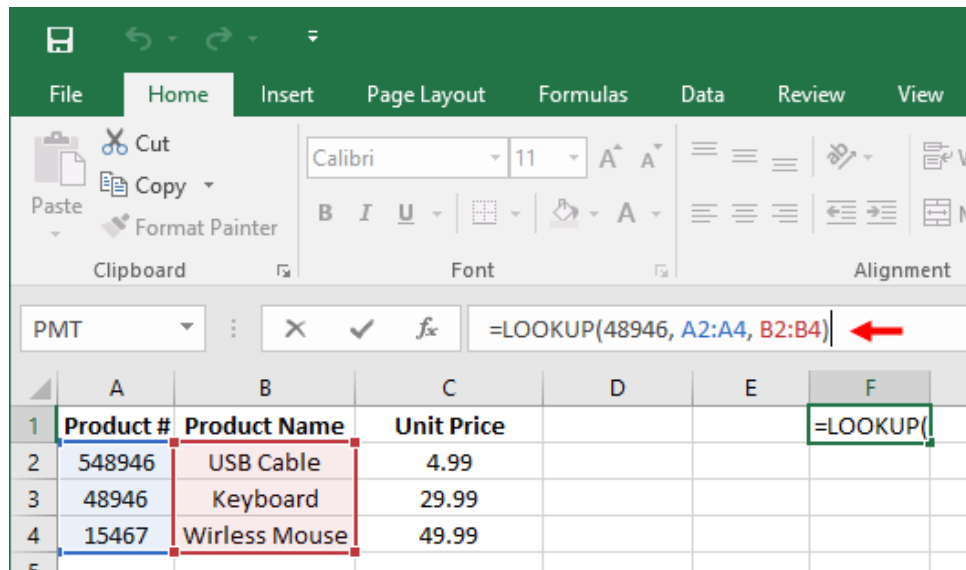

THE LOOKUP FUNCTION
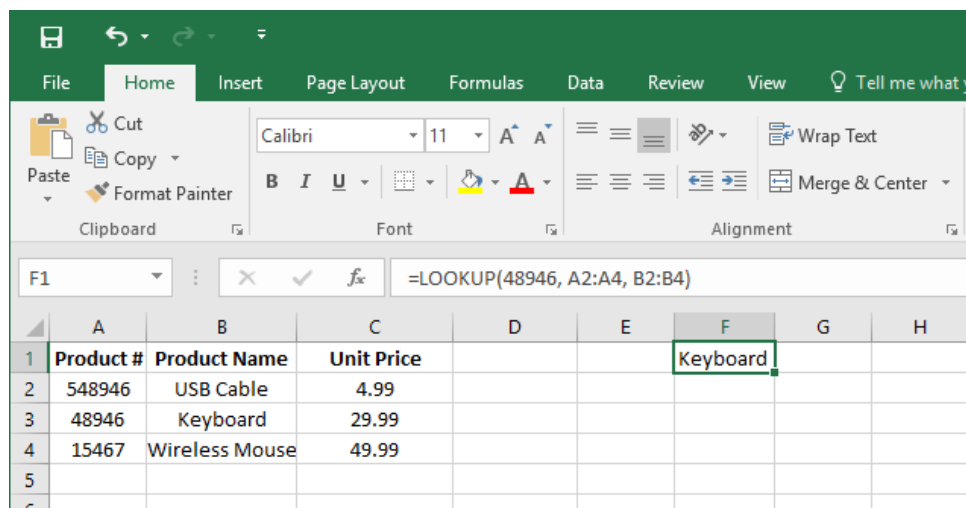
=LOOKUP(lookup_value, lookup_area, results_area)

The LOOKUP function requires three arguments. The first is the value that you are searching for, followed by the area that you would like to search, and then the corresponding range from which you would like the results to be shown. For example, let's suppose that you want to find out the product name for product number 48946 in the following worksheet:

To do this using a LOOKUP function, you would use the following formula:

As you can see the value that you are looking up is entered first (48946), followed by the lookup area (A2:A4), and it is ended with the results area where the corresponding result is found (B2:B4). In this case, the result is "Keyboard:"


THE VLOOKUP FUNCTION
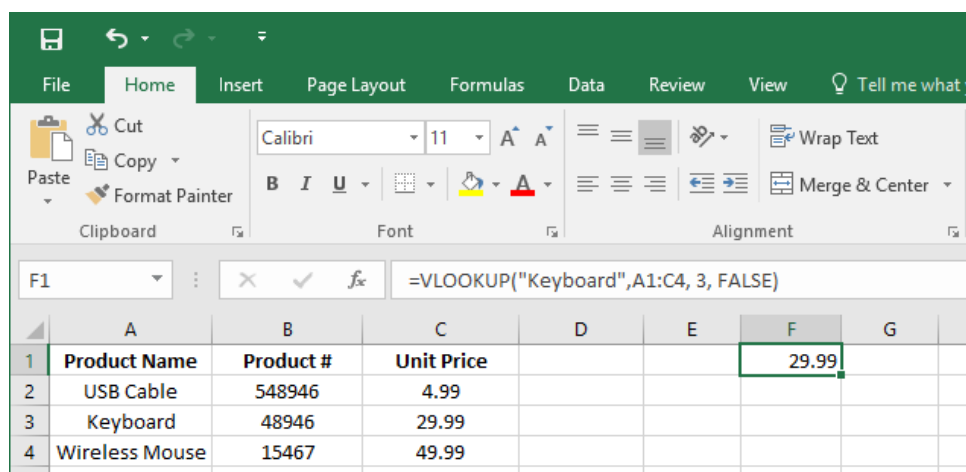
=VLOOKUP(lookup_value, lookup_area, column, approximate_match)

The VLOOKUP (vertical lookup) function operates in a similar way to the LOOKUP function. It is used when you need to find things in a table or range only by row, and it does this by only looking for a value that appears in the left-most column of a table and then returns the corresponding value from any other column that you specify.

For example, let's suppose that you want to find unit price for "Keyboard" product. To do this, you would enter the following formula:
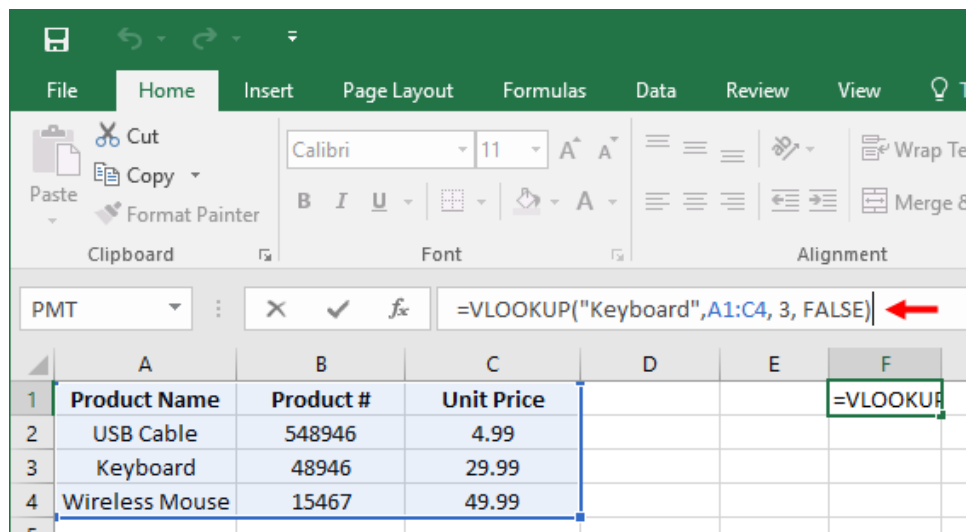
As you can see the value that you are looking up is entered first ("Keyboard"), followed by the lookup area (A2:C4) that includes the whole range (or table). Following this is the column index number. Columns in the selected range or table are numbered from left to right, with the first column being 1, the next 2, and so on. In this example, as we are looking for the unit price, we entered 3 for the third column. Finally, you can then choose between looking for approximate matches or exact. In this example FALSE was chosen as we wanted a direct match.

The final result is 29.99 being returned by the formula:

THE HLOOKUP FUNCTION

=HLOOKUP(lookup_value, lookup_area, row, approximate_match)

The HLOOKUP function is very similar to the VLOOKUP function, but it works horizontally rather than vertically. Like the others, it is used when you need to find things in a table or range only by column. It does this by only looking for a value that appears in the top-most row of a table and then returns the corresponding value from any other row that you specify.

For example, let's suppose that you want to find unit price for "USB Cable" product. To do this, you would enter the following formula:
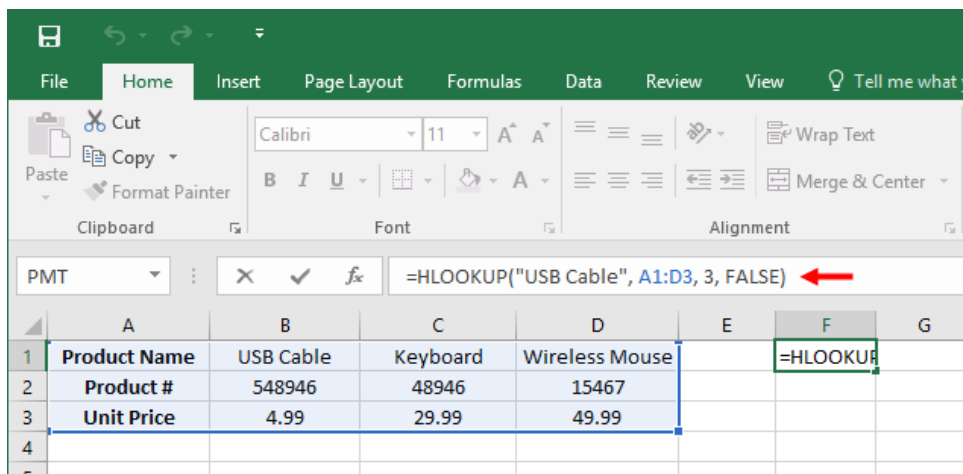
As you can see the value that you are looking up is entered first ("USB Cable"), followed by the lookup area (A1:D3) that includes the whole range (or table). Following this is the row index number. Rows in the selected range or table are numbered from top to bottom, with the first row being 1, the next 2, and so on. In this example, as we are looking for the unit price, we entered 3 for the third row. Finally, you can then choose between looking for approximate matches or exact. In this example FALSE was chosen as we wanted a direct match.

The final result is 4.99 being returned by the formula:
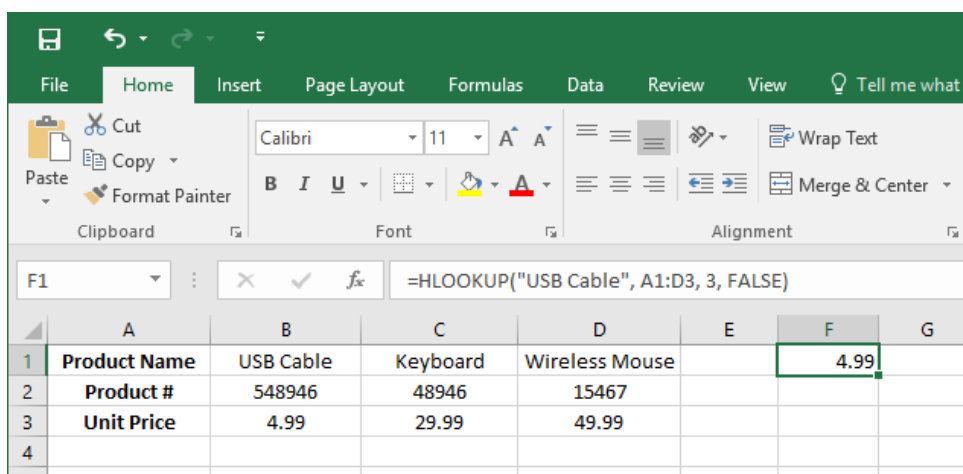
THE MATCH FUNCTION

= MATCH(lookup_value, lookup_array, [match_type])

The MATCH function searches for a value in a range of cells and then returns its position. This function requires two arguments: the value that you are searching for, followed by the range of cells that you would like to search. Note that this function is not case-sensitive.

You can also use the optional match_type argument to customize the function's behavior:

Match_Type	Behavior
1 (or omitted)	Finds the largest value that is less than or equal to the lookup value. Requires the lookup_array argument values to be in ascending order.
0	Finds the first value exactly matching the lookup_value argument.
2	Finds the smallest value that is greater than or equal to the lookup value. Requires the lookup_array argument values to be in descending order.

For example, let's suppose that you want to find the most expensive product in this worksheet:

	A	B	C
1	Product #	Product Name	Unit Price
2	548946	USB Cable	4.99
3	48946	Keyboard	29.99
4	15467	Wireless Mouse	49.99

To do this using a MATCH function, you would use the following formula:
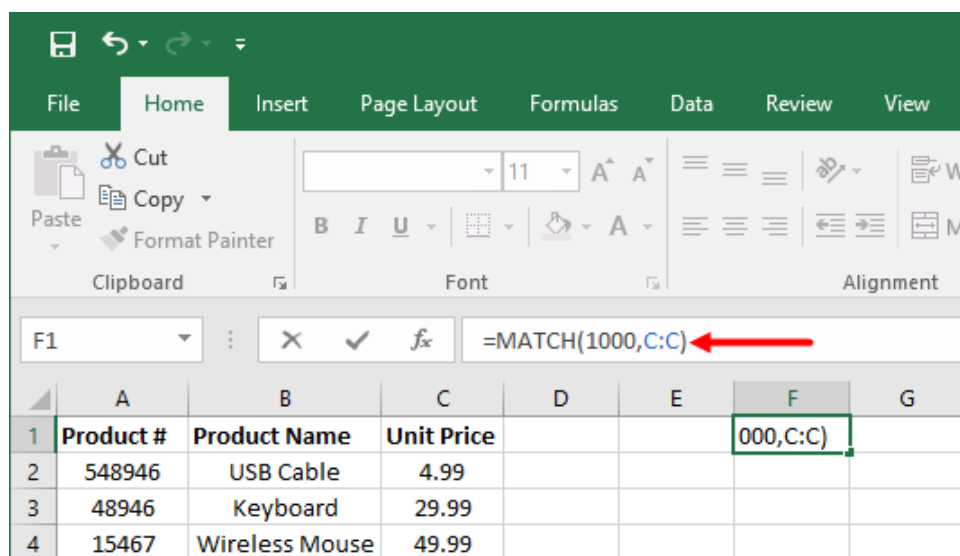
We know we do not sell any products over $1,000, so we have entered that as the lookup value, followed by the lookup area (Column C). We have also omitted the match_type argument as we want the default behavior.

In this case, results are returned showing the most expensive product is in Row 4 of our dataset:

	A	B	C	D	E	F
1	Product #	Product Name	Unit Price			4
2	548946	USB Cable	4.99			
3	48946	Keyboard	29.99			
4	15467	Wireless Mouse	49.99			

THE INDEX FUNCTION

INDEX(reference, row_num, [column_num], [area_num])

The INDEX function returns a value from a table or range. It also offers an alternative syntax which allows you to use it with an array:

INDEX(array, row_num, [column_num])

For example, let's suppose that you want to find the value at the very end of this range:

	A	B	C
1	Product #	Product Name	Unit Price
2	548946	USB Cable	4.99
3	48946	Keyboard	29.99
4	15467	Wireless Mouse	49.99

To do this using an INDEX function, you would use the following formula:
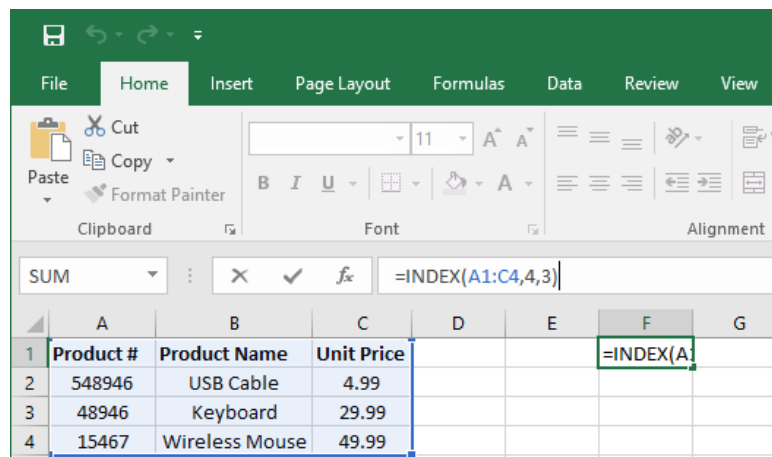
In this case, the value in Row 4, Column 3 (C4) is returned:

	A	B	C	D	E	F
1	Product #	Product Name	Unit Price			49.99
2	548946	USB Cable	4.99			
3	48946	Keyboard	29.99			
4	15467	Wireless Mouse	49.99			

ACTIVITY 2-3

Analyzing Data Using Lookup Functions

Using a lookup function, you would like to find the total amount of sales that were made by a particular employee.

1. To begin, open Activity 2-3 from your Exercise Files folder:


2. Click cell D1 to place your cursor there:

3. You would like to find out the weekly sales that Lucas made, so start by typing "=VLOOKUP("Lucas"," into the Formula Bar (without the outer most quotation marks):
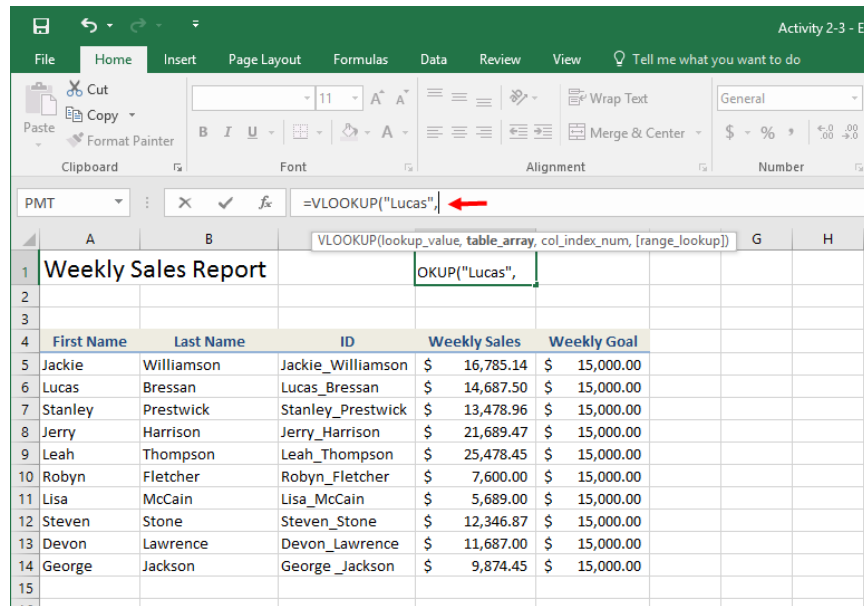

4. Next, you need to add the cell range that you are working with. For this example, type "A5:E14," (without quotation marks), following the comma:
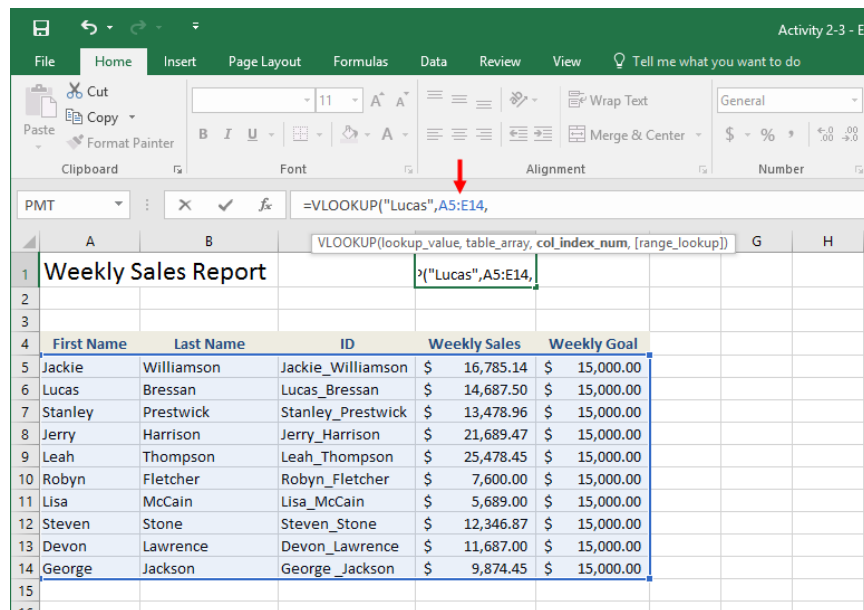
5. Now you need to enter the column whose data you would like to use as a result. In this case you want the weekly sales to be shown, so type "4," as the Weekly Sales column is further from the left:
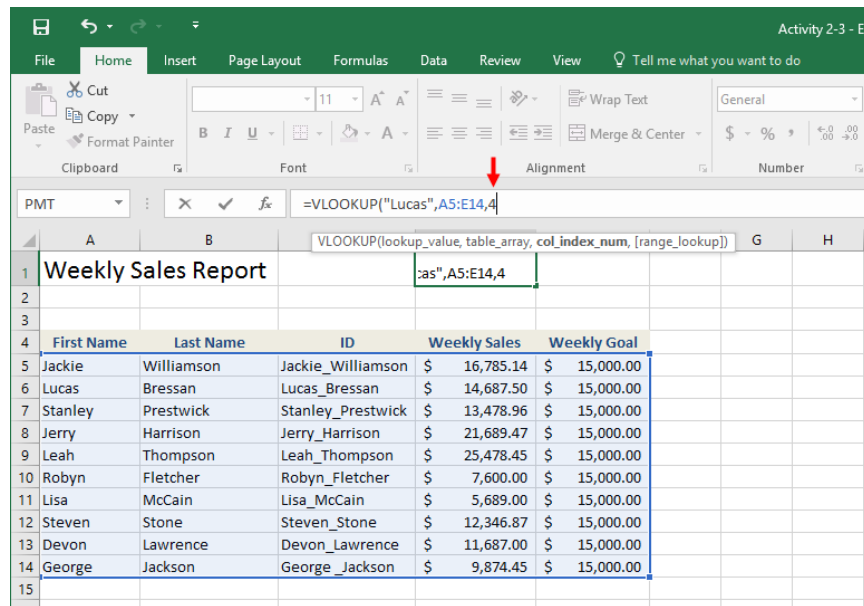
6. Finally, you need to decide if you would like only exact matches to be used or approximate matches. For this example you would like exact matches, so type "FALSE" followed by a closing parenthesis:
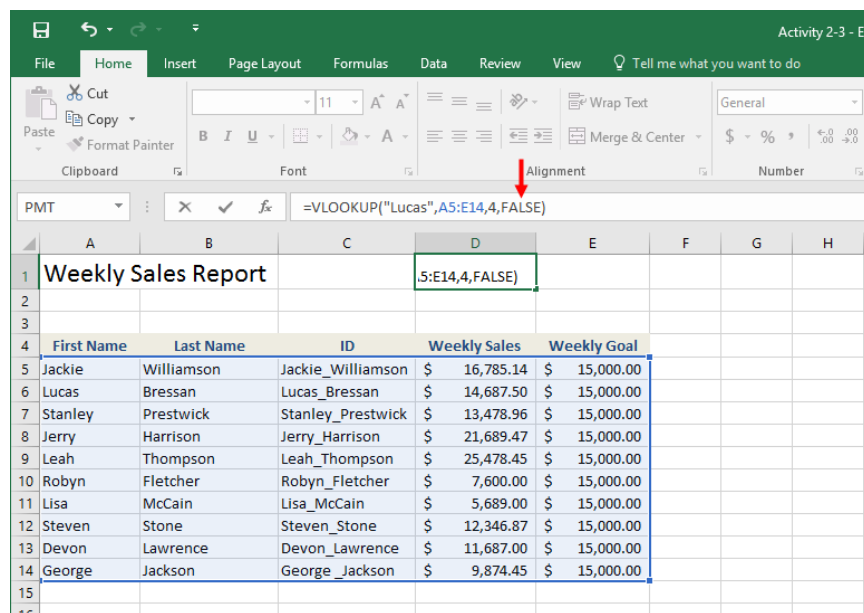
7. With the formula now completed, press Enter. The weekly sales that Lucas made will now be shown in D1:

8. Save the changes that you have made to the workbook as Activity 2-3 Complete and then close Microsoft Excel 2016 to complete this exercise.

TOPIC D: Use Date Functions

Entering the current date and time into a worksheet is one of the more common tasks that you will complete using Excel. Over the course of this topic, you will learn how to add date information using the TODAY and NOW date functions.

Topic Objectives
In this topic, you will learn:
- About the TODAY function
- About the NOW function
- How to serialize dates and times with functions

THE TODAY FUNCTION

About as simple as a function can get, the TODAY function has no arguments:

=TODAY()

When executed, it will simply print today's date into a cell:

If you wish, you can customize this function's output by changing the number format to Short Date or Long Date, depending on your requirements.
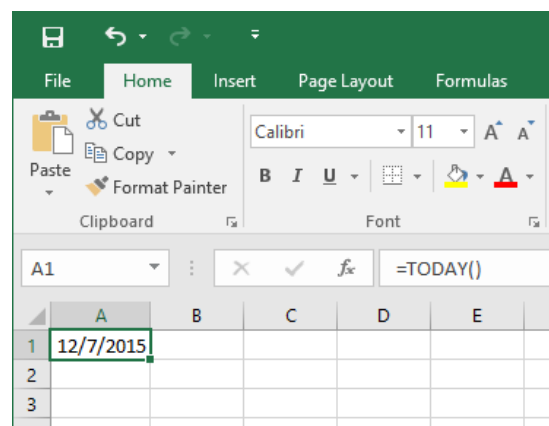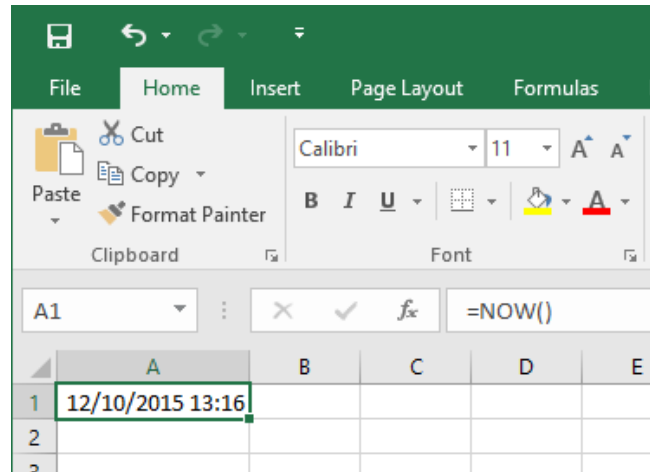
THE NOW FUNCTION

The NOW function is also very simple and uses no arguments:

=NOW()

It will print the current date and time into the cell where the function is placed:

Usually this function would be used in conjunction with others to complete time calculations.

SERIALIZING DATES AND TIMES WITH FUNCTIONS

If you are using formulas where you only need the month or a specific time of day, there are a number of different functions that you can use to gather that information from an original serial value. For example, here you can see the YEAR, MONTH, DAY, HOUR, MINUTE, and SECOND functions serializing the date in A1 and the time in A2:
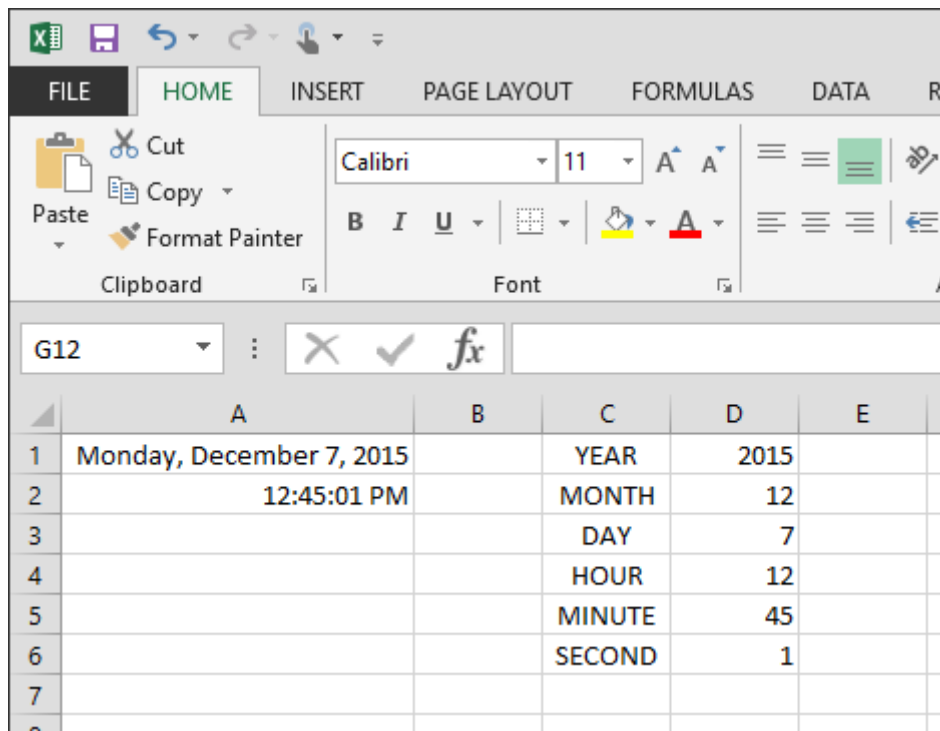
Each of these functions only accept one argument – a reference to the cell that contains the date or time value. For example, here you can see an example of the YEAR function pointing to cell A1:
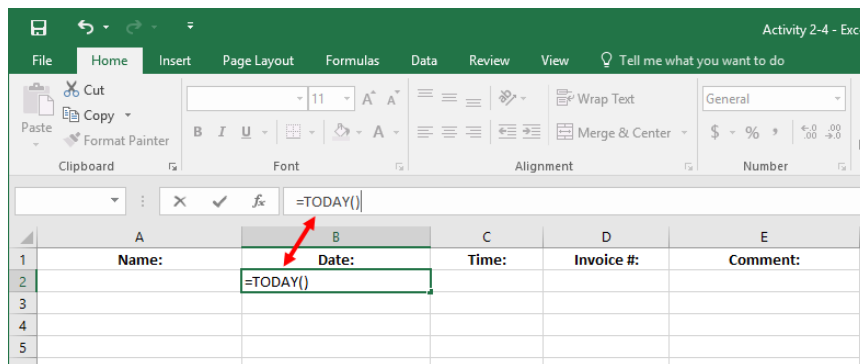
=YEAR(A1)

ACTIVITY 2-4

Analyzing Data Using Date Functions

You would like to fill out an invoice tracking sheet using some of the date functions that you learned about in this topic.
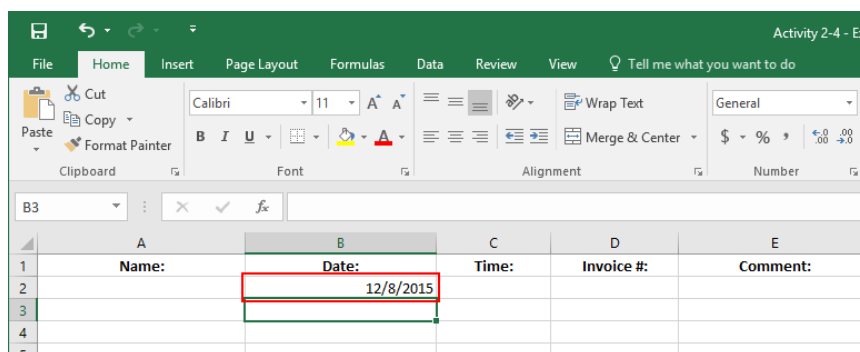
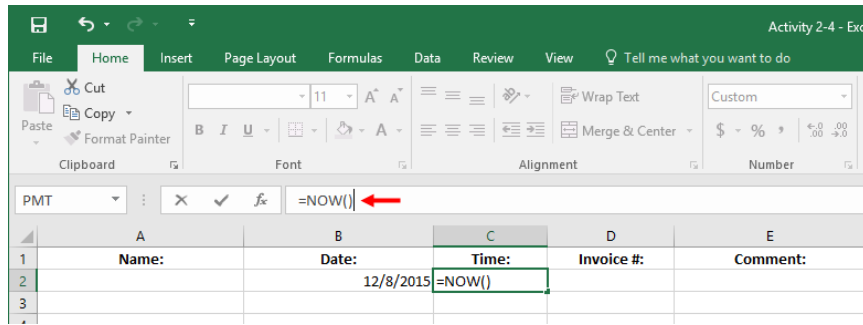**1.** To begin, open Activity 2-4 from your Exercise Files folder:
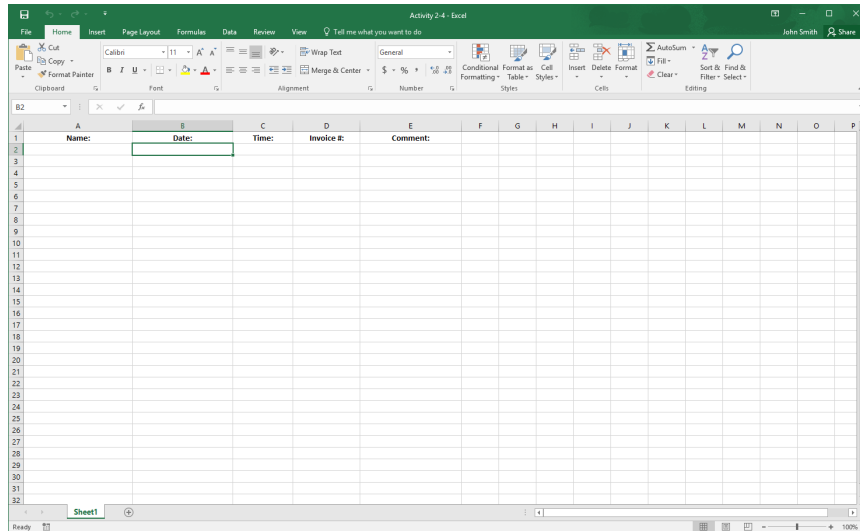
2. Ensure that cell B2 is selected and then type "TODAY()" into the formula bar:
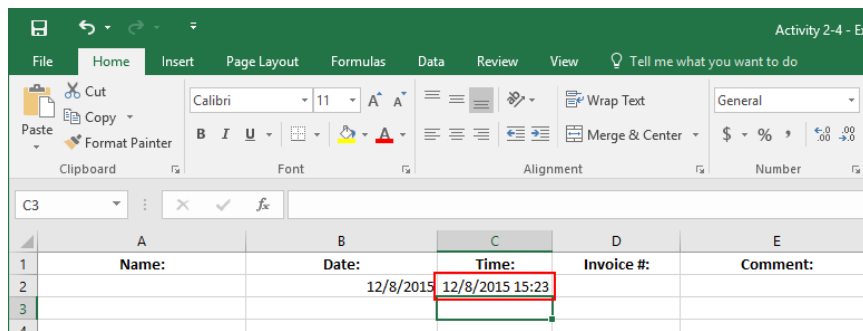

3. Press Enter and the current date will be shown as a value in previously selected cell:
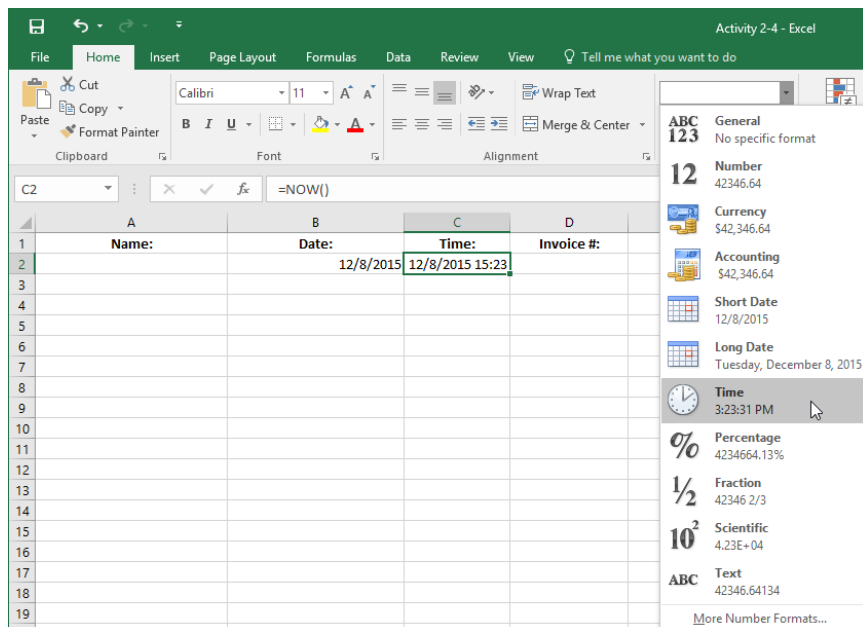
4. Click cell C2 and type "=NOW()" into the formula bar:
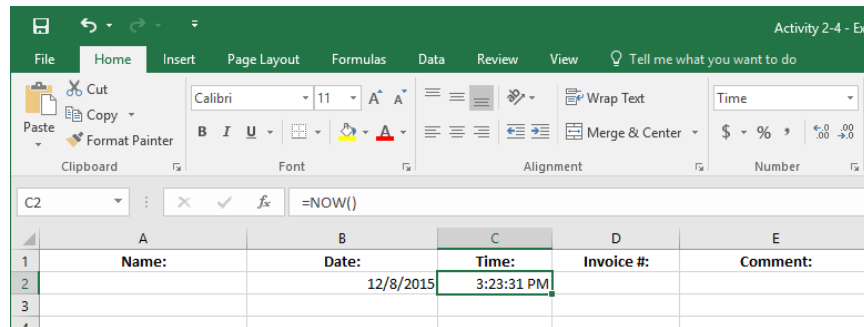

5. Press the Enter key and the current date and time will be the value shown in the previously selected cell:

6. Select cell C2 once again. Change the number format to Time by clicking Home → Number Format → Time:

7. With the time number format applied to the selected cell, you will see that its value will now only show the current time:

8. Save the current workbook as Activity 2-4 Complete and then close Microsoft Excel 2016 to complete this exercise.

TOPIC E: Use Financial Functions

As Microsoft Excel is widely used by many accounting and finance professionals, it includes a number of special financial functions. For example, some financial functions can be used to calculate loan interest, while others can be used to determine the value of investments over time. During this topic you will learn about the four major financial functions that are available in Excel 2016.

Topic Objectives
In this topic, you will learn:
- About the IPMT function
- About the PPMT function
- About the NPV function
- About the FV function

THE IPMT FUNCTION

=IPMT(rate, per, nper, pv [fv], [type])

The IPMT function is used to calculate the interest payment that is due for a period on a loan that has a fixed interest rate with regular payments. Alternatively, this function could also be used to calculate the return per period on an investment with the same restrictions.

The **rate** argument is where you declare the interest rate per period. For example, if you were trying to calculate the interest payment on a loan that has a 3% annual interest rate, you would divide 3% by 12.

The **per** argument is the period over which you need to calculate the interest. For example, if the period of the loan was four years and payments are being made monthly, the per argument would be 48. If annual payments were being made, the per argument would be 4.

The total number of payments for the loan or investment are entered as the **nper** argument. For example, if payments were being calculated on a three-year investment, nper would be 36.

Finally, the **pv** argument is where you enter the principal of the loan or total amount of money being invested.

In addition to the required argument, the IPMT function includes two optional arguments: fv and type. The **fv** argument is used to enter the future value of the investment after all payments have been made to it, or if working with a loan the balance of the loan. If you choose not set this argument, it will default to 0 (the typical balance of a loan after all the payments are made). Finally, the **type** argument is used to indicate if payments are due at the end of each payment period (indicated by "0" or by omitting the argument), or at the beginning (indicated by "1"). If left blank, this argument will default to 0.

Suppose that in a worksheet, A1 contains the value of $15,000, while cell B1 holds the value 6%, and C1 contains the value 4:

	A	B	C
1	$15,000.00	6%	4

With that information in mind, below you can see how an IPMT function could be constructed to determine how much interest the borrower would owe one and a half years into the four year loan:

Function	Description	Result
=IPMT(B1/12, 18, C1*12, A1)	This function will calculate the how much interest a borrower will owe for the loan (A1), one and a half years into the term (18) with an annual interest rate of 6% (B1/12) and a total term of four years (C1*12).	($50.46)

If this were from the lender's perspective, the function would be almost the same, but the principal would be a negative value as they would be paying that out. This would result in a positive end result rather than a negative one.

Function	Description	Result
=IPMT(B1/12, 18, C1*12, -A1)	This function will calculate how much interest is owed to you as the lender of the loan (-A1), one and a half years into the loan (18) with an annual interest rate of 6% (B1/12) and a total term of four years (C1*12).	$50.46

THE PPMT FUNCTION

=PPMT(rate, per, nper, pv, [fv], [type])

The PPMT (payment) function is used to calculate the amount owed against the principal on a loan (or gained from an investment) over a select period and a fixed interest rate. Like the IPMT function, the PPMT function uses the exact same arguments: rate, per, nper, pv, [fv], and [type]. You could even add the result from the same period of the same loan calculated by the IPMT function to the result using the same arguments from the PPMT function to calculate the total payment for the selected period.

Suppose that in a worksheet, A1 contains the value of $15,000, while cell B1 holds the value 6%, and C1 contains the value 4:

With that information in mind, below you can see how a PPMT function could be constructed to determine the required payment on the principal of a loan, one and a half years into the four year loan:

Function	Description	Result
=PPMT(B1/12, 18, C1*12, A1)	This function will calculate the amount owed to the principal of a loan (A1), one and a half years into the loan (18) with an annual interest rate of 6% (B1/12) and a total term of four years (C1*12).	$(301.81)

THE NPV FUNCTION

=NPV(rate, value1, [value2], …)

If you are unfamiliar with NPV (net present value) calculations, they are used to compare the value of money today to the value of money in the future, taking inflation and returns into account. In particular, the NPV function is used to calculate the net present value of an asset or investment using the estimated (or known) future cash flow, as well as the discount rate per period.

The **rate** argument in this function is used to declare the discount rate per period. The **value** arguments are used to represent any future cash flow. For example, suppose that an initial cost of $75,000 was incurred (A1) with a discount rate of 9% (A2). The cash flows for the next consecutive four years are $16,000, $14,000, $12,000, and $10,000 (A3:A6) respectively:

The NPV function could then be constructed as follows:

Function	Description	Result
=NPV(A2, A3:A6)	This function will calculate the net present value of $75,000 with a discount rate of 9% (A2) and future cash flow (A3:A6).	$42,812.87

Keep in mind that the output from this formula does not include the initial cost. To factor that into the result, you would subtract the result from the initial cost. With that in mind, the NPV for this example would be $32,187.13.

THE FV FUNCTION

=FV(rate, nper, pmt, [pv], [type])

The FV function is used to calculate the future value of an investment that has a fixed interest rate, as well as a fixed or periodic payment schedule. Like most of the other financial functions covered in this topic, the FV function uses many of the same arguments.

The **rate** argument is where you declare the interest rate per period. For example, if you were trying to calculate the interest payment on an investment that has a 3% annual interest rate, you would divide .03 by 12 and enter that result (.0025 in this case) as the argument.

The total number of periods from now that you want to use to calculate the future value of the investment are entered as the **nper** argument. Keep in mind that the periods entered into these arguments are the same as the ones used to calculate the rate argument.

The **pmt** argument is where you enter the payment that is being made for each period. For example, if you were paying $200 a month into this investment over ten years, you would enter 200 as the pmt value. It would also mean that the nper value would be 120 (12 x 10).

In addition to the required argument, the FV function includes two optional arguments: pv and type. The **pv** argument is used to enter the present value of the investment. This would be used if you need to calculate the future value of a one-time investment that has a fixed interest rate. The **type** argument is used to indicate if payments are due at the end of each payment period (indicated by "0" or by omitting the argument), or at the beginning (indicated by "1"). If left blank, this argument will default to 0.

Suppose that in a worksheet, A1 contains the value of -$15,000 (initial investment), while cell B1 holds the value 6% (annual interest), and C1 contains the value -$200 (additional monthly payments). As well, assume that the investor wants to contribute the additional monthly payments for a period of 25 years:

	A	B	C
1	$ (15,000.00)	6%	$(200.00)
2			

With that information in mind, below you can see how an FV function could be constructed to determine the future value of this investment:

Function	Description	Result
=FV(B1/12, 25*12, C1, A1)	This function will calculate the future value of the initial investment (A1), combined with a monthly contribution of (C1) over a period of 25 years (25*12) with a fixed annual interest rate of 6% (B1/12).	$205,573.34

Note that because you are calculating an investment, the initial payment (pv) and monthly payment (pmt) need to be entered as negative values to receive a positive result. On the other hand, entering positive values would result in a negative value.

ACTIVITY 2-5

Using Financial Functions

You have been given the task of calculating the net present value of an investment, as well as calculating the future value of an investment.

1. To begin, open Activity 2-5 from your Exercise Files folder:
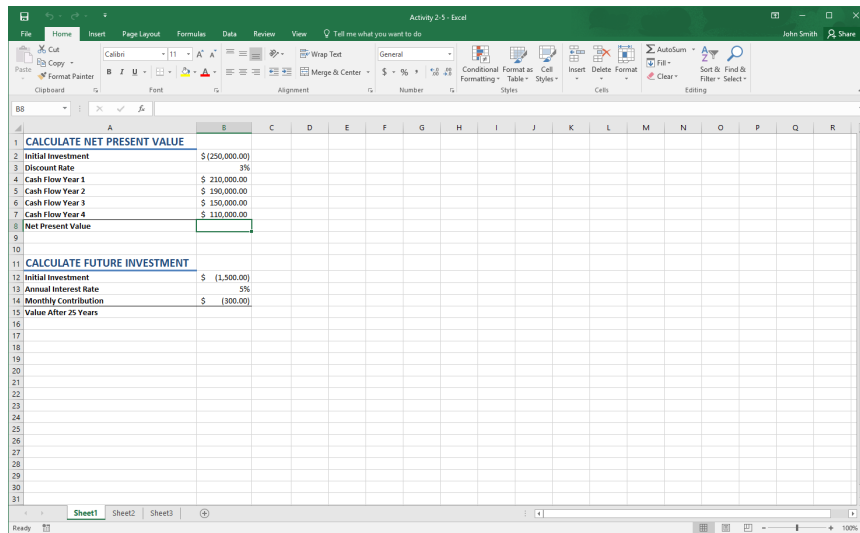
2. Let's start with the NPV calculation. Click inside cell B8 to select it:

3. Next, in the Formula Bar, type "=NPV(":

4. Now you need to enter the discount rate (rate argument). In this example it is 3%, so enter the B3 cell reference:
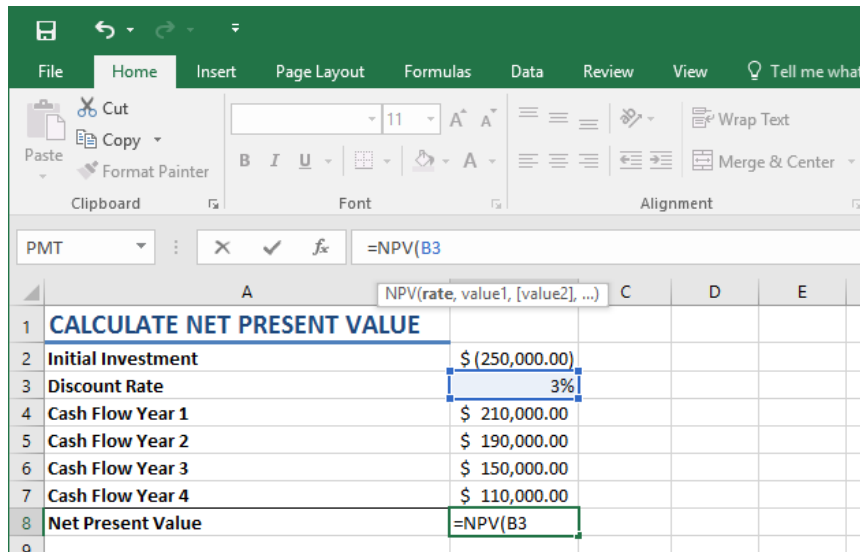
5. The future cash flow (value argument) now needs to be entered. Add a comma and then enter the B4:B7 range followed by a closing parenthesis:
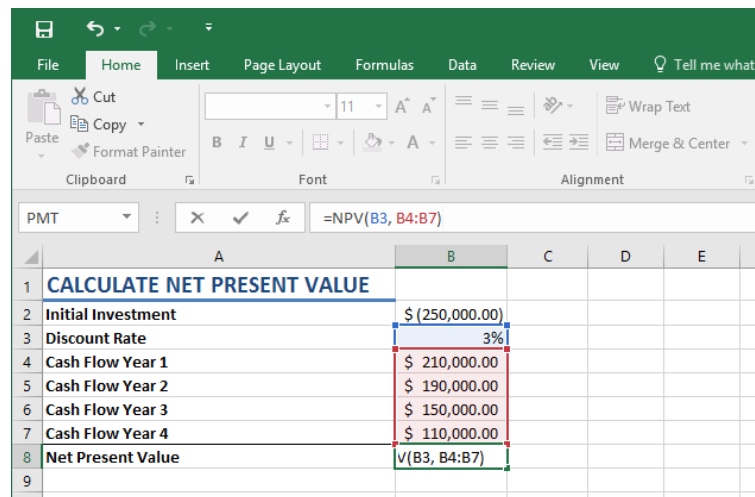
6. Press Enter to apply the new function. You will see the result in the currently selected cell:
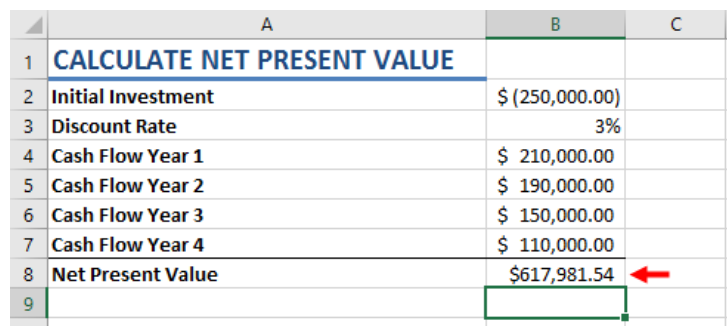
7. Keep in mind that this result does not factor in the initial cost (B2). In order to calculate the true NPV of this investment, the initial cost of the investment needs to be subtracted from the value that was returned from the NPV function. In this example, the NPV for this investment would be $367,981.54.

8. Next, you need to calculate the future investment value using the information a little lower on this worksheet. Click to select cell B15:

9. Inside the Formula Bar, type "=FV(B13/12":
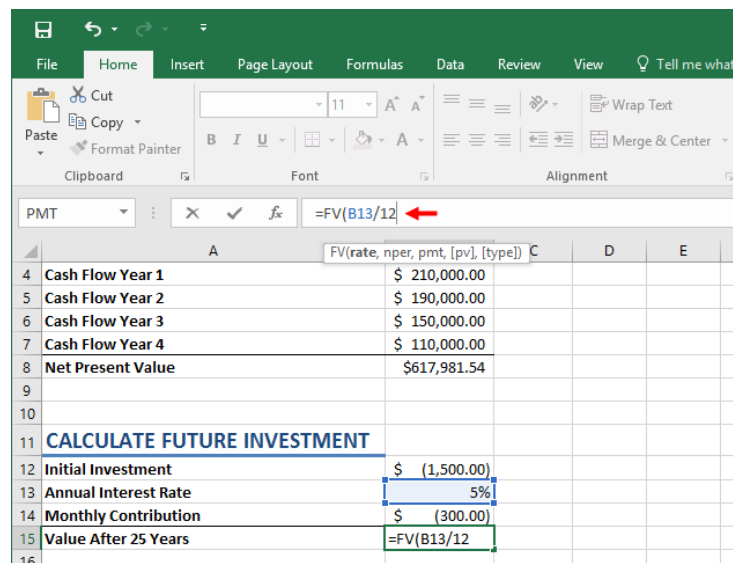
10. Now you need to add the period from now that you wish to use to calculate the future value (nper). In this example it is 25 years, so in the Formula Bar add a comma and then type "25*12":
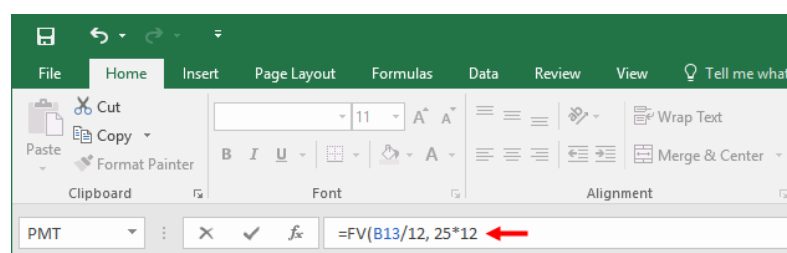
11. Next, you need to declare what the monthly contribution to this investment will be after the initial investment (pmt). In the Formula Bar, add a comma and type the "B14" cell reference:
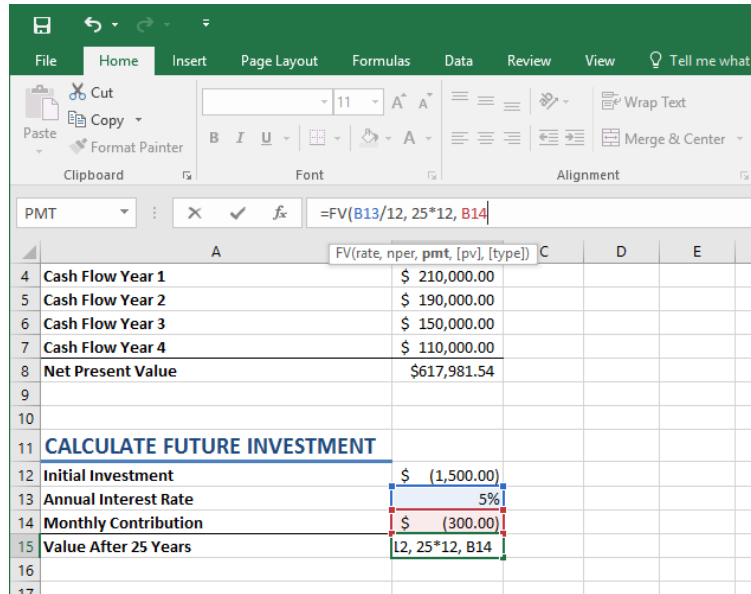
12. Finally, you need to enter the present value of the investment (pv). In the Formula Bar, add a comma and then type B12 followed by a closing parenthesis:
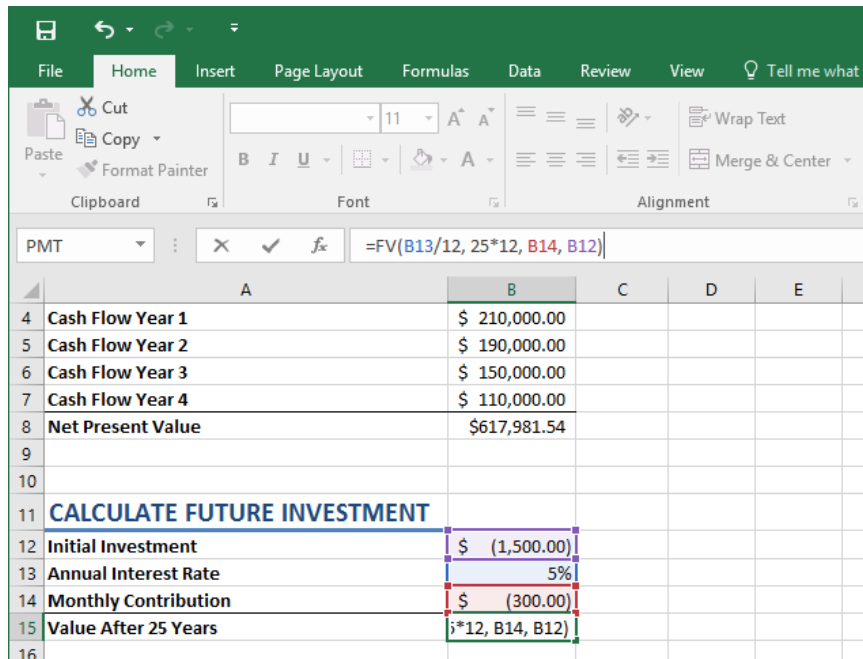
13.   Press Enter to apply the new formula. You will see that the value of this investment will be $183,874.85 after 25 years of contributions and the initial investment of $1,500:

14.   Save your changes as Activity 2-5 Complete and close Microsoft Excel 2016.

Summary

Over the course of this lesson you learned how to analyze data in your worksheets using a variety of different functions. You learned how to use text functions to manage and manipulate text, as well as date functions to return date information. Additionally, you learned about the many different financial functions that you have available to you and how they operate.

LESSON 3: ORGANIZING WORKSHEET DATA WITH TABLES

Lesson Objectives

In this lesson you will learn how to:

- Create and modify tables

- Sort data and filter data

- Use subtotal features and database functions

TOPIC A: Create and Modify Tables

While formulas and functions are great at analyzing data within your workbook, they are more apt at analyzing entire workbooks rather than specific sets of data. If you need to analyze smaller sets of data within a large workbook or break down large sets of data into smaller parts, then converting your data into tables is often the best solution. Tables allow you to use Excel's powerful organizational capabilities without modifying the data itself. Using tables you can narrow down specific data, focus on only the important information, and more.

Topic Objectives
In this topic, you will learn:
- About tables
- About the components of a table
- How to use the Create Table dialog box
- About the Table Tools – Design contextual tab
- How to use and apply table styles, as well as Quick Styles
- How to customize row display
- About table modification options

TABLES

A **table** is a specially designated range of information that has added functionality. You can have multiple tables per worksheet, and tables can be as large or small as the amount of data you want to work with. Tables can be created from existing data ranges or from empty ranges and then populated afterwards. Once a table has been created, it will automatically be given a generic name such as "Table1" or "Table2" depending upon the number of tables present in the current worksheet; however, these names can be changed at any time. Additionally, tables are flexible in that you can convert a table back to a normal range at any point without affecting the contents.

A table is made from adjacent columns of data, with a unique label or heading for each column. Columns and rows may be added to a table just as you would when working with a normal range. Remember that each worksheet has a lot more rows than columns. This design is well suited for data organized in long, adjacent, list-like columns:

	A	B	C	D	E
1	Weekly Sales Report				
2					
3					
4	First Name	Last Name	ID	Weekly Sales	Weekly Goal
5	Jackie	Williamson	Jackie_Williamson	$ 16,785.14	$ 15,000.00
6	Lucas	Bressan	Lucas_Bressan	$ 14,687.50	$ 15,000.00
7	Stanley	Prestwick	Stanley_Prestwick	$ 13,478.96	$ 15,000.00
8	Jerry	Harrison	Jerry_Harrison	$ 21,689.47	$ 15,000.00
9	Leah	Thompson	Leah_Thompson	$ 25,478.45	$ 15,000.00
10	Robyn	Fletcher	Robyn_Fletcher	$ 7,600.00	$ 15,000.00
11	Lisa	McCain	Lisa_McCain	$ 5,689.00	$ 15,000.00
12	Steven	Stone	Steven_Stone	$ 12,346.87	$ 15,000.00
13	Devon	Lawrence	Devon_Lawrence	$ 11,687.00	$ 15,000.00
14	George	Jackson	George _Jackson	$ 9,874.45	$ 15,000.00
15					

TABLE COMPONENTS

There are a number of components that come together to create a table. Some of these components, like the header row and banded rows, are required, but other components have the ability to be toggled on or off. Below you can see a table with many of the components toggled on:

Here is an overview of each element.

- The **Header row (1)** will display the column headers for each column in the table. For each header within the Header row, you will see the **Header row drop-down arrow (2)**. This is used to access a variety of organizational commands.
- **Banded rows (6)** allow you to easily differentiate between each row that appears within the table, while the **Total row (3)** is used to display the results of calculations that are done on a column-by-column basis. The Total row also includes the Total row drop-down arrow when selected. This gives you quick access to functions that can perform calculations on the table data. Note that this component will only be displayed if a cell in the Total row is selected.
- Finally, the **First column (4)** option will apply a bold effect to first column to the table to differentiate it from other columns. The **Last column (5)** option, when applied, will do the same thing to the last column of data.

THE CREATE TABLE DIALOG BOX

The Create Table dialog box is used to convert existing ranges of data into a table. Additionally, this dialog box also allows you to choose if you want to include the top row of the selected range in the new table as a header row.

To access this dialog, select the cell range that you would like to convert into a table and then click Insert → Table:
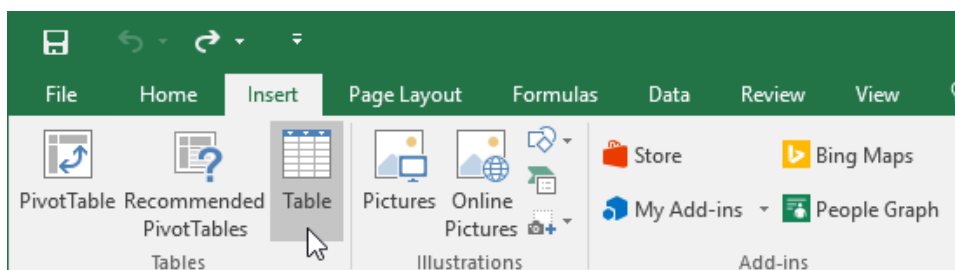
The Create Table dialog will open. You will see the selected range (using absolute cell references) in the "Where is the data for your table?" text box:
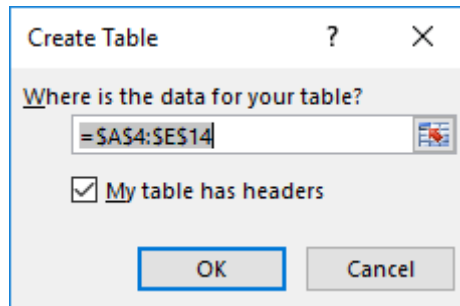
Clicking the OK button will convert the selected cell range into a table.

THE TABLE TOOLS – DESIGN CONTEXTUAL TAB

Whenever you are working with a table, the Table Tools – Design contextual tab will appear on the ribbon. Using the controls on this tab, you can modify just about any aspect of your table:
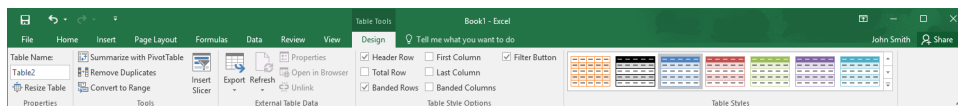
Here is a brief description of the various groups that on this tab and the commands and options that they contain.

Properties	This group allows you to view and edit the current table's name. You can also redefine the table size using the Resize Table command.
Tools	Within this group, the Remove Duplicates command allows you to remove duplicate values from the current table. The "Summarize with PivotTable" command will create a PivotTable out of the current table, and the "Convert to Range" command will convert it back to a regular range. You can also insert a slicer into the table using the Insert Slicer command.
External Table Data	The commands in this group are used to export table data to other applications, as well as manage data links to external resources.
Table Style Options	The checkbox controls in this group allow you to toggle available table components on or off.
Table Styles	This group displays a gallery of styles that you can apply to the current table.

STYLES AND QUICK STYLE SETS

Similar to cell styles, table styles are preconfigured formatting options that can be applied to tables. They allow you to quickly apply a splash of color to your tables and in some cases enhance their readability. While you do have the option of configuring your own table style, you can also select from a variety of preconfigured quick styles. You can find all of these quick styles within the Table Styles group of the Table Tools – Design tab:
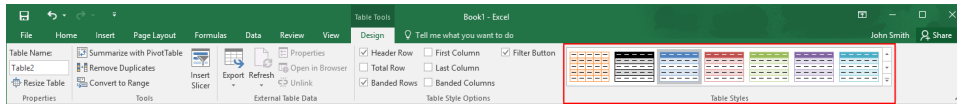
Clicking the More arrow ( ) within the Table Styles gallery will expand it to show more options:
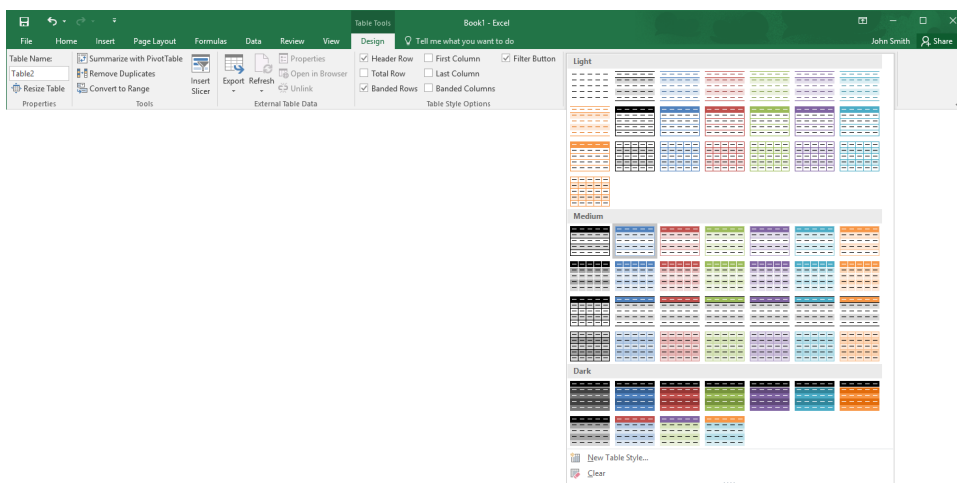
Clicking any style option inside the Table Styles gallery will apply it to the current table:
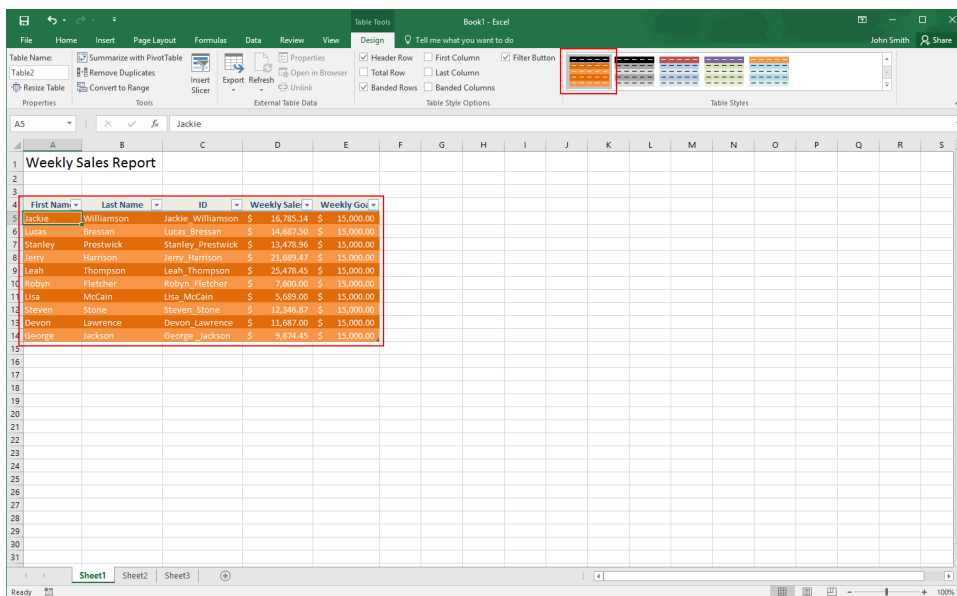
To clear an applied style, click the More arrow ( ) within the Table Styles gallery, and then click Clear:
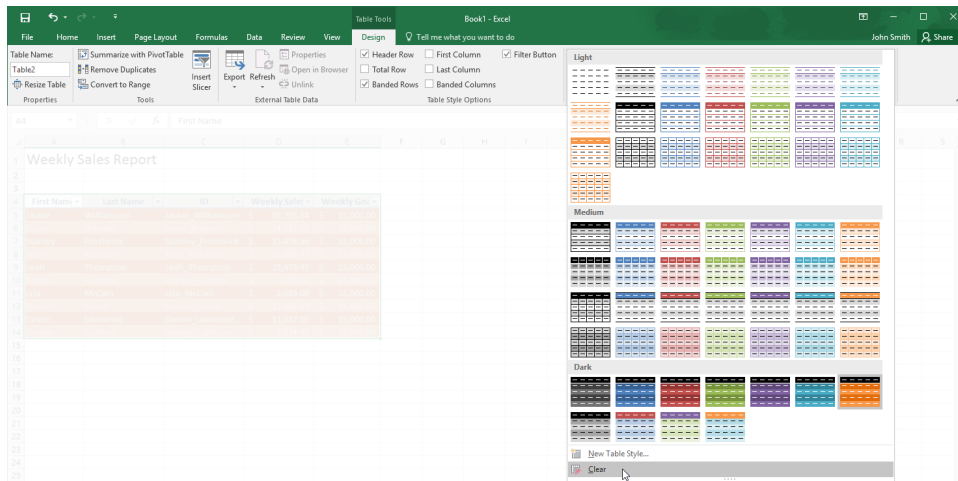
The table will then be displayed with no style at all:
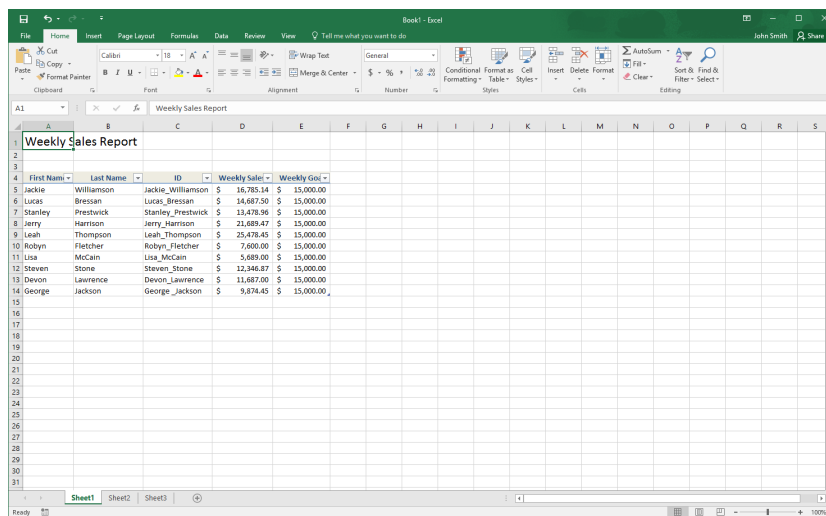
CUSTOMIZING ROW DISPLAY

Rows in a table can be customized through the enabling (or disabling) of banded rows and the inclusion of total rows. To toggle banded rows, first select the table that you would like to work with and then click Table Tools – Design → Banded Rows:
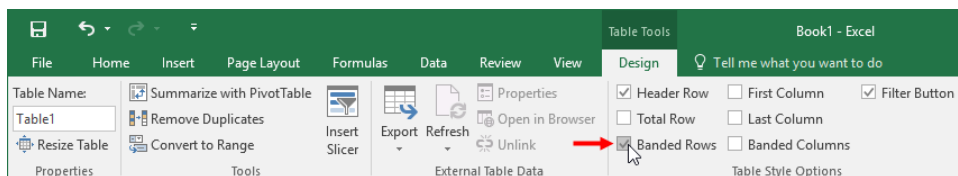
While banded rows are enabled by default to make the data easier to read, disabling it is always an option:

The total row is added to the end of the table and displays the totals for each column. Disabled by default, you can toggle this customization by clicking Table Tools – Design → Total Row:

When the total row is shown, you will see that it appears bold:

TABLE MODIFICATION OPTIONS

Tables can be modified like any worksheet found in Excel. To insert a new row, select the table row below where you want to insert one or more blank table rows. Next, click Home → Insert → Insert Table Rows Above:
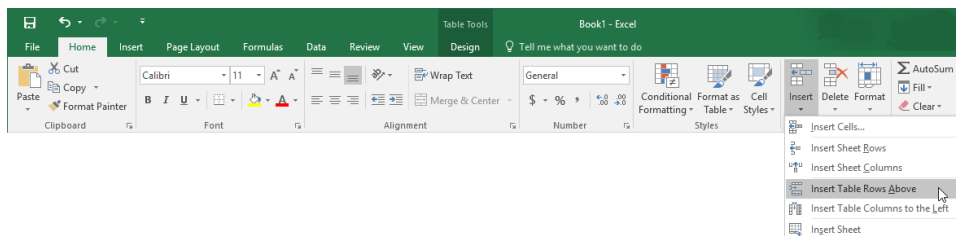
A new blank row will then be added above the selected row, shifting everything below this row downwards:

Similarly, you can add new columns by selecting the table column to the right of where you want to insert a new column. Next, click Home → Insert → Insert Table Columns to Left.

ACTIVITY 3-1

Creating and Modifying a Table

You have decided that because the Weekly Sales & Bonus Payout worksheet will grow on a weekly basis, it is a good idea to convert the range into a table to facilitate data analysis. You would also like to apply a new table style to it.

1.   To begin, open Activity 3-1 from your Exercise Files folder:
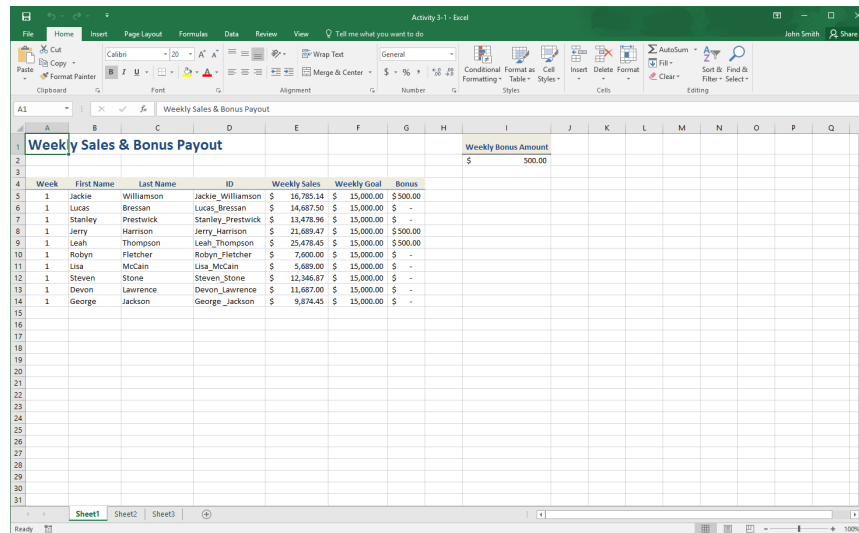
2.   First, use your cursor to select the A4:G14 cell range:
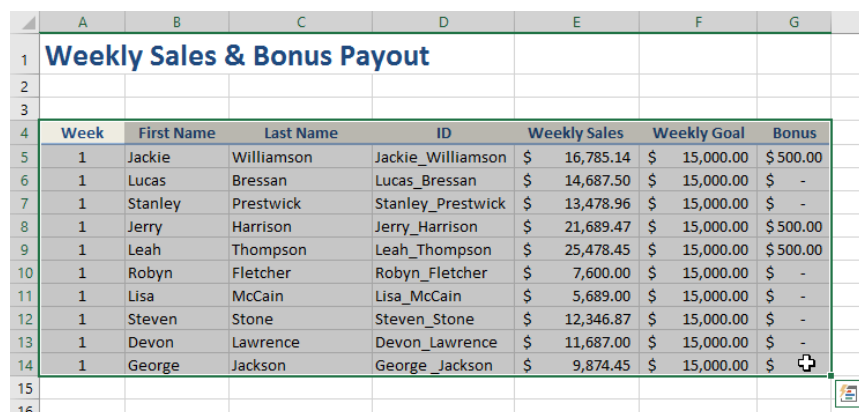
3.   Next, click Insert → Table:
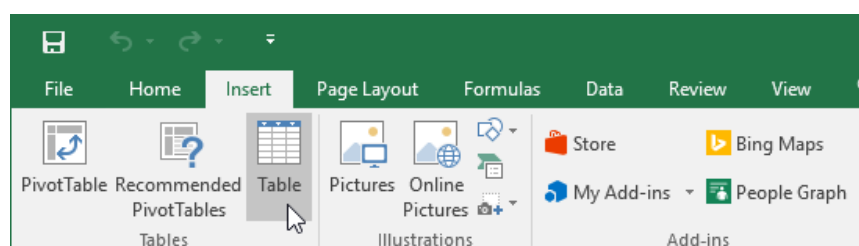
4. In the Create Table dialog box, you will see that the range you previously selected is listed inside the "Where is the data for your table?" text box:
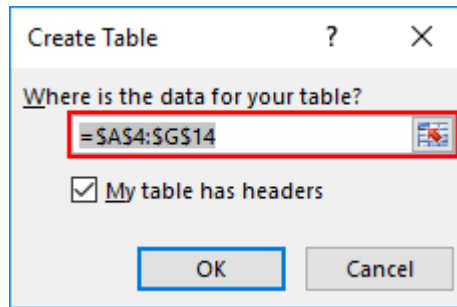
5. Ensure that the "My table has headers" checkbox is checked and click OK:
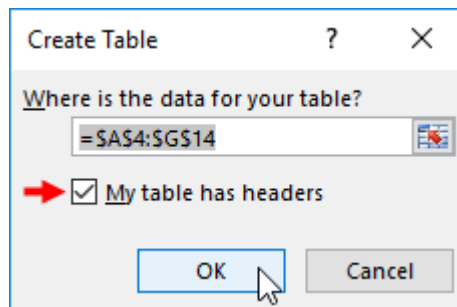
6. You will see that the previously selected range has now been converted into a table:

7. Now, you need to apply a new table style. With any of the cells inside the table selected, open the Table Tools – Design contextual tab. Within the Table Styles group, click the More arrow ( ):

8. A variety of different quick styles to choose from will now be displayed. For this example, click Table Style Medium 8:
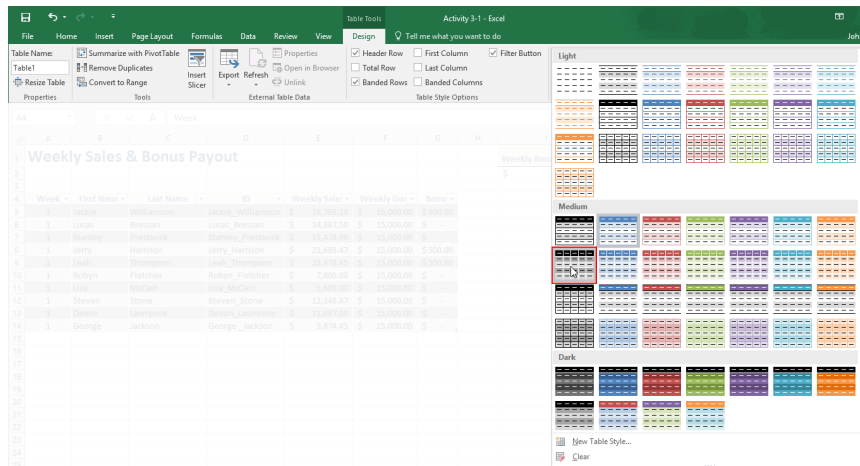
9. The new style will now be applied to the current table:

Week	First Name	Last Name	ID	Weekly Sales	Weekly Goal	Bonus
1	Jackie	Williamson	Jackie_Williamson	$ 16,785.14	$ 15,000.00	$ 500.00
1	Lucas	Bressan	Lucas_Bressan	$ 14,687.50	$ 15,000.00	$ -
1	Stanley	Prestwick	Stanley_Prestwick	$ 13,478.96	$ 15,000.00	$ -
1	Jerry	Harrison	Jerry_Harrison	$ 21,689.47	$ 15,000.00	$ 500.00
1	Leah	Thompson	Leah_Thompson	$ 25,478.45	$ 15,000.00	$ 500.00
1	Robyn	Fletcher	Robyn_Fletcher	$ 7,600.00	$ 15,000.00	$ -
1	Lisa	McCain	Lisa_McCain	$ 5,689.00	$ 15,000.00	$ -
1	Steven	Stone	Steven_Stone	$ 12,346.87	$ 15,000.00	$ -
1	Devon	Lawrence	Devon_Lawrence	$ 11,687.00	$ 15,000.00	$ -
1	George	Jackson	George _Jackson	$ 9,874.45	$ 15,000.00	$ -

10. Save your work as Activity 3-1 Complete and then close Microsoft Excel 2016.

TOPIC B: Sort and Filter Data

The data that populates your worksheets is typically randomly sorted. This can cause a problem if you need to conduct data analysis or simply get a better grasp of the data at hand. Using tables you are able to quickly sort and filter data in a number of different ways to best suit your goals. Over the course of this topic, you will learn how to sort and filter data in tables and ranges.

Topic Objectives
In this topic, you will learn:
- About the difference between sorting and filtering
- About sorting data
- About advanced filtering
- About filter operators
- How to remove duplicate values

THE DIFFERENCE BETWEEN SORTING AND FILTERING

Typically you are able to sort worksheet data alphabetically or numerically in ascending or descending order, but there are also options to sort data based on date and time, and even cell color. While you are able to sort by either row or column, the vast majority of sorting is done by column due to how most worksheets are constructed. Additionally, multiple sorts can be applied to the same set of data.

Keep in mind when sorting table data that in order to make the most of Excel's table functionality, you should make sure that your table contains headers. This will make the data more meaningful and easier to read, particularly if you are passing the data onto someone else in the future.

It is also important to keep in mind that when you sort data you are not changing the data in the worksheet; you are only changing how it is displayed. Additionally, while there is no option available to clear a sort and return it back to its original state, the Undo command can have the same effect. Finally, if you apply a sort and then save your workbook, the sort applied will also be saved. This means that if you need to undo a sort, you can only do it in the same session as when the sort was applied.

Note that the sorting of multiple columns or rows in one range or table should only be done if those columns or rows being sorted share some of the same entries. If this is not the case, the sort will tell you nothing of value. (Keep info but include with previous concept)

Filtering data limits the amount of data shown in the report based on a selected condition. For example, if you only wanted to show data from those with the last name Stone, you could use a filter to do that.

SORTING DATA

Quick sorting allows you to quickly and easily apply common sorting options to data within the table. Quick sorting can be applied to tables by clicking the pull-down arrow beside the name of the header you want to sort. Then choose an ascending or descending sort option:
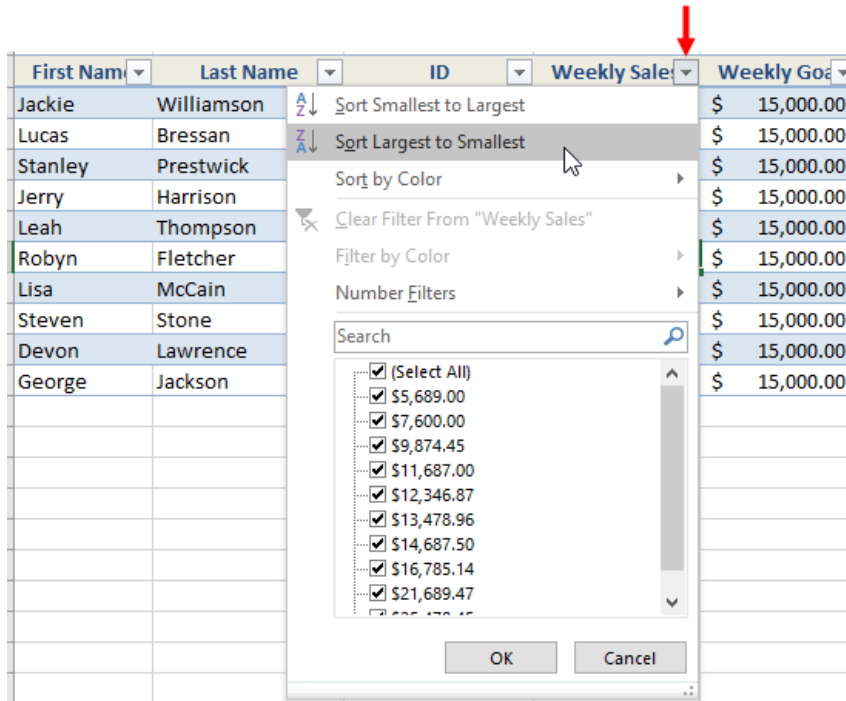
The values will now be sorted in ascending or descending order based on the criteria that you selected. The pull-down arrow beside the header name will also show what type of sort has been applied. In the example below, you can see that the Weekly Sales column is now sorted by largest value to smallest:

You can also apply a quick sort by clicking Data → Sort A to Z or Sort Z to A:
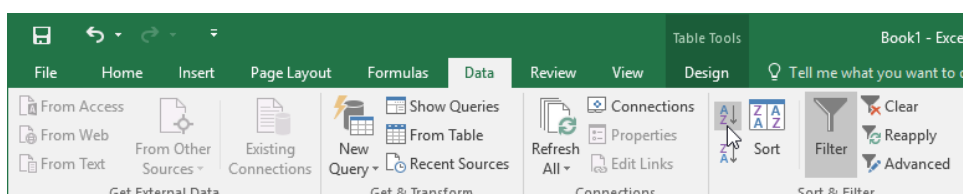
While using quick sorts is a simple way to apply basic sorting to your data, you are limited to sorting one column at a time. Additionally, quick sorts can only be used to sort columns, not rows.

ADVANCED FILTERING

Custom filters allow you to easily construct a filter using And/Or statements. However, there may come a time when you need to construct a logical statement using several parts, including multiple And/Or statements at once. To do this, Excel lets you create your own advanced filters by entering filter criteria directly onto the worksheet that contains the data that you are filtering.

Consider the following table. If you wanted to list all people who were more than 40 years old, you can define a parameter directly in the worksheet, like this:

Notice that the heading in F1 matches the corresponding table heading. The advanced filter is now ready to be applied. This is done by clicking anywhere inside the table and then clicking Data → Advanced (in the Sort & Filter group):
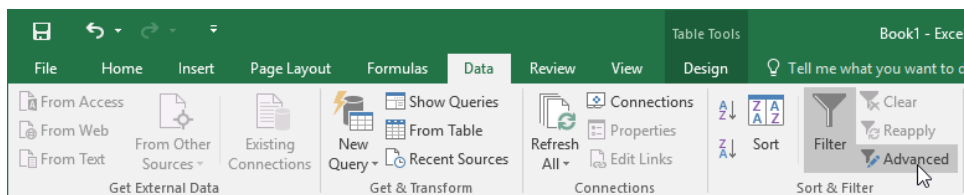
This action will cause the Advanced Filter dialog box to appear. The table data and headings will also be selected with a flashing border on the worksheet, and you will see that the cell range has automatically been entered in the "List range" field. The top of the dialog shows that the filter will be applied to the current table. You will also see the option to create a copy of the filtered data in a new location.
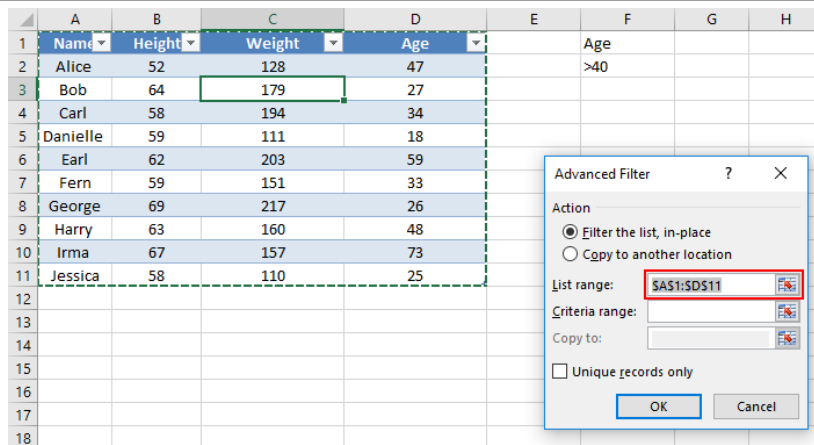
Next, you would then need to choose the criteria range using the "Criteria range" text box:
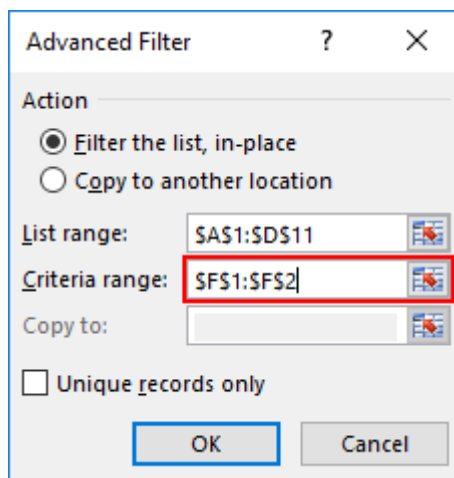
Finally, clicking OK would then apply the sort. Only the data that meets the selected criteria will be displayed. In this case only those who are older than 40 will be shown:

FILTER OPERATORS

Similar to logical operators, filter operators are used to define the criteria for advanced filtering. They are used to narrow down the specific data that you are looking for. You can use them in a variety of combinations.

Below is a breakdown of the filter operators that you can choose from in Excel 2016.

Operator	Example	Action
=	= 1	Will filter out data that is not an exact match to the value entered. Note that because Excel will assume the equals sign is the start of a formula or function, you need to enclose this symbol in double quotations when using it as a filter operator.
>	> 1	Displays only data that is greater than a specified value.
<	< 2	Displays only data that is less than a specified value.
>=	>= 1	Displays only data that is equal to or greater than a specified value.
<=	<= 2	Displays only data that is equal to or less than a specified value.
<>	<> 2	Display only data that is not equal to a specified value.
?	1?	The question mark is used as a wildcard character. You would put this character in position where the digit can be any number between 0 and 9. For example, if you want to filter for data that starts with a 1 but is followed by any number, you would enter 1?.

REMOVING DUPLICATE VALUES

In Excel, duplicate values occur when all of the values in a single row are identical to all of the values in another row. Additionally, duplicate values are identified by a value that is displayed in cell – not necessarily the one that is stored. For example, if you have two different date formats (1/22/2018 versus January, 22nd, 2018), these values will be determined to be unique. Below, you can see

the table contains a duplicate value with the information for Irma being shown twice:

Excel has a built-in function to remove duplicate values where and when necessary. To take advantage of this function, click anywhere inside of the table where the duplicate values occur and then click Data → Remove Duplicates:
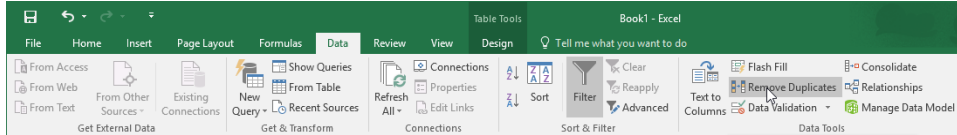
This action will display the Remove Duplicates dialog box. Here, you can select the columns that contains the duplicates that you would like to remove (By default all of the columns in the table will be selected). Click OK:
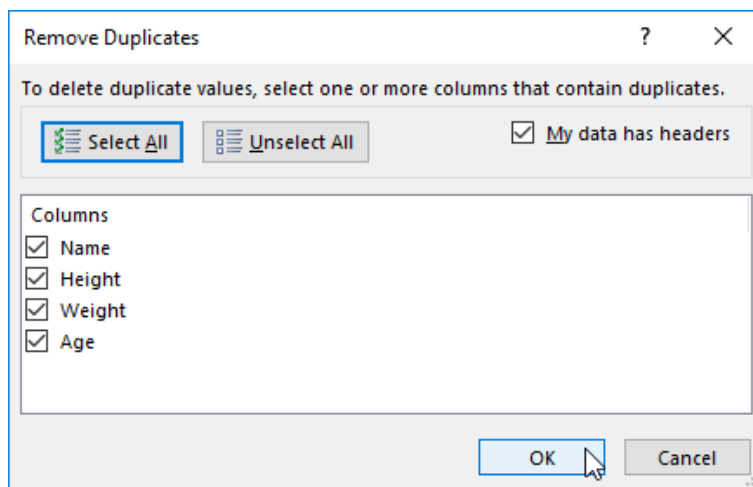
Any duplicate value found will then be removed. A dialog box will appear that informs you of the number of duplicate values found and how many unique values remain:
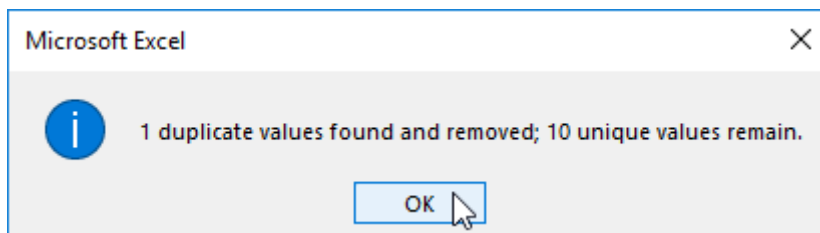
ACTIVITY 3-2

Sorting Data

You would like to analyze the top sales associates sorted by week in the Weekly Sales & Bonus Payout worksheet that you have been working on. You will use custom sorts to find this information and then apply a quick sort to the Week column that sorts its data from low to high.

1.   To begin, open Activity 3-2 from your Exercise Files folder:
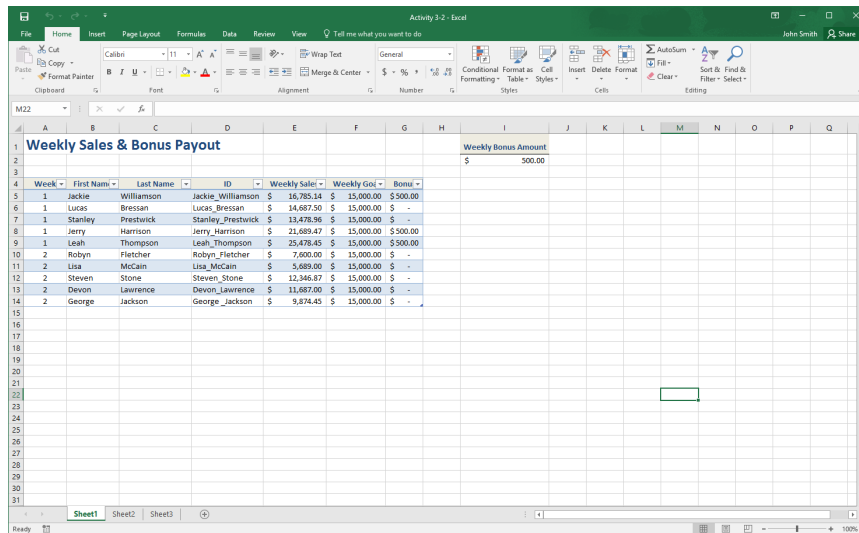
2.   The data in this worksheet has been formatted into a table. Click to place your cursor anywhere inside this table to select it and then click Data → Sort:
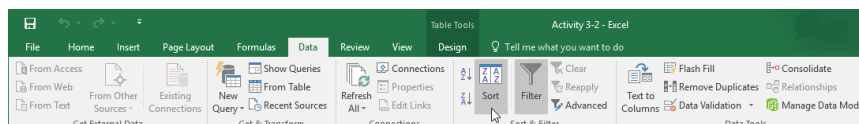
3.   The Sort dialog will now be displayed. On the first level in this dialog, click the "Sort by" drop-down menu and then click the Weekly Sales option:
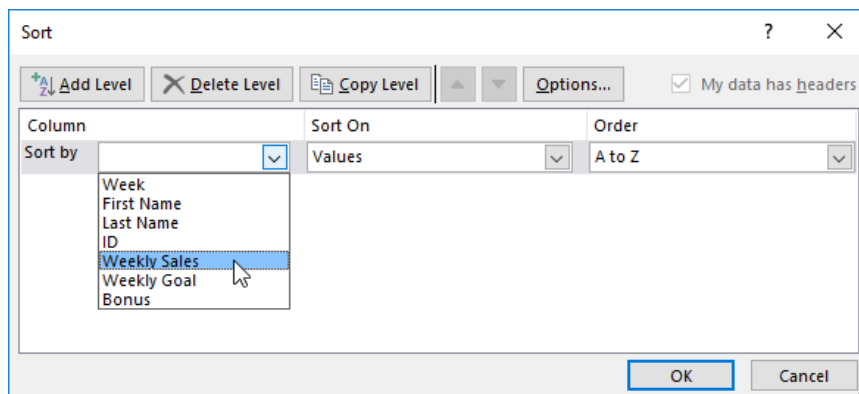
4. Ensure that this level has Values selected under the Sort On column, and then click the Order drop-down menu. Click Largest to Smallest:
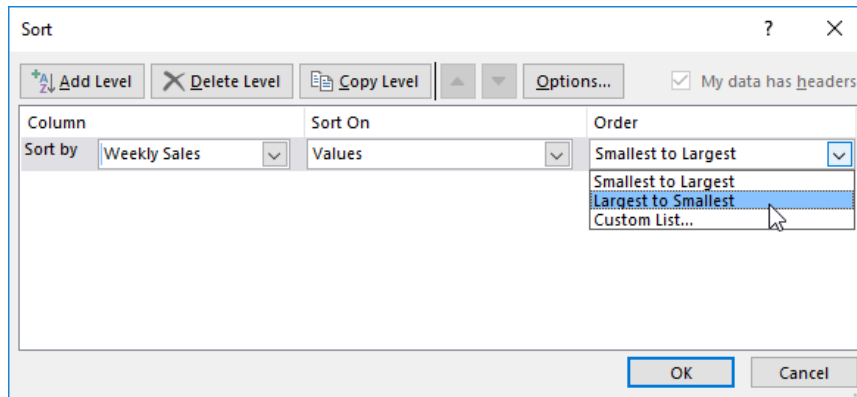
5. Click the Add Level button:
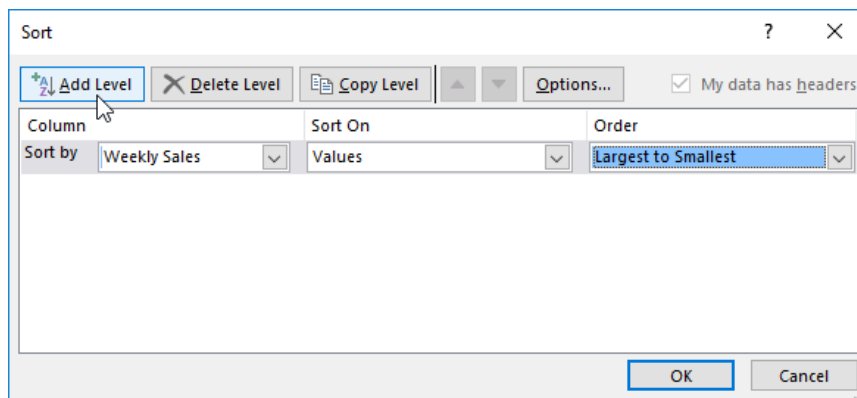
6. A new level will now be added to the custom sort. Click the "Then by" drop-down menu and click the Week option:
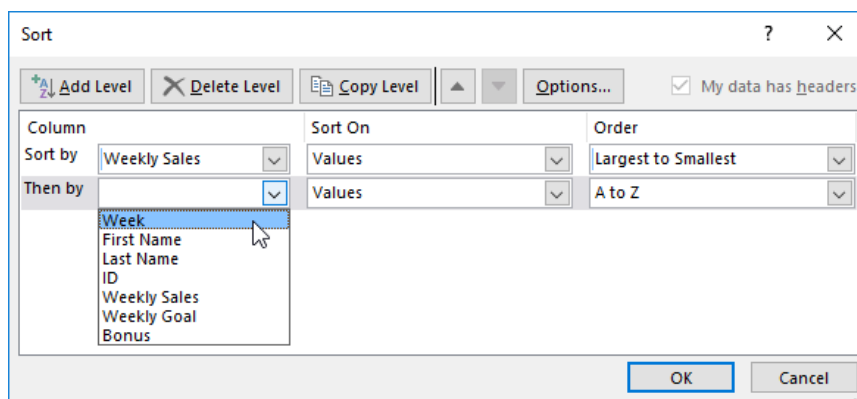
7. Ensure that the Values option is selected in the Sort On drop-down menu, as well as "Smallest to Largest" in the Order drop-down menu. Click OK:
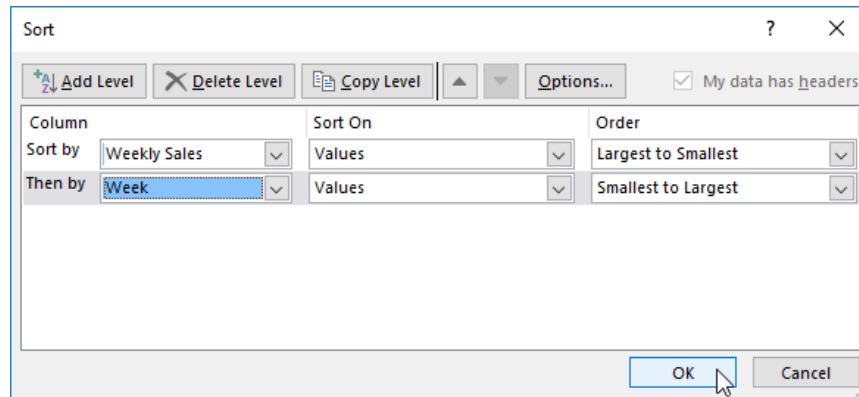
8. The new custom sort will now be applied to the currently selected table. In this case the data is being sorted first by the Weekly Sales column and then by the Week column. This is helpful in showing you, from largest to smallest, the sales made by each salesperson in each week. Now you can quickly determine the highest and lowest earners by week:

9. Next, you will use a quick sort to sort this data by last name. Click the arrow beside the Last Name column and click "Sort A to Z:"
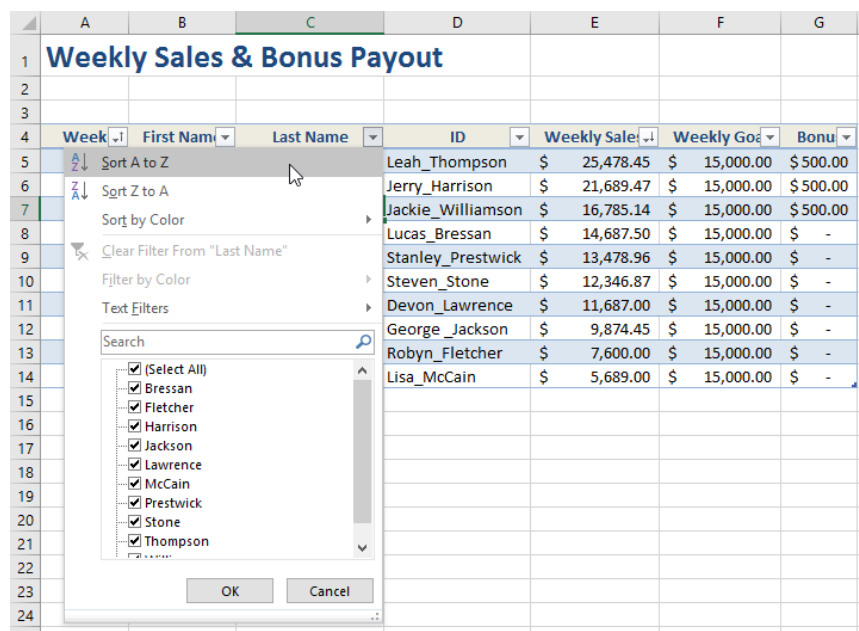
10. The data in this table will now be sorted alphabetically based on the last names of the sales associates:

Note that this action will overrule the previously applied custom sort. If you wanted to apply that custom sort once again, you would need to reconstruct it from scratch.

11. Save your work as Activity 3-2 Complete and then close Microsoft Excel 2016.

TOPIC C: Use Subtotal and Database Functions to Calculate Data

While the ability to sort and filter your data can be essential to conducting common data analysis tasks, you may at some point be required to apply calculations to a specific set of data within a larger dataset. Using a variety of tools that Excel provides, you can do this by drilling down into your data. During this topic you will learn how to use the SUBTOTAL function, subtotaling features, and database functions to complete these tasks.

Topic Objectives
In this topic, you will learn:
- About the SUBTOTAL function
- About the Subtotal dialog box
- About summary functions in tables
- About database functions and their syntax

SUBTOTAL FUNCTIONS

SUBTOTAL functions are used to perform calculations on only subsets of data within a range or table. As the name suggests, this type of function is typically used to calculate subtotals. For example, suppose that you are working with sales data that is sorted by Buyer:

	A	B	C	D	E
1	SKU	Unit Price	Quantity	Order Price	Buyer
2	1574	$ 2.99	5	$ 14.95	11
3	2358	$ 399.99	5	$ 1,999.95	11
4	1478	$ 0.49	1587	$ 777.63	11
5	589	$ 6.50	54	$ 351.00	11
6	147	$ 129.99	214	$ 27,817.86	11
7	1358	$ 4.99	45	$ 224.55	11
8	4785	$ 34.99	65	$ 2,274.35	32
9	5167	$ 42.50	45	$ 1,912.50	32
10	3258	$ 1.99	89	$ 177.11	32
11	4786	$ 199.99	8	$ 1,599.92	32
12	235	$ 569.99	55	$ 31,349.45	32
13	1567	$ 147.59	35	$ 5,165.65	32
14	1459	$ 16.99	89	$ 1,512.11	32
15	1478	$ 0.85	854	$ 725.90	157
16	23	$ 4.99	475	$ 2,370.25	157
17	47	$ 8.99	89	$ 800.11	157
18	354	$ 750.00	25	$ 18,750.00	157
19	1547	$ 134.58	2	$ 269.16	157
20					

While you could calculate the subtotal for each of these sections using the SUM function, this approach would become more and more inefficient as the worksheet grows. A better approach would be the SUBTOTAL function. This is because of the SUBTOTAL function's unique ability to use other functions within itself. For example, you can use SUM, AVERAGE, MAX, and MIN within the SUBTOTAL function depending upon the type of calculations that you want performed. The functions can then be applied to the range(s) in the function arguments.

Below is the syntax for the SUBTOTAL function:

=SUBTOTAL(function_num, ref1, [ref2], [...])

The **function_num** argument is where you are able to call other functions that you would like to use to calculate subtotals. Functions are called using numeric values of 1 to 11 when including hidden values and 101 to 111 when you would like to ignore them. For example, if you wanted to call the SUM function and include hidden values in the calculation, you would type "9" as the argument. Below is a table that tells you what value calls what function:

Function Argument Including Hidden Values	Function Argument Ignoring Hidden Values	Function
1	101	AVERAGE
2	102	COUNT
3	103	COUNTA
4	104	MAX
5	105	MIN
6	106	PRODUCT
7	107	STDEV
8	108	STDEVP
9	109	SUM
10	110	VAR
11	111	VARP

This function also uses reference arguments (**ref1**, **ref2**, etc.) to identify the ranges that you want this function to work with. For example, if you wanted the SUM of the A1:C10 range (including hidden values), you would type =SUBTOTAL (9, A1:C10). You can have up to 254 ranges within a single SUBTOTAL function.

THE SUBTOTAL DIALOG BOX

To use Excel's subtotal feature, use your mouse to select the range of data you want to apply subtotals to and then click Data → Subtotal:
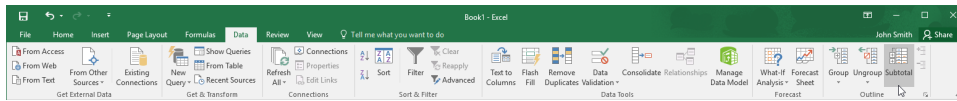
This action will display the Subtotal dialog box:
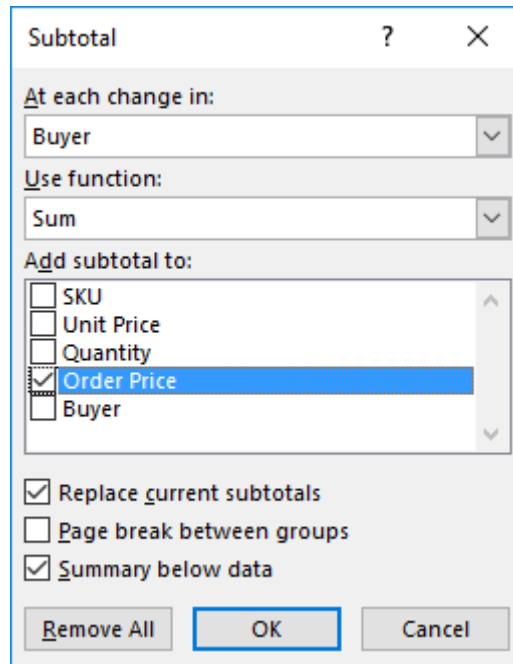
Using this dialog box, you can specify the criteria that Excel will use to create subtotals. You will need to set how Excel will organize subsets of data within the selected range, what function you would like to use, as well as the column in which the calculation will be made.

To set the criteria that will be used to organize subsets of data, click the "At each change in" drop-down menu and then choose one of the columns from the selected range.

For example, if the range that you are working with is sorted by the Buyer column, choosing the Buyer option would be an excellent way to create subtotals based upon each Buyer that exists in the range:
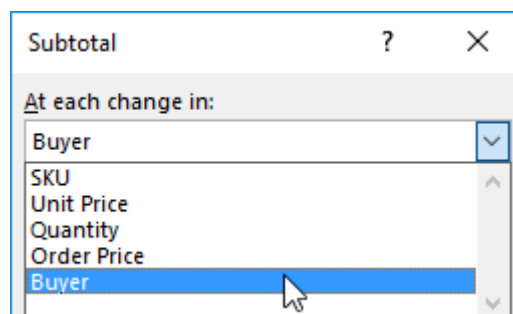
The "Use function" drop-down menu is used to choose the SUBTOTAL function that you want. There are 11 functions to choose from:
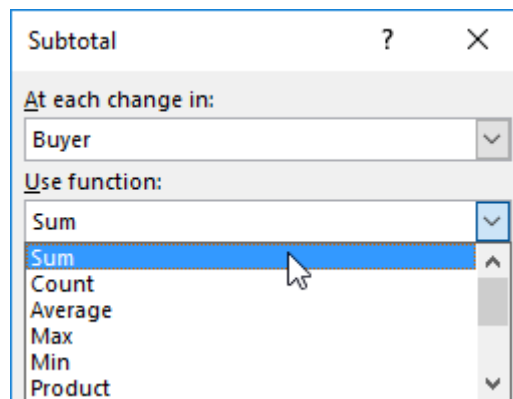
In the "Add subtotal to" section, you can select checkboxes for the columns you want totals for. You can apply totals to a single column or to multiple columns as long as they are covered by your selected range:
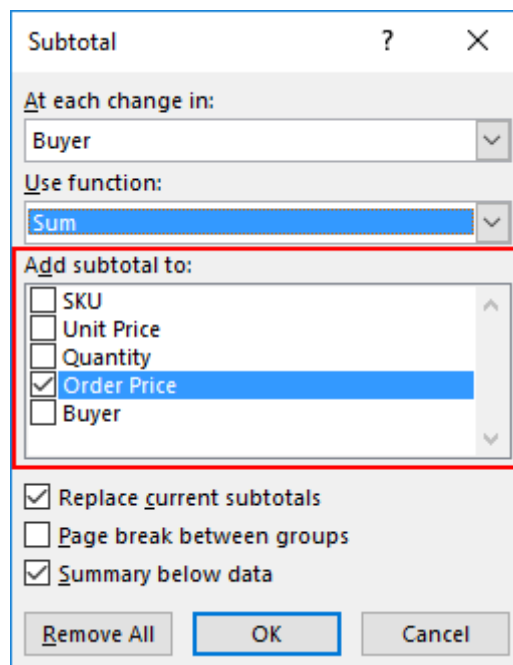
Finally, there are three checkboxes at the bottom of the Subtotal dialog box that will allow you to:
- Replace any pre-existing subtotals
- Put page breaks between totaled groups so they can be printed on separate pages
- Place the subtotals and grand totals above or below the corresponding data

The Remove All button is used to clear all subtotals and subsets from the original selection. Once you are ready to create subtotals, click OK.
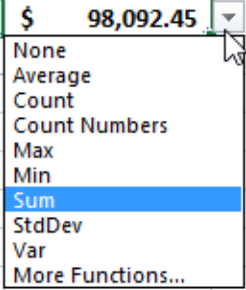
SUMMARY FUNCTIONS IN TABLES

Since the subtotal feature is unavailable for tables, Excel provides summary functions that can be used to achieve the same results when using tables instead of ranges. The primary difference between these two tools is that summary functions do not automatically create data subsets in

tables; however, you can work around this by applying a summary function and then using filters to show only the dataset that you wish you view.

To apply a summary function to a table, you must first add a total row to the table (Table Tools – Design → Total Row). With the total row displayed, click inside the total cell under the desired column and click the pull-down arrow next to that cell. You can then choose from a list of functions:

14	1459	$ 16.99	89	$ 1,512.11	
15	1478	$ 0.85	854	$ 725.90	
16	23	$ 4.99	475	$ 2,370.25	
17	47	$ 8.99	89	$ 800.11	
18	354	$ 750.00	25	$ 18,750.00	
19	1547	$ 134.58	2	$ 269.16	
20	**Total**			$ 98,092.45 ▼	
21				None	
22				Average	
23				Count Count Numbers	
24				Max Min	
25				Sum	
26				StdDev Var	
27				More Functions...	
28					

With the function selected, you can now apply a filter to this table to only display the subset that you want this function to be applied to. For this example, a filter was applied to only show orders where the quantity of product ordered was less than 10:

	A	B	C	D
1	**SKU** ▼	**Unit Price** ▼	**Quantity** ⊼	**Order Price** ▼
2	1574	$ 2.99	5	$ 14.95
3	2358	$ 399.99	5	$ 1,999.95
11	4786	$ 199.99	8	$ 1,599.92
19	1547	$ 134.58	2	$ 269.16
20	Total			$ 3,883.98

DATABASE FUNCTIONS

Database functions allow you to perform operations on multiple fields in an Excel database. In a sense, they offer some of the power of array formulas, but generally make worksheets faster because they do not require the same amount of recalculation.

With database functions you can get counts, averages, or sums of your database on selected criteria involving multiple fields. Implementing database functions is a little like implementing advanced filters: you have to establish a criteria range before you use the function.

Take the following Excel table as an example:

	A	B	C	D
1	SKU	Unit Price	Quantity	Order Price
2	1574	$ 2.99	5	$ 14.95
3	2358	$ 399.99	5	$ 1,999.95
4	1478	$ 0.49	1587	$ 777.63
5	589	$ 6.50	54	$ 351.00
6	147	$ 129.99	214	$ 27,817.86
7	1358	$ 4.99	45	$ 224.55
8	4785	$ 34.99	65	$ 2,274.35
9	5167	$ 42.50	45	$ 1,912.50
10	3258	$ 1.99	89	$ 177.11
11	4786	$ 199.99	8	$ 1,599.92
12	235	$ 569.99	55	$ 31,349.45
13	1567	$ 147.59	35	$ 5,165.65
14	1459	$ 16.99	89	$ 1,512.11
15	1478	$ 0.85	854	$ 725.90
16	23	$ 4.99	475	$ 2,370.25
17	47	$ 8.99	89	$ 800.11
18	354	$ 750.00	25	$ 18,750.00
19	1547	$ 134.58	2	$ 269.16

Imagine that you had to calculate the number of orders that have a quantity under ten, with an order price over $200. This could be performed with a number of separate calculations, but this solution quickly becomes impractical with large volumes of data. There is an easier method of doing this using a database function.

The first step in using a database function is to set up a criteria range. You would start by entering the field headings that we want to use exactly as they are in the original data list. For this example, you would need the fields Quantity and Unit Price for the criteria range.

Next, you would enter the criteria for the function somewhere in the worksheet, making sure to match the headings with the criteria:

F	G
Quantity	Order Price
<10	>200

If you wanted to join the criteria with a logical Or operator, you would offset the criteria on separate rows (like an advanced filter).

You can now select another empty cell on the worksheet and enter the database function. For this example, you could type "=DCOUNT(A1:D19, "Quantity", F1:G2)" into the Formula Bar to complete the calculation:
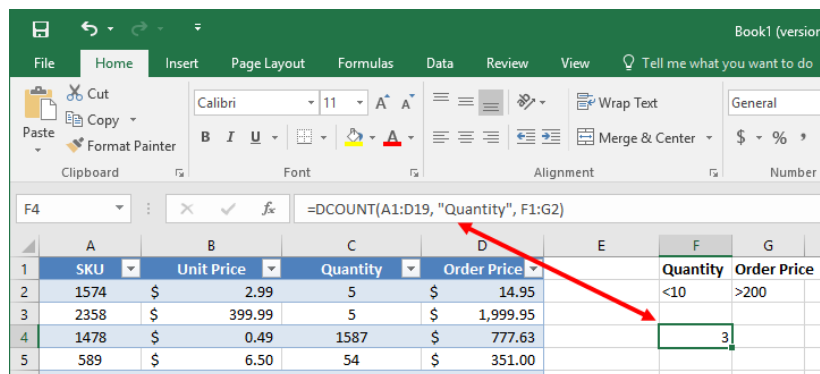
Keep in mind that there are lots of database functions that you choose from, including:
- DSUM
- DAVERAGE
- DCOUNT
- DCOUNTA
- DGET
- DMAX
- DMIN
- DPRODUCT
- DSTDEV
- DSTDEVP
- DSUM
- DVAR
- DVARP

ACTIVITY 3-3

Using SUBTOTAL and Database Functions

Using the SUBTOTAL function you need to add subtotals that display the total weekly sales, as well as a grand total, to a sales worksheet. Additionally, you need to calculate what the average sale was during week 1 on a separate worksheet. These tasks will be completed using database functions.

1. To begin, open Activity 4-4 from your Exercise Files folder:

2. First you are going to use the subtotal feature to calculate the subtotals for each week in the worksheet. Use your cursor to select cells A4:G15:

3. Next, click Data → Subtotal:

4. The Subtotal dialog box will now be displayed. As you want subtotals calculated based on the change in the Week column, ensure that Week is selected in the "At each change in" drop-down menu:

5. Ensure that the Sum function is selected from the "Use function" drop-down menu:
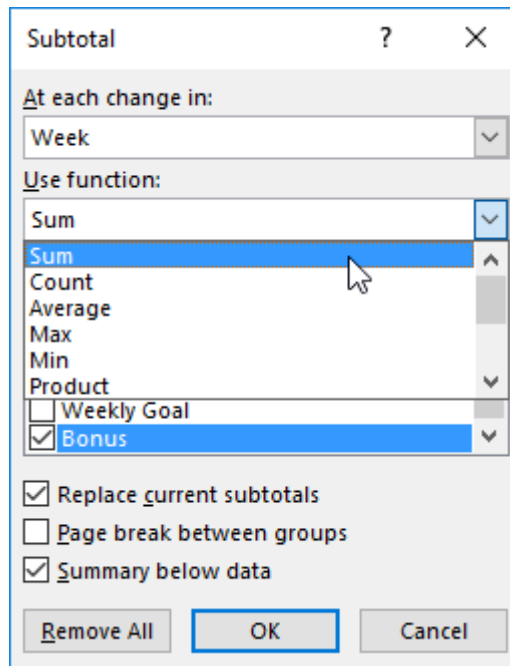
6. Finally, you need to select the column where you want the calculation to be made. Ensure that only the Weekly Sales column is selected:
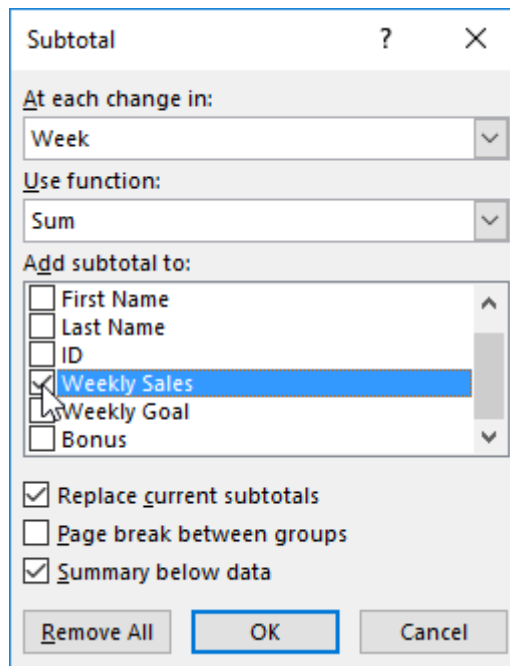
7. Click OK:
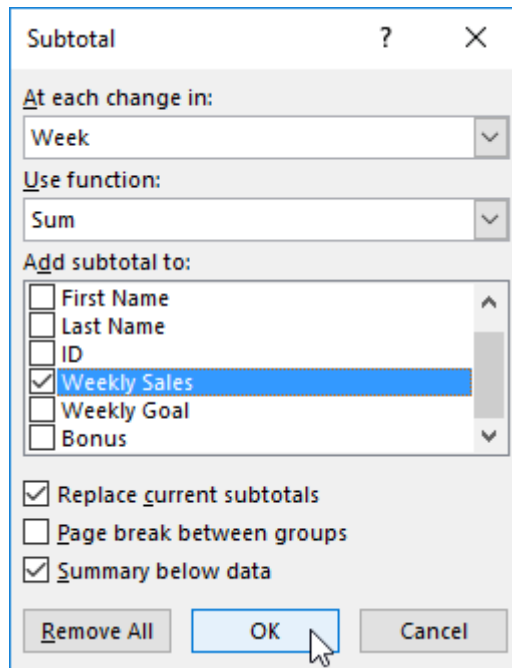
8. Deselect the cell range. You will see that subtotals have been added to both weeks. Additionally, a grand total that calculates the sum of both subtotals is shown:

9. Switch to Sheet2:

10. This worksheet contains the same data as the previous sheet, but with the data displayed in a table rather than a range:
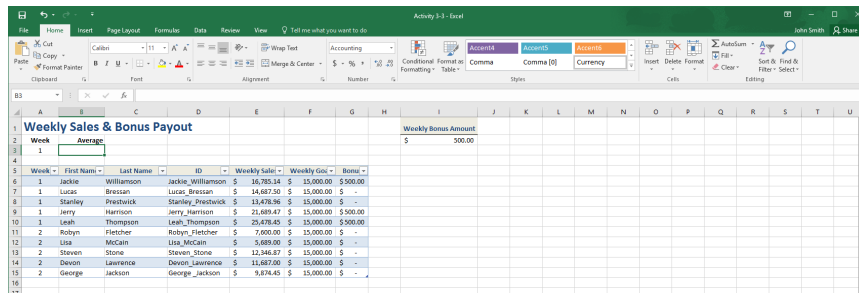
11. In this worksheet, you are going to use a database function to calculate the average sales for week 1. Click to select cell B3:

12. Inside the Formula Bar type "=DAVERAGE(" followed by the entire table range – A5:G15 in this case:
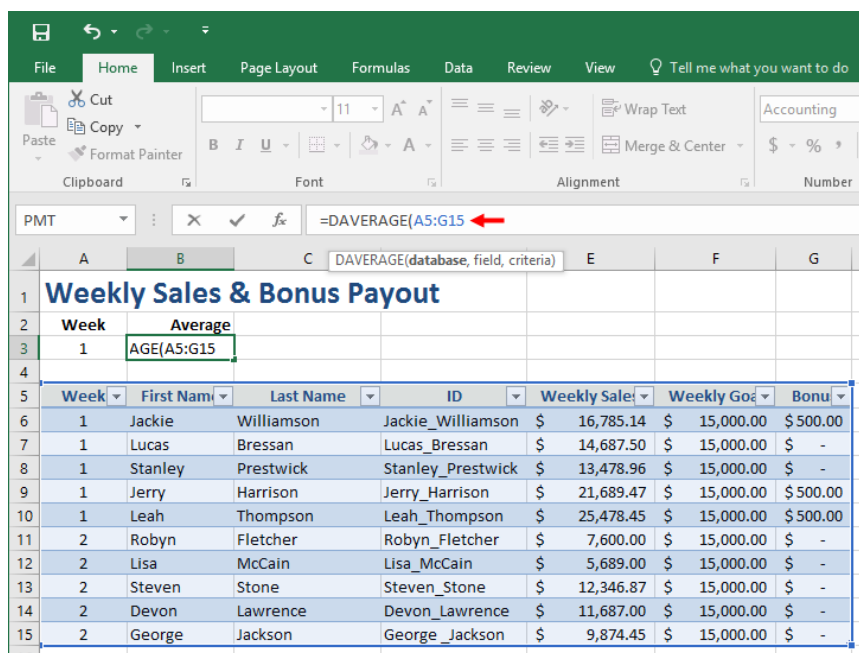
13. Add a comma after the table range and then type "E5" to declare the field argument (the column that the function will perform a calculation on). For this exercise it is the Weekly Sales column:
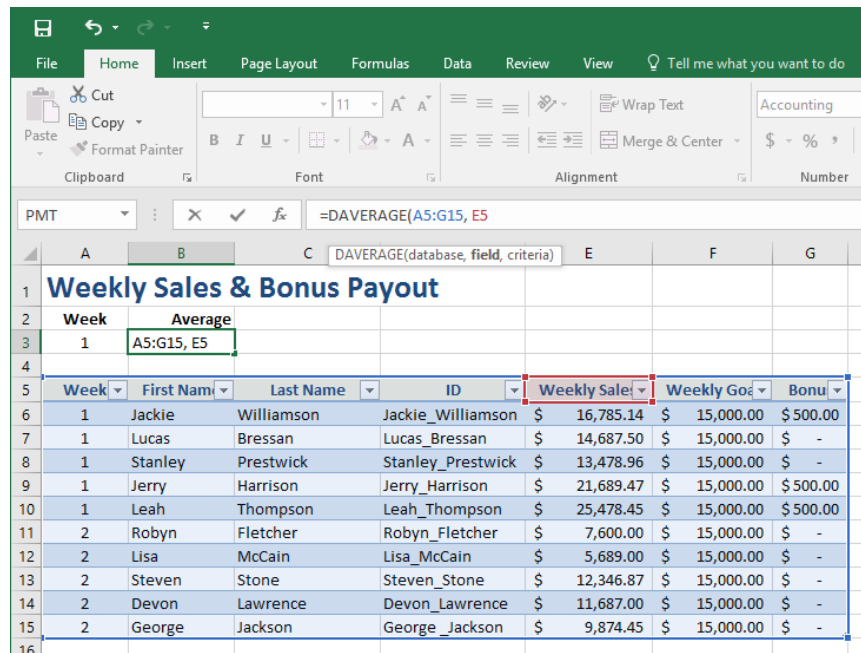
14. Next, you need to add the criteria argument. This has already been added to the worksheet, so add another comma and then type "A2:A3" followed by a closing parenthesis:
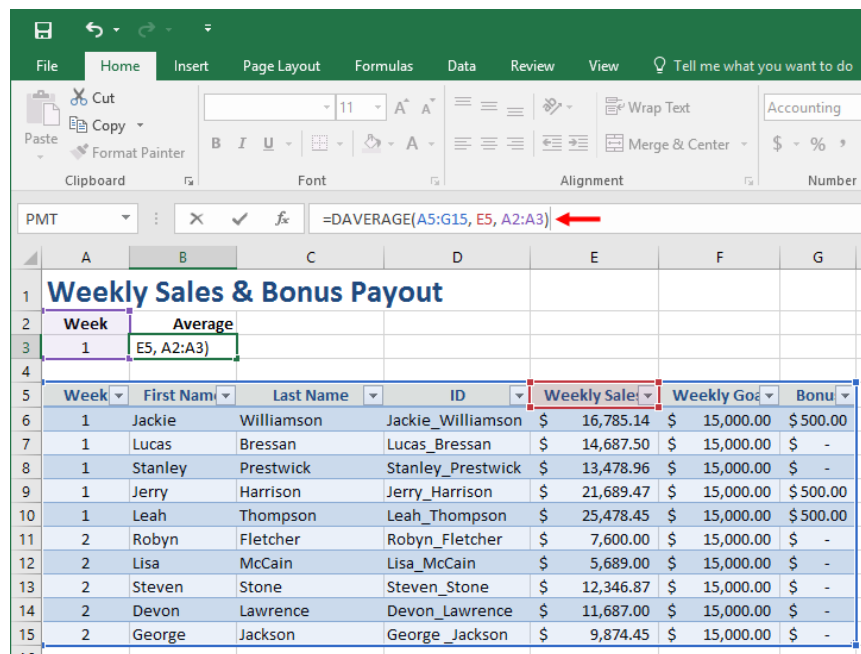
15. Press Enter to apply the new formula. You will now see the average amount of sales that were made by all sales associates in week 1 – $18,423.90:

	A	B	C	D	E	F	G
1	**Weekly Sales & Bonus Payout**						
2	**Week**	**Average**					
3	1	$ 18,423.90					
4							
5	**Week** ▾	**First Name** ▾	**Last Name** ▾	**ID** ▾	**Weekly Sales** ▾	**Weekly Goa** ▾	**Bonu** ▾
6	1	Jackie	Williamson	Jackie_Williamson	$ 16,785.14	$ 15,000.00	$ 500.00
7	1	Lucas	Bressan	Lucas_Bressan	$ 14,687.50	$ 15,000.00	$ -
8	1	Stanley	Prestwick	Stanley_Prestwick	$ 13,478.96	$ 15,000.00	$ -
9	1	Jerry	Harrison	Jerry_Harrison	$ 21,689.47	$ 15,000.00	$ 500.00
10	1	Leah	Thompson	Leah_Thompson	$ 25,478.45	$ 15,000.00	$ 500.00
11	2	Robyn	Fletcher	Robyn_Fletcher	$ 7,600.00	$ 15,000.00	$ -
12	2	Lisa	McCain	Lisa_McCain	$ 5,689.00	$ 15,000.00	$ -
13	2	Steven	Stone	Steven_Stone	$ 12,346.87	$ 15,000.00	$ -
14	2	Devon	Lawrence	Devon_Lawrence	$ 11,687.00	$ 15,000.00	$ -
15	2	George	Jackson	George _Jackson	$ 9,874.45	$ 15,000.00	$ -
16							

16. Save your changes as Activity 3-3 Complete and close Microsoft Excel 2016.

Summary

In this lesson you learned how to organize workbook data. You can create tables, sort data, apply filters, and use the SUBTOTAL and database functions. By taking advantage of all these tools you will be able to take your data analysis tasks a few steps further and learn more about your data than ever before.

LESSON 4:
VISUALIZING DATA WITH CHARTS

Lesson Objectives

In this lesson you will learn how to:

- Create charts

- Modify and format existing charts

- Create a trendline

- Create advanced charts

TOPIC A: Create Charts

While pure data can be analyzed by those familiar with this data and the tools that Excel provides, sometimes you need graphical assistance to help interpret it. Additionally, charts are an enormous help when people do not have time to study the data and only need a brief overview of the relevant information. Over the course of this topic, you will learn how to create charts of different types, using different methods in Excel 2016.

Topic Objectives
In this topic, you will learn:
- About charts
- About chart types
- How to insert a chart
- How to resize and move a chart
- How to add additional data
- How to switch between rows and columns

CHARTS

Charts are graphical representations of data and relationships in a dataset. They are commonly used in situations where viewers need to be able to quickly interpret data, without having to wade through the worksheet itself.

For example, here you can immediately see on this chart that A division generates the vast amount of sales within the organization, while D generates the least:
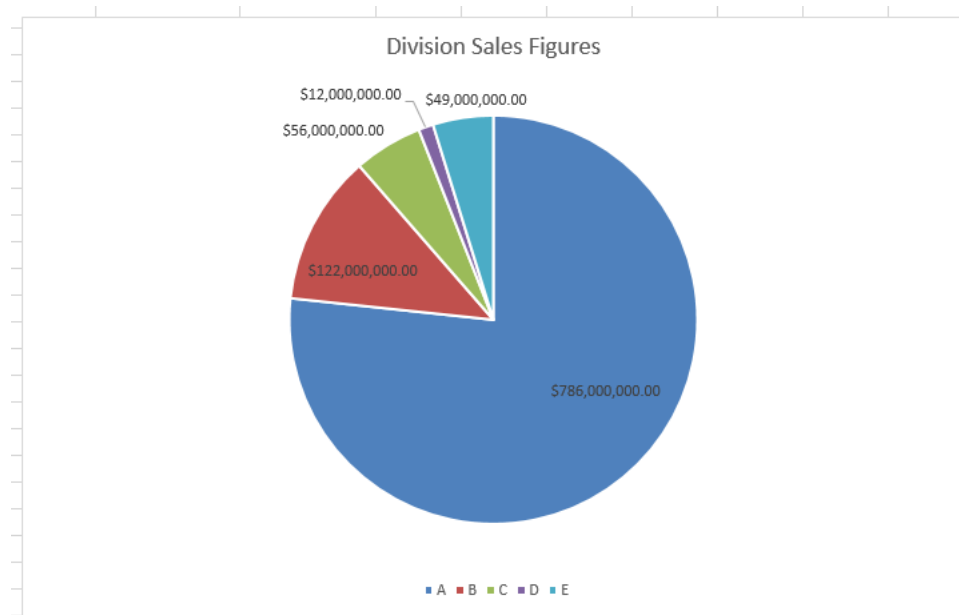
CHART TYPES

There are 11 different chart types that you can choose from, and each of them are tailored to display specific types of data. Each chart type then has even more sub-types that you can choose from in order to further customize their appearance. All of these chart types and sub-types are accessed using the Insert Chart or Change Chart Type dialog boxes. To open the Insert Chart dialog box, click the Insert tab and click the option button (⬓) in the Charts group while the dataset that you would like to represent is selected:
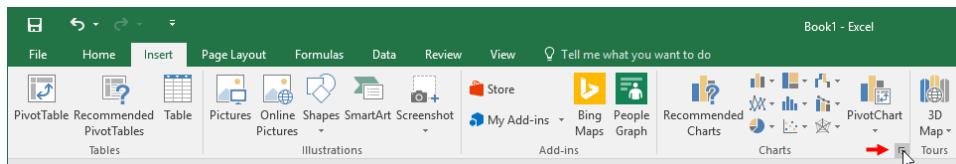
(Alternatively, you can click Insert → [Any Chart Category] → All Chart Types.)

The Insert Chart dialog box consists of two tabs – Recommended Charts and All Charts. The Recommended Charts tab will be displayed by default and will suggest a few chart types that best fit the data that you are trying to represent. Usually, there a few options to choose from with the top-most option being the most recommended one:
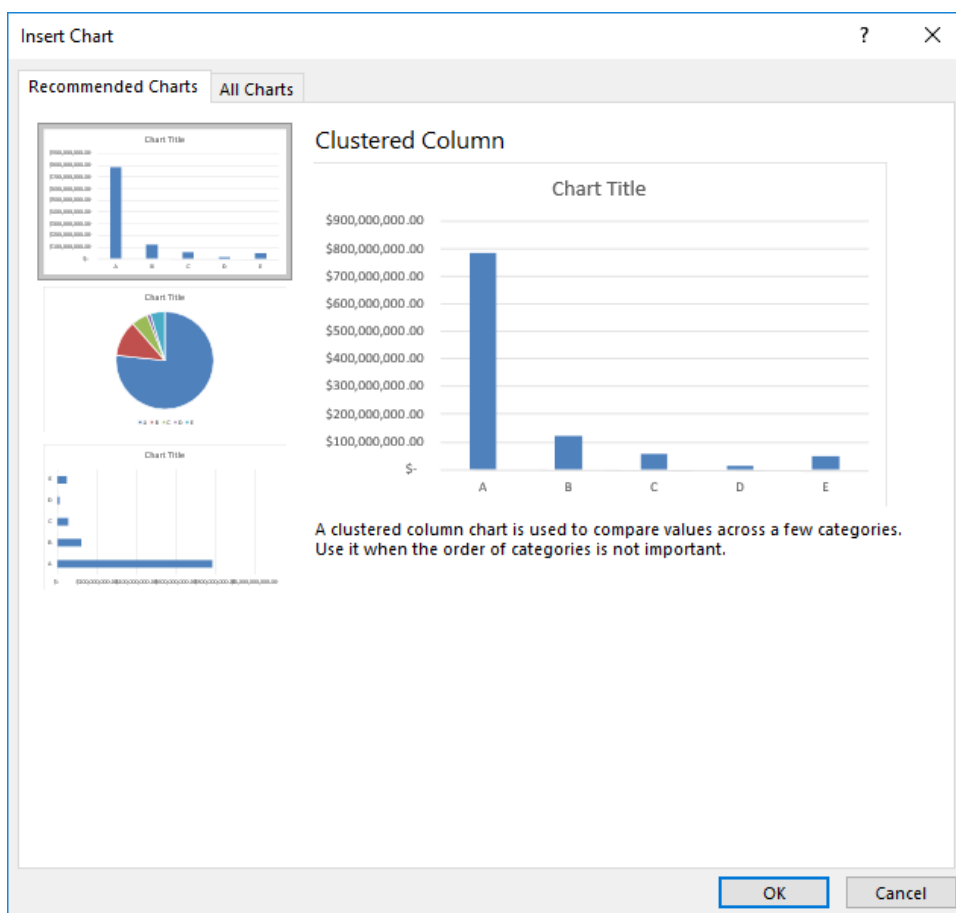
The All Charts tab displays a list of primary chart types on the left, with a gallery of sub-types on the right:
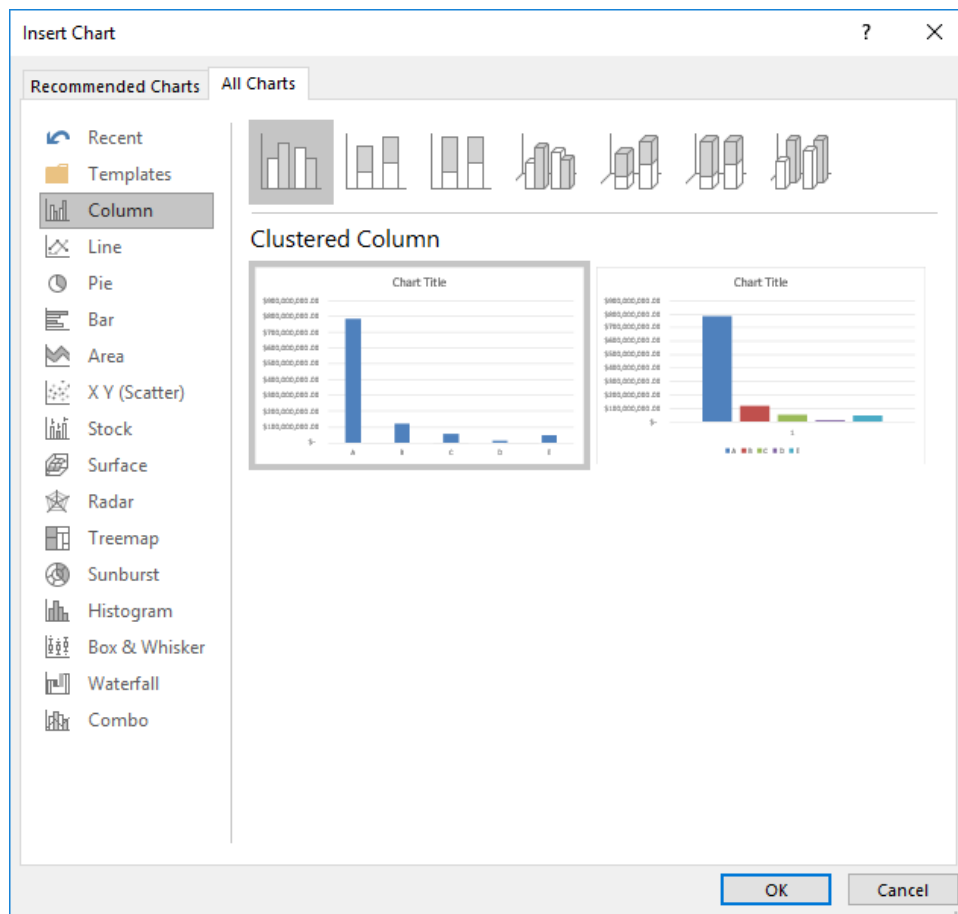
Below is a breakdown of each chart type that is available and what data each type is best suited to display:

- **Column**: Best suited to display data changes over time or to compare separate data points.
- **Line**: Typically used to display data changes over a period of time.
- **Pie**: Used to compare different data points in relation to a total. For example, you could use this chart type to show the total expenses of a company broken down by department.
- **Bar**: Typically this chart type is used to compare different data points. It is similar to the Column chart type, but instead has the X-axis as the vertical axis and the Y-axis as the horizontal axis.
- **Area**: This chart type is typically used to illustrate rates of change over a period of time, as well as include the total value in a trend.
- **X Y (Scatter)**: Used to illustrate values from a variety of different trends and their relationship to one another.
- **Stock**: As the name implies, this chart type is designed to show data fluctuations in a stock market.
- **Surface**: While more complex than other options, this chart type is used to find favorable patterns between two separate data sets.
- **Radar**: This chart type is used to compare values from multiple data sets all on the same chart with each separate data (category) on a separate axis. Typically, this chart type is best suited to identify outliers and commonalities between data points.

- **Treemap**: This chart type is designed to display hierarchical data through nested rectangles. Each branch of the tree is shown as a rectangle which is then tiled with smaller rectangles that show sub-branches.
- **Sunburst**: Displays data hierarchy as a series of rings where each ring represents the children of the ring it encloses.
- **Histogram**: A column chart that is designed to show frequency data.
- **Box & Whisker**: Also known as a box plot, this chart type is designed to depict groups of numerical data as boxes on the chart. These boxes will also have a line that extends from each end (whiskers) that are used to describe upper and lower quartiles.
- **Waterfall**: Sometimes referred to as a flying bricks chart or a Mario chart, this chart type represents data through a series of columns that are suspended in mid-air. These are typically used to understand how an initial value (e.g. sales revenue) is affected by positive or negative values (e.g. staff costs).
- **Combo**: This type of chart combines the features of the bar chart and the line chart. Typically, this type of chart is useful if you need to compare values in different categories.

CHART INSERTION METHODS

When inserting a new chart into a worksheet, you should always have the dataset that you would like represented selected. If you select only one cell within the dataset in question, Excel will automatically try and guess the data range that you are trying to represent. While this is a good idea in theory, this feature does not always work as intended in practice.

Additionally, when you are inserting charts remember to include the row or column header when selecting the dataset. This will ensure that categories that you want plotted along the X axis of the chart are your column labels from the dataset and the data series are row labels. Once the data set, including labels, is selected, you can then insert a chart using one of several options. Perhaps the most direct way is to use the commands inside the Charts group of the Insert tab; however, you can also use the Insert Chart dialog box, or insert the most recommended chart type for the selected data using keyboard shortcuts.

If you would like the most recommended chart type to be inserted onto the same worksheet, you would press Alt + F1. If you want the default chart type to be inserted into a new worksheet, press F11.

RESIZING AND MOVING THE CHART

Once a chart has been added to a worksheet, you are able to resize and move the chart around as you see fit. To move a chart, click to select the chart in question and then drag it to its new destination. Release your mouse button to place it there:
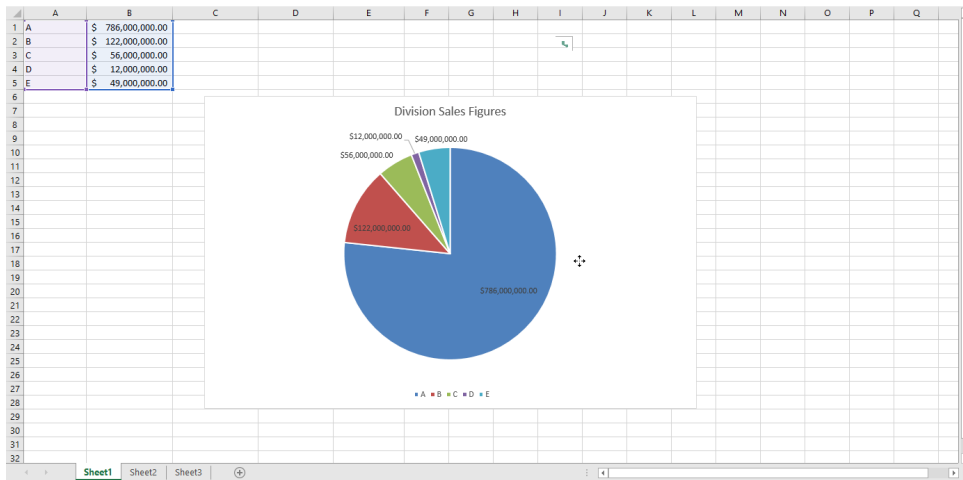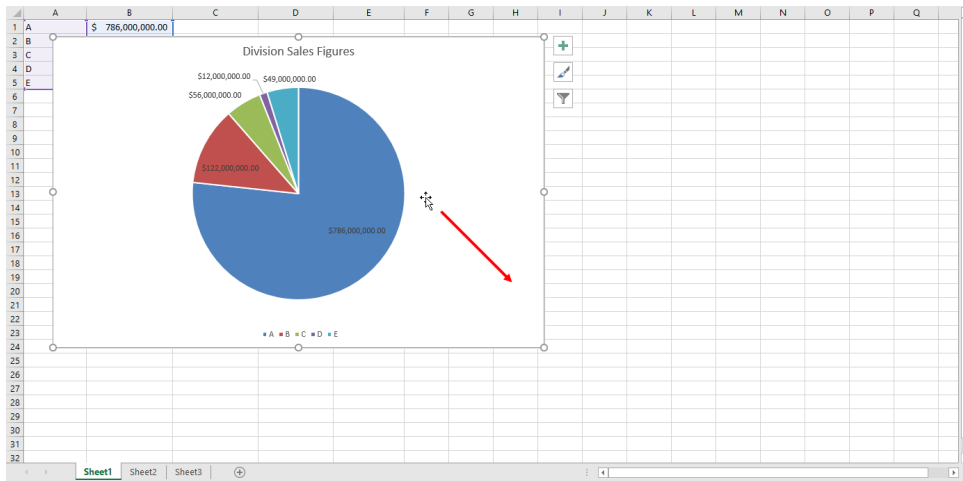
To resize the overall size of a chart, first click to select it. Next, click the Chart Tools – Format tab and examine the Size group. Inside of this group you are able to enter the exact height and width that you would like the chart to use:
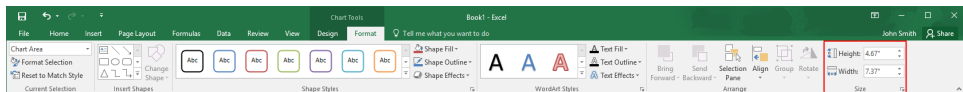
Alternatively, you can resize a chart using the resize handles that appear on each of its sides and corners while it is selected:
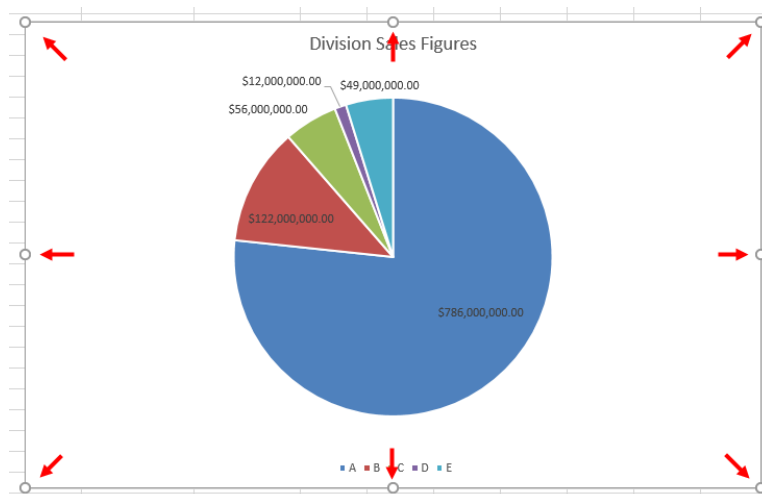
To use these handles click and drag them in the direction that you want the chart enlarged or made smaller. Using the handles on the sides you can modify the chart size in one direction (horizontal and vertical), while the corner resize handles allow you to resize the chart size in both directions at the same time.

You can also find some resize options in the Format Chart Area pane, in the Size & Properties section:
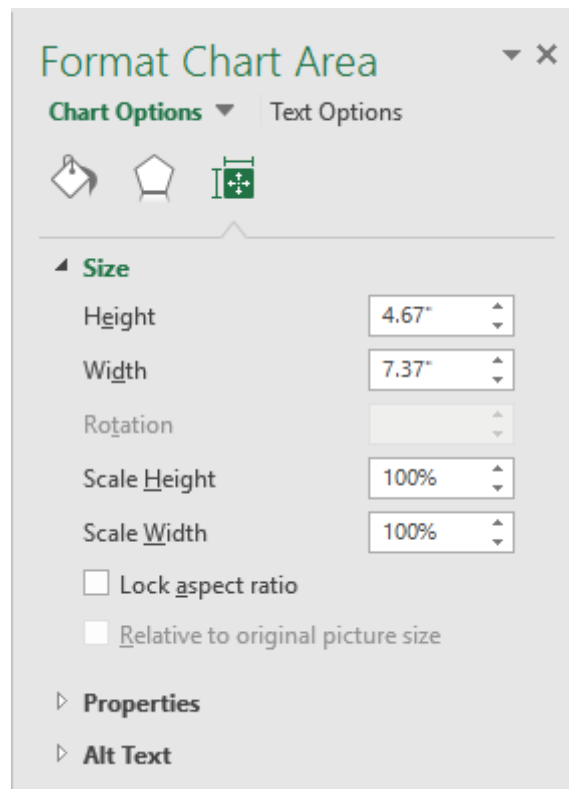
Included are both the Height and Width increment boxes, as well as options to adjust the height and width scaling. You would use the scaling options if you would like to decrease the size of your chart by half (50%) or increase it by half (150%). You will also find the "Lock aspect ratio" check box. When checked this will prevent your chart from getting skewed when you try to change only the height but not the width for example.

ADDING ADDITIONAL DATA

Once a chart has been created, the data that it represents doesn't have to be static. You can add or remove information from the data range and have the chart represent these changes instantaneously. To do this, first click to select the chart in question. While the chart is selected, you will see that the associated data range will appear outlined and shaded in on the worksheet:
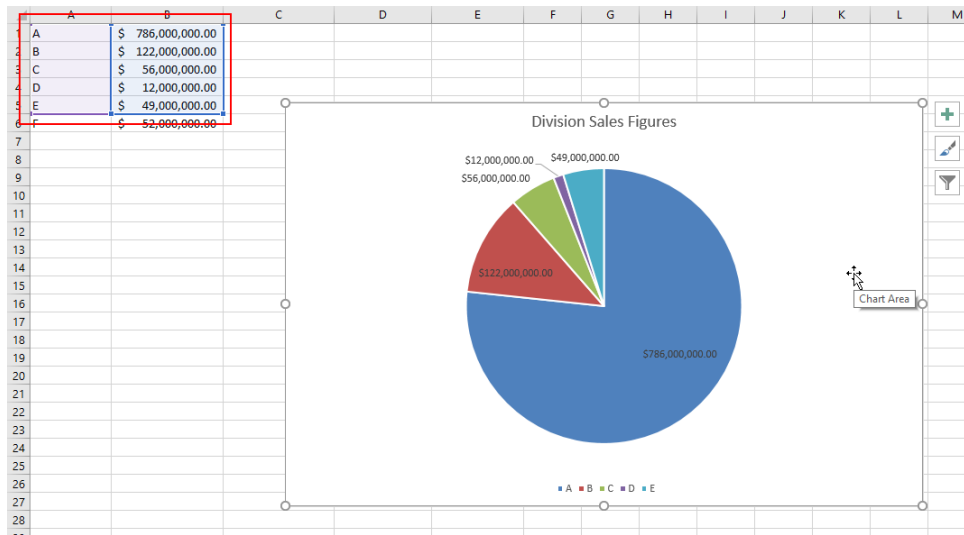
By clicking and dragging the resize handles for these outlines, you can choose which data you would like to include in the chart. For example, if you wanted to include the additional line of information shown in the example above, you would click and drag the resize handle downwards:

Once the range area has been successfully resized, the new data will immediately be incorporated into the chart. In this case you can see that F is now represented:
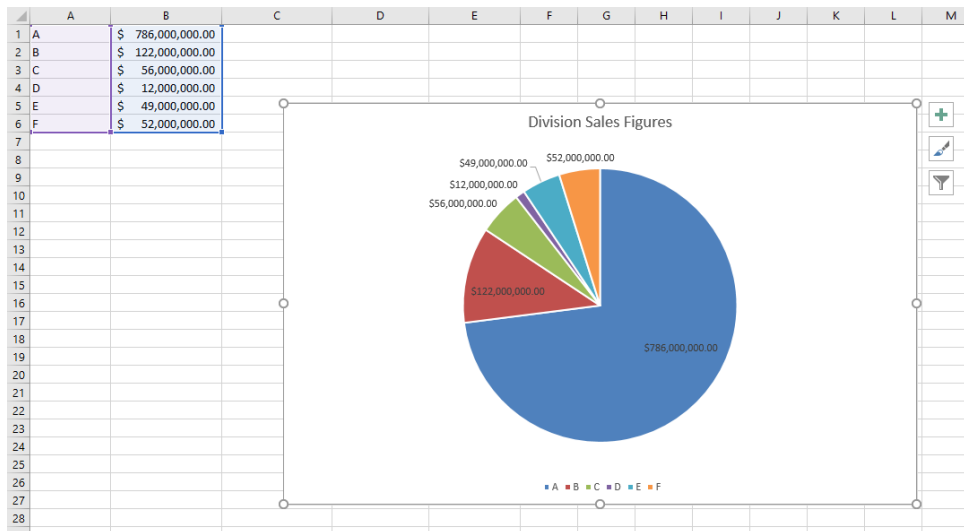
SWITCHING BETWEEN ROWS AND COLUMNS

Occasionally, you may find the need to switch between rows and columns so that your chart represents the data differently. To do this, first click Chart Tools – Design → Select Data:
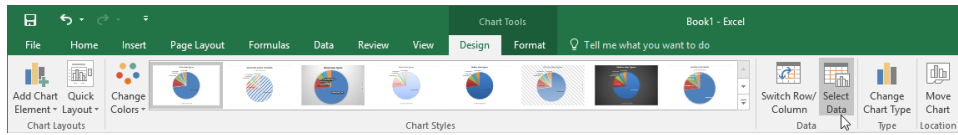
This action will display the Select Data Source dialog box. Click the Switch Row/Column button to swap the rows and columns:
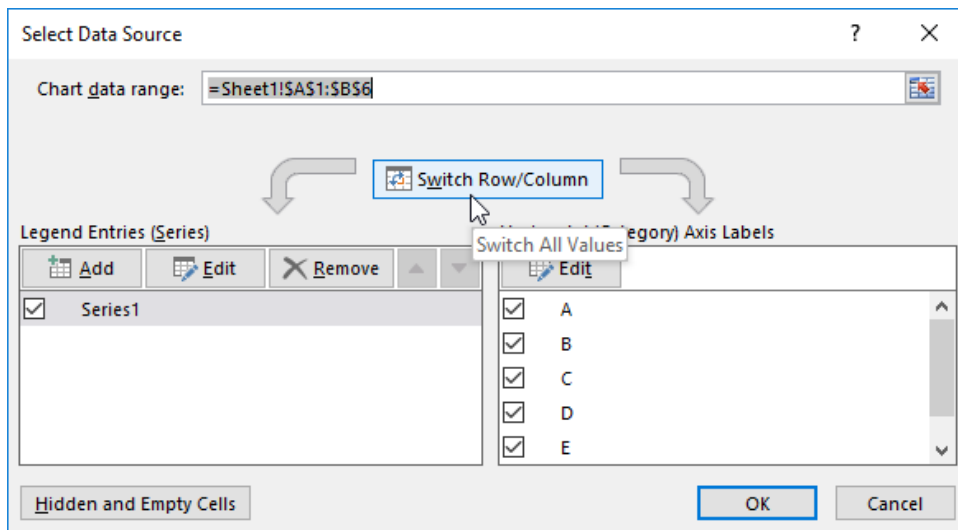
Clicking the OK button will apply the new changes and they will be represented in the chart:
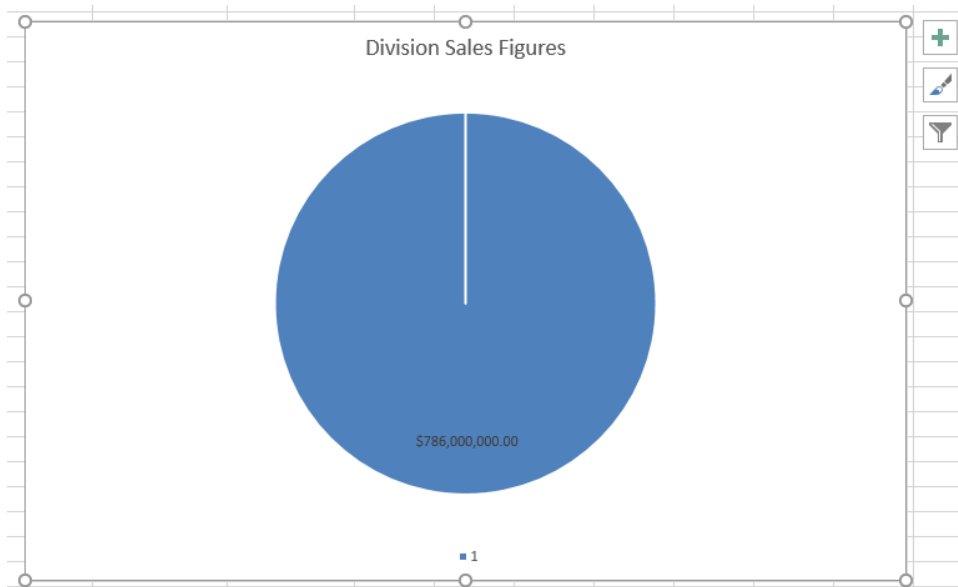
ACTIVITY 4-1

Creating Charts

You need to produce a chart that will easily demonstrate to your supervisor which salesperson made the most sales in week 1.

1. To begin, open Activity 4-1 from your Exercise Files folder:
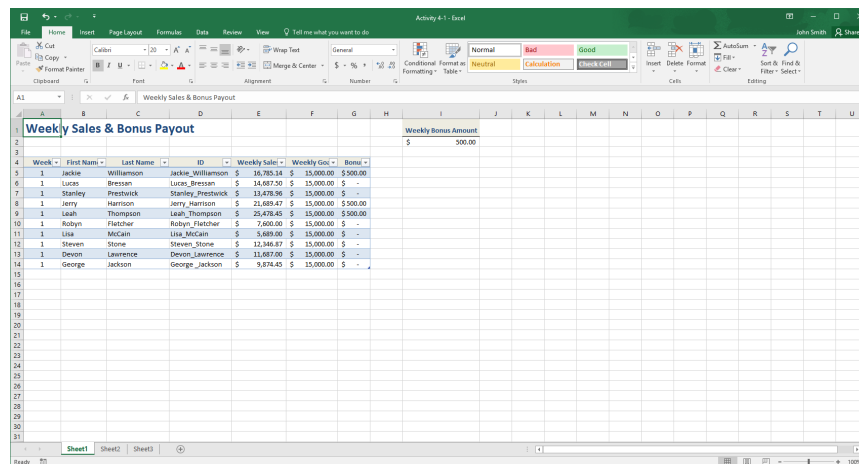
2. First, you need to select the dataset that you would like to work with. Use your cursor to select cells C4:C14 and E4:E14. Remember to hold the Ctrl key down when selecting non-adjacent cell ranges:

3.   Next, click Insert → Insert Column or Bar Chart → Clustered Column:

4.   The new chart will now appear on the current worksheet, overlapping some of the data:

5.   Click and drag this chart to a location on the worksheet where it isn't overlapping anything:
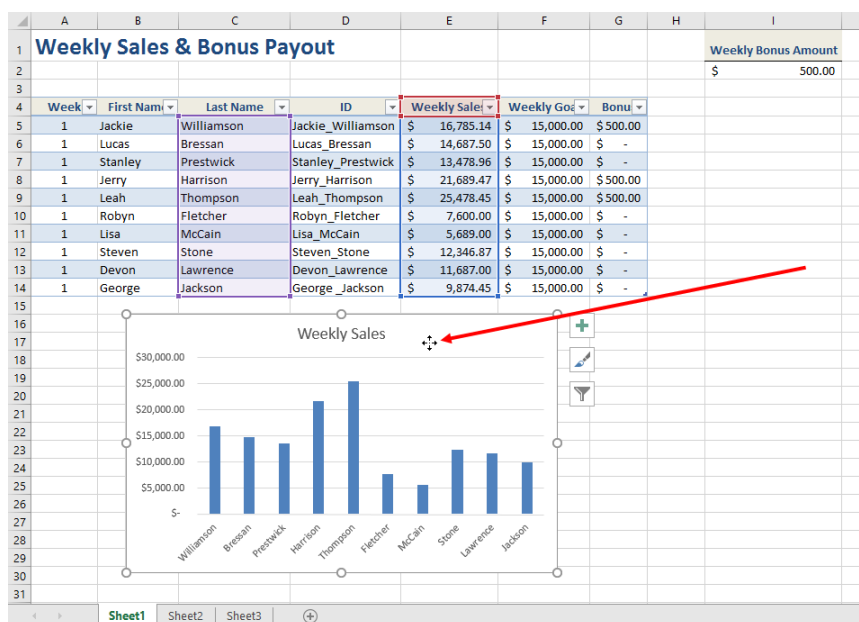
6. Examine the new chart. You will quickly see that Thompson made the most sales in week 1, with Harrison as the next runner up. McCain clearly has some work to do:
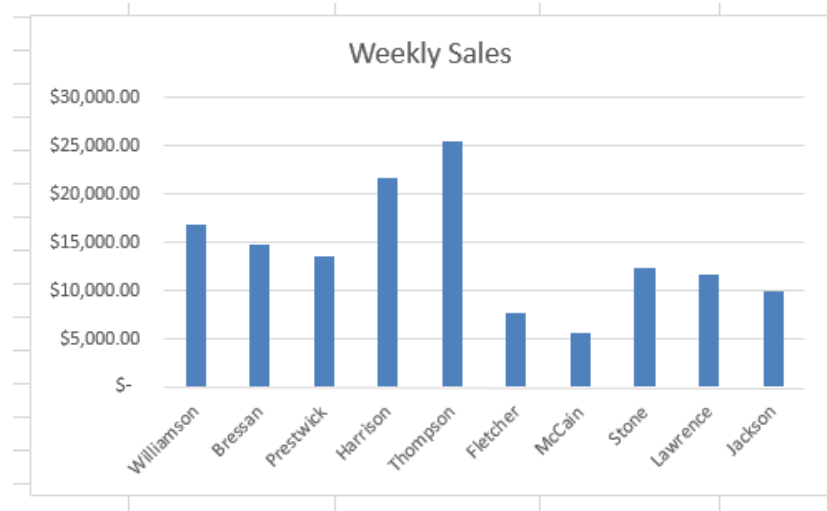
7. Save your worksheet as Activity 4-1 Complete and close Microsoft Excel 2016.

TOPIC B: Modify and Format Charts

Charts can be added quickly and easily using the default chart configurations, but sometimes those configurations are not suitable. In such cases, you will need to know how to modify and format your chart to include more or less data, adjust the size of the chart, and apply company branding.

Topic Objectives
In this topic, you will learn:
- About modification vs. formatting
- About chart elements
- Guidelines for including chart elements
- About the Chart Tools contextual tabs
- About formatting the chart with a style
- How to add a legend to the chart

THE DIFFERENCE BETWEEN MODIFYING AND FORMATTING

While modifying and formatting charts sound like the same thing, they are actually different in this context. When you choose to **modify** a chart, you are changing the various elements that are used to illustrate the data. For example, adding or removing chart elements or changing the chart type would be considering modifying a chart.

Formatting is the process of altering the overall appearance of the chart. This includes changing the chart's colors, fonts, and/or size. For example, if you need to change a chart to incorporate your organization's branding rules, you would in fact be formatting it.

CHART ELEMENTS

Chart elements are the individual pieces of the chart that come together to create it. There will always be at least one chart element present in a chart, but the combination of chart elements largely depends on the chart type. Here is a sample column chart:
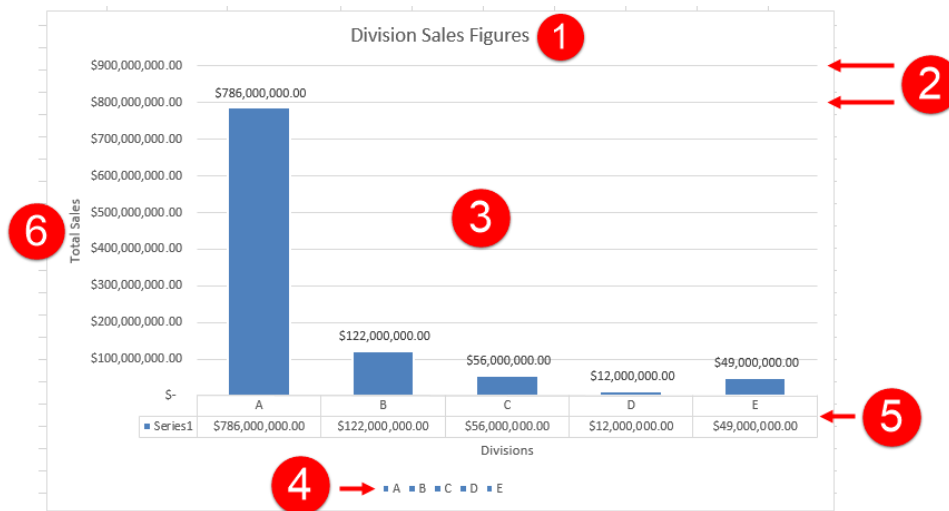
The above chart contains six chart elements: Chart **Title (1)**, **Gridlines (2)**, **Data series (3)**, **Legend (4)**, **Data table (5)**, and **Axis Titles (6)**.

MINIMIZE EXTRANEOUS CHART ELEMENTS

When modifying charts, you can have a significant impact on how and what information is conveyed. Due to this fact, it is best to keep your charts as simple as possible. This will allow the data to speak for itself without cluttering it with extraneous information that the chart was trying to simplify in the first place. However, there are some instances where chart elements can help add meaning and context to the information being displayed. For example, the legend can be helpful when you are dealing with multiple sets of data, but less so when you are working with only one dataset.

THE CHART TOOLS CONTEXTUAL TABS

When a chart is selected on the workspace, the Chart Tools contextual tab set will become available on the ribbon. This contextual tab set contains two tabs that allow you to change various aspects of the selected chart.

The Chart Tools – Design Tab
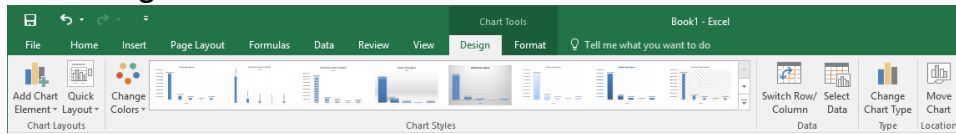
The Chart Tools – Design tab includes commands to change the overall appearance of the selected chart. This includes things like adding and removing chart elements, changing the chart layout, colors, and applying chart styles. Additionally, this tab gives you access to commands to change the chart's dataset range and switch row and column data. The Type group contains a command to change the chart type, while the Location group contains a command that is used to move charts between worksheets in the current workbook.

The Chart Tools – Format Tab
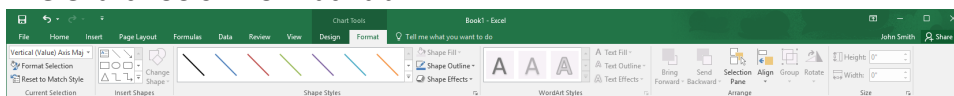
On the Chart Tools – Format tab, the Current Selection controls allow you to select individual chart elements to edit, as well as access the Format Selection dialog box. Shape styles can be applied and configured using the commands in the Shape Styles group. The WordArt Styles group is used to configure and format chart text. Inside the Arrange group you will see controls to change the layered order of elements on a chart, as well as change the orientation of selected chart elements. Finally, the Size group is used to view and change the overall size of the currently selected chart.

FORMATTING THE CHART WITH A STYLE

Chart styles are used to slightly adjust how a chart is laid out without changing the primary color scheme. This is excellent for adding a little visual flair to your chart and on occasion a new chart style can also help a chart's readability.

To format a chart with a style, first click to select the chart in question and then click Chart Tools – Design. Examine the Chart Styles group and you will see a gallery of different chart styles that you can choose from:
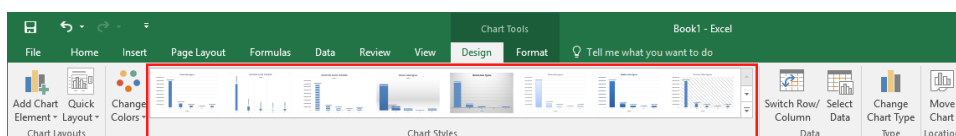
Move your cursor over these chart styles and you will see a preview of how these styles will look once applied to your chart. Clicking on a style will apply it:
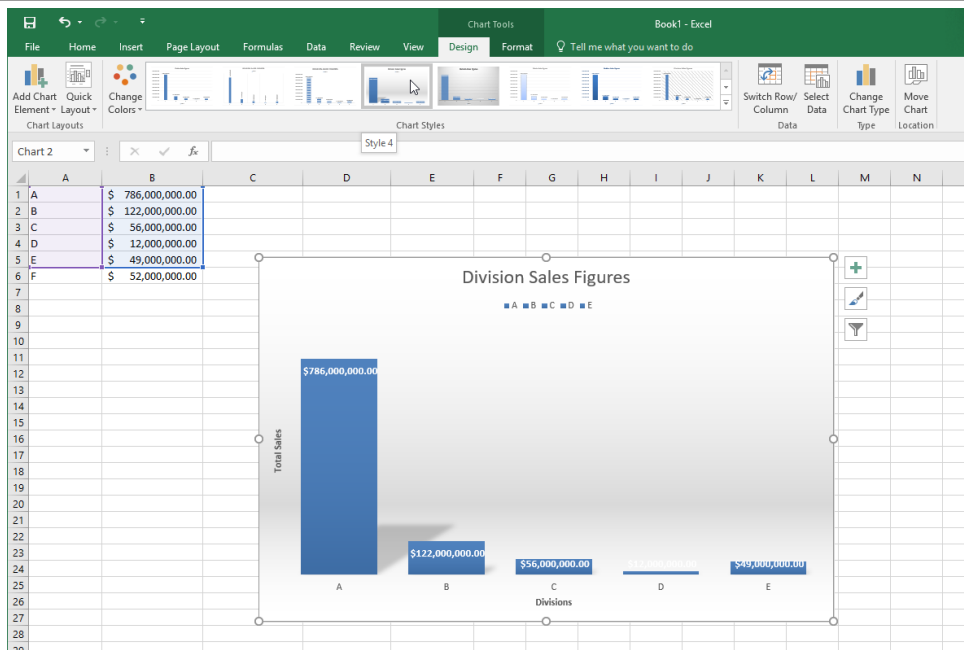
You can also find these styles by clicking the Chart Styles button that appears to the top right of a selected chart:

This button will display a scrolling menu of the same chart styles that you can select from:
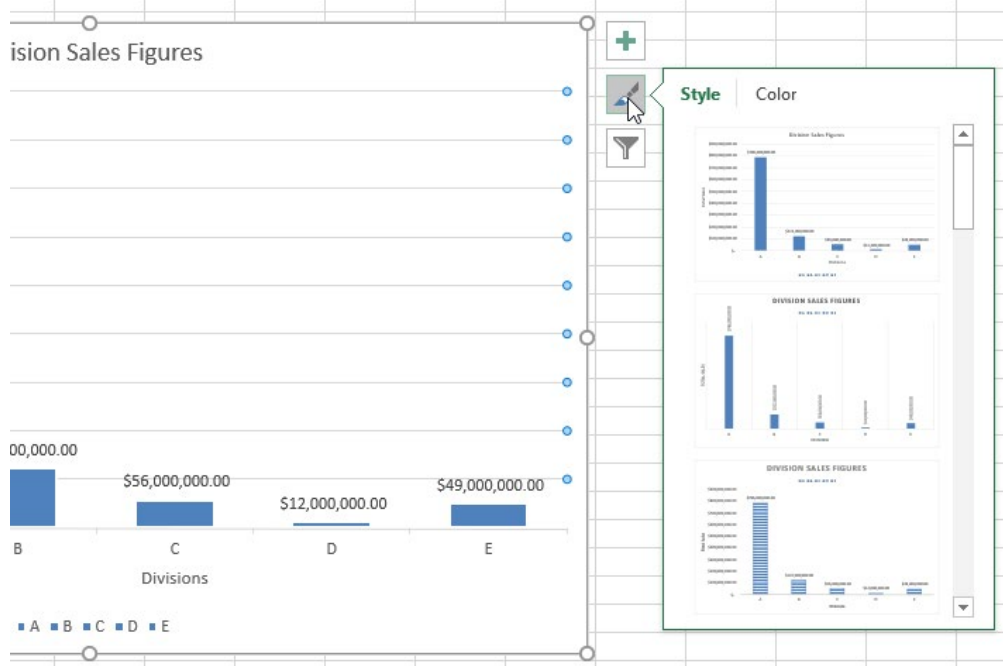
ADDING A LEGEND TO THE CHART

When working with charts, legends can be very important to the understanding of the data that a chart is trying to convey. While legends are usually displayed by default, you are able to toggle this legend on or off, as well as reposition it. To do this, select the chart in question by clicking Chart Tools – Design → Add Chart Element → Legend → [Position]:
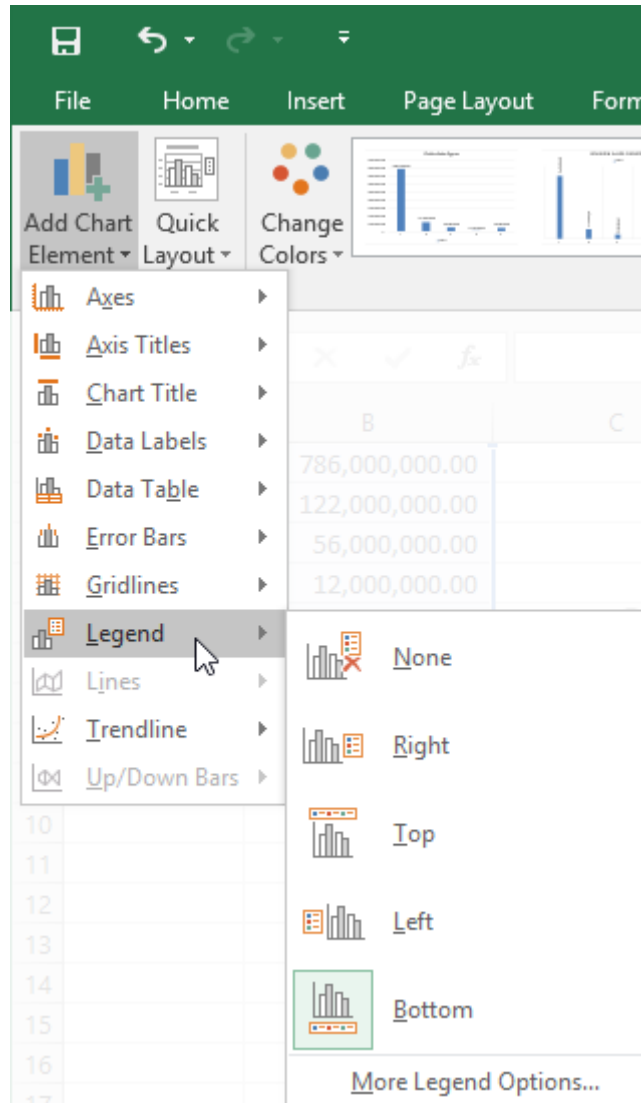
Alternatively, you can use the Chart Elements buttons and submenu that appears near the top right-hand corner of a selected chart.

ACTIVITY 4-2

Modifying and Formatting Charts

You have created a chart that illustrates the weekly sales made by your sales staff. While it doesn't look terrible, you think it could use some sprucing up. Additionally, it looks as though George Jackson's data has been accidentally left out of the chart.

1.   To begin, open Activity 4-2 from your Exercise Files folder:
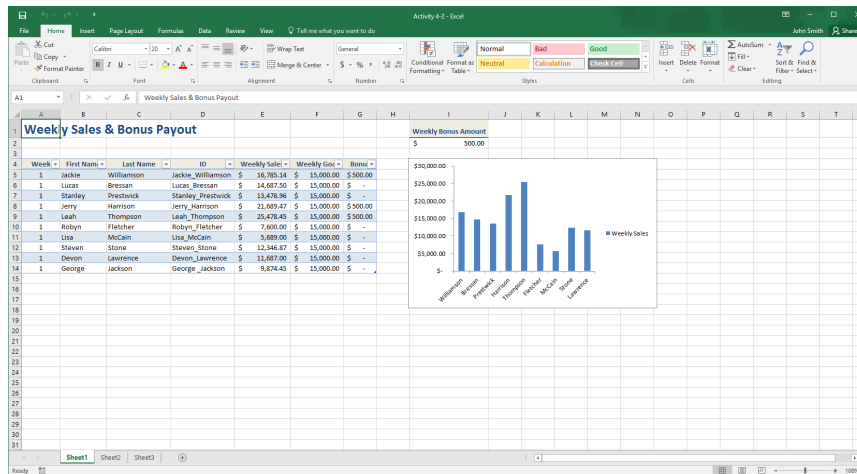
2.   Click to select the chart on the current worksheet. You will see the Chart Tools contextual tab set appear on the ribbon:
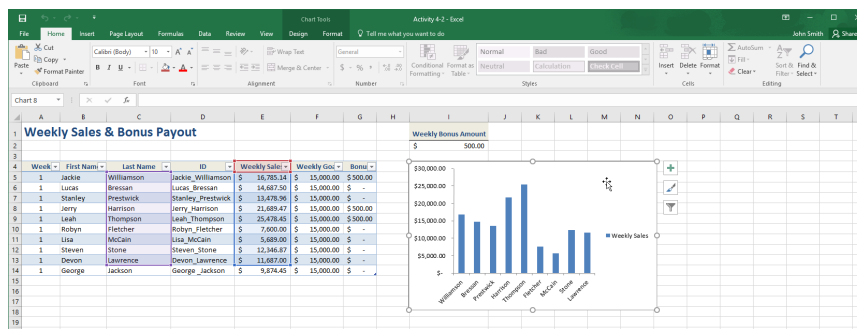

3.   First, you should add a title to this chart. Click Chart Tools – Design → Add Chart Element → Chart Title → Above Chart:
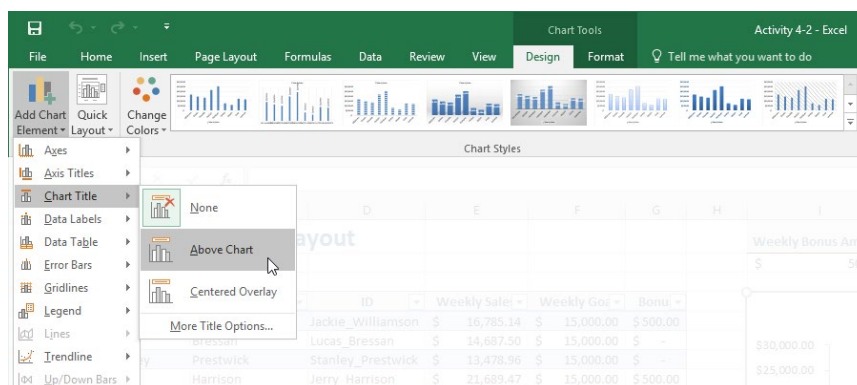
4. The chart title will now be displayed above the data series on the chart:
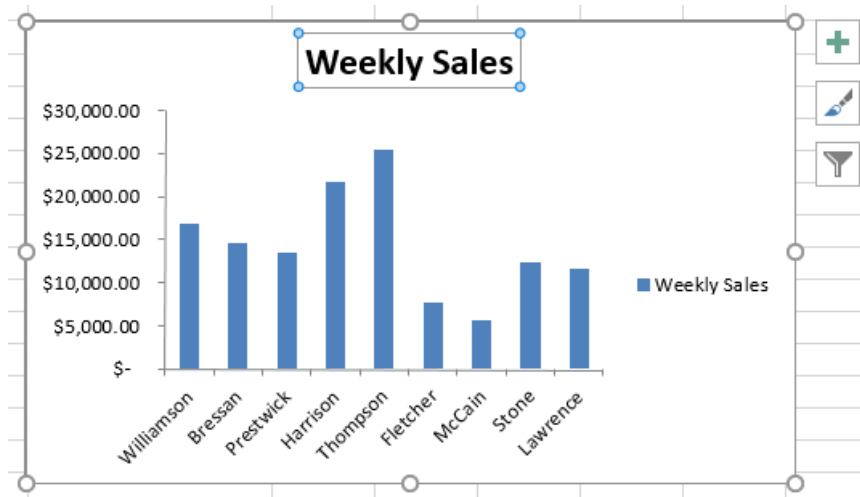
5. Next, you should add gridlines to make this chart a little easier to read. Click to select the chart and then click the Chart Elements button that appears near the top right-hand corner:
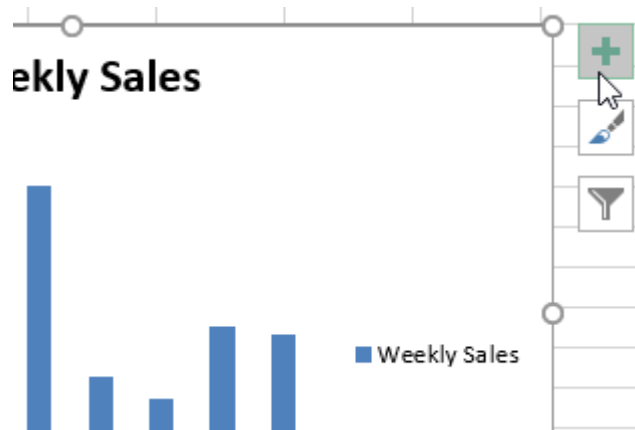
6. From the menu that appears, check the Gridlines check box:
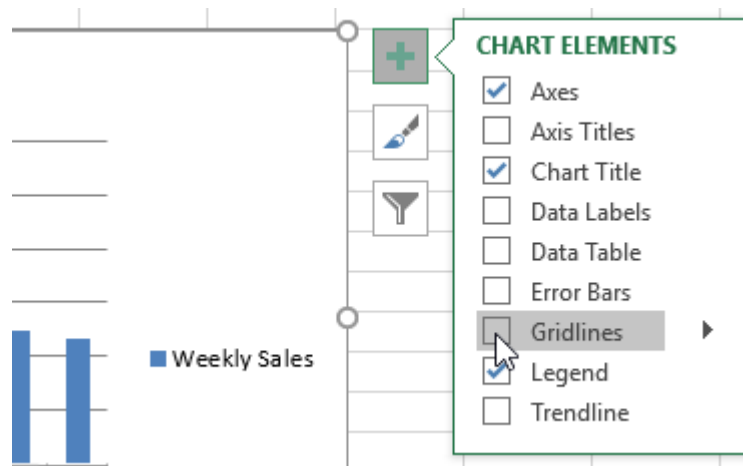
7.   Major gridlines will now be displayed on the chart:
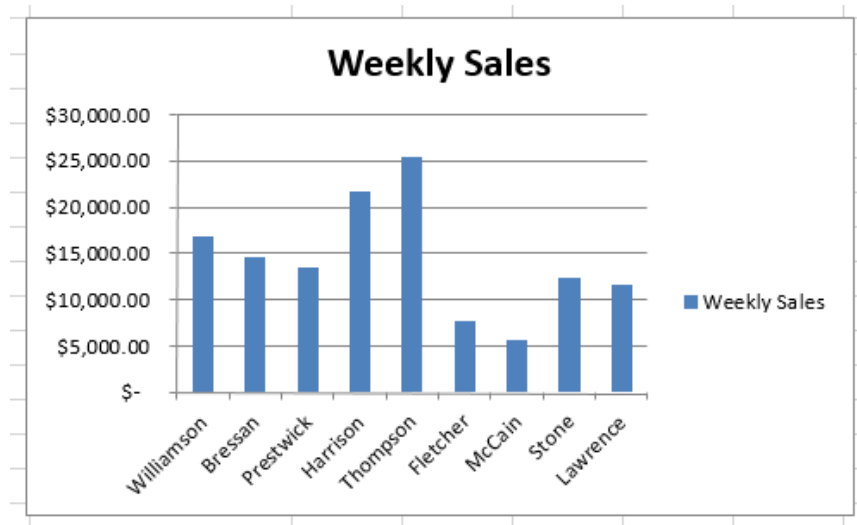
8.   Finally, you might as well remove the legend as it is pretty self-evident what this data represents. Click Chart Tools – Design → Legend → None:
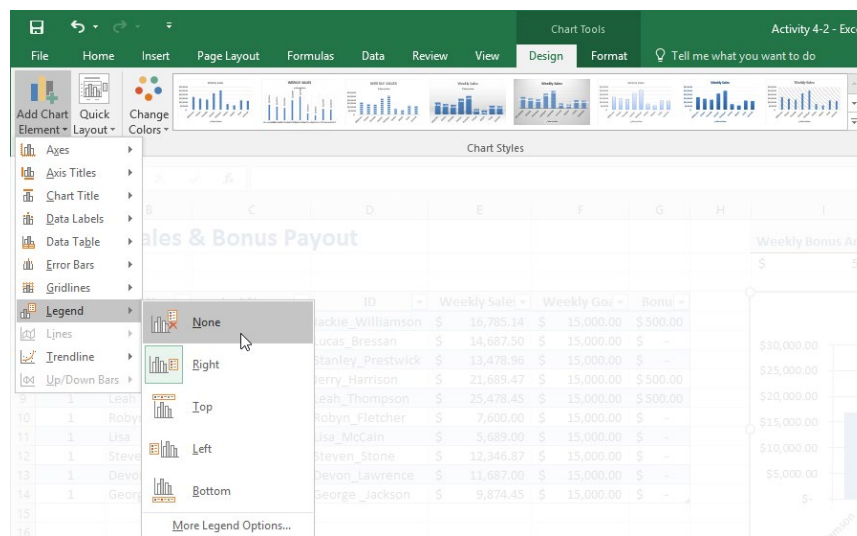
9.   Now you need to adjust the color of this chart. Click Chart Tools – Design. Within the Chart Style gallery, click any of the chart styles presented:
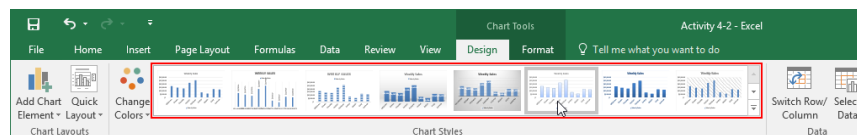
10. The new style will now be applied to the selected chart:
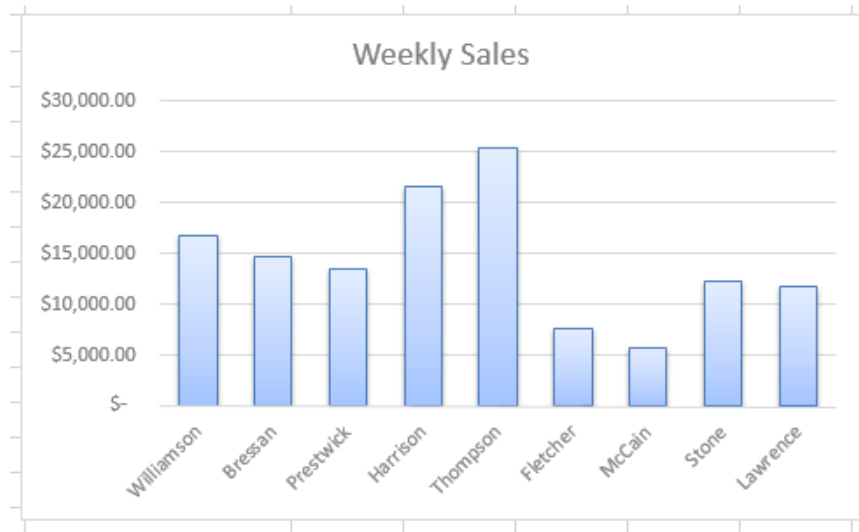
11. Save your work as Activity 4-2 Complete and close Microsoft Excel 2016.

TOPIC C: Create a Trendline

Trendlines are designed to help you better understand the data that a chart shows, as well as try and predict future data points. Over the course of this topic, we will learn all about trendlines, the different types that are available, and how to add them.

Topic Objectives
In this topic, you will learn:
- About trendlines
- About the types of trendlines
- How to add a trendline
- About the Format Trendline task pane

TRENDLINES

Trendlines are used to graphically depict trends that exist within your data or show a forecast of future data in a chart. For example, here you can see a trendline that forecasts two years ahead that shows a trend towards increasing revenue:
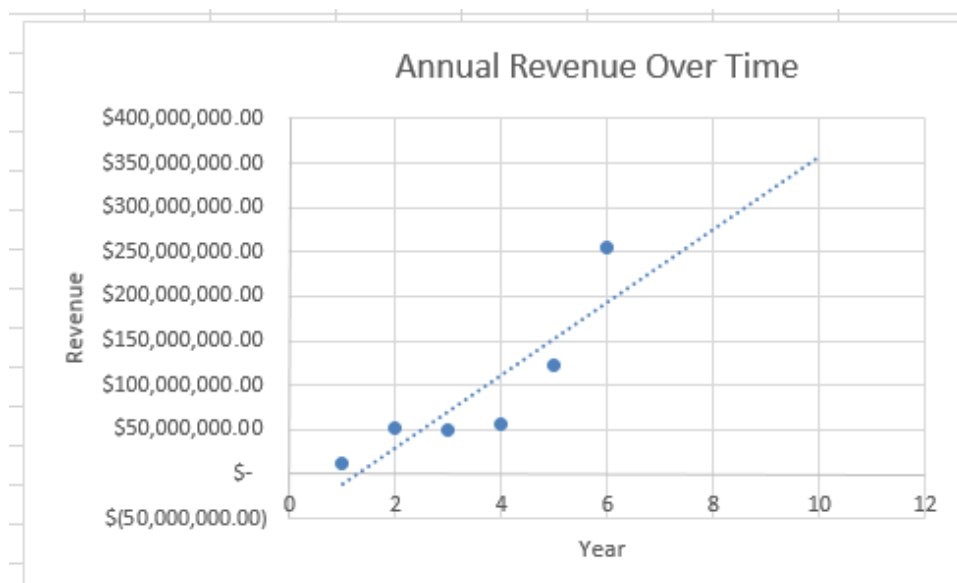
TYPES OF TRENDLINES

Excel includes six different trend types that you can add to a chart. The type of trendline that you add depends on the type of data that the chart represents. Let's breakdown each type of trendline and the type of data that they are best suited to represent:

- Exponential – These types of trendlines are curved to illustrate data rising or falling at constant rates:
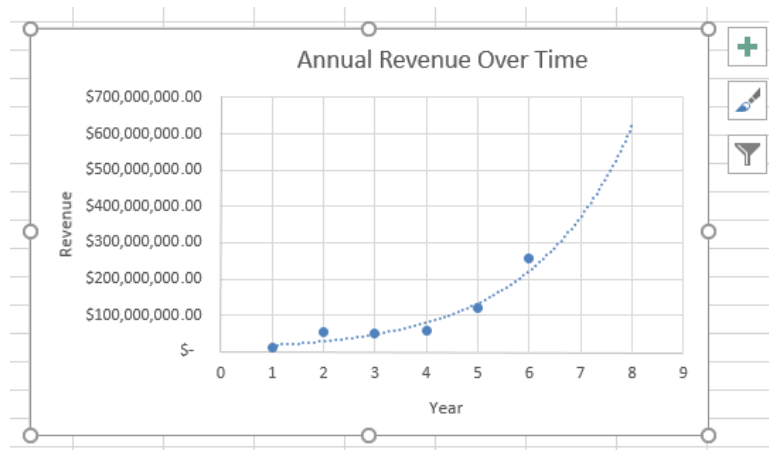
- Linear – This trendline is typically used to represent simple linear data sets. It is a way to illustrate that something is increasing or decreasing over time:
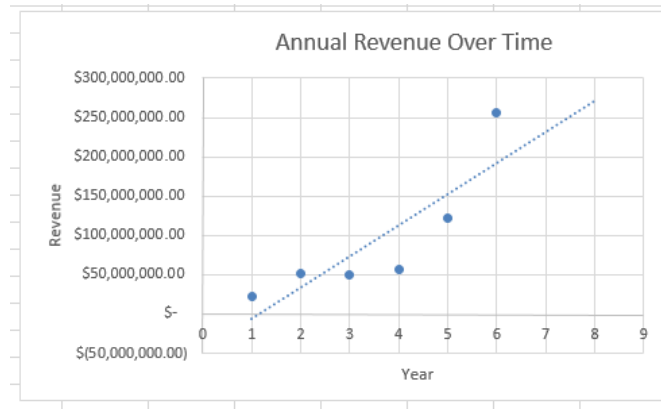
- Logarithmic – This trendline is best suited for data that changes quickly and then evens out over time:
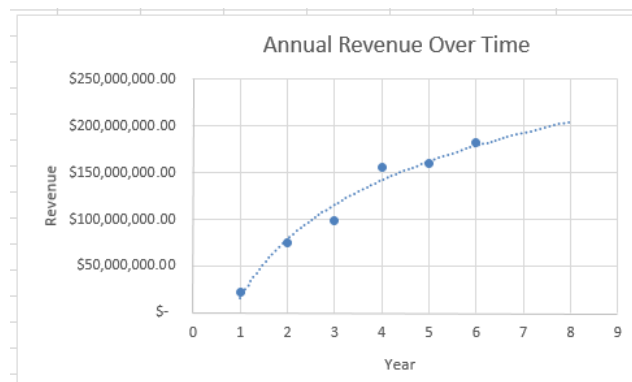
- Polynomial – This type of trendine is curved to help illustrate fluctuating data points. It is divided in three orders: Order 2, Order 3, and Order 4. Order 2 trendlines include one hill or valley. Order 3 trendlines have one or two hills or valleys, while Order 4 trendlines have up to three hills or valleys:
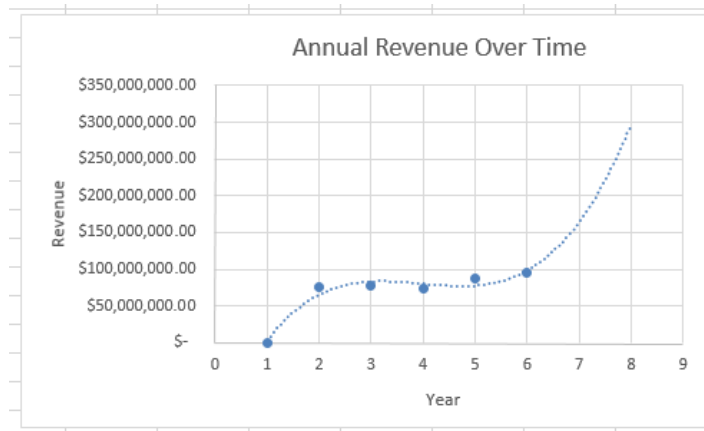
- Power – This type of trendline is also curved, but is used with data sets that compare measurements at a specific rate. For example, you could use this trendline to measure acceleration over time:
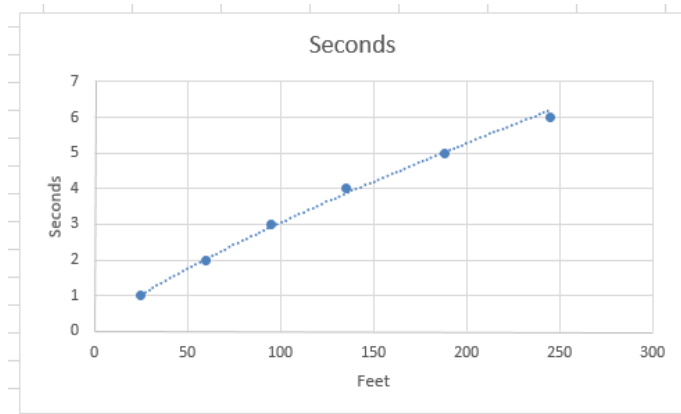
- Moving average – This type of trendline is intended to smooth out data that includes a lot of fluctuation. It does this by averaging a chosen number of data points. The number of data points is decided by setting the Period option. If this option is set to "2" then the first two points will be used to create the trendline:
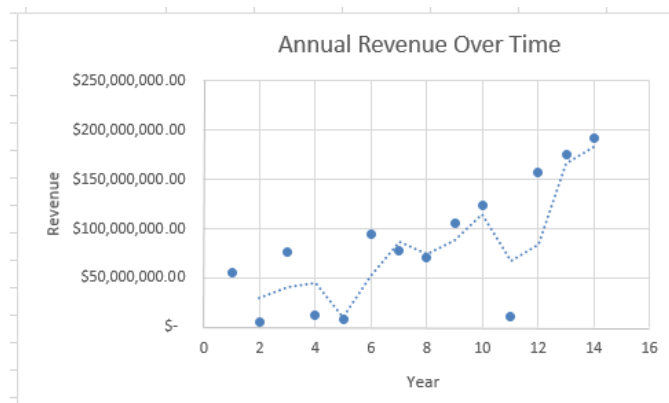
ADDING A TRENDLINE

Trendlines can be added to charts in Excel through a number of different methods. The first is to select the chart in question and then click Chart Tools – Design → Add Chart Element → Trendline → [Trendline]:
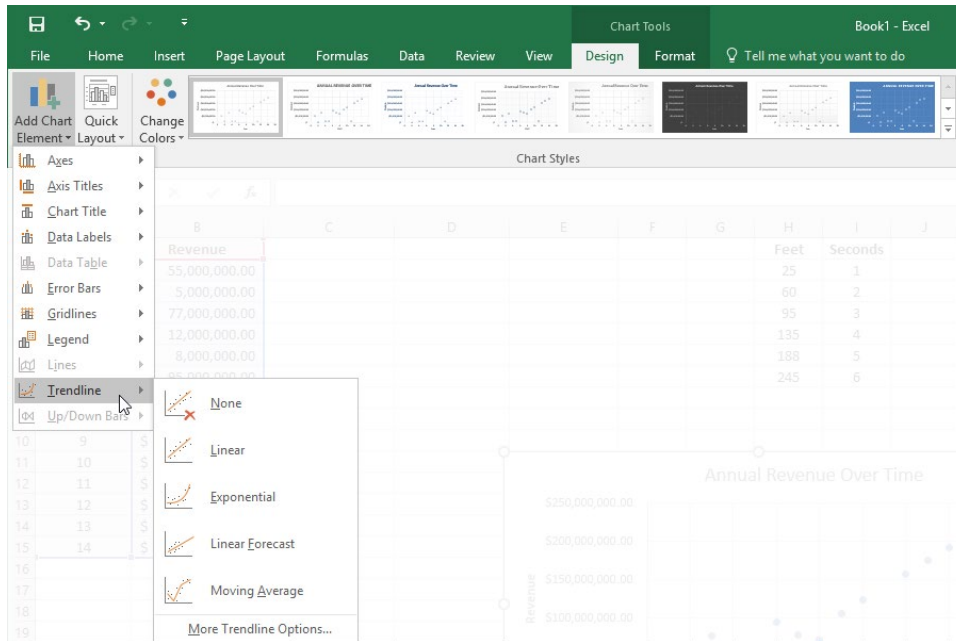
Alternatively, you can click to select the chart in question to display the Chart Elements button. Click this button and click the arrow icon that appears next to the Trendline listing. Click the trendline that you would like to add:
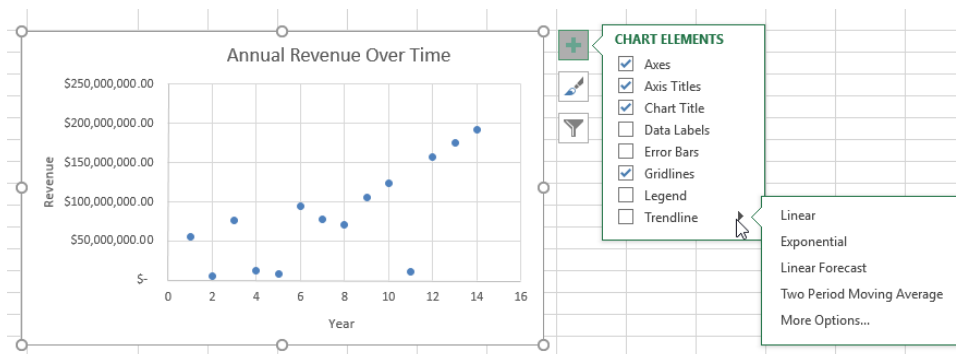
THE FORMAT TRENDLINE TASK PANE

The Format Trendline task pane allows you to add and modify a trendline
In a number of different ways. To open this task pane, click Chart Tools – Design → Add Chart
Element → Trendline → More Trendline Options:
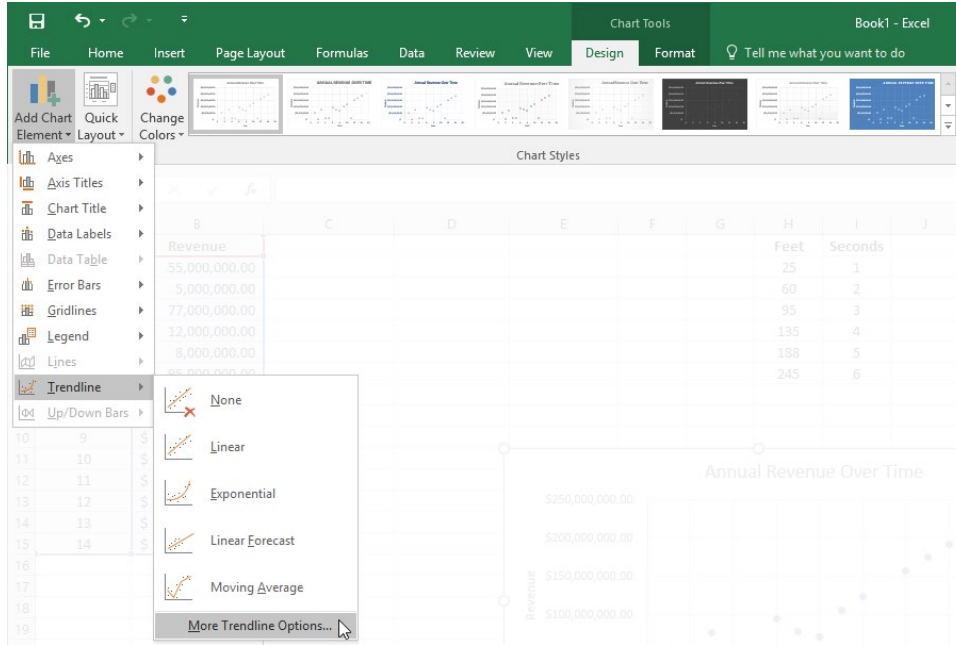
Alternatively, you can click More Options from the Trendline submenu when the Chart Elements
button is clicked:
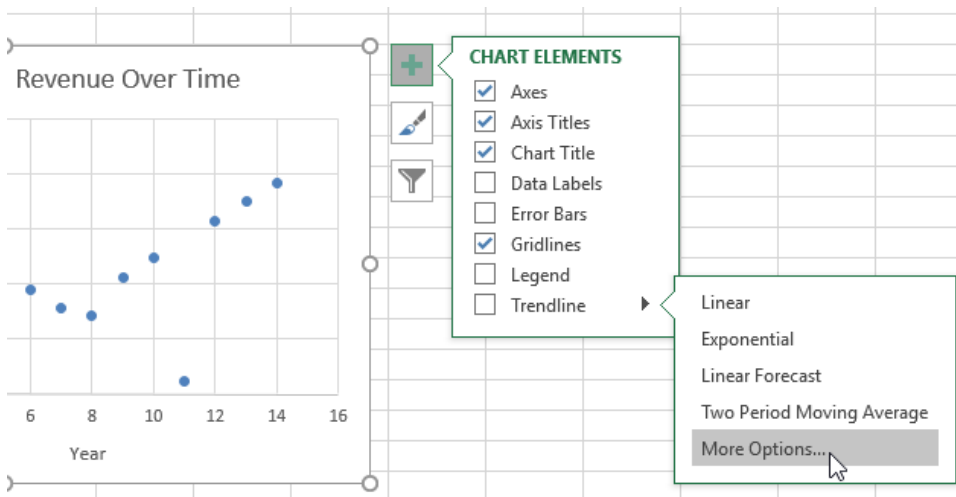
ACTIVITY 4-3

Create a Trendline

You would like to add a moving average trendline to a chart that illustrates sales data over the period of several weeks.

1.   To begin, open Activity 4-3 from your Exercise Files folder:
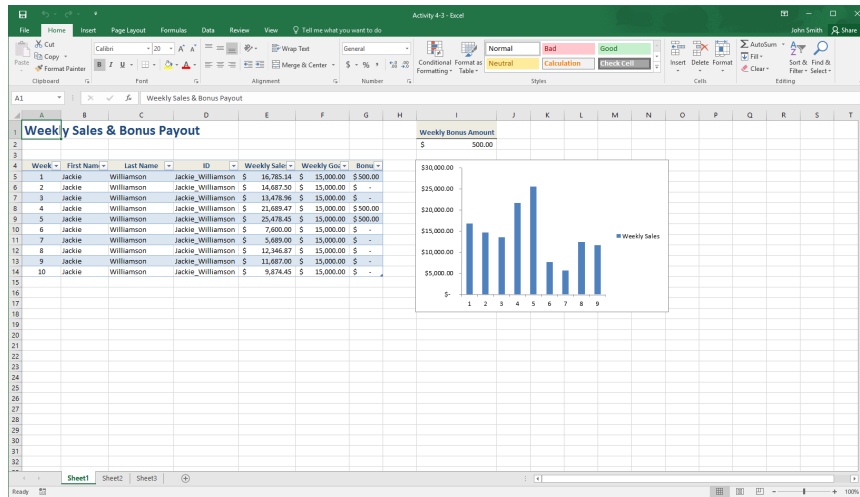
2.   Click to select the large chart that appears on Sheet1 of the current workbook:
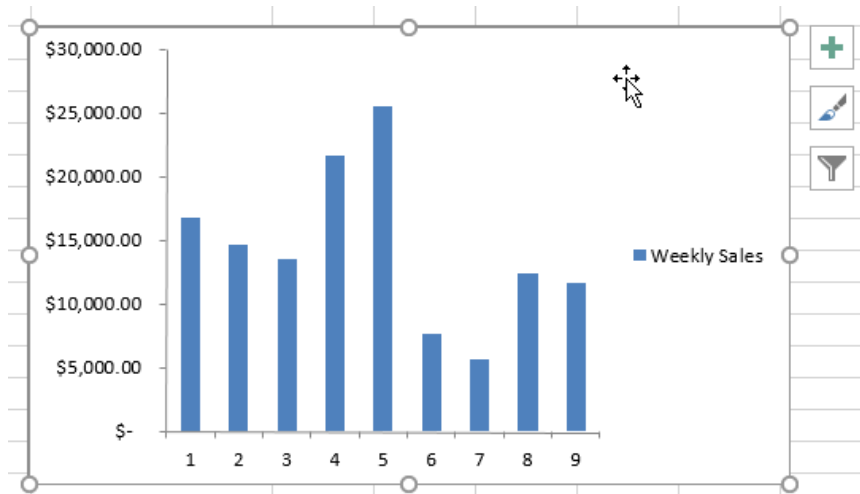
3. Click Chart Tools – Design → Add Chart Element → Trendline → More Trendline Options:
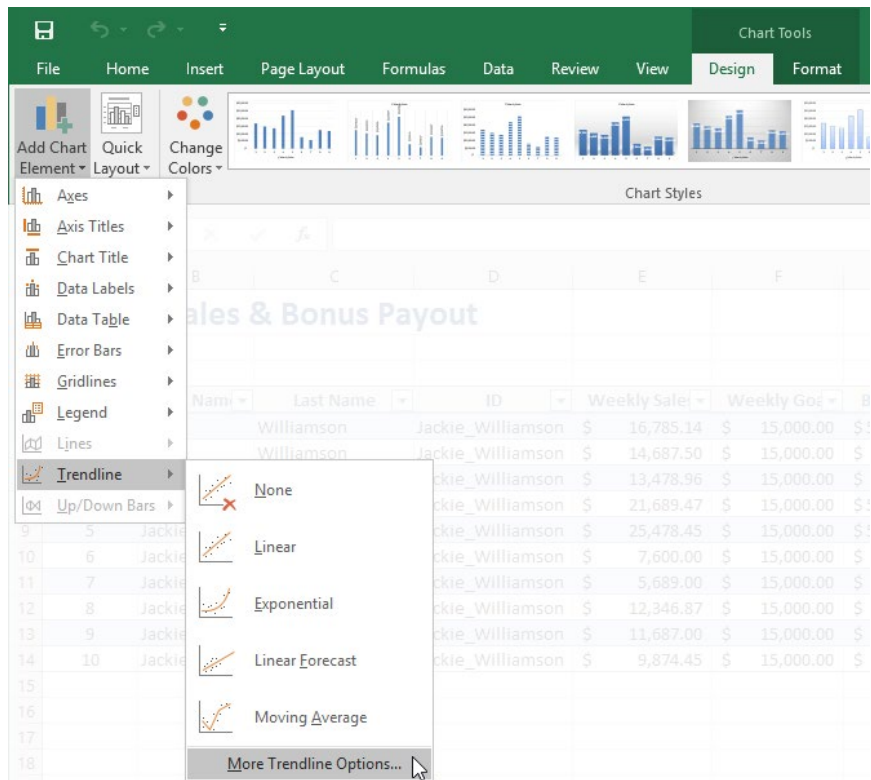
4. The Format Trendline task pane will now appear on the right side of the Excel window. Click the Moving Average radio button:
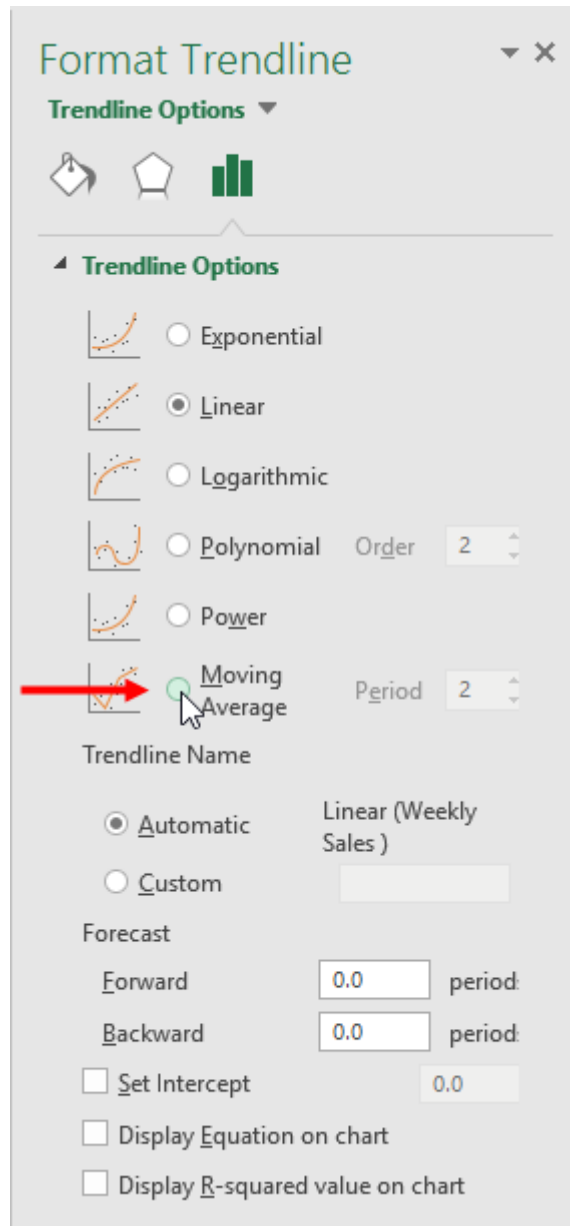
5. Ensure that the Period setting is set to "2" and that the Trendline Name radio button is set to Automatic:
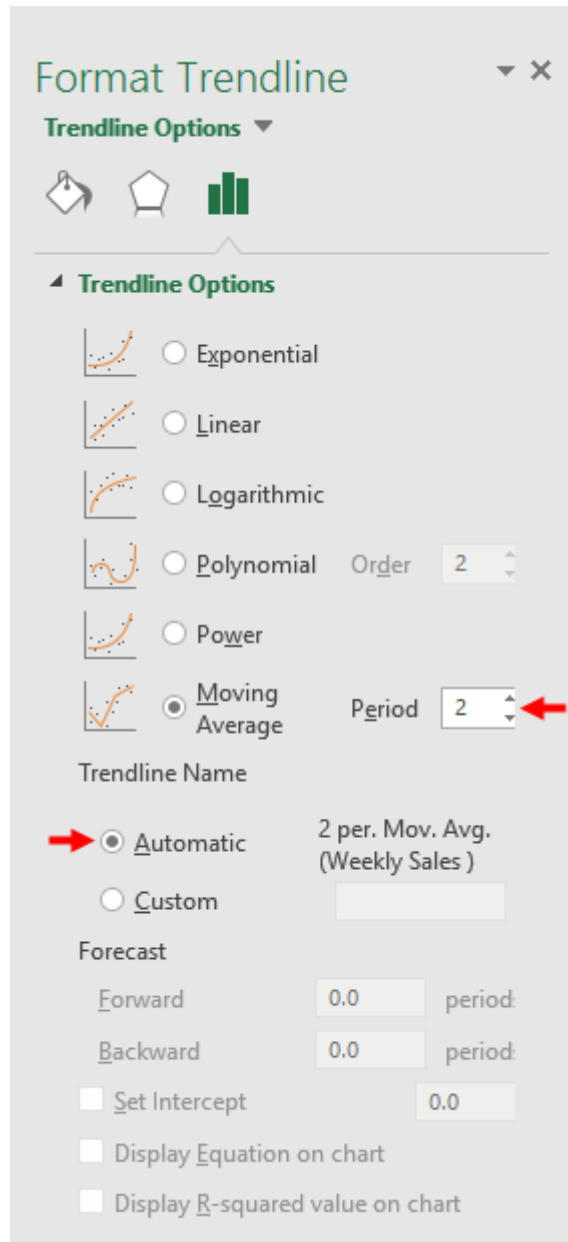
6.   Close the Format Trendline task pane by clicking the Close button (✖) in its upper right-hand corner:
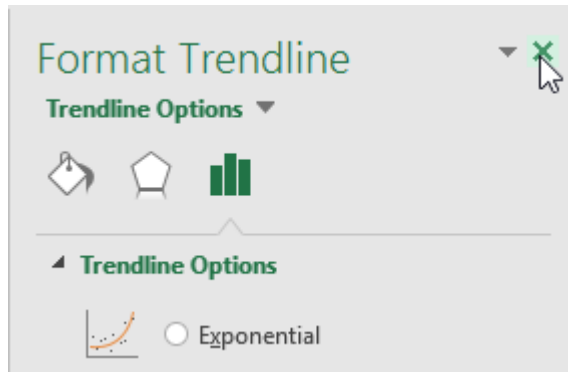
7.   Examine the graph and you will see that the trendline that has been added better illustrates the fluctuation in this data over time:
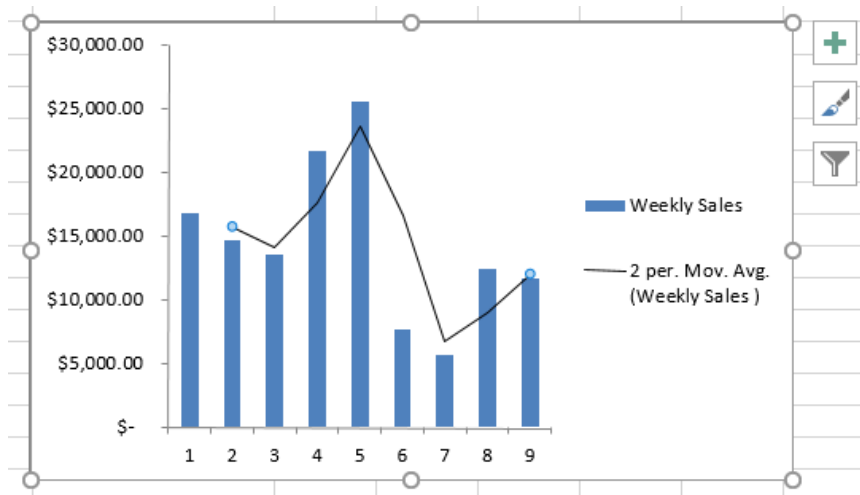
8.   Save you changes as Activity 4-3 Complete and then close Microsoft Excel 2016 to complete this exercise.

TOPIC D: Create Advanced Charts

Beyond the basic chart types that are available and the simple modifications that you can make to them, Excel 2016 offers more advanced charts that can be used to represent your data. Over the course of this topic you will learn how to create advanced charts.

Topic Objectives
In this topic, you will learn:
- About dual axis charts
- How to create custom chart templates
- How to view chart animations

DUAL AXIS CHARTS

A chart in Excel 2016 is capable of displaying two different (but related) pieces of data through dual axis. For example, if you wanted to see the total sales of a company, as well as the percentage of those sales that were from international customers, a dual axis chart can do this for you by including a second scale.

To create a dual axis charts, first select all of the data that you would like to include in the chart and then insert a chart using a preferred chart type. In the example a clustered column has been chosen:
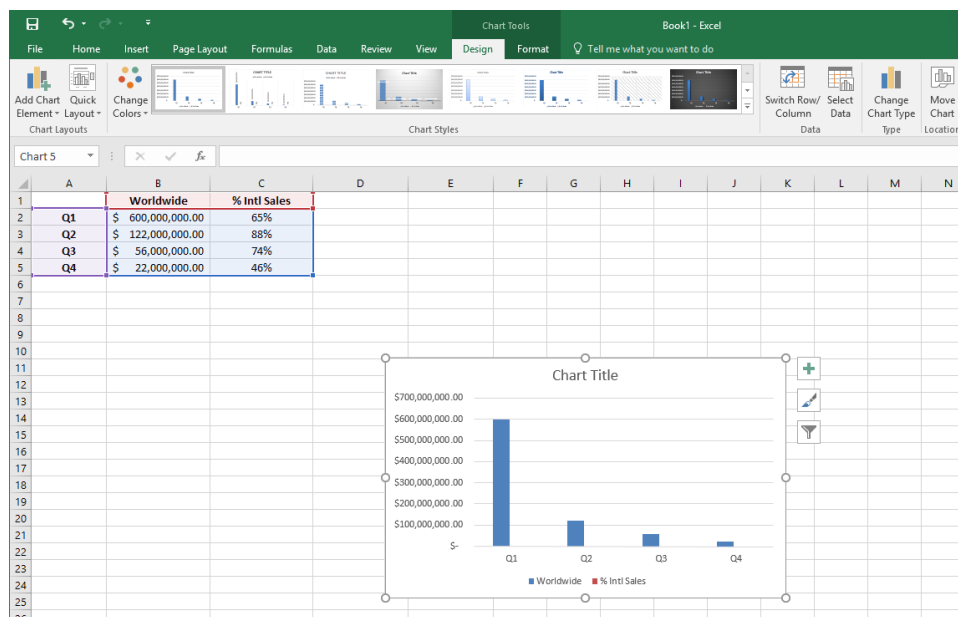
Next, click the Chart Tools – Format tab. Click the Chart Elements drop-down menu from the top left-hand corner of this tab and click the series that you would like to appear on the second axis. This example "% Intl Sales" is being selected:
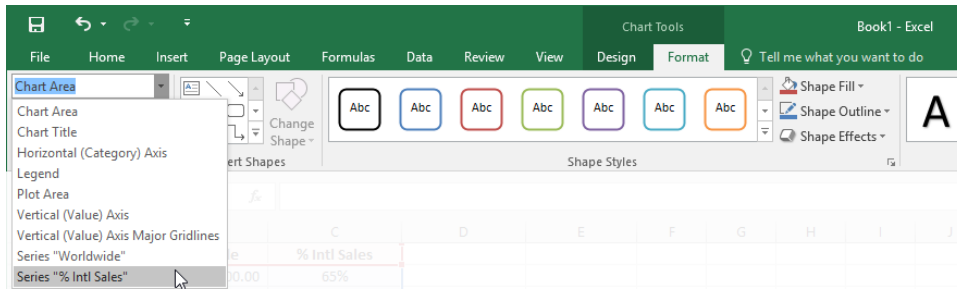
With the series in question selected, click Chart Tools – Format → Format Selection:
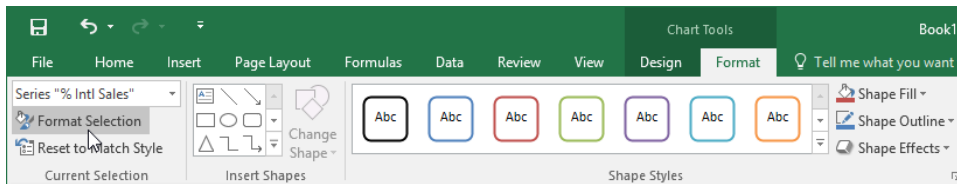
The Format Data Series task pane will now be displayed on the right hand-side of the Excel window. Click the Secondary Axis radio button:
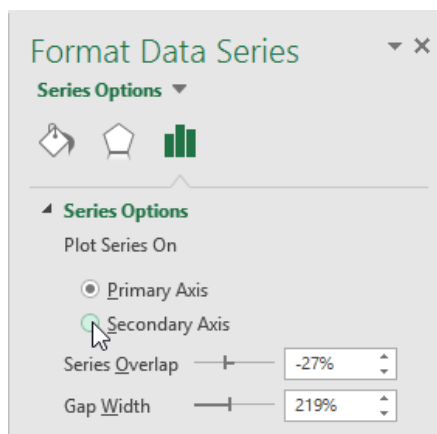
Depending on the chart type that you are using, you may find that the secondary axis will overlap the primary one:
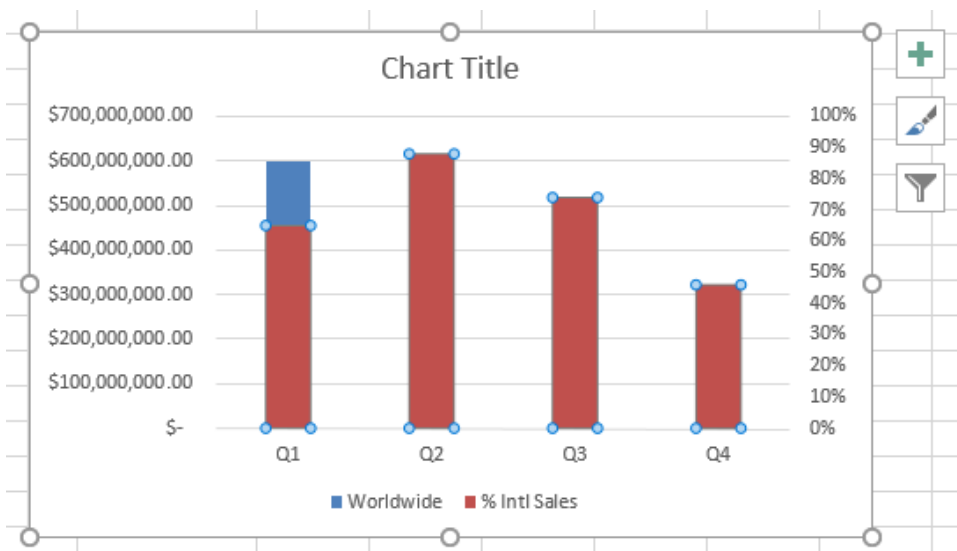
To fix this, you need to change the chart type for the secondary axis. With the secondary data series still selected, click Chart Tools – Design → Change Chart Type:
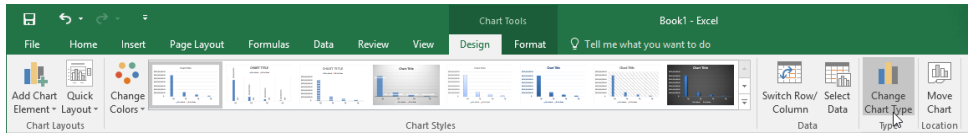
This action will display the Change Chart Type dialog box. Change the chart type for the secondary data series by clicking the associated Chart Type drop-down menu. From the options provided, click the chart type option:
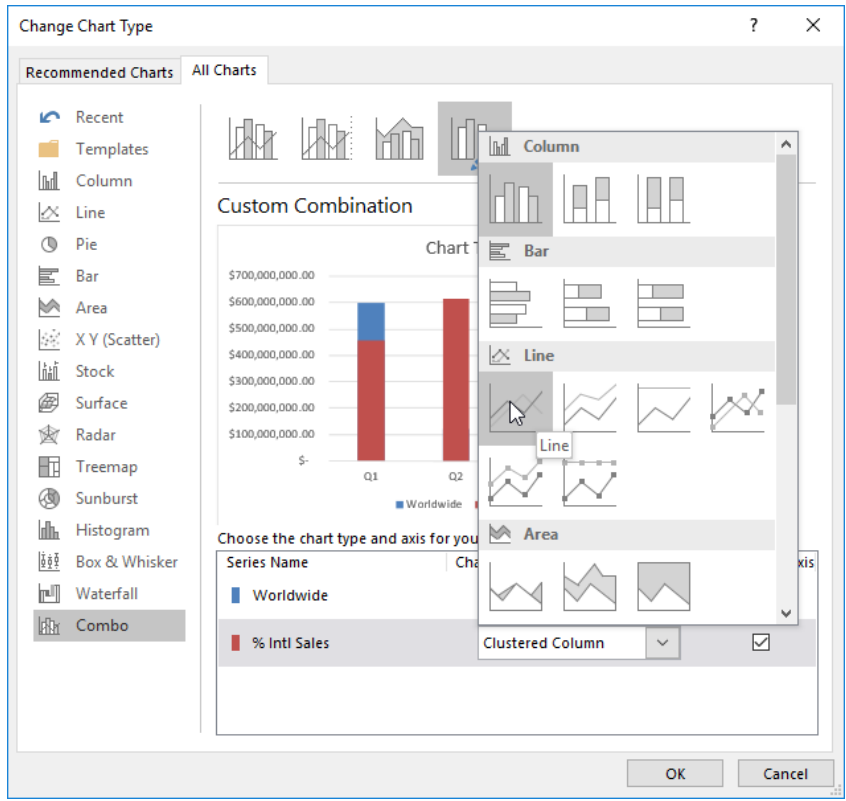
Ensure that this data series has its associated Secondary Axis check box selected and click OK to complete the process. The chart in question will now be a very usable dual axis chart:
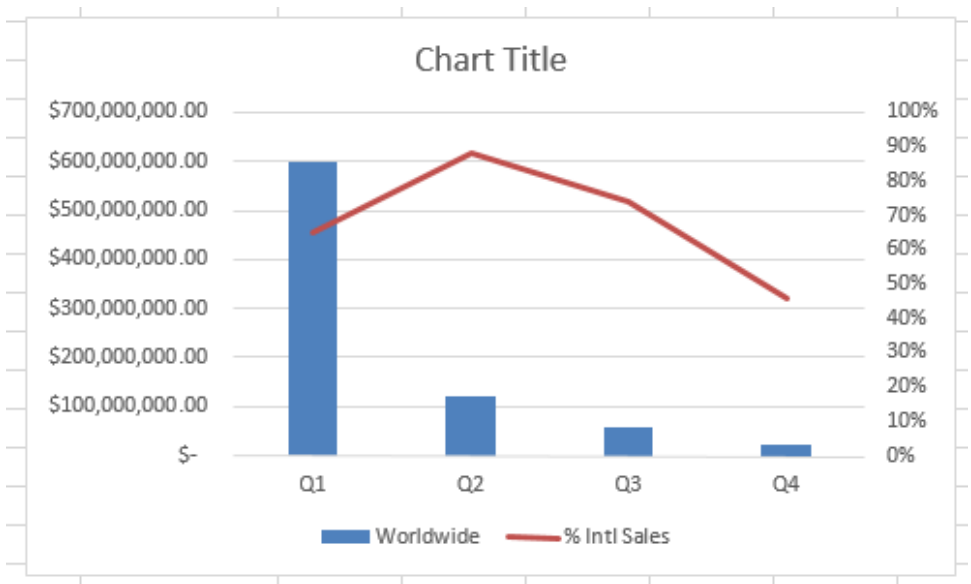
CREATING CUSTOM CHART TEMPLATES

It can take a long time to create a fully customized chart to suit your exact needs, so Excel includes the ability to save an existing chart as a chart template (.crtx). This will allow you to quickly recreate this type of chart using a different data set.

To create a custom chart template, first click to select the chart that you want to work with. Next, right-click this chart and then click Save as Template:
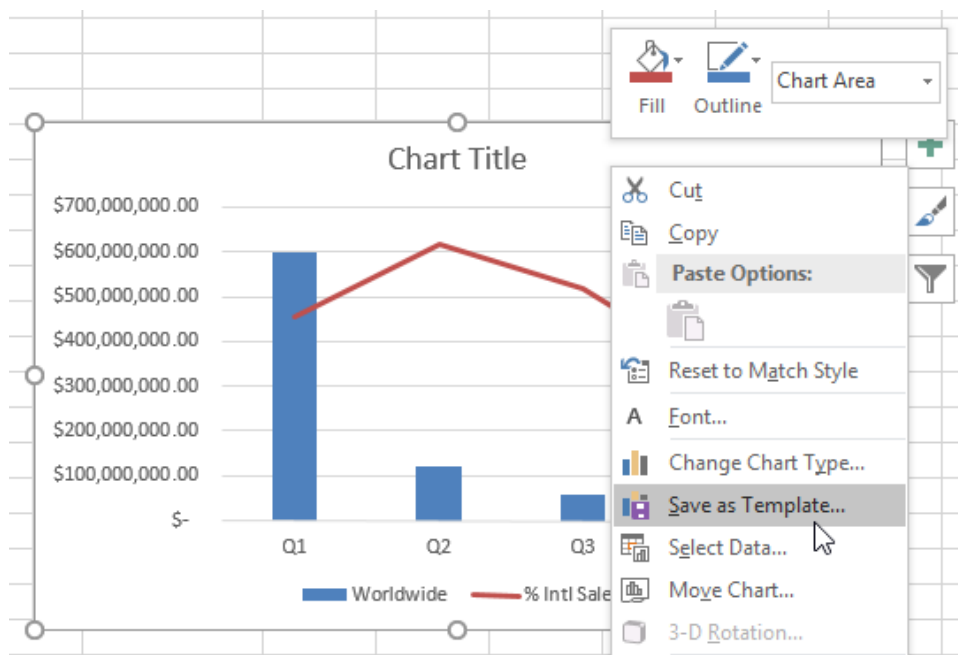
This action will display the Save Chart Template dialog box, with the Charts folder already open. In the "File name" text box, enter a name for this new template and then click Save:
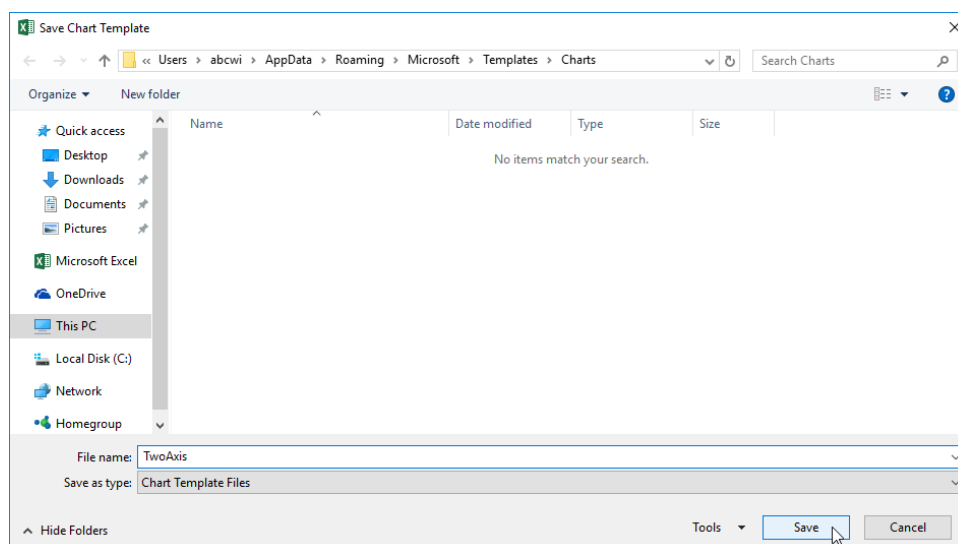
With the new custom chart template saved, you can then create new charts using this template using the Templates category of the All Charts tab in the Change Chart Type dialog box:
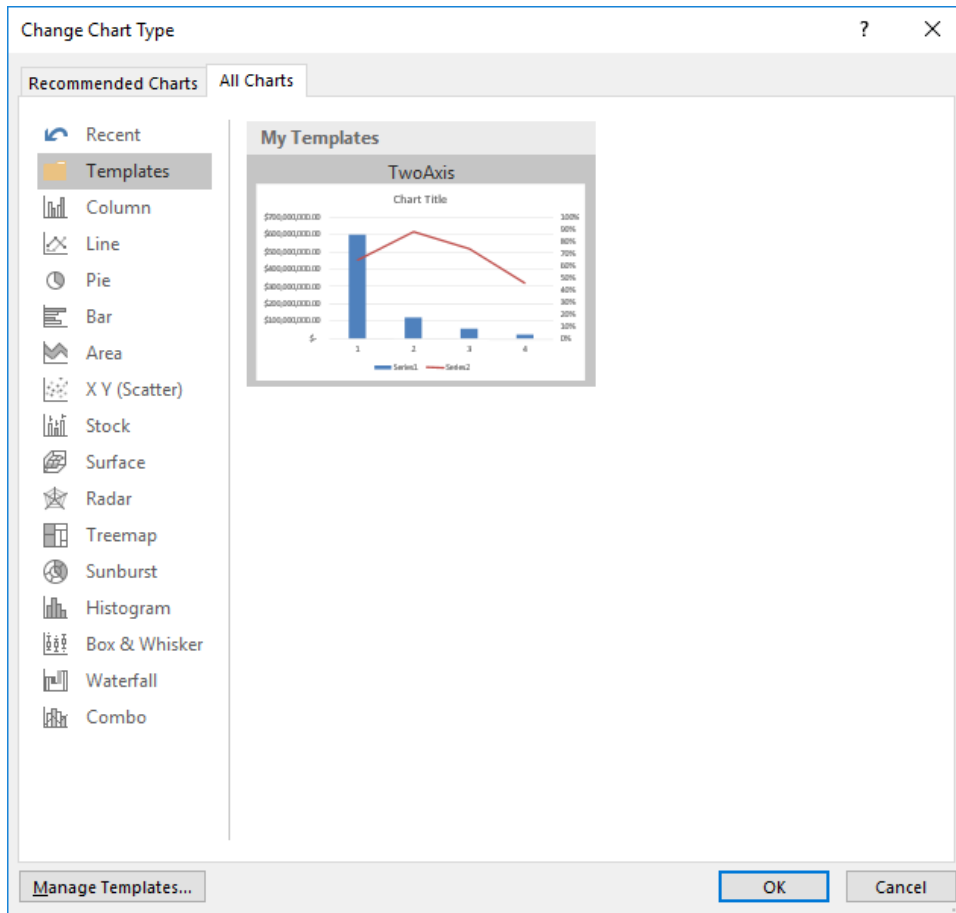
VIEWING CHART ANIMATIONS

Charts in Excel 2016 include the ability to animate data as you update its associated data points. For example, if you were to change the data for Q2 in the example below from 88% to 22%, the chart will animate this change and adjust the axis as required:
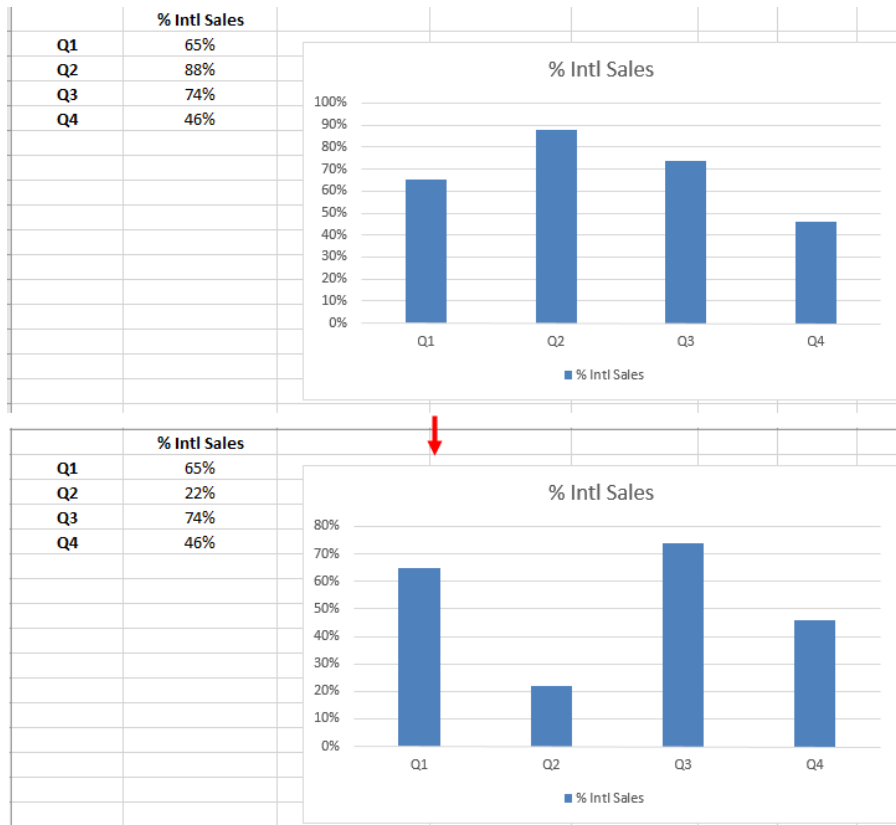
While this type of animation isn't intended for presentation purposes, they do help you understand the impact certain changes can have on your data.

If you were looking to present a chart created in Excel, you can take advantage of the animations that Microsoft PowerPoint provides. To do this, copy and paste the chart from Excel into the slide of the PowerPoint presentation that you are creating:
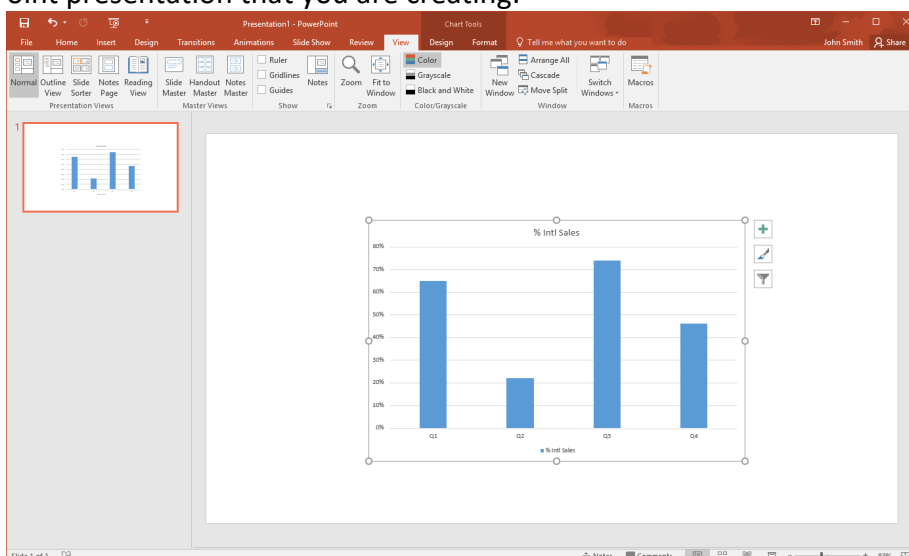
Ensure that the chart is selected, and then click Animations → [Animation Type]:
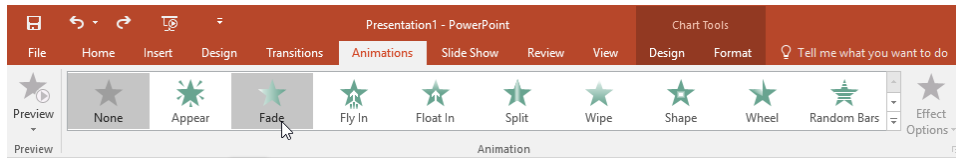
The animation that you initially apply to a selected chart will affect the chart in its entirety. You can modify this by clicking Animations → Effect Options, and then choosing one of the unique chart animation options:
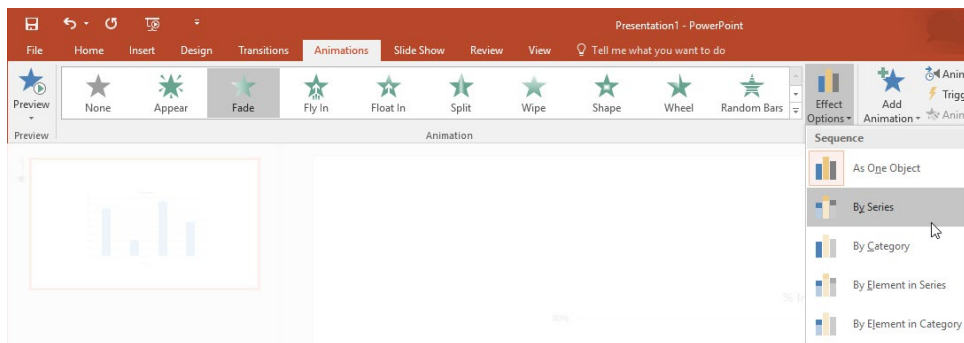
ACTIVITY 4-4

Creating Advanced Charts

Using some existing data, you would like to create a dual axis chart and then save the finished chart as a template.

1. To begin, open Activity 4-4 from your Exercise Files folder:
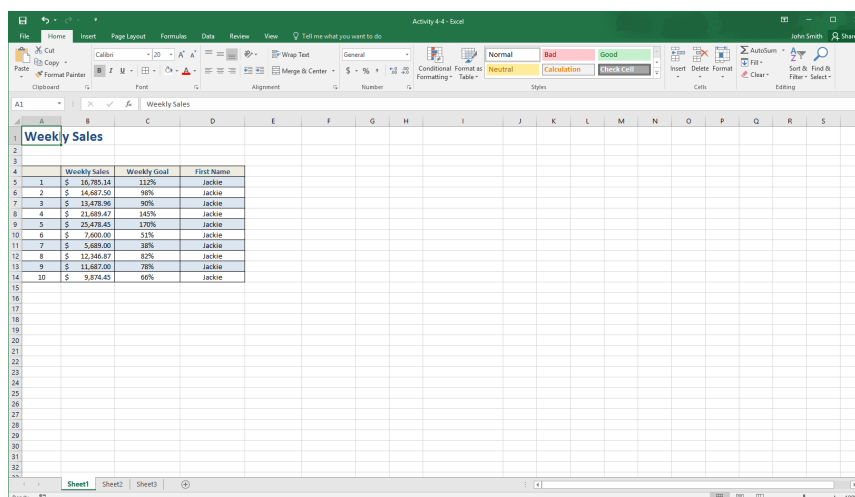
2. Use your cursor to select cells A4:C14 on the current worksheet:

3. Click Insert → Insert Column or Bar Chart → Clustered Column:

4. With the chart now added, you need to select the second data series. Click Chart Tools – Format → Chart Elements → Series "Weekly Goal:"
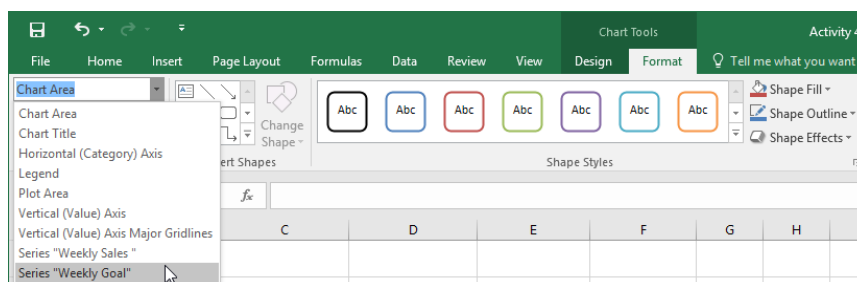
5. Next, you need to open the Format Data Series task pane by clicking Chart Tools – Format → Format Selection:
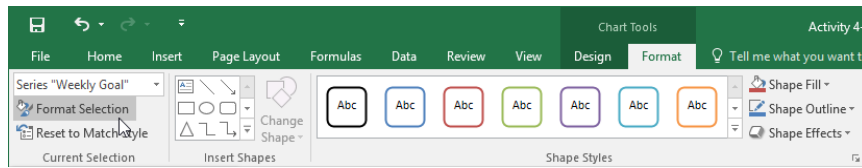
6. Inside the Format Data Series task pane, click the Secondary Axis radio button:
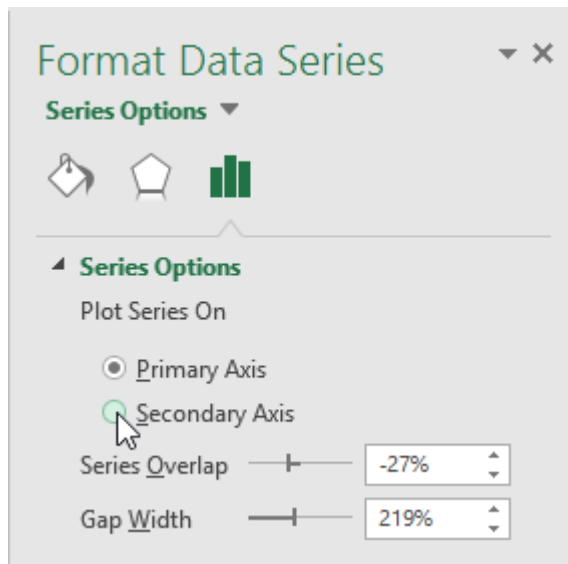
7. Due to the chart type, you find that the secondary axis overlaps the primary. To solve this issue, you need to change the chart type for the secondary axis. Click Chart Tools – Design → Change Chart Type:
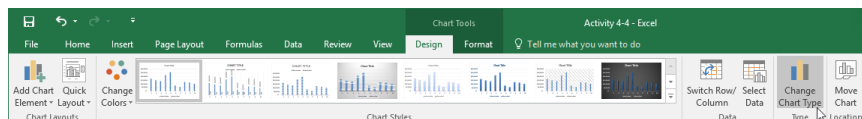
8. The Change Chart Type dialog box will now be displayed. Click the Chart Type drop-down menu that is adjacent to the Weekly Goal listing:
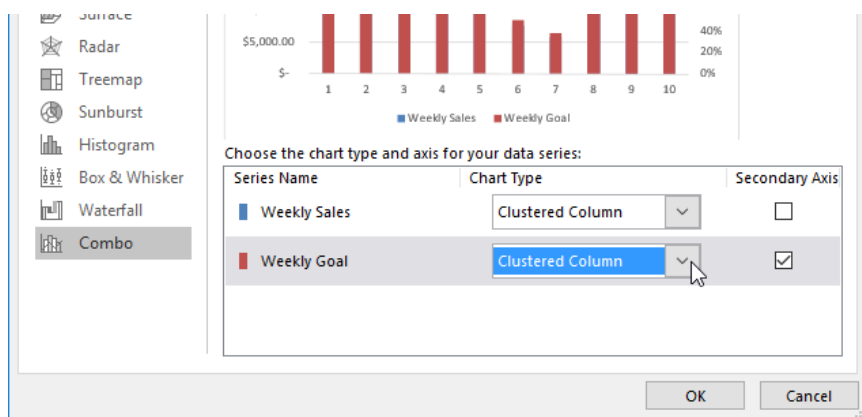
9. For this example, click the Stacked Line with Markers chart type:
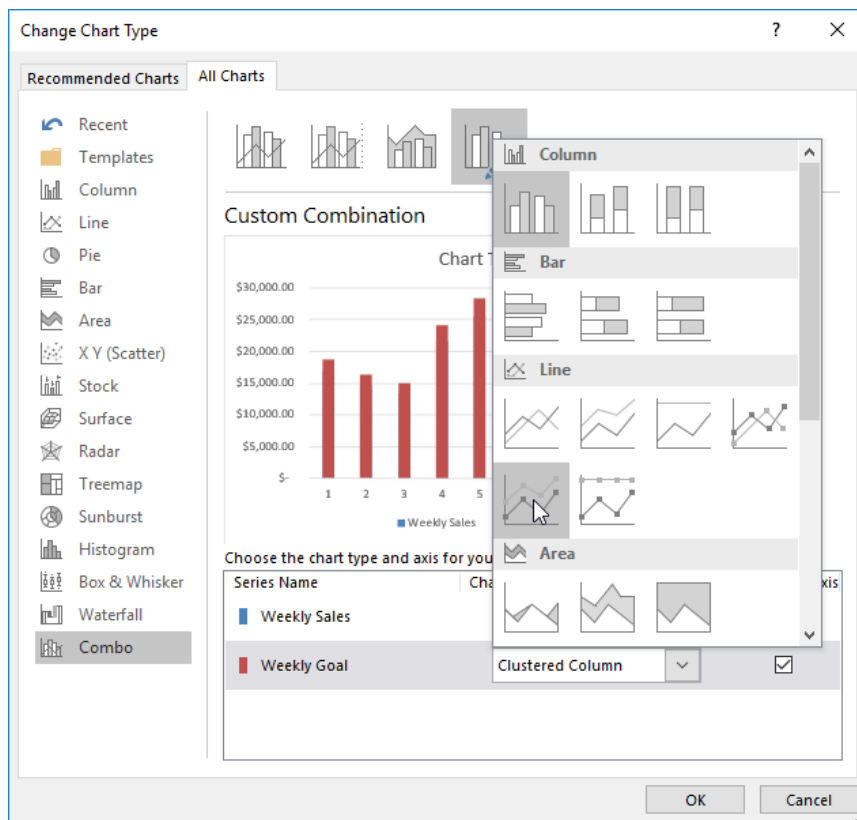
10. Ensure that the Secondary Axis check box is checked for the Weekly Goal series and then click OK:
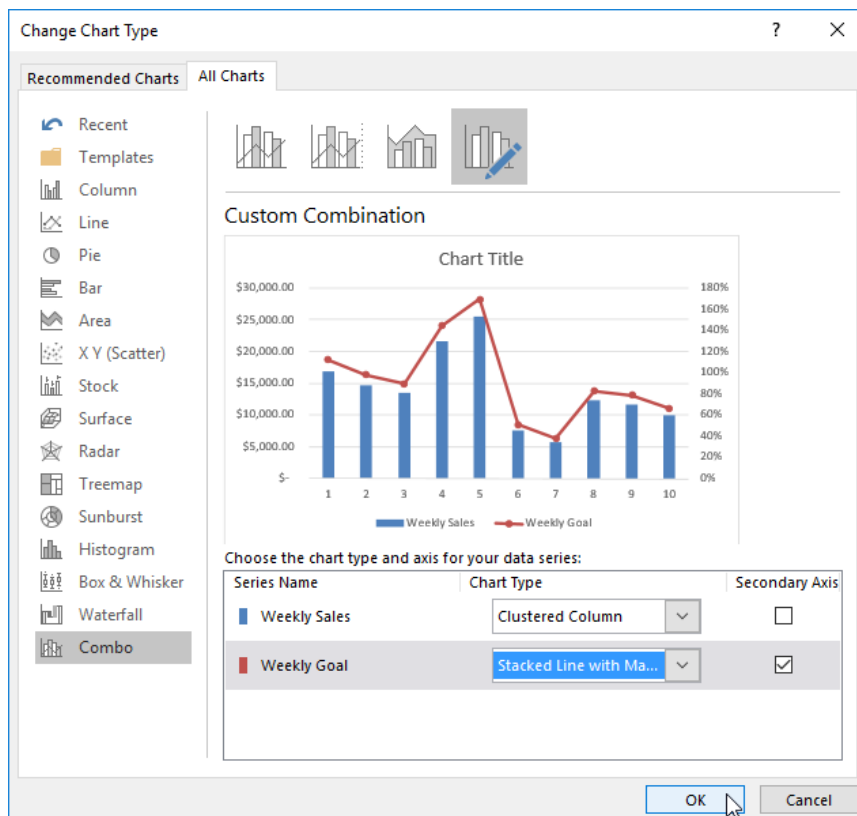
11. The dual axis chart is now complete:
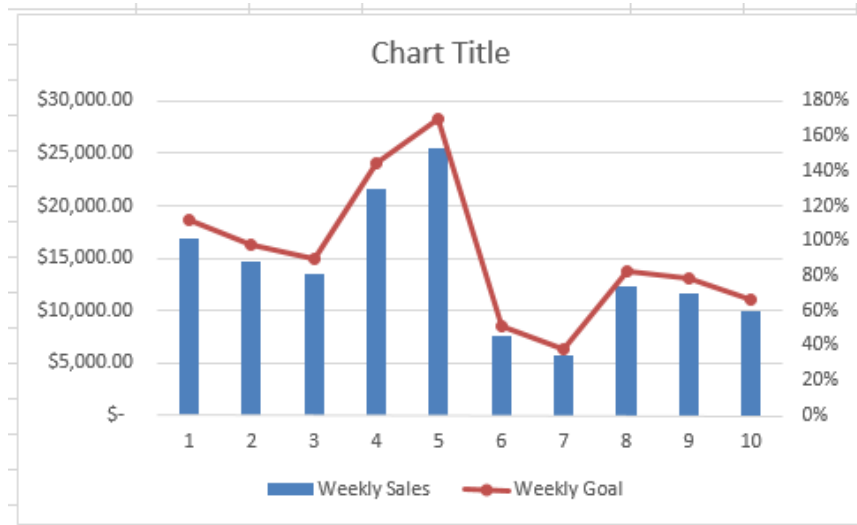
12. Now you need to save this chart as a template. Right-click the chart and then click Save as Template:
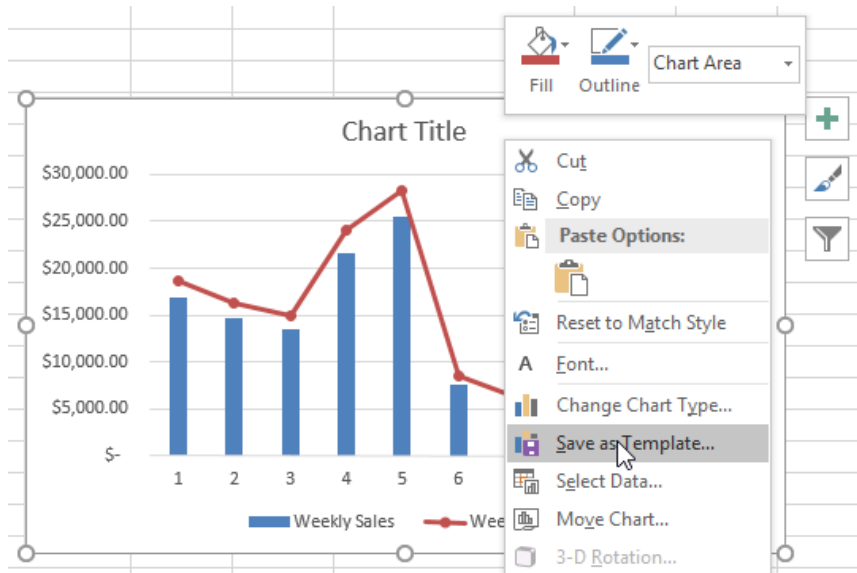
13. The Save Chart Template dialog box will now be displayed. Type "Activity 4-4 Complete" into the "File name" text box and then click the Save button:
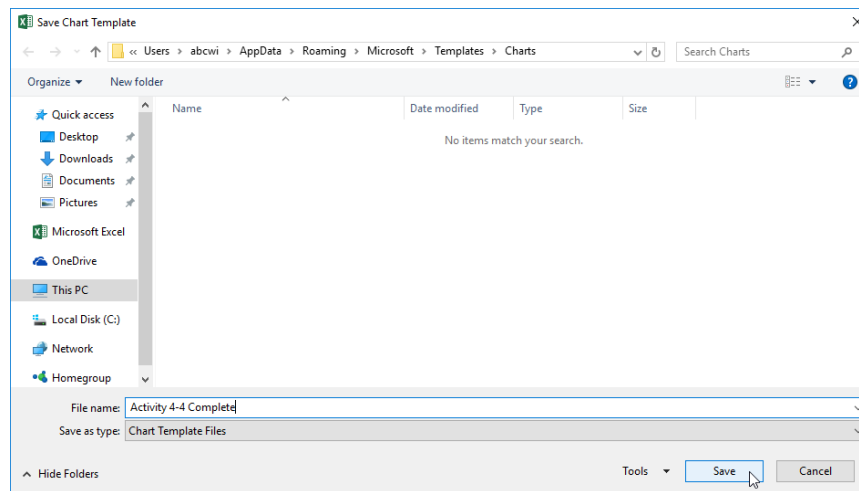
14. Save the current workbook as Activity 4-4 Complete.

Summary

This lesson taught you how to insert charts into worksheets as well as the best way to format charts to meet the specific needs of you and your audience. Additionally, you learned about the wide variety of charts that are available to you depending upon the data that you are working with. You should now feel comfortable modifying as well as formatting existing charts. You should also understand how to work with dual axis charts, create custom chart templates, and view chart animations.

LESSON 5: ANALYZING DATA WITH PIVOTTABLES, SLICERS, AND PIVOTCHARTS

Lesson Objectives

In this lesson you will learn how to:

- Create a PivotTable

- Filter data using slicers

- Analyze data using PivotCharts

TOPIC A: Create a PivotTable

One of the most powerful tools that you have your disposal when analyzing data in Excel is the PivotTable. While extremely useful, these interactive objects are somewhat cumbersome to execute properly and are often misused. For this reason it is important to understand how they work and gain some fundamental understanding of their purpose before creating PivotTables of your own data.

Topic Objectives
In this topic, you will learn:
- About PivotTables
- How to start with questions and end with structure
- About the Create PivotTable dialog box
- About the PivotTable fields pane
- How to summarize data in a PivotTable
- About the "Show value as" functionality
- How to format a PivotTable
- About using external data with PivotTables
- About PowerPivot
- About PowerPivot functions

PIVOTTABLES

Why are PivotTables called PivotTables? Because they let you move data around easily (by dragging and dropping fields) to perform a sort of rotation on the structure of your table and at the same time, change your view of the data. With PivotTables, columns can become rows and rows can become columns, all without altering the original data.

When a PivotTable is created, you are given the option to put it on the worksheet that you currently have open or on a new one. In either case, once the PivotTable is created you can pivot, re-pivot, sort, and summarize your data without affecting it directly. You are able to choose the level of detail that you want to view depending on your needs. Additionally, you have access to all of the summary functions in Excel to complete your data analysis.

Below you can see an example of a very simple PivotTable:

Row Labels	Sum of Quantity	Sum of Order Price
23	475	$ 2,370.25
47	89	$ 800.11
147	214	$ 27,817.86
235	55	$ 31,349.45
354	25	$ 18,750.00
589	54	$ 351.00
1358	45	$ 224.55
1459	89	$ 1,512.11
1478	2441	$ 1,503.53
1547	2	$ 269.16
1567	35	$ 5,165.65
1574	5	$ 14.95
2358	5	$ 1,999.95
3258	89	$ 177.11
4785	65	$ 2,274.35
4786	8	$ 1,599.92
5167	45	$ 1,912.50
Grand Total	3741	$ 98,092.45

In this case, the Location, Quantity, and Order Price columns have been pivoted to appear as rows. A summary of each numerical column in this PivotTable is displayed by default.

START WITH QUESTIONS, END WITH STRUCTURE

Before you even create a PivotTable, you need to think of the questions that you are trying to answer using it. Just like when working with functions or formulas, half of the work in data analysis is finding the right questions. This process is especially important for PivotTables because how you construct them depends on the question that you are asking. Once you have the question that you would like the PivotTable to answer, you can start constructing it. While there are no hard and fast rules to constructing a PivotTable, there are some ways to make things easier.

Here are a few tips to keep in mind when constructing your PivotTable.
- First, it is usually best to create rows and columns using fields that have a relatively low set number of entries. Using entries that span a huge swath of data (such as five years of transaction numbers) to create rows and columns can only cause confusion rather than answer any specific questions.
- Next, it is almost always a good idea to create a row out of a field that you need an answer from and then create a column out of that criterion to narrow down the answer.

Examine the worksheet below. You will see a range that contains 18 entries:

	A	B	C	D	E
1	**Warehouse** ▼	**SKU** ▼	**Unit Price** ▼	**Quantity** ▼	**Order Price** ▼
2	Warehouse A	1574	$ 2.99	5	$ 14.95
3	Warehouse A	2358	$ 399.99	5	$ 1,999.95
4	Warehouse C	1478	$ 0.49	1587	$ 777.63
5	Warehouse A	589	$ 6.50	54	$ 351.00
6	Warehouse C	147	$ 129.99	214	$ 27,817.86
7	Warehouse A	1358	$ 4.99	45	$ 224.55
8	Warehouse A	4785	$ 34.99	65	$ 2,274.35
9	Warehouse A	5167	$ 42.50	45	$ 1,912.50
10	Warehouse C	3258	$ 1.99	89	$ 177.11
11	Warehouse A	4786	$ 199.99	8	$ 1,599.92
12	Warehouse A	235	$ 569.99	55	$ 31,349.45
13	Warehouse A	1567	$ 147.59	35	$ 5,165.65
14	Warehouse B	1459	$ 16.99	89	$ 1,512.11
15	Warehouse A	1478	$ 0.85	854	$ 725.90
16	Warehouse A	23	$ 4.99	475	$ 2,370.25
17	Warehouse A	47	$ 8.99	89	$ 800.11
18	Warehouse B	354	$ 750.00	25	$ 18,750.00
19	Warehouse A	1547	$ 134.58	2	$ 269.16

A PivotTable created from this dataset answers the question, "What is the total value of the products stored in each warehouse?"

Row Labels ▼	Sum of Order Price
Warehouse A	$ 49,057.74
Warehouse B	$ 20,262.11
Warehouse C	$ 28,772.60
Grand Total	$ 98,092.45

As you can see, the warehouses are listed by row and the price (the criterion) is listed as a column. A SUM function automatically totals the order price of each product price stored by each warehouse.

You can change the function that is used by the PivotTable to whatever you need in order to answer a question. For example, suppose you wanted to see how many different products each warehouse had, not a total count. You could do this by adding the SKU field as a column and applying the COUNT function:

Row Labels ▼	Count of SKU
Warehouse A	13
Warehouse B	2
Warehouse C	3
Grand Total	18

THE CREATE PIVOTTABLE DIALOG BOX

The first step to creating a PivotTable is to open the Create PivotTable dialog box by clicking Insert → PivotTable:
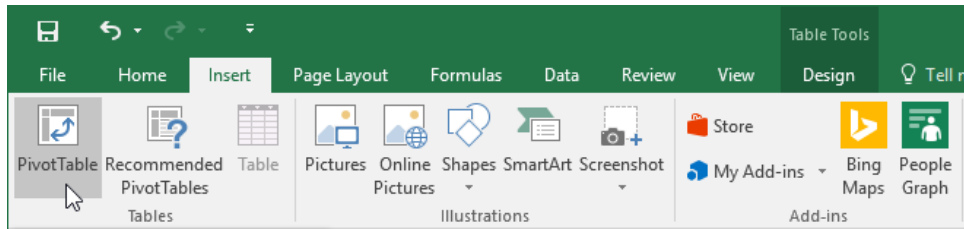
The controls in the Create PivotTable dialog box are used to choose the dataset (or data source) for the new PivotTable that you are creating, and where you want it to be placed. By default new PivotTables will be placed on new worksheets, but you do have the option of adding them to existing worksheets in your workbook:
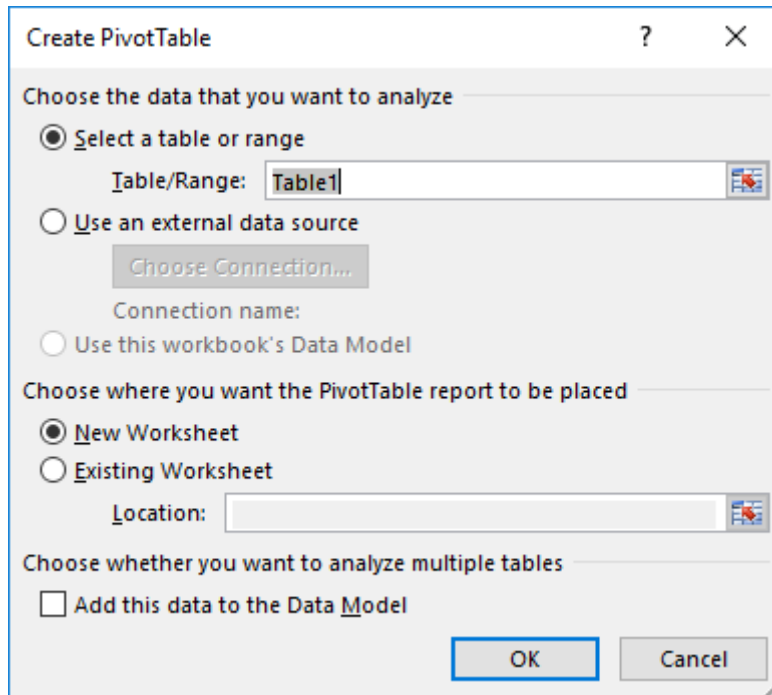
Once you have set your options, click OK to create the PivotTable.

THE PIVOTTABLE FIELDS PANE

When you insert a PivotTable into your workbook, the PivotTable Field task pane will automatically be displayed on the right hand-side of the Excel 2016 window:
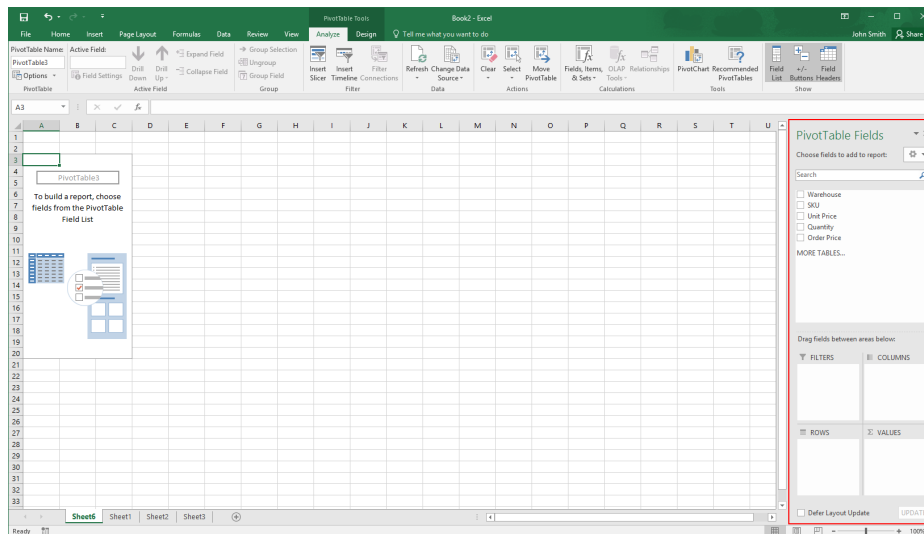
The PivotTable Field List pane is the primary tool that you will use to configure PivotTables. (Note that it is hidden when the PivotTable is not selected.) The **top portion of this pane (1)** lists all of the fields from the dataset that you can add to the PivotTable. To add or remove a field from the PivotTable, toggle the corresponding checkbox. Alternatively, to give you more control over field placement on the PivotTable, you can click and drag these fields to the PivotTable itself. Note that field names are derived from the column header in the dataset.

The bottom half of this pane is comprised of **four areas (2)**: Filters, Columns, Rows, and Values. If you drag fields between these areas you are able to change the structure of the PivotTable and choose the values that will be used to make calculations.

Here is an overview of these four areas.
- Adding fields to the **Filters area** will include those field values as filter criteria.
- The **Columns area** will create columns out of unique field entries.
- Similarly, the **Rows area** will create rows out of unique field entries.
- Finally, fields that are dragged to the **Values area** will have calculations performed on them or their values summarized.
- Note that any fields that appear in these four areas will include a **pull-down arrow (3)** that give you access to a number of different settings and the Field Settings dialog that you can use to further customize your PivotTable.
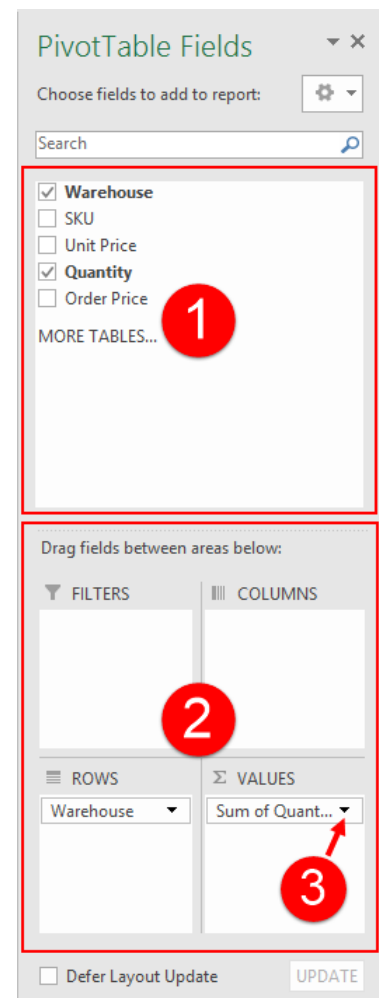
Remember that any changes that you make in the PivotTable Field List pane will be applied dynamically. Additionally, due to the flexible nature of PivotTables, you can add or remove fields to or from the pane at any time.

SUMMARIZE DATA IN A PIVOTTABLE

By combining options from the Summarize Values By and the Show Values As tabs on the Value Field Settings dialog box, you can get further insight into your data. For example, suppose that you want to calculate the total unit price of all the products that each warehouse is storing. You can do this by dragging the Unit Price field to the Values area of the PivotTable Field List pane. Next, you would then click the drop-down arrow for this field and click the Field Settings option to open the Value Field Settings dialog box. Inside the Value Field Settings dialog box, you would then ensure that the Sum function was selected:
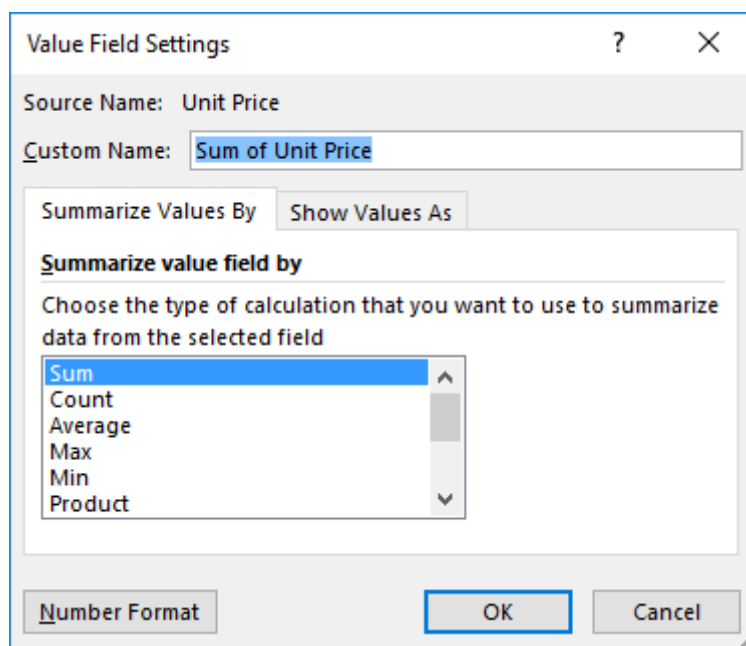
The PivotTable will then display the sum of the unit prices found in each warehouse:

Row Labels	Sum of Unit Price
Warehouse A	1558.94
Warehouse B	766.99
Warehouse C	132.47
Grand Total	2458.4

Note that you can retrieve data from PivotTables to other Excel worksheets using the GETPIVOTDATA function:

GETPIVOTDATA(data_field, pivot_table, [field1, item1, field2, item2], …)

THE "SHOW VALUES AS" FUNCTIONALITY OF A PIVOTTABLE

Now suppose that you want to see the percentage of the total that each warehouse holds in value. While you could do this calculation manually, it would be easier to change how the values are shown. Within the Show Values As tab of the Value Field Settings dialog box, you would click the "% of Grand Total" option from the "Show values as" drop-down menu:
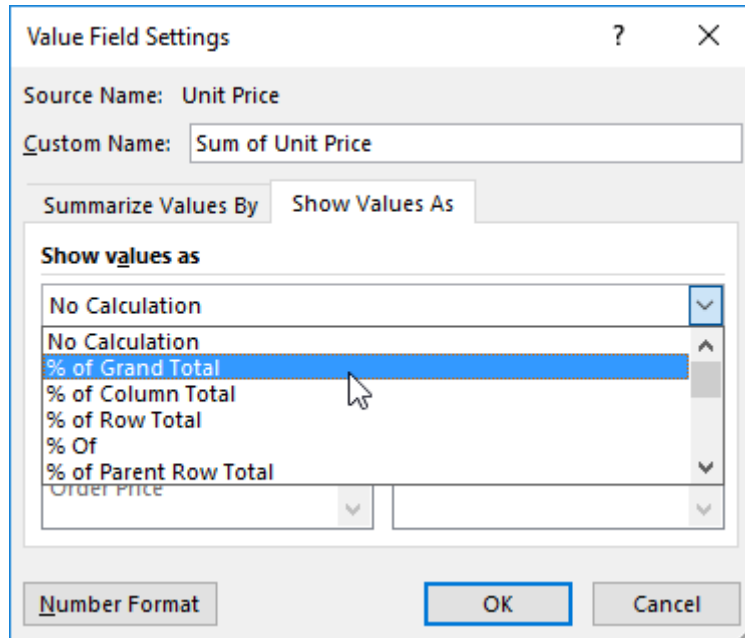
You will now see what percentage of the grand total each warehouse holds. In this case you can see that Warehouse A contains the vast majority of value in products, while Warehouse C has the least:

FORMAT A PIVOTTABLE

When you are working with PivotTables, you will see two contextual tabs. One of these is Design:
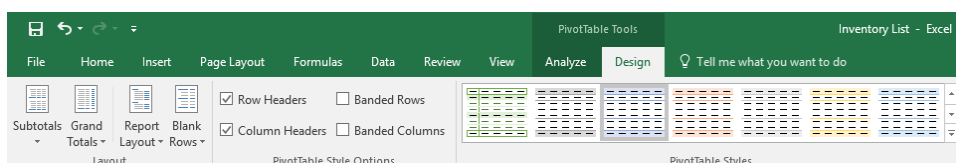
This tab allows you to add layout elements to your PivotTable, customize style options, and apply a style (just as you would with a regular table). You can modify these options at any time.

EXTERNAL DATA

If the data that you would like to analyze exists outside of Excel, such as a Microsoft Access database, you can still use PivotTables to summarize it. To do this, you need to create a connection to that external data by opening the Create PivotTable dialog box and then clicking the "Use an external data source" radio button. Next, click the Choose Connection button:
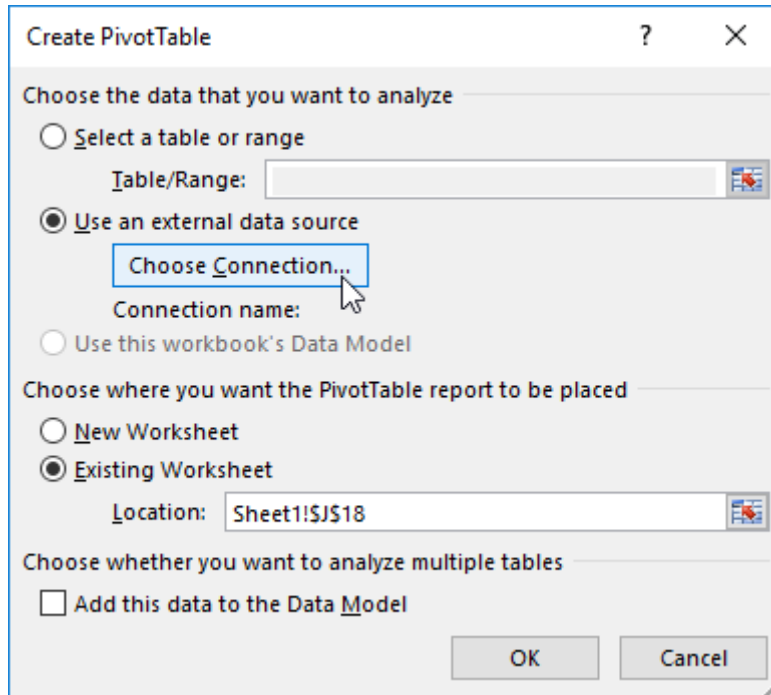
The Existing Connections dialog box will then allow you to choose from existing connections that exist, as well as browse for more connections:
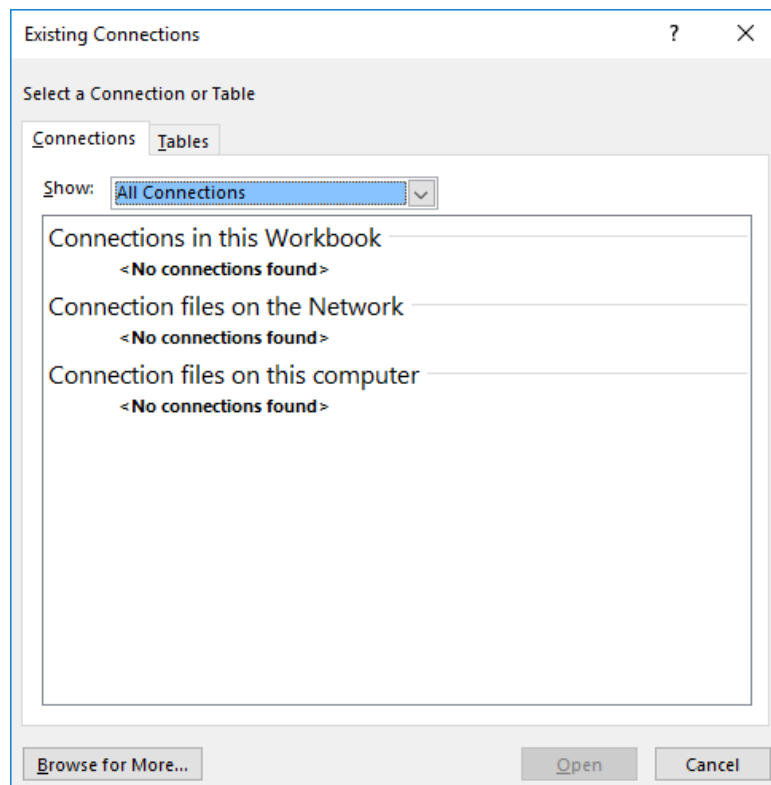
POWERPIVOT

PowerPivot is an Excel add-in that is available for Excel 2016. It is additional software that is included with some editions of Excel 2016, but not all. In cases where it is not included, it can be added on later if required. Once installed, this additional software extends the functionality of Excel to allow for greater data analysis.

What makes PowerPivot special is that is uses compression and processing algorithms that allow you to work efficiently with large amounts of data. This facilitates analysis with data that would otherwise be too cumbersome to work with. Additionally, PowerPivot also facilitates the integration of data from multiple sources, and has been designed with extra features and flexibility for environments that rely on Microsoft SharePoint and/or Microsoft SQL servers.

POWERPIVOT FUNCTIONS

DAX (Data Analysis Expression) is a type of formula language that is used to create custom calculations inside calculated columns in a PowerPivot table. It is also used to create measures inside a PivotTable. This means that PowerPivot provides you with additional functions using DAX that can be used to work with relational data in a much more powerful manner.

Arguments in a DAX function commonly use tables and columns. For example, below you can see a DAX function that uses the Totals and Date columns from the Employee Sales table as arguments:

=TOTALQTD(SUM('Employee Sales'[Totals]), 'Employee Sales'[Date])

While there are lots of DAX functions that you can choose from, each is classified under one of the following categories:
- **Data and Time functions**: Functions of this type are used to manipulate date and time values. As such, they are similar to the data and time functions that can be used in Excel.
- **Filter functions**: These functions are used to manipulate data and filter it dynamically.
- **Information functions**: This type of function is used to scan the values inside a cell range and match them against an expected data type.
- **Logical functions**: Typically these functions are used to validate expressions and values, and then work with other data that is based upon the evaluation.
- **Math and Trigonometric functions**: Functions of this type are used to perform mathematical calculations.
- **Statistical functions**: These functions are used to generate statistical data like minimum and maximum values, as well as averages.
- **Time Intelligence functions**: This type of function is used to manipulate data using time periods. They can be used to compare data of one time period against another.

ACTIVITY 5-1

Creating PivotTables

You have been given the raw transactional data for the daily sales numbers of your sales staff. In order to determine the total sales numbers for each sales associate, you would like to create a PivotTable using this data.

1.   To begin, open Activity 5-1 from your Exercise Files folder:

2.   Use your cursor to select cells A4:E40:

3.   Next, click Insert → PivotTable:
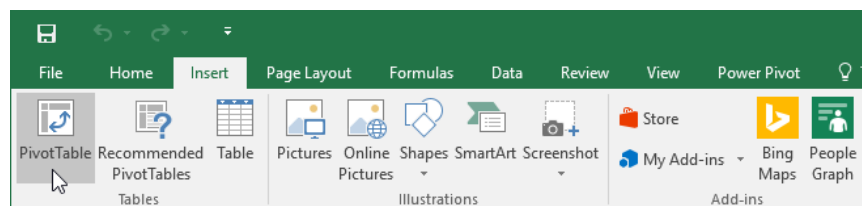
4. The Create PivotTable dialog box will now be displayed. The data range that you previously selected will be shown within the Table/Range text box:
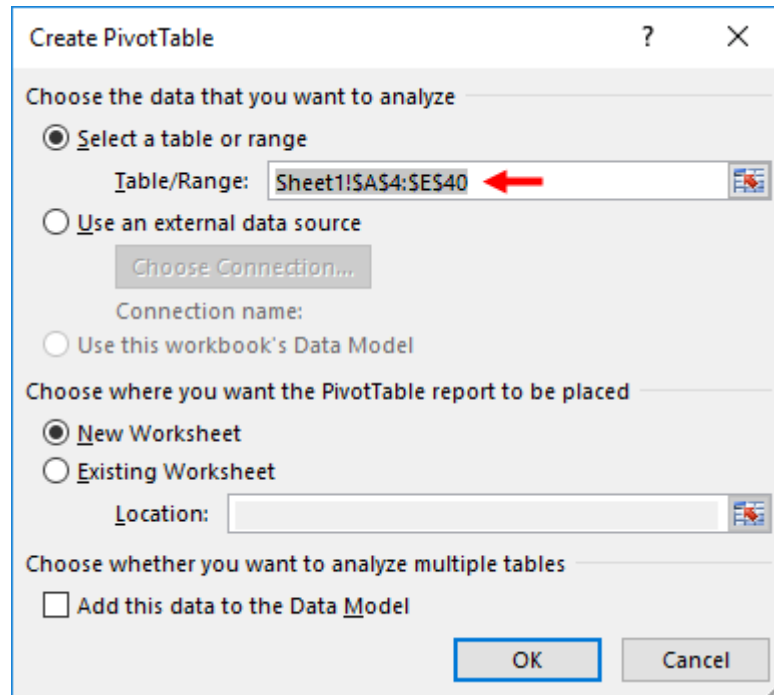
5. You want this new PivotTable to be inserted into the current worksheet, so click the Existing Worksheet radio button:
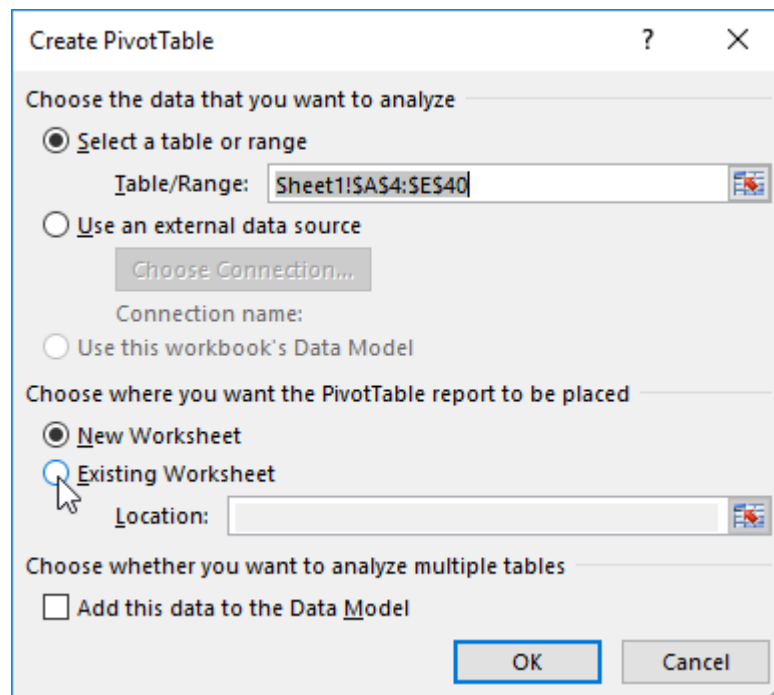
6.   Inside the Location text box, click the range picker button (⬚):
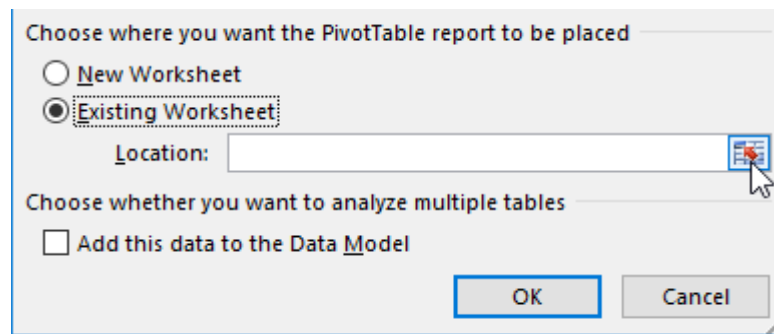
7.   Use your cursor to select cell H4:
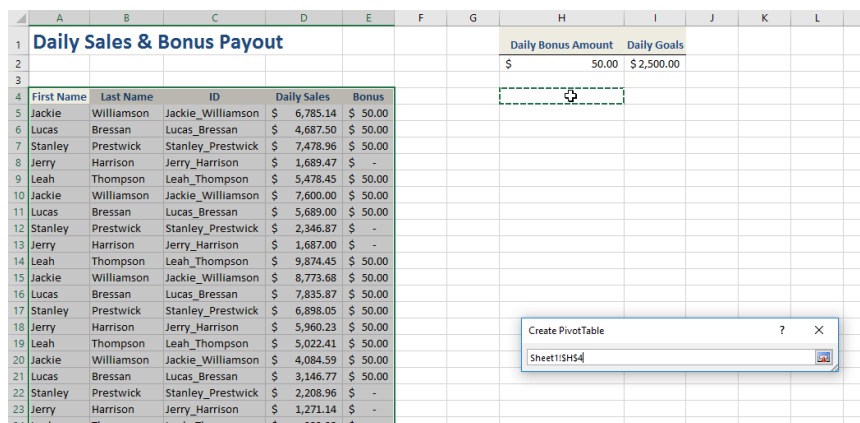
8.   Press Enter to apply the new location. Back at the Create PivotTable dialog box, click OK to apply the new settings:
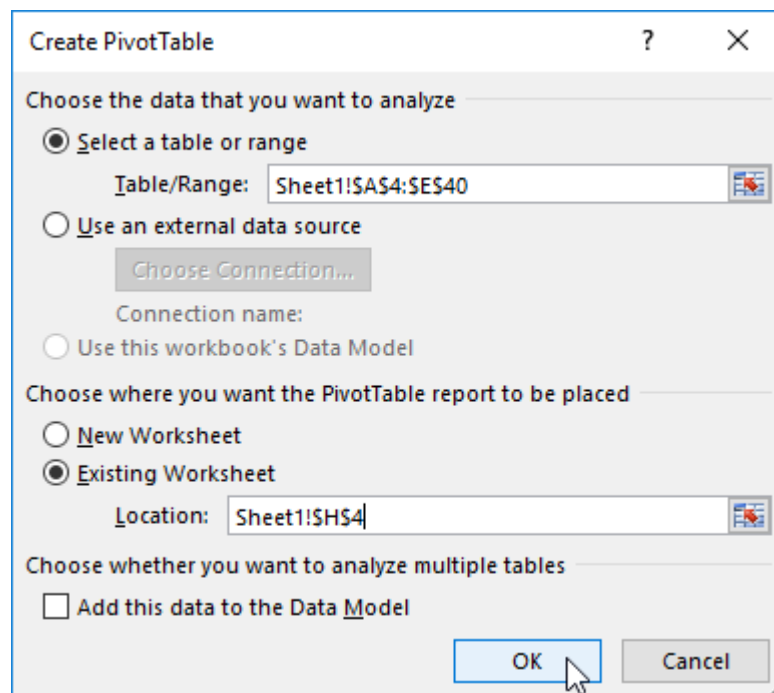
9. The PivotTable will now be added to the current worksheet in the location that you previously set:
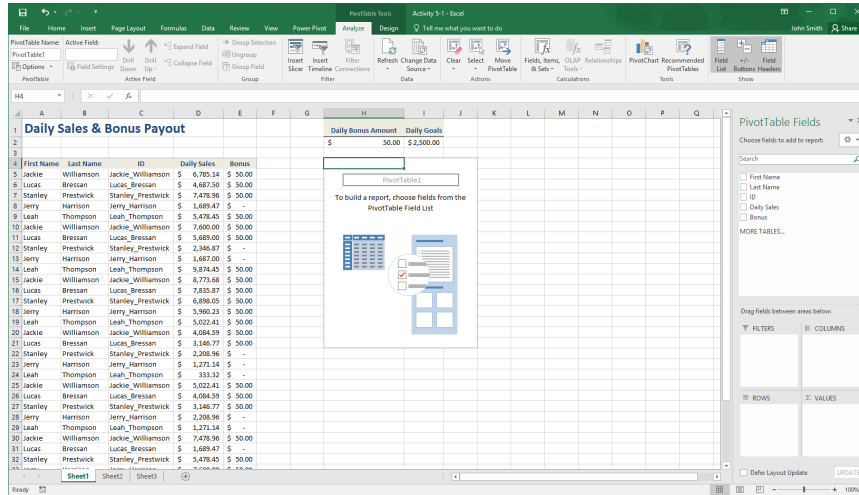
10. Save your changes as Activity 5-1 Complete and then close Microsoft Excel 2016.

TOPIC B: Filter Data by Using Slicers

While regular filters can be effective in drilling down through your data, they can quickly become a chore to manage. Between having to clear existing filters before applying new ones and trying to determine which data is actively being filtered out, filters definitely have some downsides. To give you more control over filtering capabilities, Excel provides slicers. These are easy-to-use filters that can be applied multiple times without negative effects on the data's readability. Throughout this topic you will learn about slicers and how to use them to filter data in a PivotTable.

Topic Objectives
In this topic, you will learn:
- About slicers
- About the Insert Slicer dialog box

SLICERS

Slicers can be a great help when working with PivotTable data. While the main purpose of PivotTables is to help you analyze information and find patterns or trends that might be difficult to spot in a large volume of raw data, the Slicer tool takes this idea to the next level.

Slicers can be created out of any field that exists within the dataset for the PivotTable. These slicers can then be used to filter each field by its unique entries. For example, if you wanted to filter out data from one of the three warehouses in a worksheet that tracks inventory, a slicer would be able to do that for you easily. Slicers can also be linked to more than one PivotTable. Typically this occurs when using raw transactional data as a dataset and multiple PivotTables exist for that data.

Slicers are displayed graphically as a small pane that contains a series of buttons that represent each unique value from the field that the slicer is associated with. To toggle between filtering and not filtering unique values from the field, you can simply click these buttons:
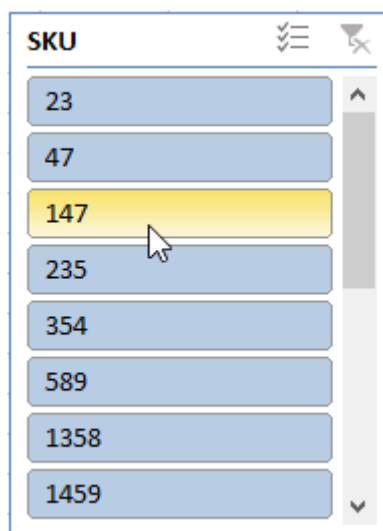
Filters in a slicer that are not applied appear blue, while those that are white are active. Should a filter button appear grayed out, this indicates that an already active filter has removed the values represented by this filter from view. Multiple filters that exist in the same slicer can be applied at once by holding down the Ctrl key and clicking on each filter that you would like to apply. Additionally, the Clear Filter button in the top right-hand corner of a slicer will deactivate all of its filters.

THE INSERT SLICERS DIALOG BOX

To create a slicer, first click anywhere in the PivotTable to display the PivotTable Tools tabs. Next, click Insert → Slicer:
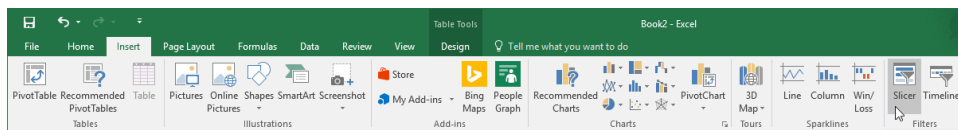
(Alternatively, you can click Table Tools – Design → Insert Slicer.)

This action will display the Insert Slicers dialog box:
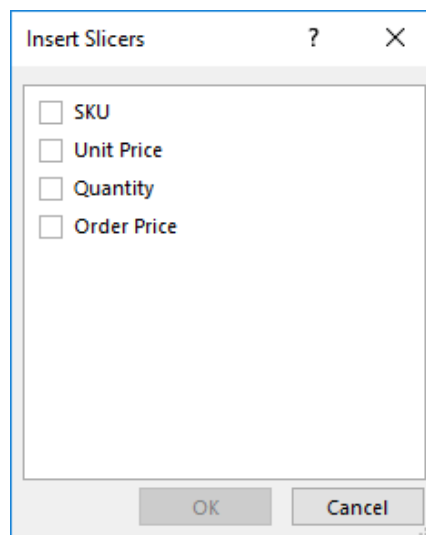
This dialog box will list each field in the PivotTable as a checkbox. To create a slicer of a field, check its associated checkbox. Once you have finished choosing the fields that you would like to appear as filters, click OK to apply your settings.

Returning to the worksheet, you will now see the slicer(s) placed there:
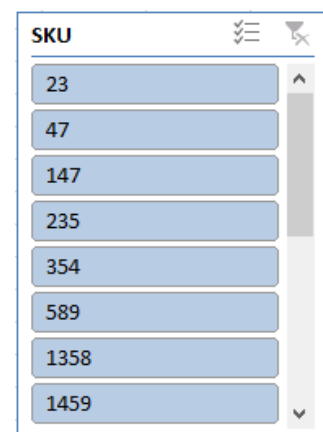
ACTIVITY 5-2

Filtering Data Using Slicers

You have constructed a PivotTable that displays the total sales made by each sales associate, as well the total amount of bonuses they each received. Jerry Harrison and Leah Thompson are going to form their own sales department that sells a specialty product. In an effort to estimate bonus payouts and sales goals you would like to use slicers to display only their data in the PivotTable.

1. To begin, open Activity 5-2 from your Exercise Files folder:
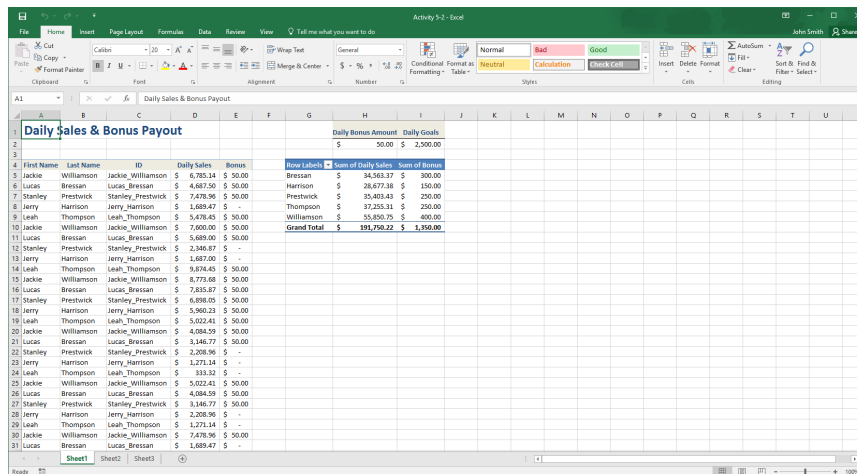
2. Click inside the PivotTable to display the PivotTable Tools contextual tabs. Next, click PivotTable Tools – Analyze → Insert Slicer:
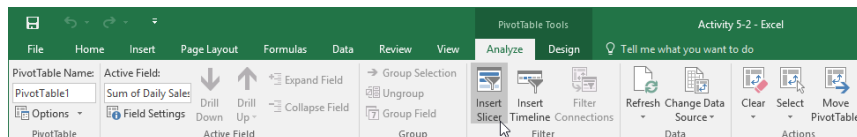
3. The Insert Slicer dialog box will now be displayed:
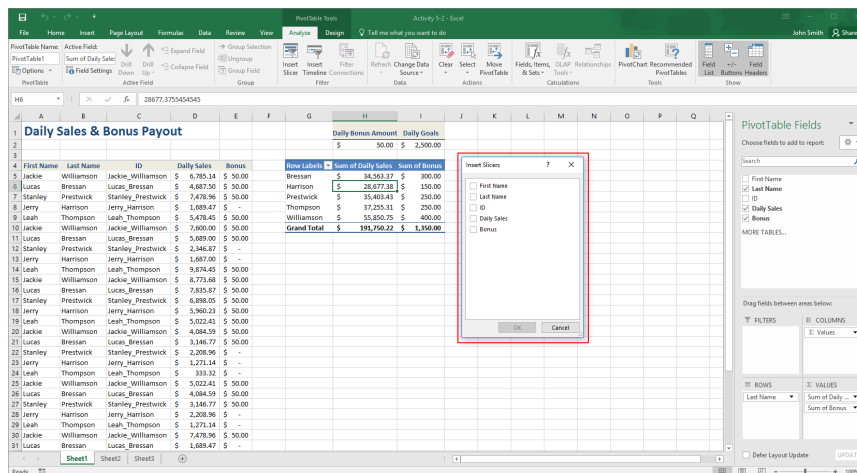
4. Check the Last Name checkbox and then click OK:
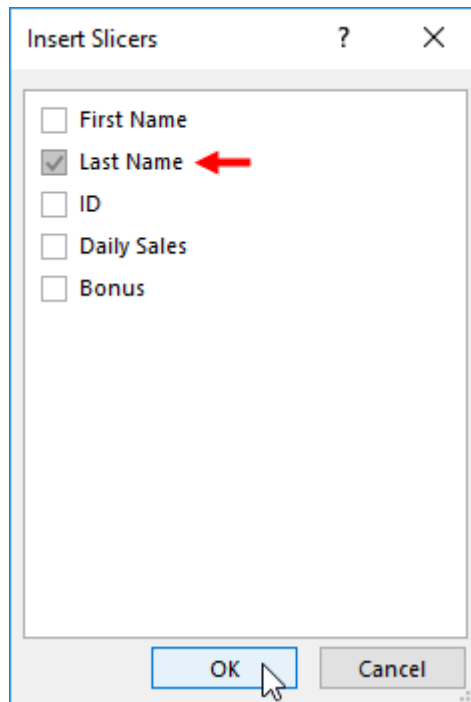
5. A slicer for the Last Name field will now be on your worksheet:

6. For this exercise you want to filter out everyone except for Jerry Harrison and Leah Thompson. While holding down the Ctrl key, click the Bressan, Prestwick, and Williamson buttons:
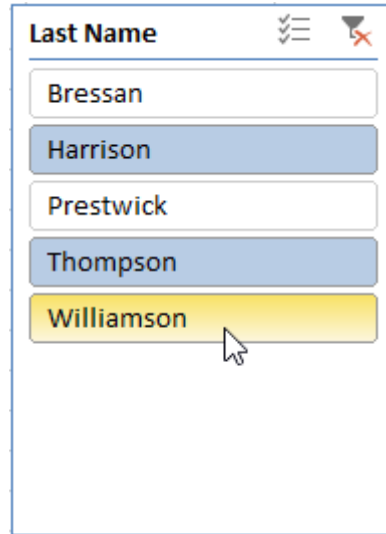
7. The entries that you clicked on in the slicer will now have been filtered out of the PivotTable:

8. Save your work as Activity 5-2 Complete and then close Microsoft Excel 2016.

TOPIC C: Analyze Data with PivotCharts

PivotTables are fantastic at analyzing your data, but they are not so great at being able to quickly convey it. To solve this problem, PivotTable data can quickly be converted into charts just as you can with regular datasets. Over the course of this topic you will learn how use PivotCharts to present PivotTable data visually.

Topic Objectives
In this topic, you will learn:
- About PivotCharts
- How to create PivotCharts
- How to apply a style to a PivotChart

PIVOTCHARTS

PivotCharts are just like regular charts in that they are designed to convey data analysis in a visual form. The primary difference is simply that PivotCharts are linked to PivotTables, while charts are linked to data ranges or tables. Despite this difference, both PivotCharts and regular charts share many of the same features, such as dynamic updating, lots of chart types to choose from, and easy creation.

CREATING PIVOTCHARTS

To insert a PivotChart into your worksheet, first click to select the PivotTable that you would like to work with. Next, click PivotTable Tools – Analyze → PivotChart:
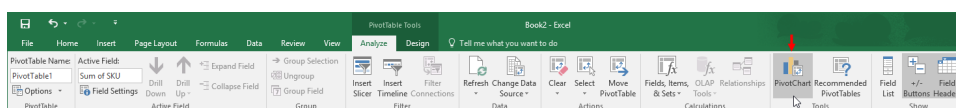
This action will display the Insert Chart dialog box. Just like when working with regular charts, you need to consider what chart type best suits your data. For this example, the Clustered Column chart type has been selected:
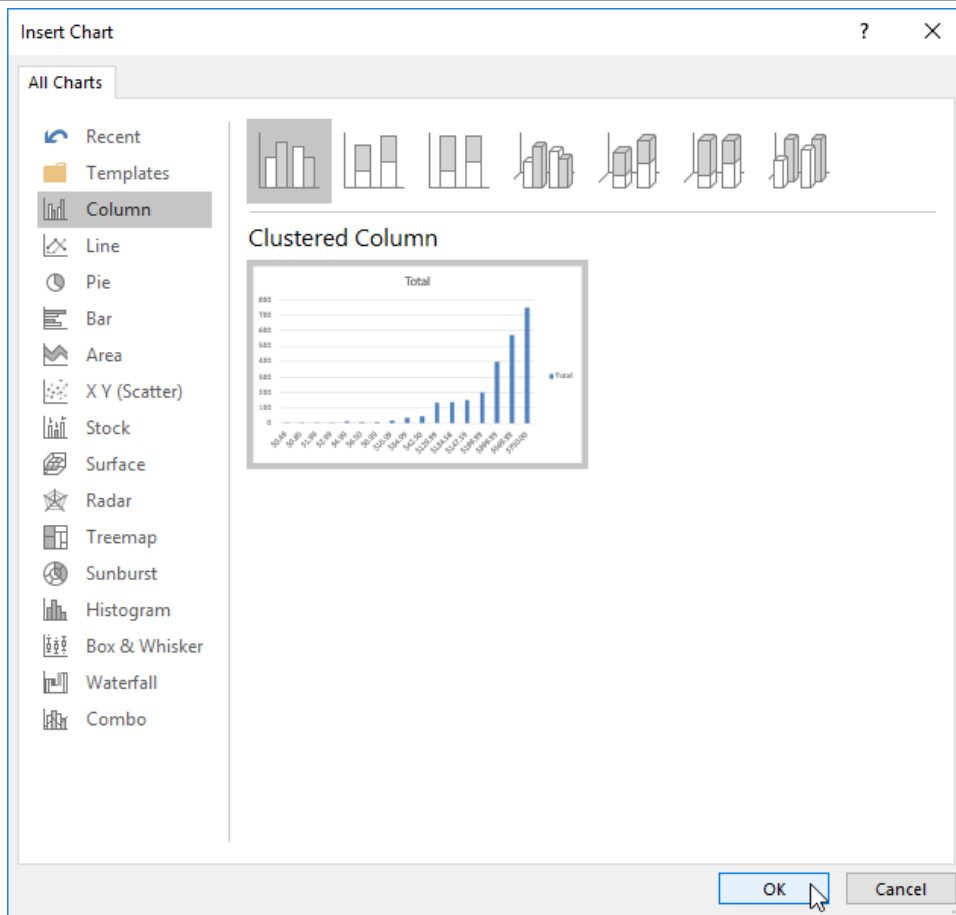
Once you click OK, the PivotChart will then be added to the current worksheet, displaying data from the selected PivotTable:
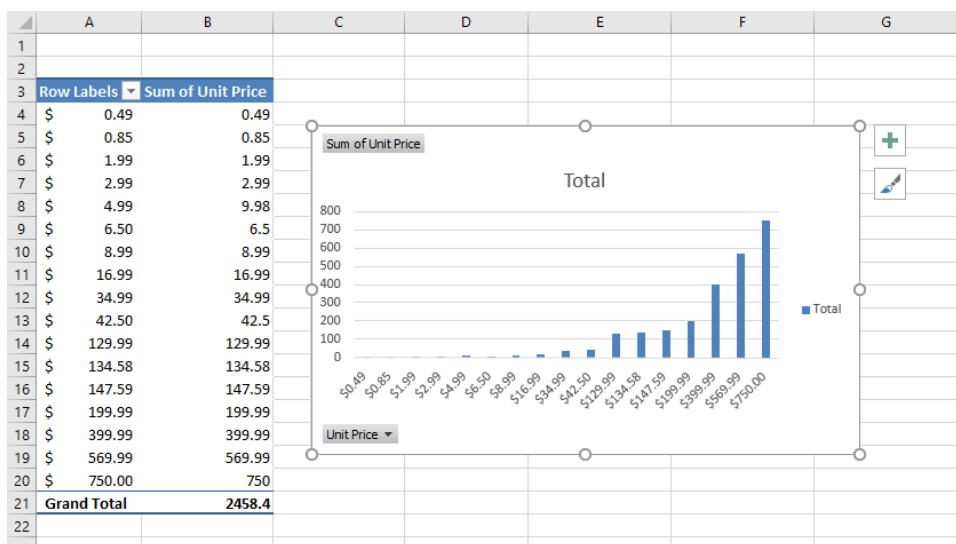
APPLYING A STYLE TO A PIVOTCHART

PivotChart styles are used to slightly adjust how a chart is laid out without changing the primary color scheme. This is excellent for adding a little visual flair to your chart and on occasion, a new chart style can also help a chart's readability.

To format a PivotChart with a style, first click to select the PivotChart in question and then click PivotChart Tools – Design. Examine the Chart Styles group and you will see a gallery of different chart styles that you can choose from:
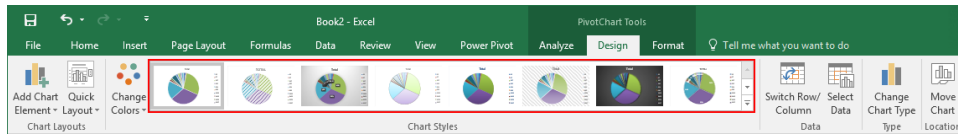
Move your cursor over these chart styles and you will see a preview of how these style will look once applied to your chart. Clicking on a style will apply it:
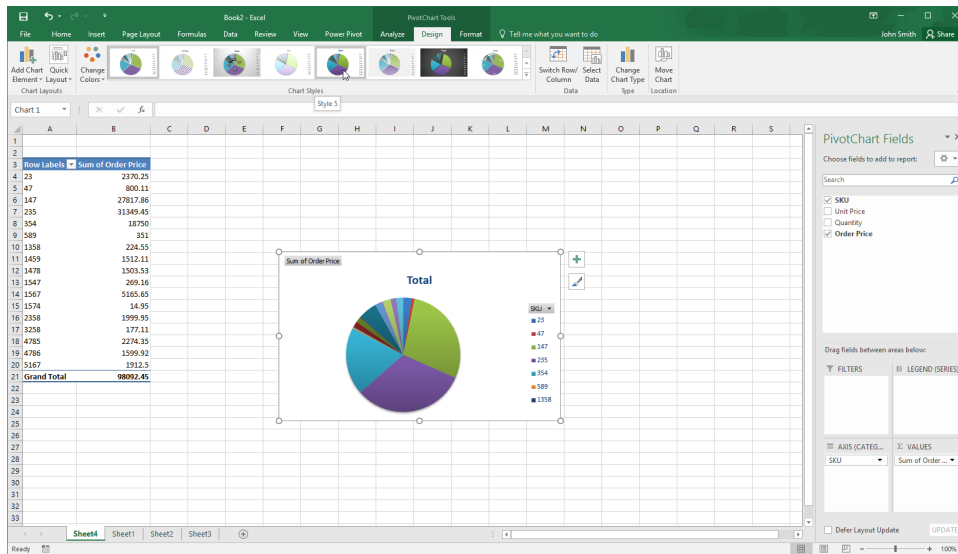
You can also find these styles by clicking the Chart Styles button that appears to the top right of a selected chart:
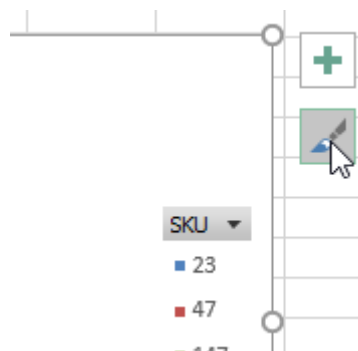
ACTIVITY 5-3

Analyzing Data with PivotCharts

Now that you have completed a PivotTable, you would like to visualize its results using a PivotChart.

1.   To begin, open Activity 5-3 from your Exercise Files folder:
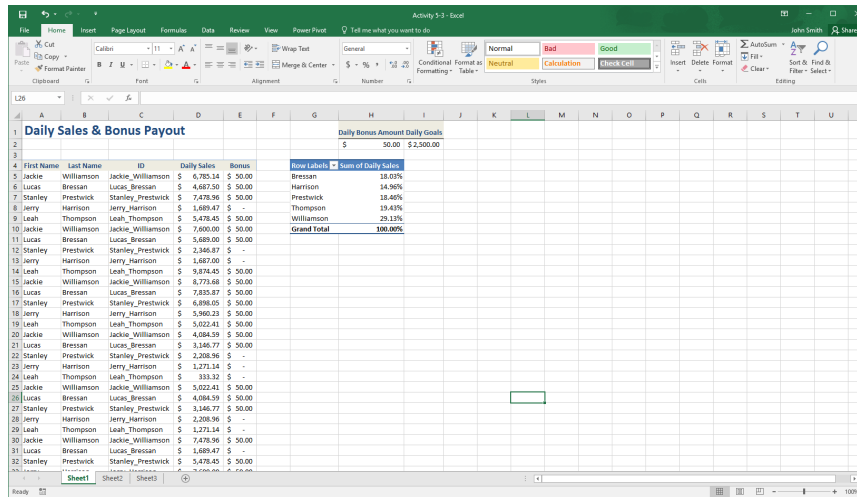
2.   Click inside the PivotTable to select it and then click PivotTable Tools – Analyze →
        PivotChart:
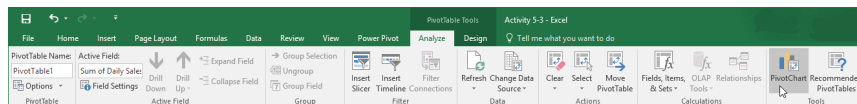
3. The Insert Chart dialog box will now be displayed. For this exercise, click the Pie chart type:
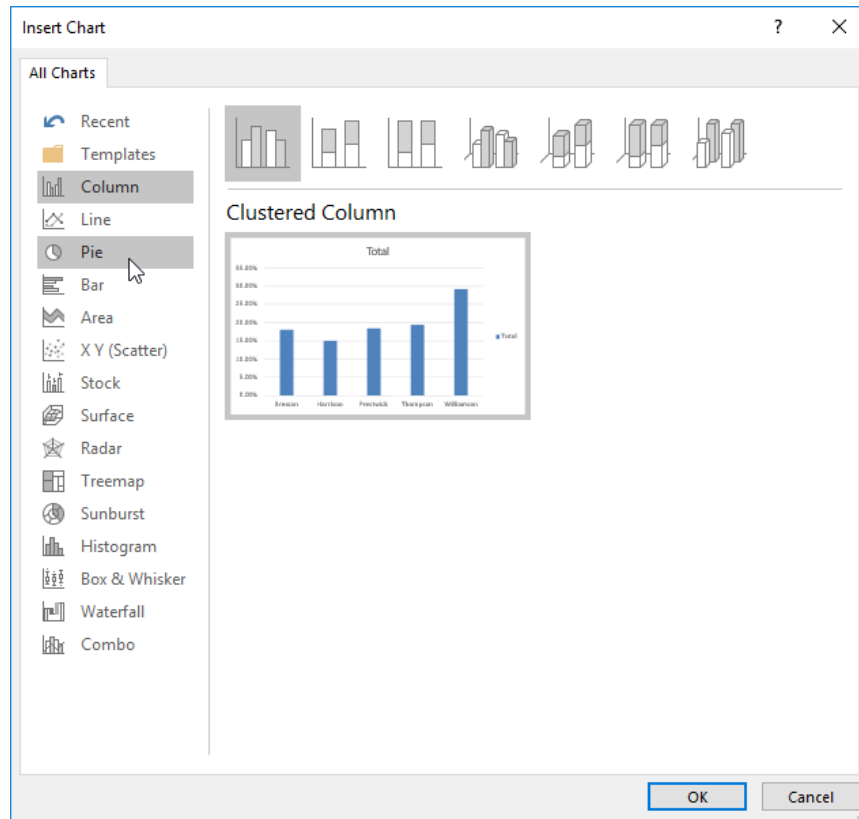
4. With the default pie chart selected, click OK to apply the new settings:
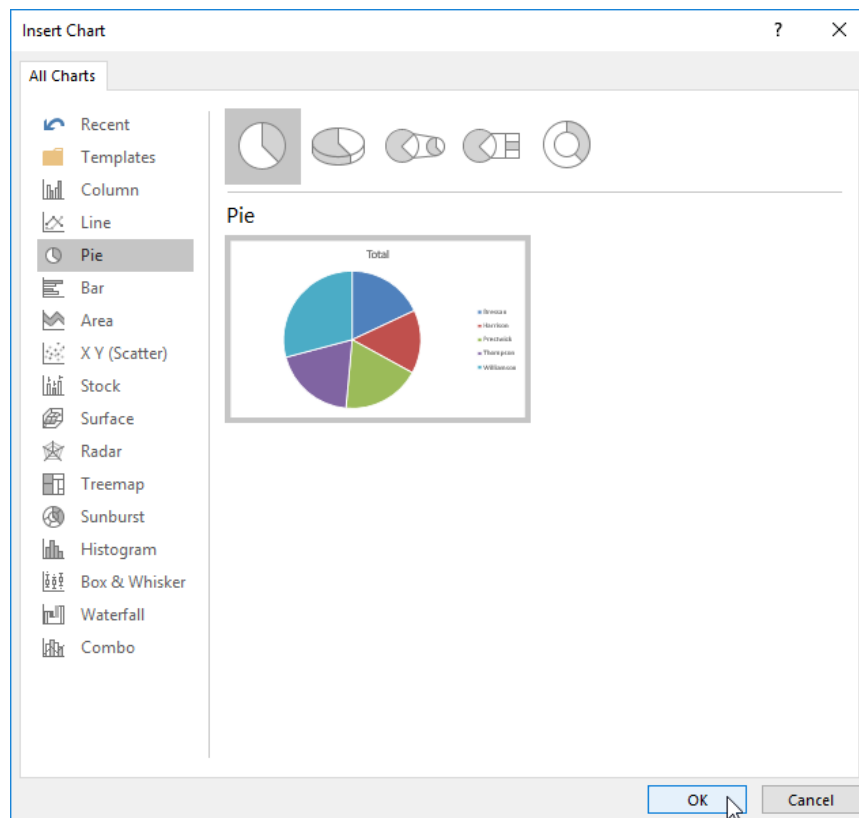
5. The new PivotChart will now appear on your worksheet:
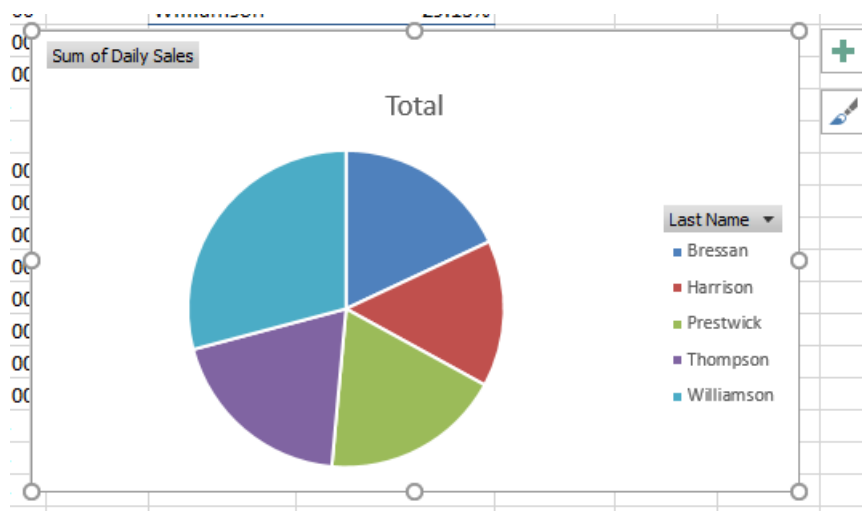
6. As you can see, Williamson generated most of the total sales, so you should filter his results out to focus on the remaining associates. On the PivotChart, click the Last Name drop-down:
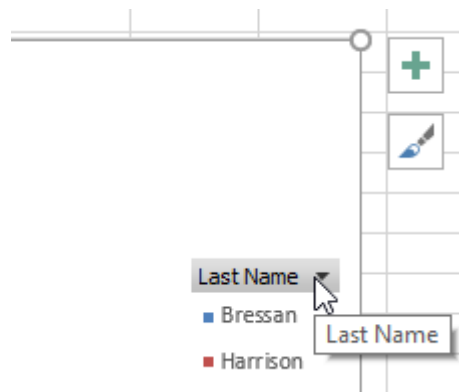
7. On the menu that appears, deselect the Williamson checkbox and then click OK:
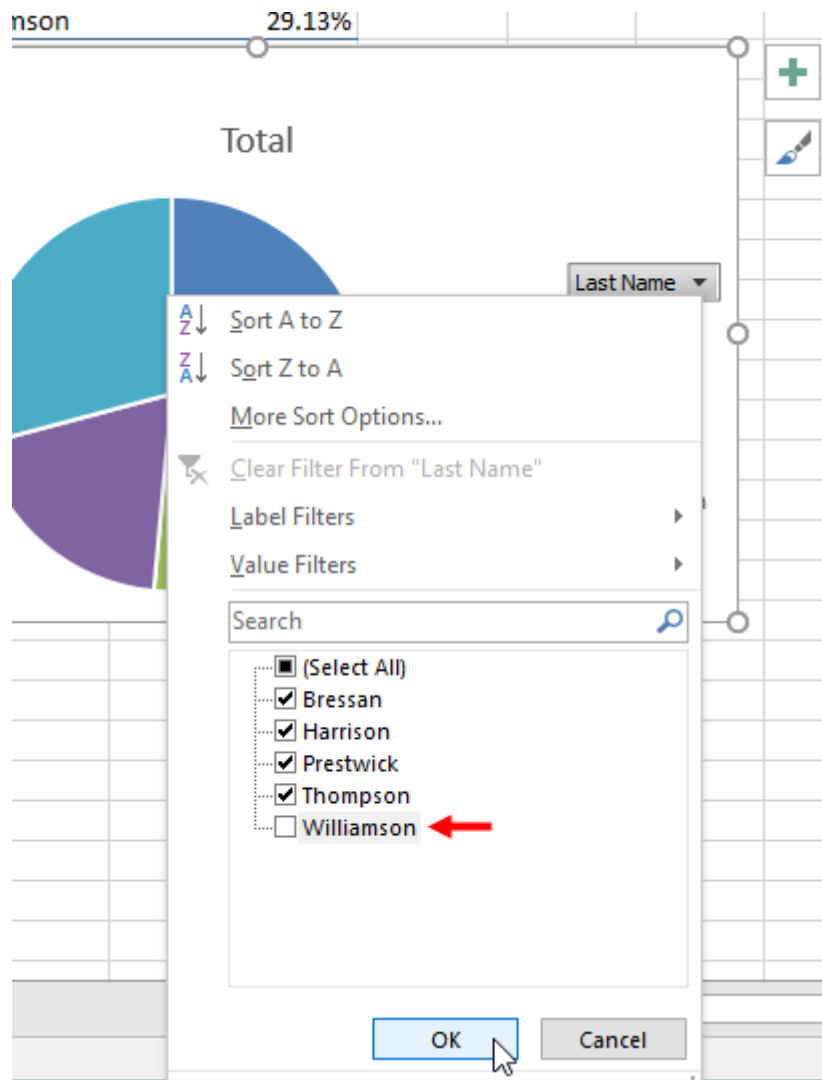
8. The results for Williamson will no longer be displayed on the PivotChart or the PivotTable:
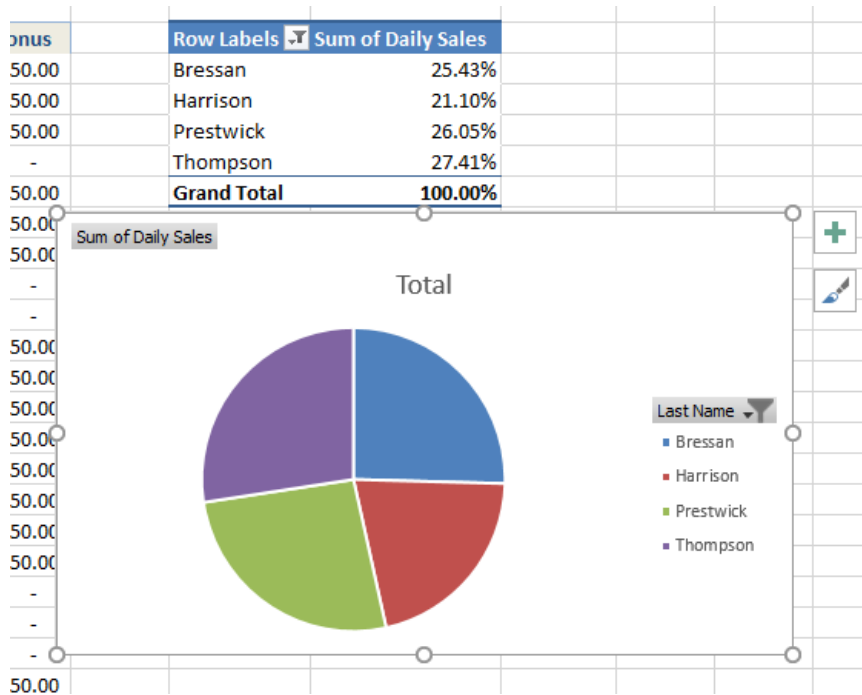
9. Save your work as Activity 5-3 Complete and then close Microsoft Excel 2016.

Summary

In this lesson you learned what PivotTables are and how they can be best used to answer many different types of questions you may have of your data. You now know how to insert a PivotTable, as well as add and remove fields from it. Additionally you are able to generate PivotCharts from a PivotTable, as well as use slicers to selectively filter out unique field entries.

LESSON 6:
INSERTING GRAPHICS

Lesson Objectives

In this lesson you will learn how to:

- Insert and modify graphical objects

- Layer and group graphic objects

- Incorporate SmartArt into your workbooks

TOPIC A: Insert and Modify Graphic Objects

While the default appearance of your worksheets can be quite plain, Excel offers you access to a variety of graphical objects that you can use to enhance their visual appeal. Over the course of this topic, you will learn all about the various different types of graphical objects that you can add to your worksheets, as well as the various contextual tabs that are used to work with them.

Topic Objectives

In this topic, you will learn:
- About graphical objects
- How to insert shapes
- How to insert WordArt
- How to insert text boxes
- How to insert images
- About the Picture Tools – Format contextual tab
- About the Drawing Tools – Format contextual tab
- About the SmartArt Tools contextual tabs

GRAPHICAL OBJECTS

In Excel there are five types of graphical objects that can be inserted into a workbook: SmartArt, screenshots, pictures, online pictures, and shapes. While each graphical object type is mostly tailored to a specific purpose, all of them behave the same once placed on a worksheet. For example, they are all able to be resized, changed, and moved using the same techniques.

The commands to insert graphical objects are located in the Illustrations group on the Insert tab:
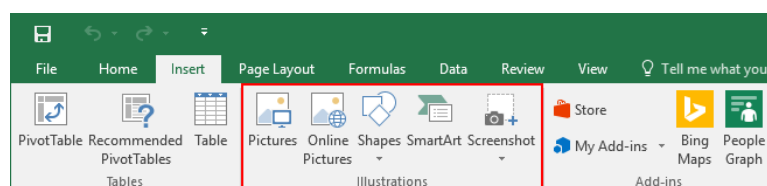
Here is an overview of these commands:

- The **Picture command** will insert image files from outside of Excel into your worksheet. These can be pictures that were downloaded from the Internet, uploaded from a digital camera, or created using imaging software. Most common image formats are supported.
- The **Online Pictures command** gives you access to the Bing search engine, which you can then use to find the exact picture that you need directly from the Internet.
- The **Shapes drop-down command** is used to insert basic shapes, including circles, squares, rectangles, text callouts, and arrows. You can customize all of these objects in a variety of ways.

- Clicking the **SmartArt command** will allow you to choose and insert a SmartArt graphic. These types of graphics are pre-configured and are typically used to graphically represent text-based content, such as flowcharts and lists.
- Finally, the **Screenshot command** will allow you to take a screenshot of any open window or your desktop. This screenshot will then be inserted into the current worksheet.

INSERTING SHAPES

To insert a shape into the current worksheet, first click Insert → Shapes:
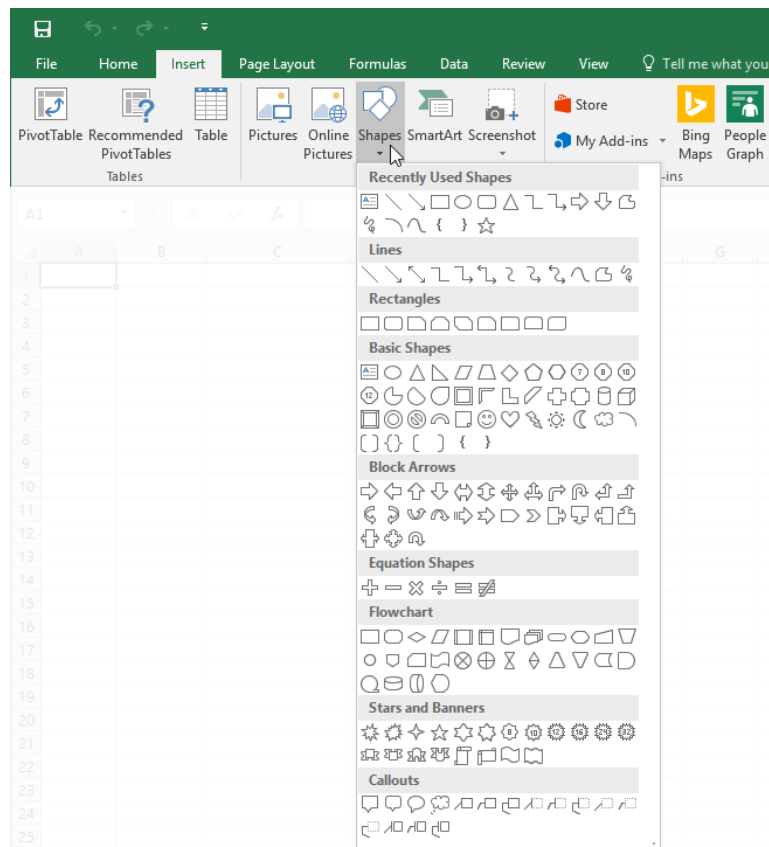
This dropdown command will reveal that there are nine major categories in the Shapes menu:
- **Recently Used Shapes:** Contains the most recently used shapes (up to the last 24).
- **Lines:** Create a variety of lines and plain arrows.
- **Rectangles:** Create a variety of rectangular shapes.
- **Basic Shapes:** Create basic shapes, such as circles and triangles. Fun shapes like smiley faces are also included here.
- **Block Arrows:** Create block-style arrows and lines.
- **Equation Shapes:** Create mathematical shapes.
- **Flowchart:** Create shapes used in flowcharts, such as decision points and terminators.
- **Stars and Banners:** Offers 20 different types of these shapes.
- **Callouts:** Annotate other drawings and images.

Once you decide on the shape that you would like to insert, click on its listing in the drop-down menu. This action will cause your cursor to change into a crosshair. You can then click once to add the shape using its default dimensions or click and drag over the worksheet area to add it using custom dimensions of your own selection:
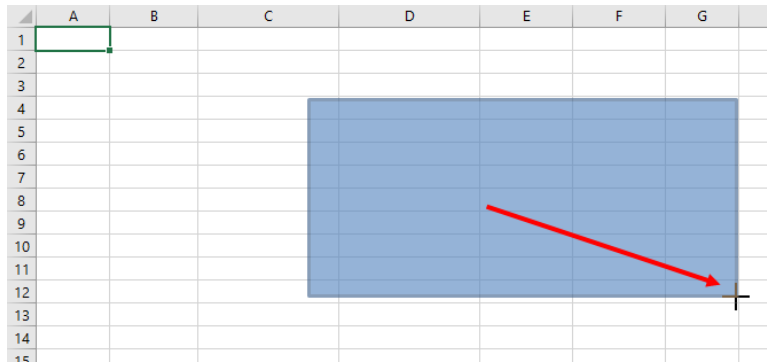
Upon releasing your mouse button, the shape will now appear on the worksheet. You can then manipulate and work with it as you would any other object in Excel:
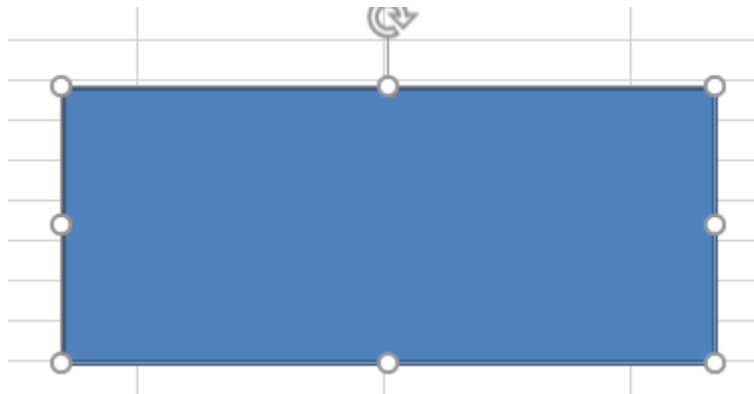
INSERTING WORDART

WordArt is special text that you can add to your workbook that includes decorative flair like drop-shadows and other accents. To insert WordArt into the current worksheet, click Insert → WordArt → [WordArt Style]:
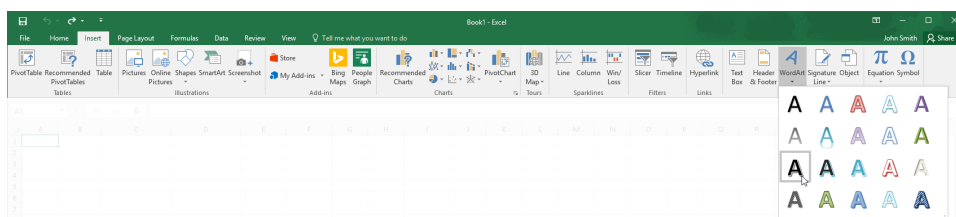
The WordArt will then be added in its own text box using the style that you selected:
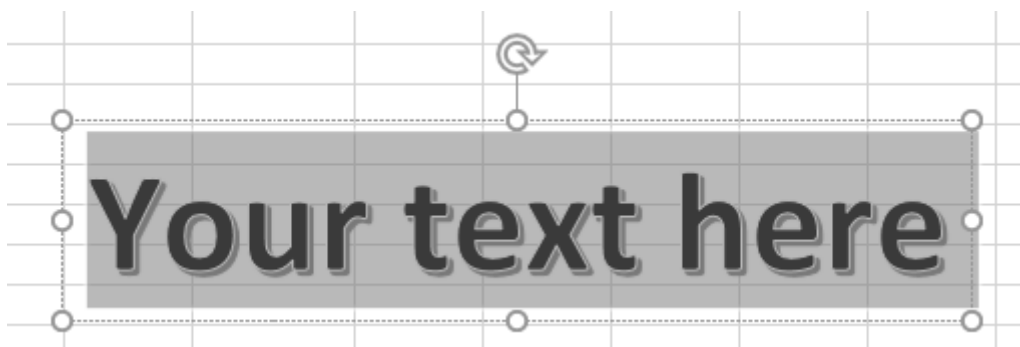
Click inside of this text box and type the content that you would like to appear inside of it:
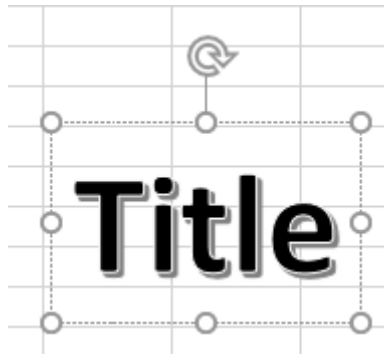
You can then move this text around on the current worksheet in the same manner as you would move any other object in Excel.

INSERTING TEXT BOXES

As the name suggests, text boxes are simply boxes that you can add to a worksheet that are used to display text without having to embed that text directly within a cell. This adds some added flexibility when designing your worksheets and it is commonly used to add additional information without interfering with the data.

To insert a text box into a worksheet, click Insert → Text Box:
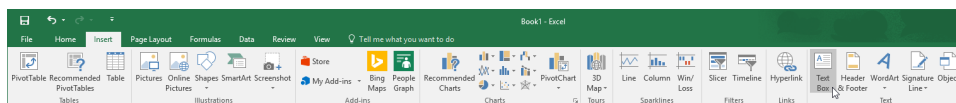
This action will change the shape of your cursor. Use your cursor to draw the text box on the current worksheet through the click and drag method:
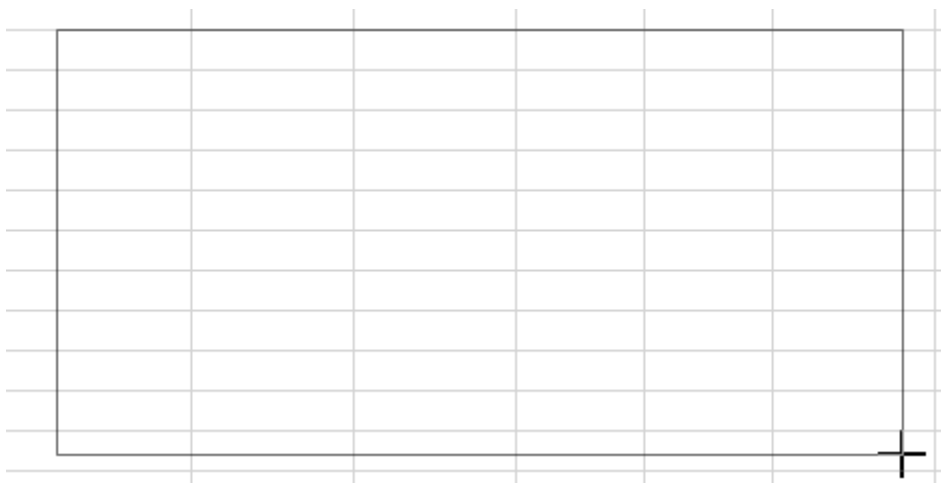
Upon releasing your mouse button, the new text box will be added and selected. Inside of this text box, you can immediately begin adding any text that you want included:
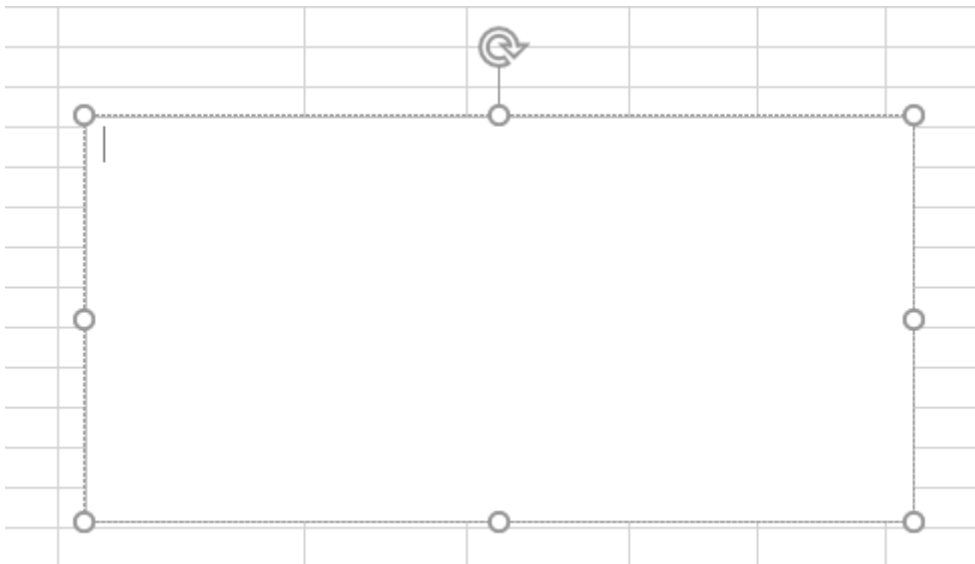
INSERTING IMAGES

Images are able to be inserted into your workbooks from your computer or from those that are found online. To insert images from your computer, first click Insert → Pictures:
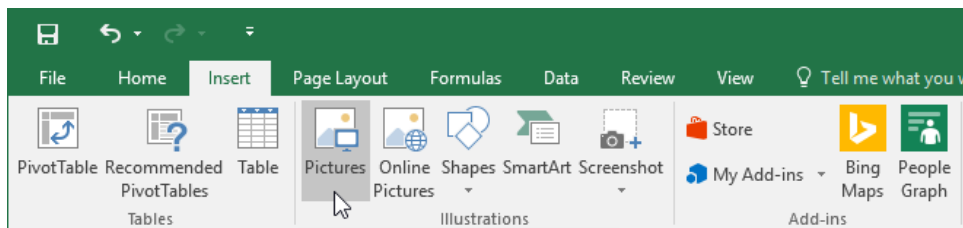
This action will display the Insert Picture dialog box. Use its controls to browse to the location on your computer where the image that you would like to insert is located. Click to select the image in question and then click Insert:
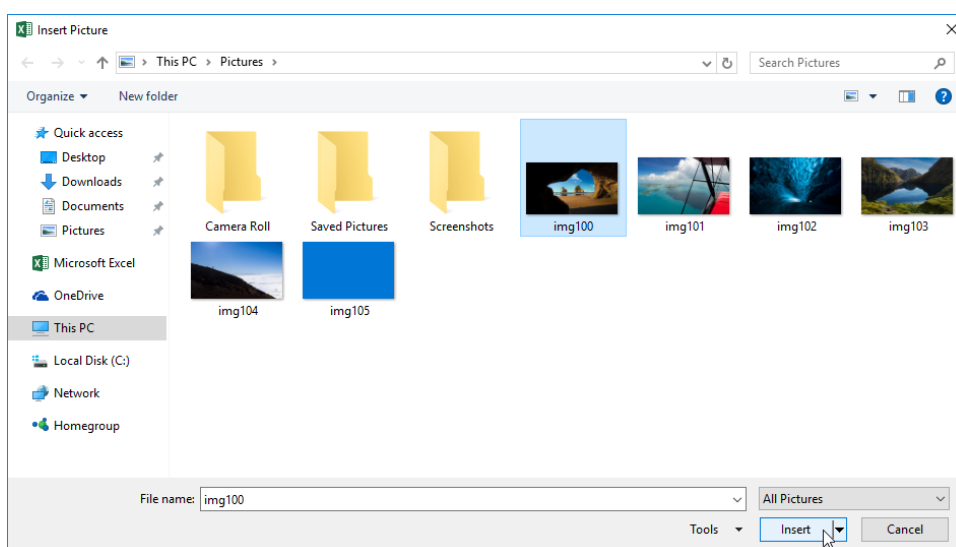
The picture will then be inserted into your worksheet where you can move and resize it like any other object in Excel:

To insert an online picture, click Insert → Online Pictures:
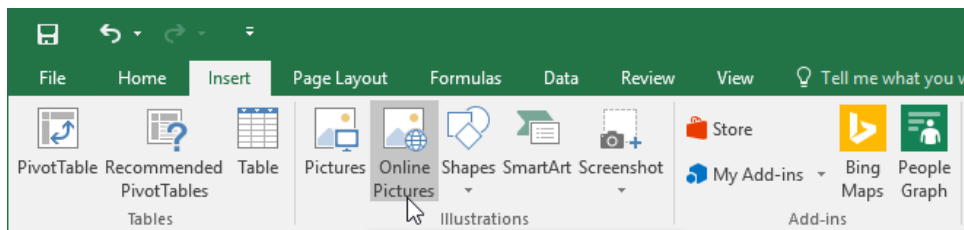
This action will display the Insert Pictures dialog. Listed inside you will see the option to search the web for images using Bing. If you are signed into a Microsoft account, you may also see options to insert pictures from Facebook, Flickr, and other sites:
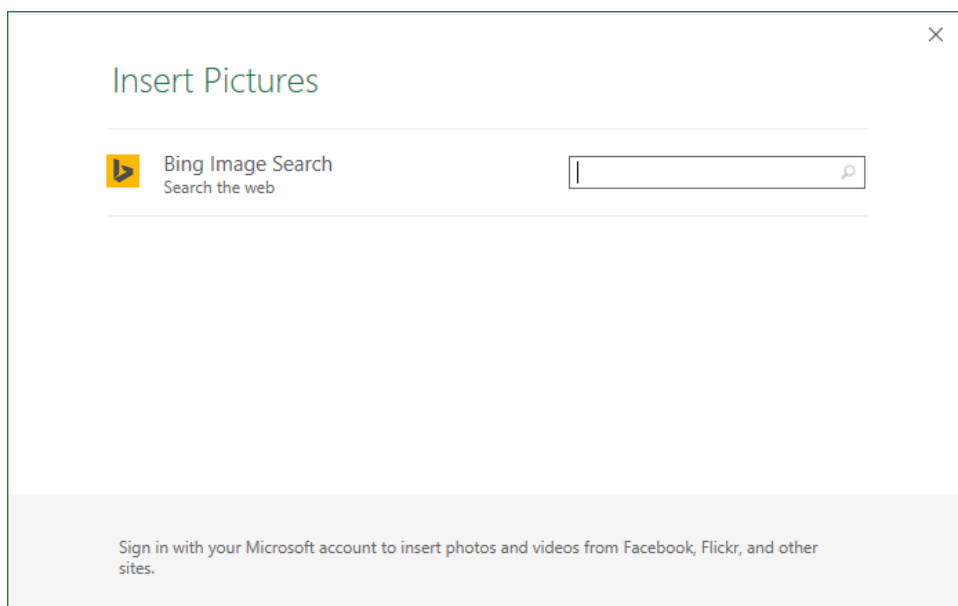
To use the Bing image search functionality type keywords into the provided text box and press Enter. Results from you search will be displayed. Click to select the result that you would like to add to the current worksheet and then click Insert:
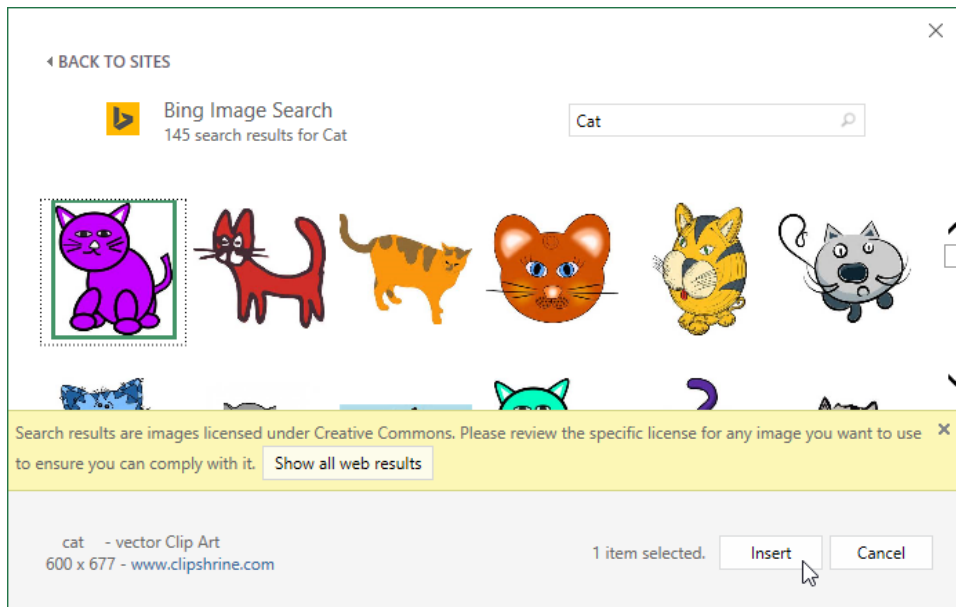
The selected image will then be inserted into the current worksheet. You can then work with this image as you would any other graphical object in Excel:
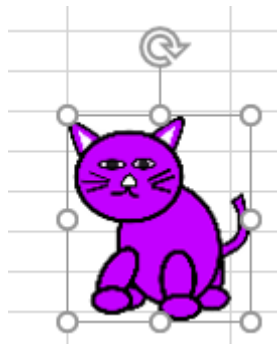
THE PICTURE TOOLS – FORMAT CONTEXTUAL TAB

The Picture Tools – Format contextual tab is displayed whenever a graphical object that is considered a picture is selected. This tab displays many of the tools and commands that you will need to format and edit a picture in Excel:
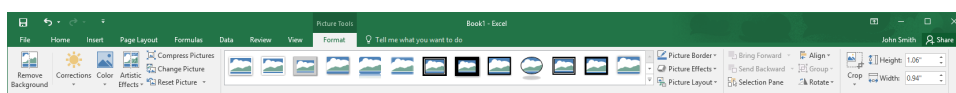
This tab contains the following groups:
- The **Adjust group** contains image editing tools, including options to remove the background and touch up the picture.
- The **Picture Styles group** contains pre-configured styles that you can apply to an image, as well as menus to customize the border, layout, and effects applied to the image.

- The **Arrange group** allows you to manage the position of images.
- The **Size group** gives you control over the height and width of the image.

THE DRAWING TOOLS – FORMAT CONTEXTUAL TAB

The Drawing Tools – Format contextual tab is displayed whenever a graphical object that is considered a drawing (such as a shape) is selected. This tab displays many of the tools and commands that you will need to format and edit a drawing in Excel:
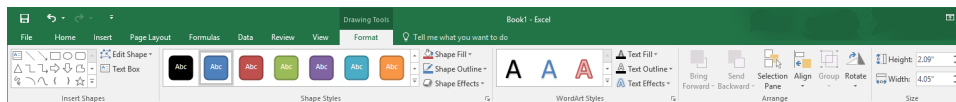
This tab contains five groups with commands that can be used to edit drawings in some way:
- The **Insert Shapes group** allows you to insert more shapes into the current worksheet, as well as insert text boxes and change the type of shape.
- The **Shape Styles group** includes a gallery which contains a variety of pre-configured styles that you can choose from. You can also customize the fill, outline, and effects of a selected shape.
- The **WordArt Styles group** also contains a gallery, but this one includes a variety of WordArt styles that can be added to drawings. You can also customize the fill, outline, and effects of the WordArt.
- The **Arrange group** allows you to adjust how objects are placed on a worksheet and the order in which they appear if they overlap.
- Finally, the **Size group** includes two increment boxes that are used to change the width and height of a selected object.

THE SMARTART TOOLS CONTEXTUAL TABS

The SmartArt Tools contextual tab set will be displayed whenever a SmartArt graphic is selected. This contextual tab set consists of two tabs: Design and Format.

The SmartArt Tools – Design Tab
The SmartArt Tools – Design tab is comprised of four groups that contain commands to change the structure of SmartArt graphics, apply styles, and more:
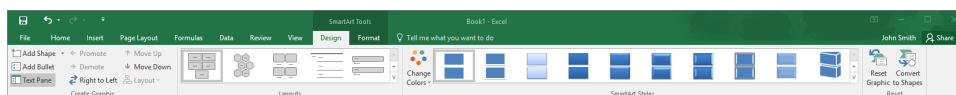
Let's look at each of these groups:
- The first group on the Design tab is the **Create Graphic group**. This is where you will find commands to add SmartArt shapes and text to the selected SmartArt graphic. Additionally, this group also contains commands to position the selected SmartArt graphic in the hierarchy of other SmartArt graphics.
- The **Layouts group** contains a gallery of possible layout options that you can choose from and apply.

- The **SmartArt Styles group** contains a gallery with styles to change the color scheme and effects of the selected SmartArt graphic. You can also change the overall color scheme from this group.
- Finally, the commands inside the **Reset group** are used to remove customization from the selected graphic, as well as convert SmartArt graphics into basic Excel shapes.

The SmartArt Tools – Format Tab

The SmartArt Tools – Format tab is comprised of five groups. Most of the commands on this tab are used to customize individual shapes within a SmartArt graphic:
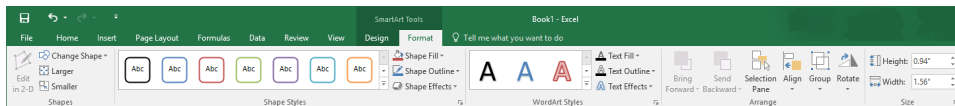
Let's look at each of these groups:

- The **Shapes group** contains commands to change the shape and size of individual SmartArt shapes.
- The **Shape Styles group** includes a gallery to apply a variety of styles to a selected SmartArt shape.
- The **WordArt Styles group** also contains a gallery, but this is used to apply formatting to text inside a SmartArt shape.
- The **Arrange group** includes commands for customizing how shapes are arranged and placed on the worksheet.
- The **Size group** contains increment controls to change the size of the selected SmartArt shape.

ACTIVITY 6-1

Inserting Graphical Objects

To add some visual flair to one of your workbooks, you would like to insert a few graphical objects.

1. To begin, open Activity 6-1 from your Exercise Files folder:

2. Let's start by inserting some online pictures. Click Insert → Online Pictures:
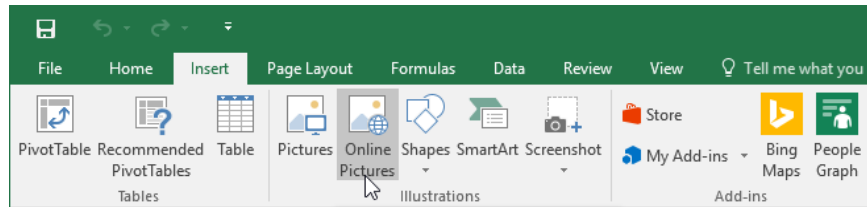
3. The Insert Pictures dialog will now be displayed:
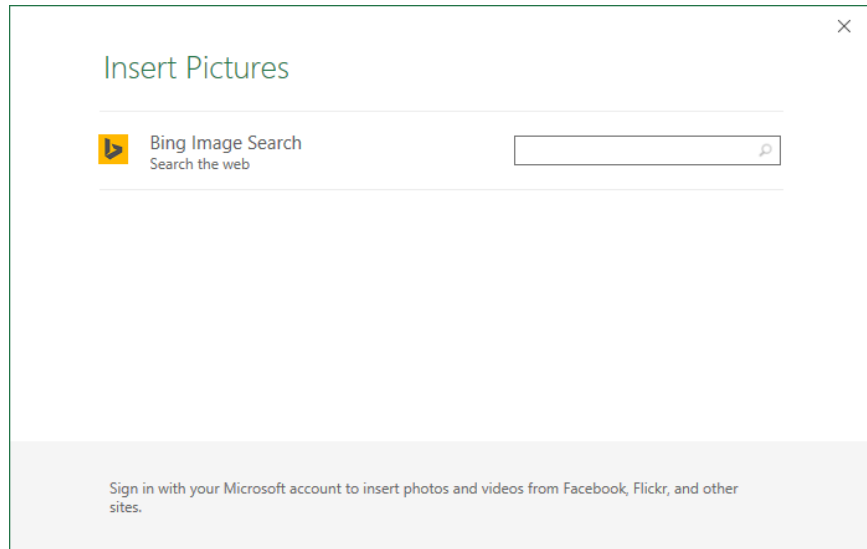
4. Click inside the search text box and type "Calculator." Execute the search by pressing the Enter key or clicking the magnifying glass icon:
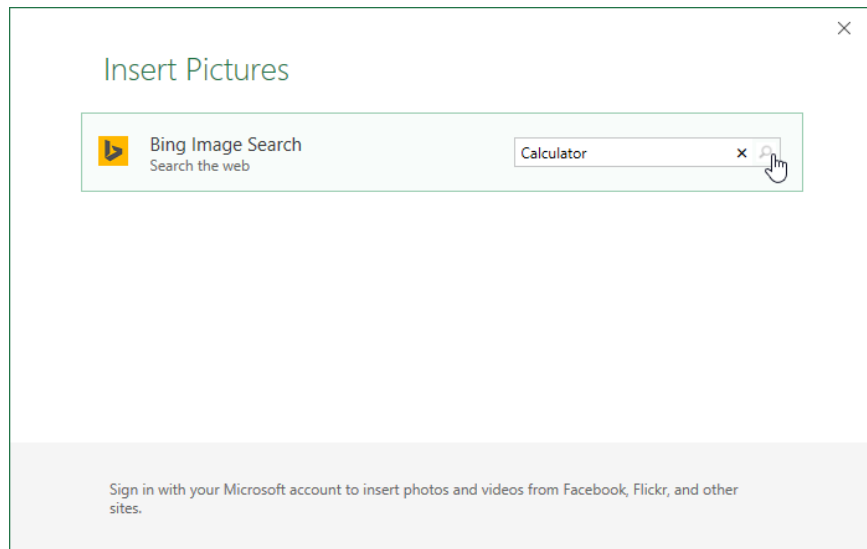
5. The results from the search will now be displayed. Click any result that you like:
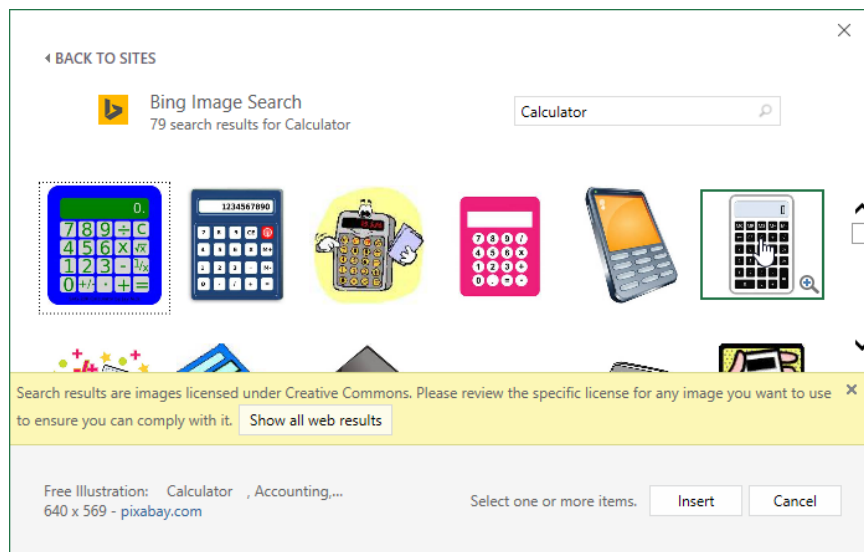
6. With the picture that you would like to use selected, click Insert:
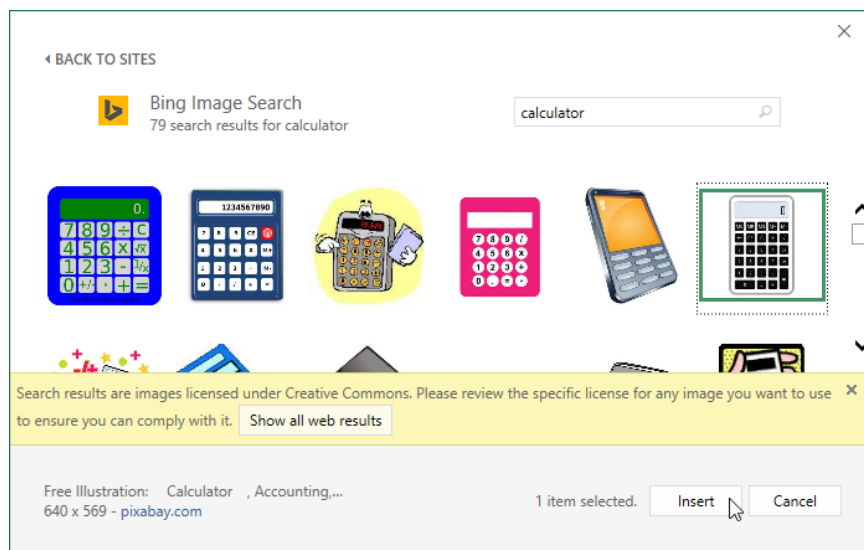
7. The selected Clip Art will be placed on the current worksheet:
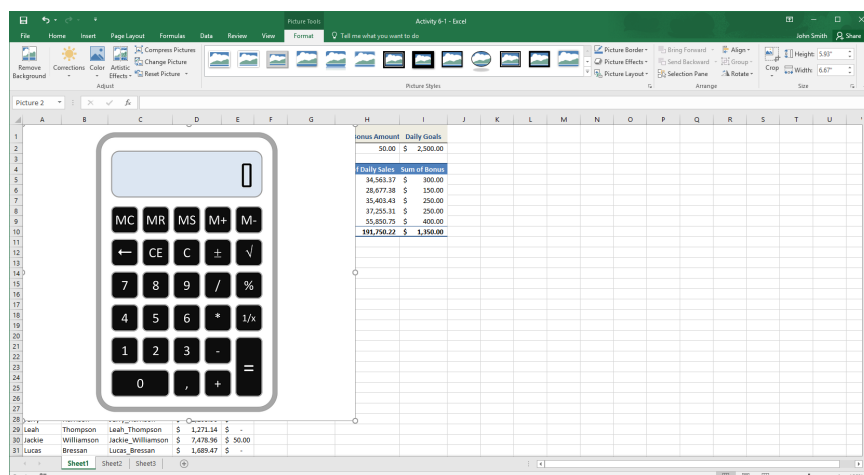
8. If necessary, click and drag the bottom right-hand corner handle of the image while holding down the Ctrl key to make the image about the same size as the example shown below:

(You may be able to skip this step if you picked a small image.)

9. Now, click and drag the image so that it appears just under the existing PivotTable:

10. Now, you just need to add a small shape to the title. Click Insert → Shapes → 5-Point Star:
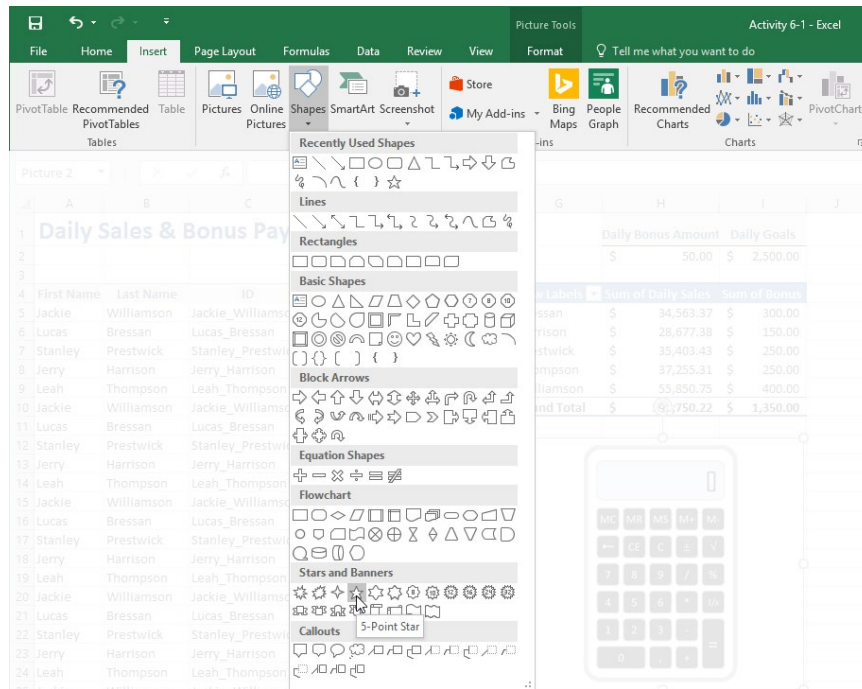
11. Your cursor will now have turned into a crosshair. Just to the right of the title, click and drag until the star shape is roughly the same height as row 1:
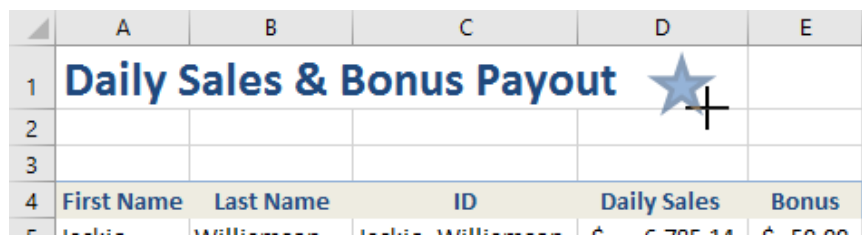
12. Release your mouse button to add the shape. Click on a blank area of the worksheet to deselect the new shape. The worksheet will now look like this:
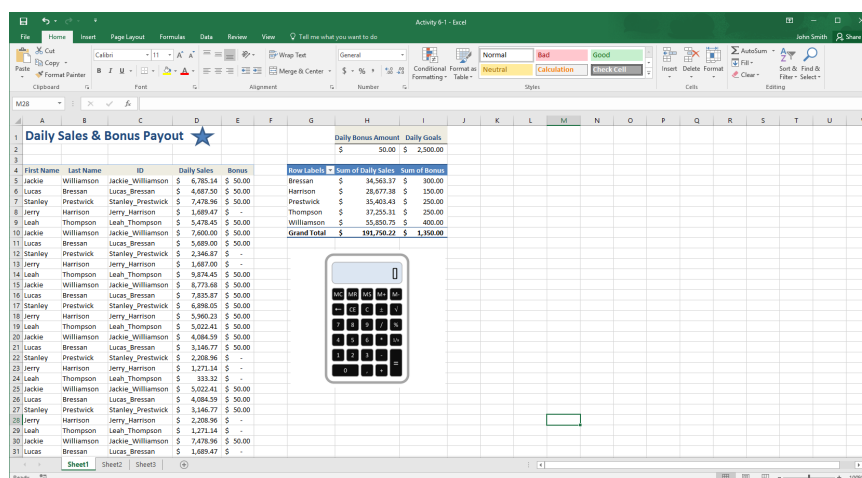
13. Save your changes as Activity 6-1 Complete and close Microsoft Excel 2016.

TOPIC B: Layer and Group Graphic Objects

Once you have added graphical objects to a worksheet, it is important to know how to organize their positioning in relation to one another. Using layers, you can choose which object overlaps another, while grouping allows you to group multiple graphical object together so that you can adjust their properties all at the same time. Over the course of this topic, you will learn all about layering and grouping graphical objects in Microsoft Excel 2016.

Topic Objectives
In this topic, you will learn:
- About layering objects
- About grouping objects
- About positioning objects

LAYERING OBJECTS

When a graphical object is added to a worksheet, it is added to its own layer so that it can overlap any existing objects. You can manipulate a layer and how it interacts with others by moving it forward or backward in the stack of layers – just like moving the top-most card in a deck below the next and vice-versa. To do this, first click to select the object that you would like to work with and then click Picture Tools – Format (or Drawing Tools – Format) → Bring Forward or Bring Backward:
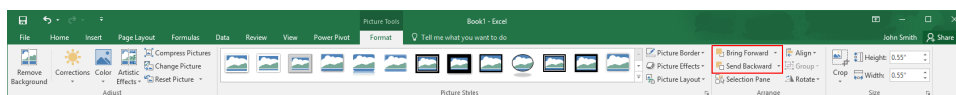
If you would instead like to move a selected graphical object to the bottom or top of the stack of layers, the Bring Forward → Send to Front, or Send Backward → Send to Back commands can be used:
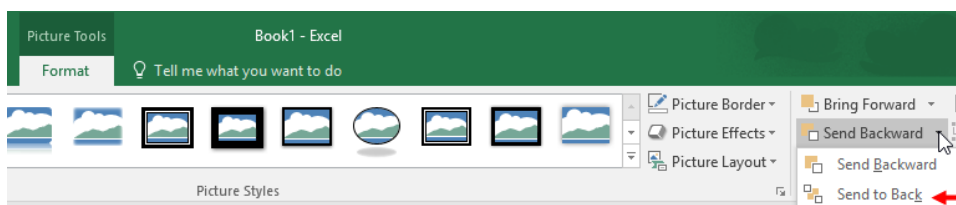
Alternatively, you can view and interact with the various graphical objects that exist on layers within the worksheet by opening the Selection task pane. To do this, click Picture Tools (or Drawing Tools) – Format → Selection Pane:
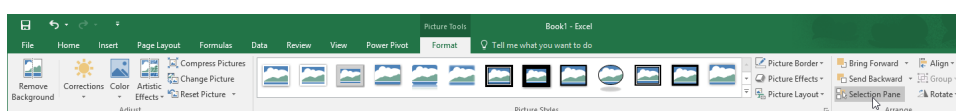
This task pane will list all of the graphical objects that exist on the current worksheet and how they are currently arranged:
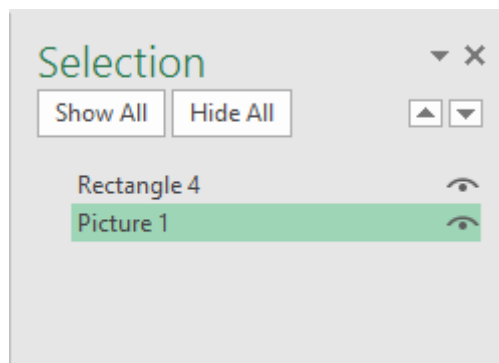
If you would like to change how these objects are arranged, click and drag them around in this list to shift their location:
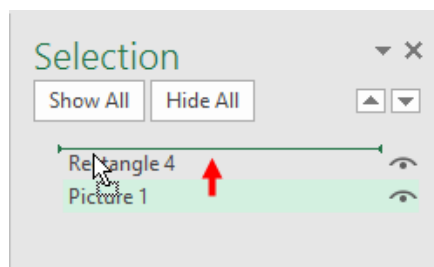
GROUPING OBJECTS

If you would like to work with multiple objects as a group, such as moving them all at the same time, you can group them together. To do this, select each graphical object that you would like to group (hold the Ctrl key while clicking on each object). Next, click Picture Tools – Format (or Drawing Tools – Format) → Group → Group:
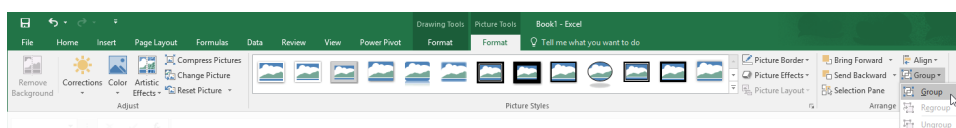
Once two or more graphical objects are grouped together, any changes made to the group will be applied to all of its members – including size, position, and more:

	A	B	C
1			
2	ABC Widgets Inc. Global Sales		
3		Global	Outside of USA
4	Q1	$ 600,000,000.00	65%
5	Q2	$ 122,000,000.00	88%
6	Q3	$ 56,000,000.00	74%
7	Q4	$ 22,000,000.00	46%
8			

To ungroup any objects that have been grouped together, first click to select the group in question and then click Picture Tools – Format (or Drawing Tools – Format) → Group → Ungroup:
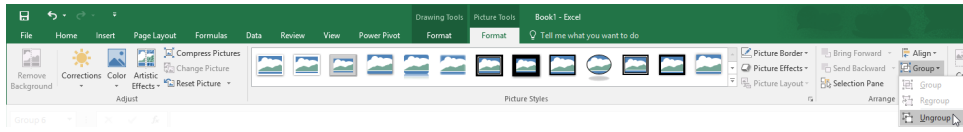
After ungrouping a group, you can quickly reform it by selecting one of the objects that a member of the previous group and clicking Picture Tools – Format (or Drawing Tools – Format) → Group → Regroup.

POSITIONING OBJECTS

Objects can be positioned in relation to the grid of the worksheet, as well as in relation to other shapes appear on it. You can enable either of these options by clicking Picture Tools – Format → Align → Snap to Grid (or Snap to Shape) while the object that you would like to work with is selected:
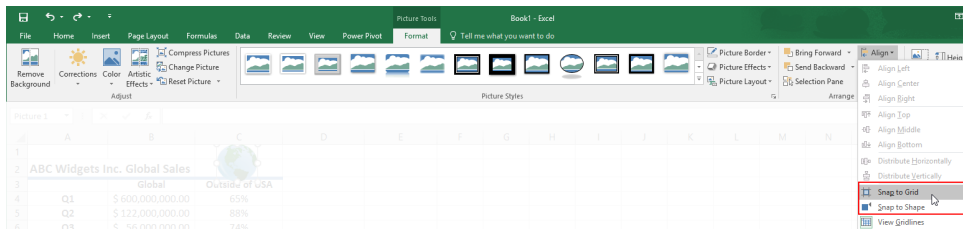
ACTIVITY 6-2

Inserting and Grouping Shapes

The workbook that you have been working on includes multiple shapes. You would like to arrange how these objects are layered, as well as group them together.

1.   To begin, open Activity 6-2 from your Exercise Files folder:
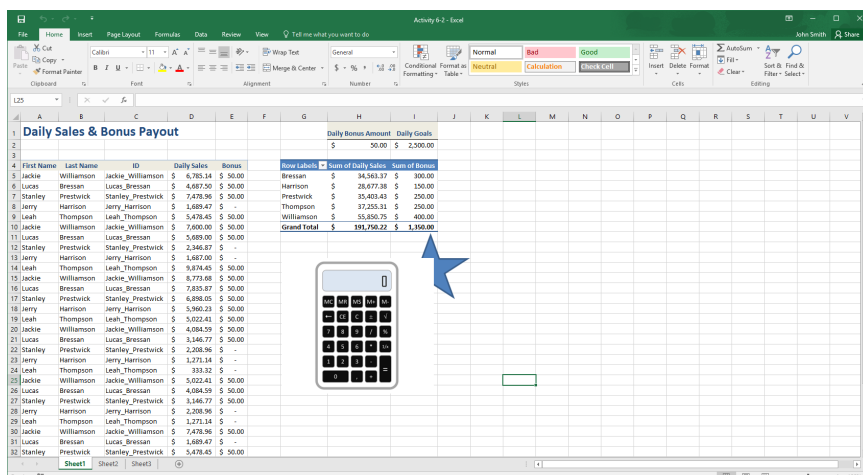
2. First, you need to move the star shape so that it appear in front of the calculator drawing. Click to select the calculator drawing and then click Drawing Tools – Format → Send Backward:
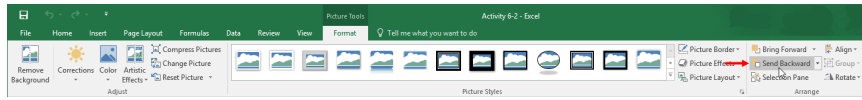
3. The star shape layer will now appear above the calculator drawing:
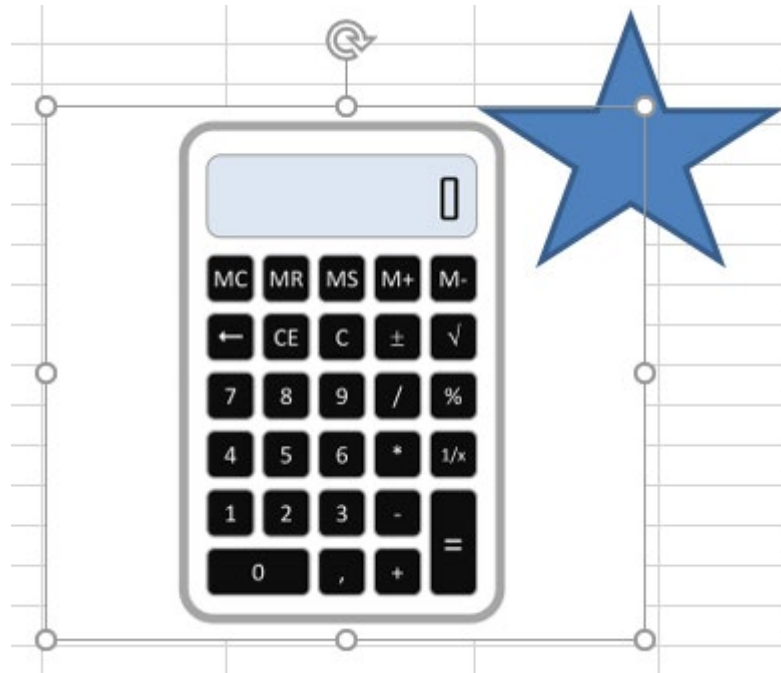
4. While holding down the Ctrl key, click to select both the calculator drawing and the star shape:
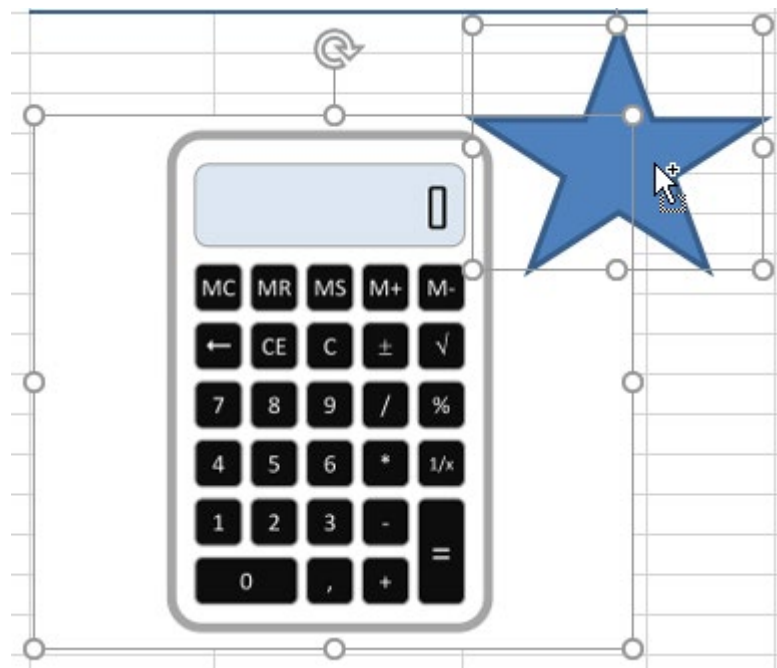
5.   Click Picture Tools – Format → Group → Group:
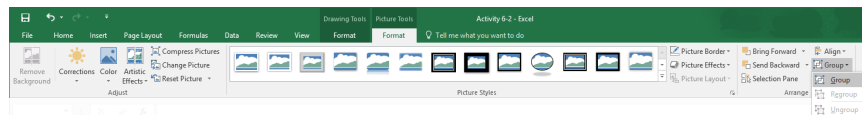
6.   The two graphical objects are now grouped together. Click and drag this group so that they are placed to the right of the table:
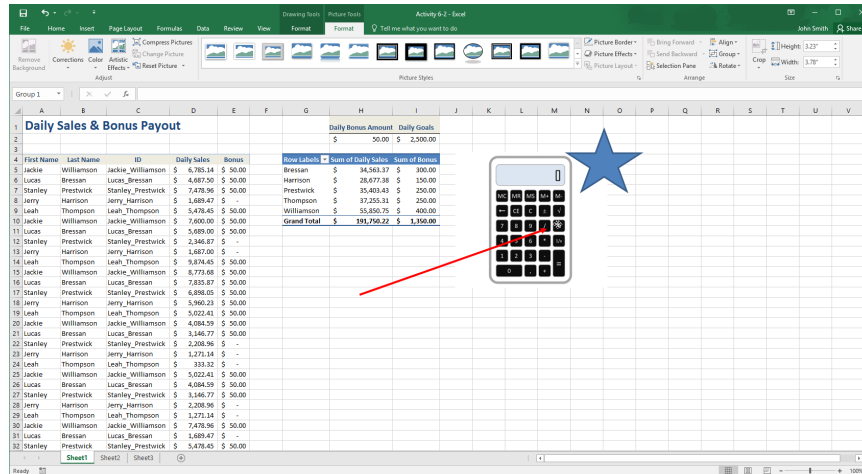
7.   Save your changes as Activity 6-2 Complete and then close Microsoft Excel 2016 to complete this exercise.

TOPIC C: Incorporate SmartArt

SmartArt combines text-based information with graphics to create a more appearance-driven look. Using Excel's tools, you will be able to create great SmartArt that can be used for a variety of different purposes. Over the course of this topic, you will learn how to insert SmartArt into your workbooks, as well as customize it after it has been inserted.

Topic Objectives
In this topic, you will learn:
- About SmartArt graphics
- About the Choose a SmartArt Graphic dialog box
- About the Text pane

ABOUT SMARTART

SmartArt graphics are used to visually represent text-based content. A great example of this would be a flowchart or hierarchy diagram; while you can describe these things, it is much more intuitive to the reader to see a graphic that describes and separates each step. Just like other graphical objects, SmartArt graphics are individual objects on a worksheet that can be moved and modified as group when needed. Some of these changes are made using the **Sizing handles (1)**, while the **Text Pane (3)** allows you to quickly add text. This pane is toggled by clicking the **arrow button (2)** that appears on the left side of a SmartArt object:
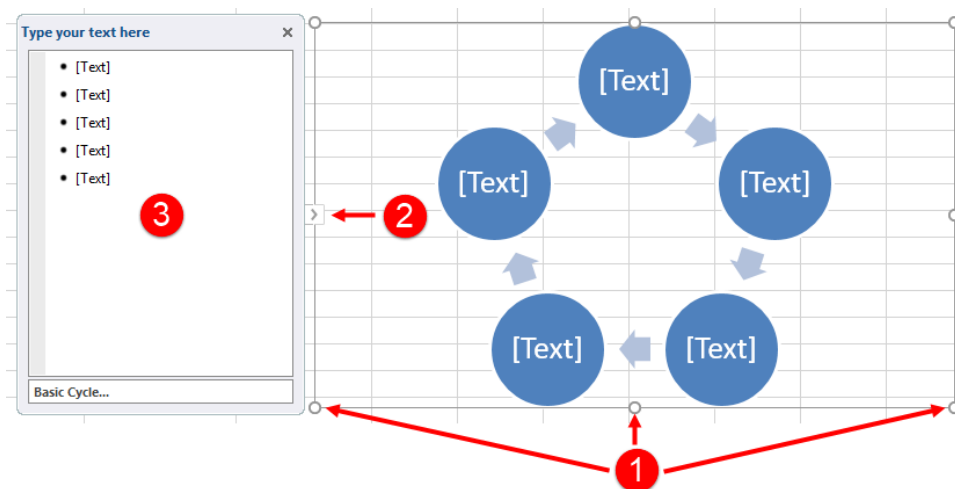
THE CHOOSE A SMARTART GRAPHIC DIALOG BOX

To insert SmartArt into a worksheet, click Insert → SmartArt:
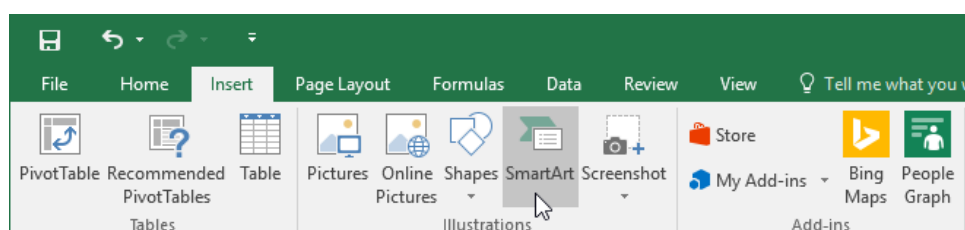
This action will display the Choose a SmartArt Graphic dialog box:
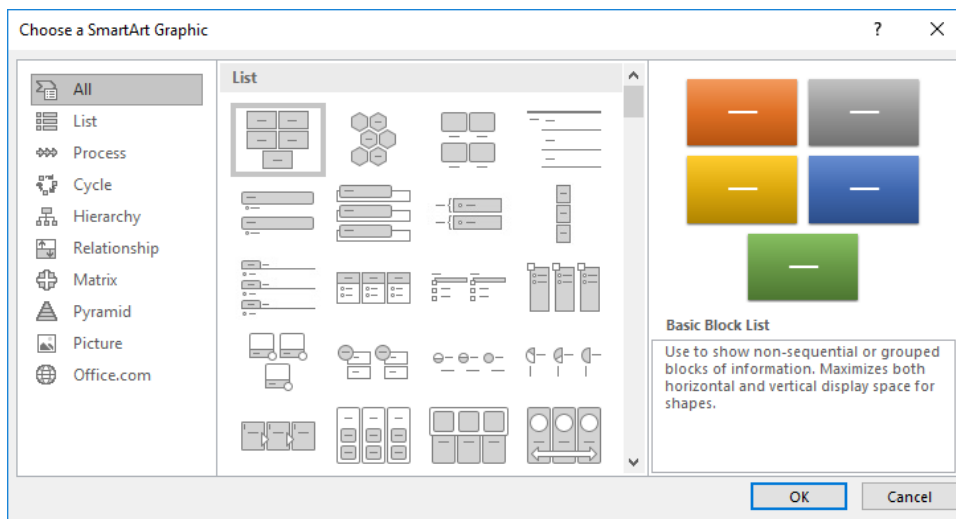
The Choose a SmartArt Graphic dialog box is divided into several categories of graphics, each of which is displayed in a panel on the left. Here is an overview of each of these categories.

- The **List category** is used to create bulleted lists with some visual flair
- The **Process category** is used to illustrate information in sequential order, such as a series of steps to complete a task
- The **Cycle category** is intended to illustrate continuous processes
- The **Hierarchy category** will display the steps in a process or the people in an organizational chart
- The **Relationship category** is used to show how elements can connect to each other
- The **Matrix category** is used to show how elements in a system relate to it.
- The **Pyramid category** is used to create diagrams that display how elements of varying importance, size, or power relate proportionally to each other
- Finally, the **Picture category** is used to create diagrams that display content using a combination of text and graphics

By clicking on these categories, you will change what type of SmartArt layouts are displayed in the middle pane. Clicking the thumbnail for a SmartArt graphic will display a preview for that graphic as well as a brief description for it. With the thumbnail still selected, click OK to insert this graphic.

ABOUT THE TEXT PANE

When you first insert SmartArt into a worksheet, the Text pane will be displayed beside it:
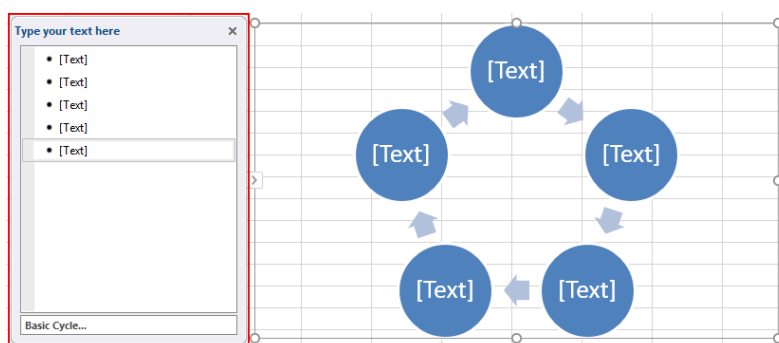
(It can also be displayed or hidden by clicking SmartArt Tools – Design → Text Pane.)

Using this pane you are able to enter text into the SmartArt graphic. While you are still able to enter text directly into the graphic by clicking on the placeholder text and typing over it, the Text pane offers broader control over it.

For example, if you are working with bulleted lists, the Text pane will give you a clear indication where you are inserting text in relation to the other bullet points. Additionally, because each bullet point represents a graphic, adding new graphics is usually as simple as adding another bullet point inside the Text pane. (However, note that not all SmartArt graphics work this way. Depending upon exactly what SmartArt graphic that you are working with, adding new bullet points may just add a bullet point to the text within the shape.)

ACTIVITY 6-3

Incorporating SmartArt

You need to create a simple SmartArt graphic that will list all of the sales associates in your department.

1. To begin, open Activity 6-3 from your Exercise Files folder:
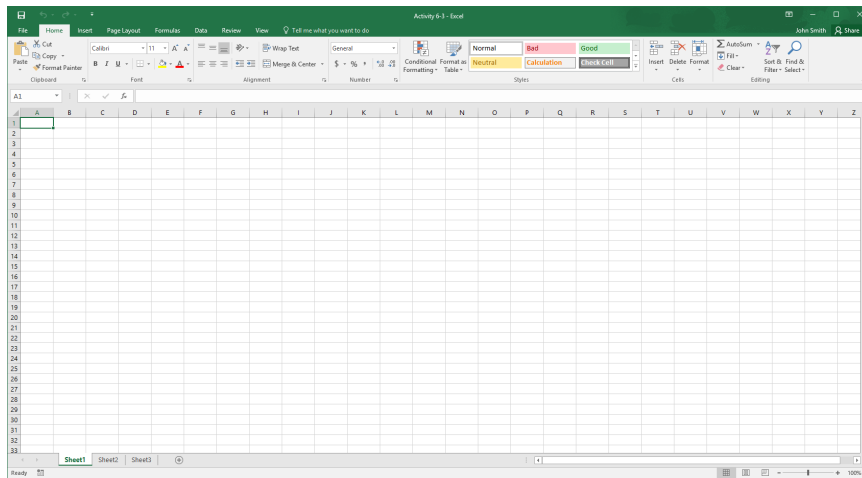
2. Click Insert → SmartArt:
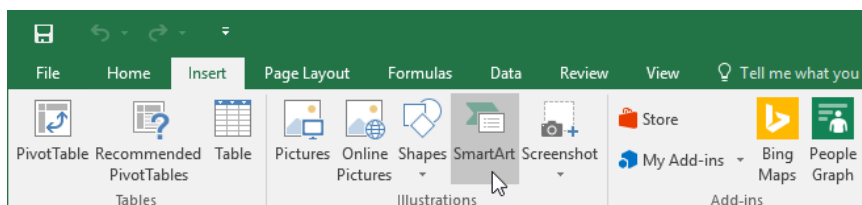
3. The Choose a SmartArt Graphic dialog box will now be displayed. Ensure that either the All or List category has been chosen and then ensure that the Basic Block List graphic has been selected. Click OK:
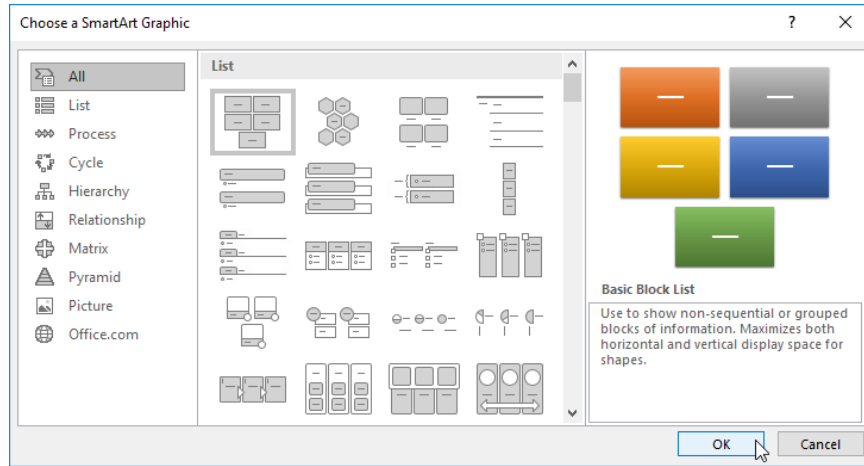
4. The SmartArt graphic will now be placed on the current worksheet:
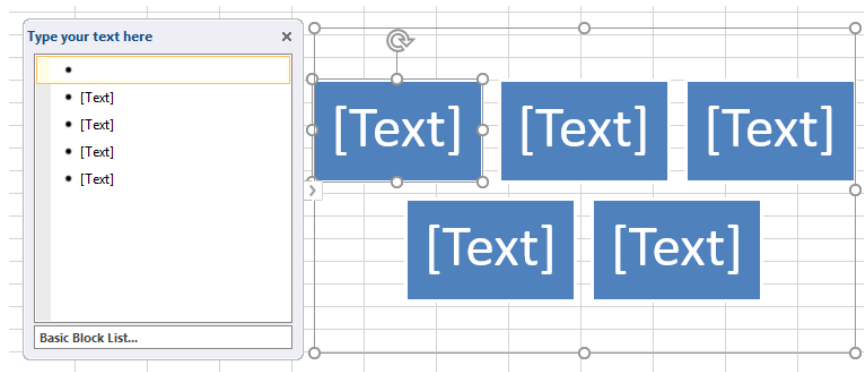
5. Inside the Text pane, type "Williamson:"
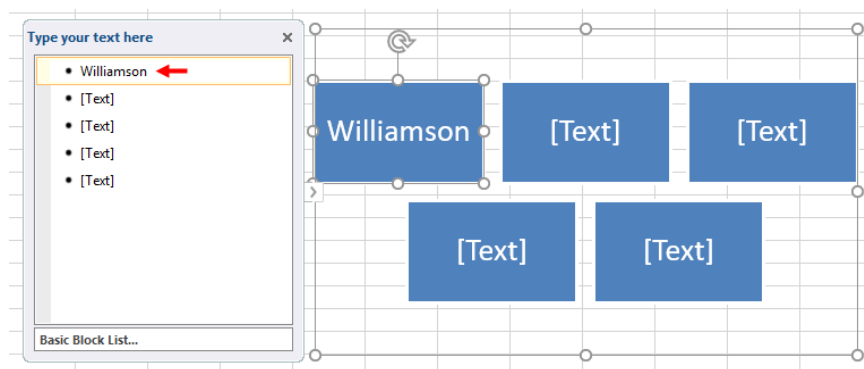
(If you do not see the Text pane, click SmartArt Tools – Design → Text Pane.)

6. Click to select the next bullet point in the list. This time type "Bressan:"
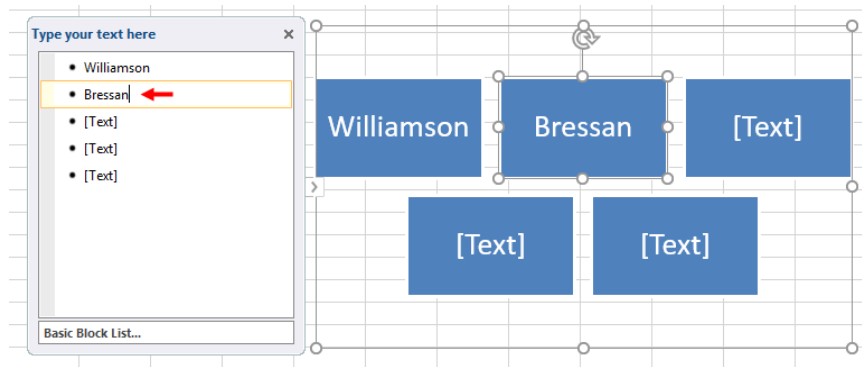
7. Repeat the above steps until the Text pane looks like the example shown here:
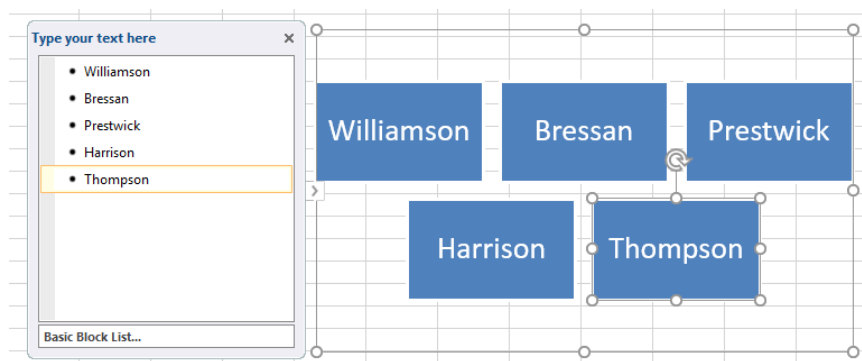
8. Save your work as Activity 6-3 Complete and then close Microsoft Excel 2016.

Summary

This lesson taught you how graphical objects can be used to enhance the appearance of your workbooks. You learned how to insert graphical objects of different types into worksheets as well as how to modify them to suit your needs. Additionally, you learned about SmartArt, how it works, and how to add it to a worksheet.

LESSON 7:
ENHANCING WORKBOOKS

Lesson Objectives

In this lesson you will learn how to:

- Customize workbooks

- Manage themes

- Create and use templates

- Protect files

- Prepare a workbook for audiences

TOPIC A: Customize Workbooks

Your workbooks can be customized in a number of different ways. Over the course of this topic, we will focus on customization through the addition of comments, hyperlinks, watermarks, and background pictures.

Topic Objectives
In this topic, you will learn:
- About comments
- About hyperlinks
- About watermarks
- About background pictures

COMMENTS

Notes can be added to any worksheet by adding **comments**. Typically they are used to add additional context to items within a worksheet to help guide other users, but they can be used to add notes about any topic.

To add a comment, first select the cell that you would like the comment to be added to. Next, click Review → New Comment:
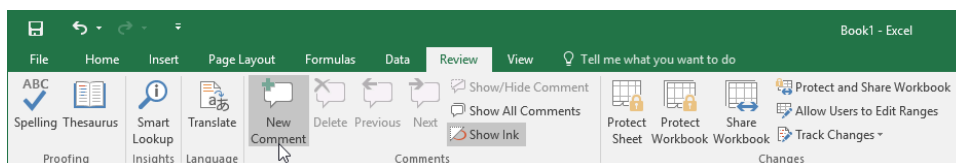
This action will create a new comment and a red comment indicator will appear in the upper right-hand corner of the currently selected cell. The comment will be labeled with the current user's name, but this can be changed by replacing that text as needed. To add text to the comment, type inside the provided text area:

Once you are done, click anywhere outside of the comment text area to hide it; however, the red comment indicator will remain visible:

To view the comment again, click to select the cell in question or simply hover your cursor over it. To delete a comment, click to select the cell in which the comment has been placed and click Review → Delete.

HYPERLINKS

Hyperlinks are a mainstay in the computing world. They enable you to navigate around your computer, browse the Internet, and jump to different cells within the same workbook. Excel lets you use this handy feature for breaking up long workbooks, pointing people to a web page, providing contact information, and much more.

To create a hyperlink, first click to select the cell where you want the hyperlink to be created. Next, click Insert → Hyperlink:
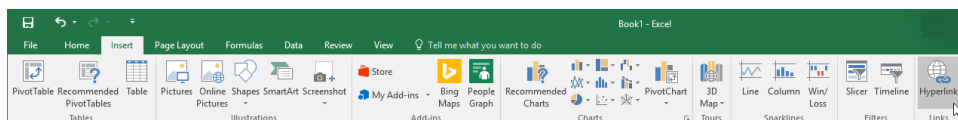
This action will display the Insert Hyperlink dialog box.
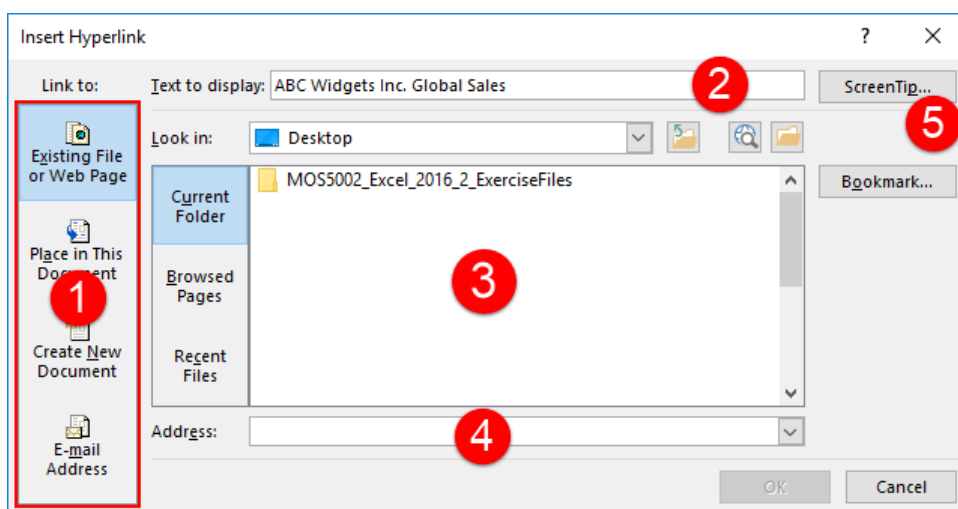
The left-hand side of the dialog allows you to **choose the type of link (1)** that you want to create. By default, the "Existing File or Web Page" option will be selected. (It will likely be the type of link you use most often.)

With this option, you will see the settings shown above. At the top of the dialog, you can set the **text to display (2)**. This is the text that will turn blue and will contain the actual link. (By default, any text in the cell that you selected will appear in this field, but you can modify it if you wish.)

Below this field, you can choose the **file (3)** or **website (4)** that you want to link to. You can also set up a **ScreenTip (5)** for the link.

When you are ready, click OK to save your changes, or click Cancel to discard them. Note that the OK button will not be active until both the "Text to display" and Address fields are filled in.

Once the hyperlink has been inserted, you will see that it appear blue and underlined. Clicking on the link will open it, but clicking and holding on the link will select the cell that contains it:

To remove a link, right-click the hyperlink in question and then click Remove Hyperlink in the context menu.

WATERMARKS

While Excel 2016 does not include a direct way to create watermarks, you can add them using WordArt. To do this, first insert WordArt by clicking Insert → WordArt → [WordArt Style]:
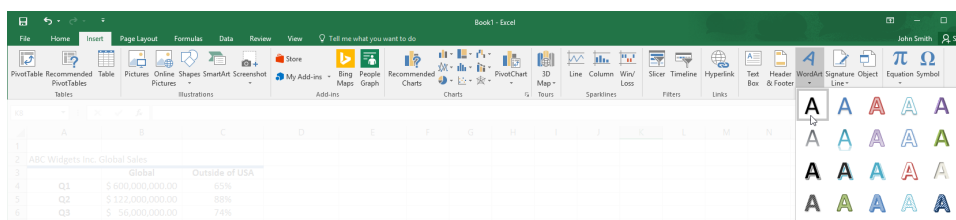
Next, type the text that you would like to make up the watermark and rotate it if needed:
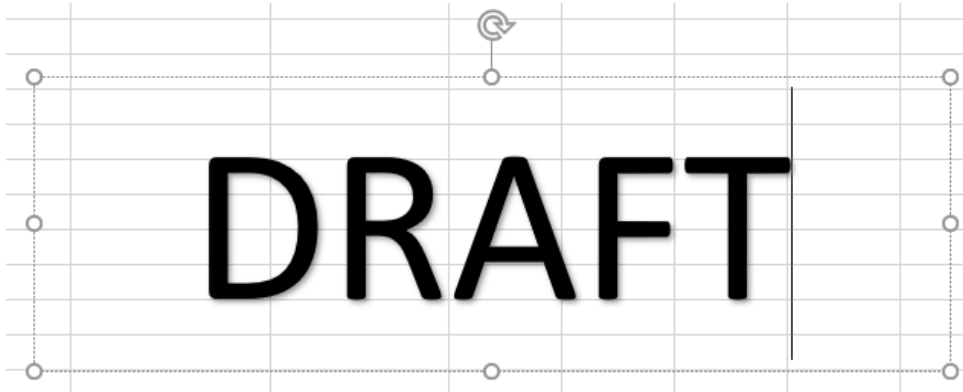
With the WordArt selected, open the Text Fill & Outline category of the Format Shape pane and adjust the Transparency slider:
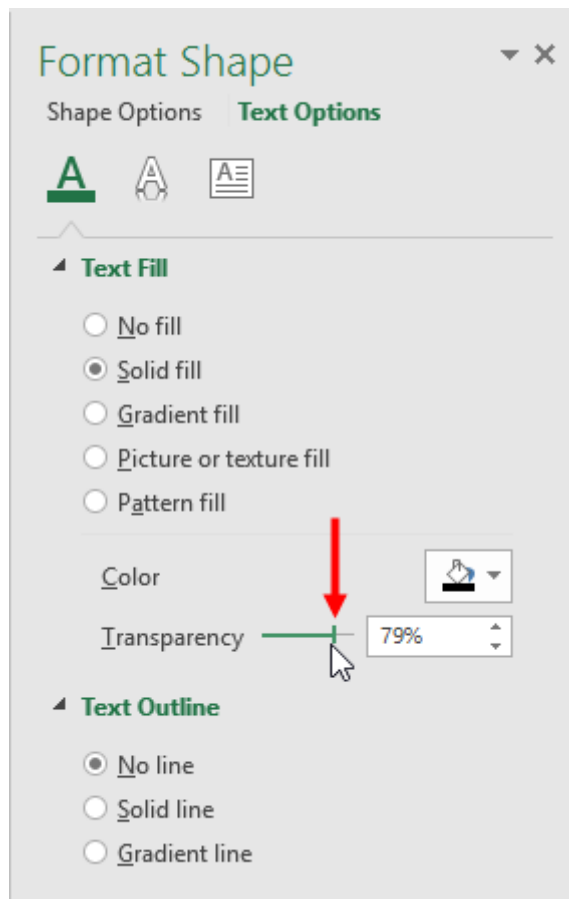
The watermark will now be ready and you can reposition it as needed:
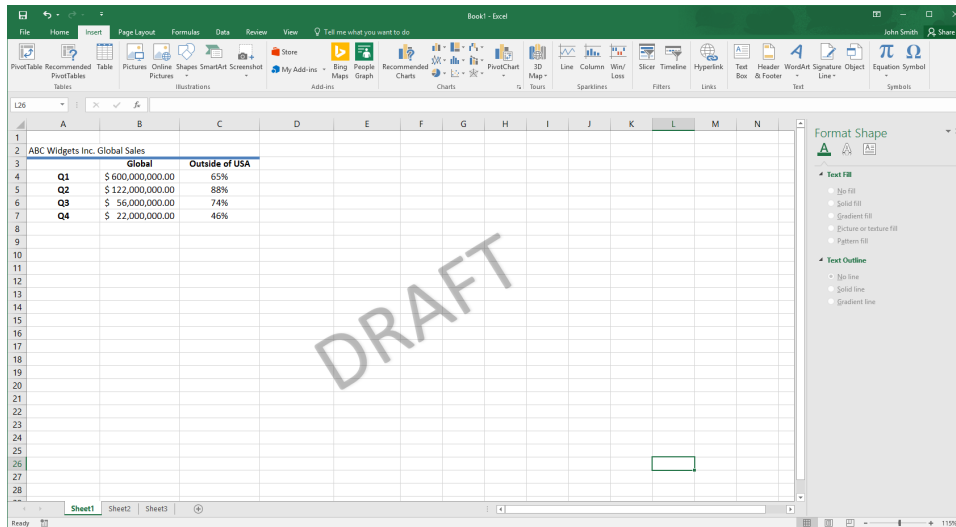
BACKGROUND PICTURES

To add some design elements to your workbooks, you have the option to add background pictures. These pictures will appear entirely in the background of a worksheet without interfering with the contents of the cells.

To insert a background picture, click Page Layout → Background:
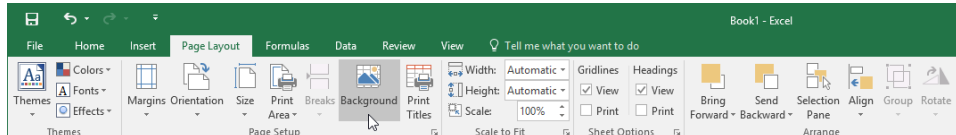
This action will display the Insert Pictures dialog box. Using the options provided here, you can insert a picture that resides on your computer or local network, from a web search, or even Facebook and Flickr if you are using a Microsoft account:
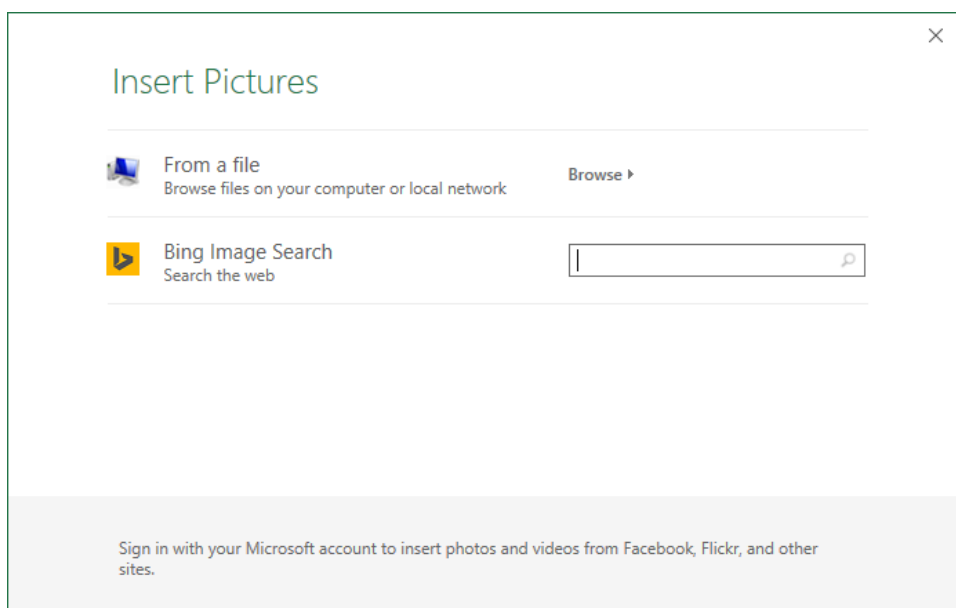
Once you find and select a background picture, it will be added to the current worksheet. Note that if it doesn't span the entire dimensions of the worksheet, it will tile itself automatically:
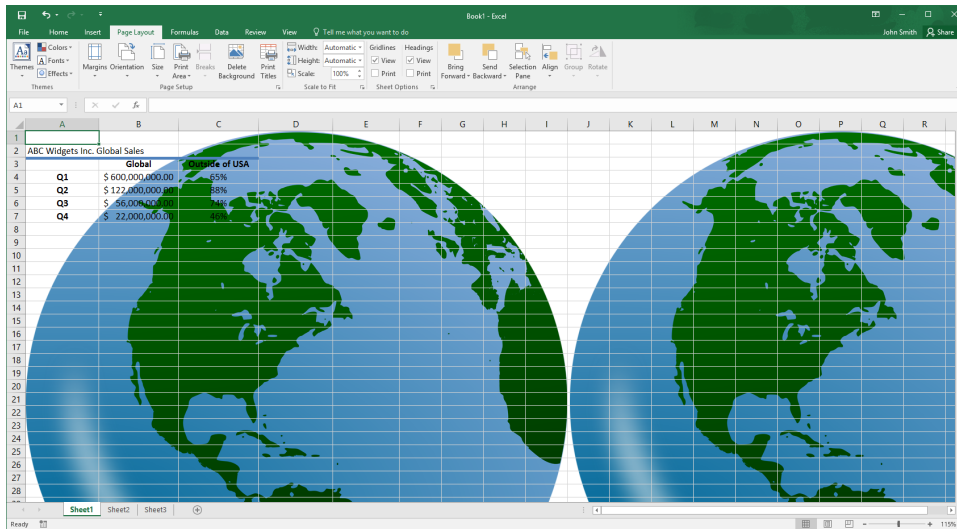
To remove a background image, click Page Layout → Delete Background:
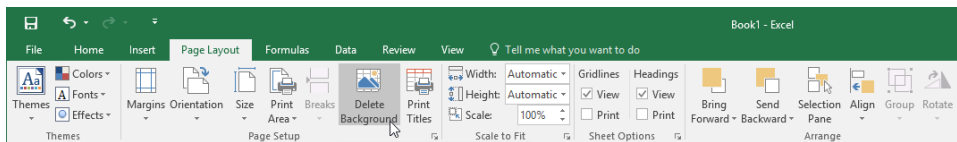
ACTIVITY 7-1

Customizing Workbooks

You would like to customize a workbook that you have been working with using some of the customization options that you learned about in this topic.

1.   To begin, open Activity 7-1 from your Exercise Files folder:
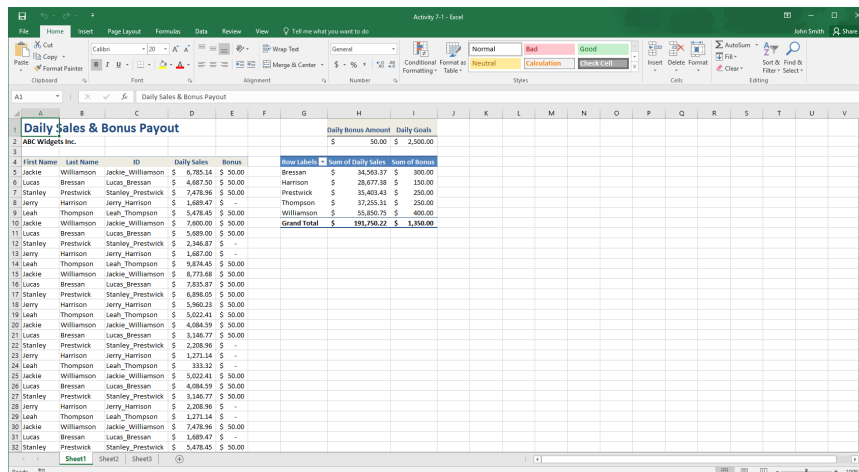
2. First, you would like to change the contents of cell A2 into a hyperlink. Click to select this cell and then click Insert → Hyperlink:
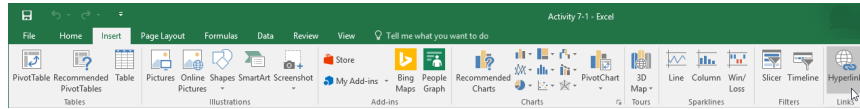
3. The Insert Hyperlink dialog box will now be displayed. Ensure that the Existing File or Web Page category is selected and then type "http://www.example.org" into the Address text box. Click OK:
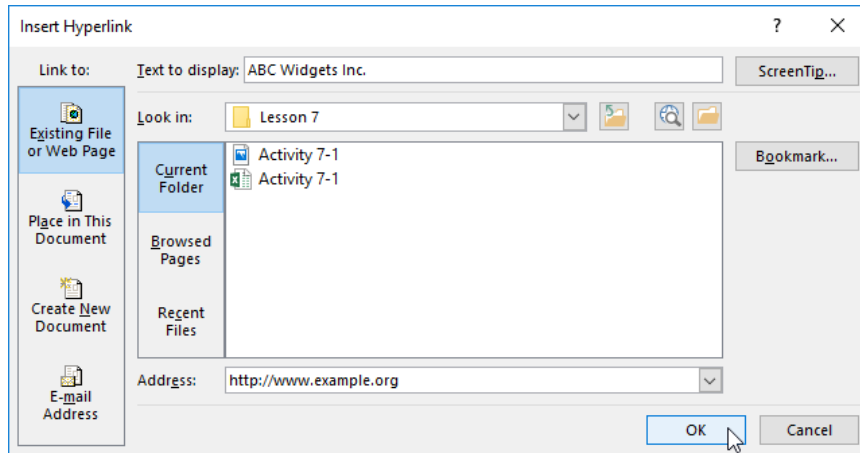
4. With the new link created, test it out by clicking on it once:

5. Your default browser will open displaying the website that the hyperlink pointed to:
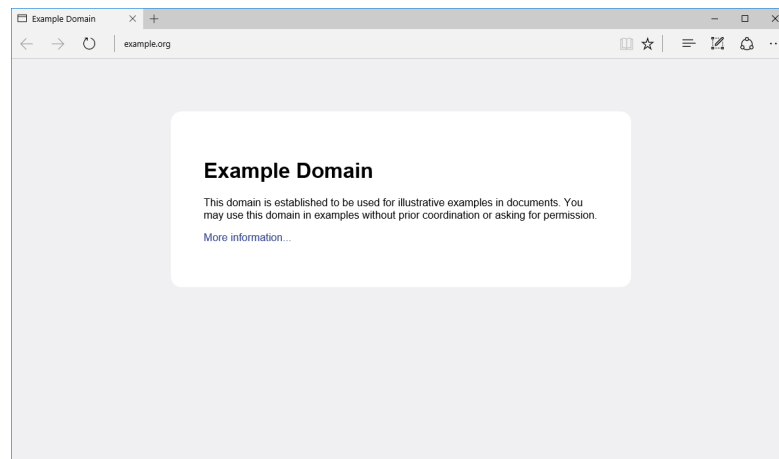
Close the browser window.

6. Return to the workbook that you have been working with. Start adding a background picture by clicking Page Layout → Background:
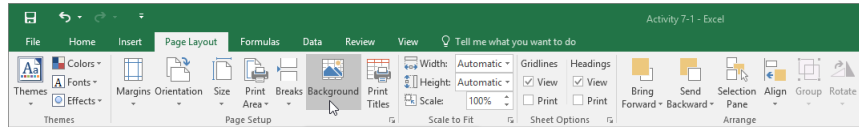
7. The Insert Pictures pop-up dialog box will now be shown. The picture that you would like to insert is within your Exercise Files folder, so click the Browser button:
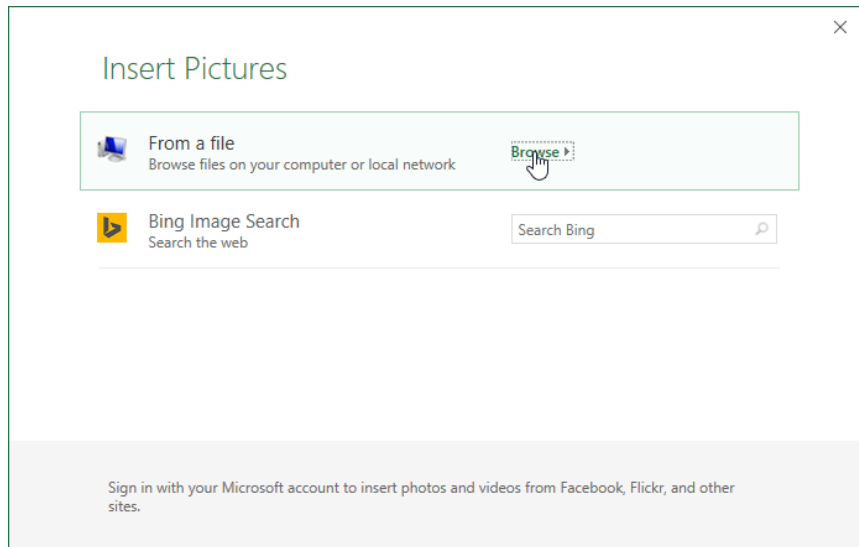
8. The finder dialog box will open. Use its controls to browse to your Exercise Files folder and select the Activity 7-1 picture file. Click Insert:
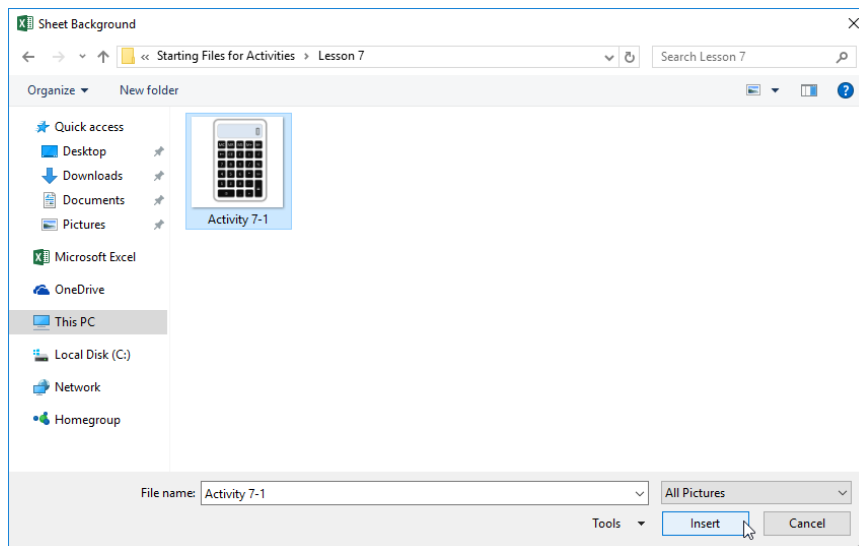
9. The background picture will now have been added:
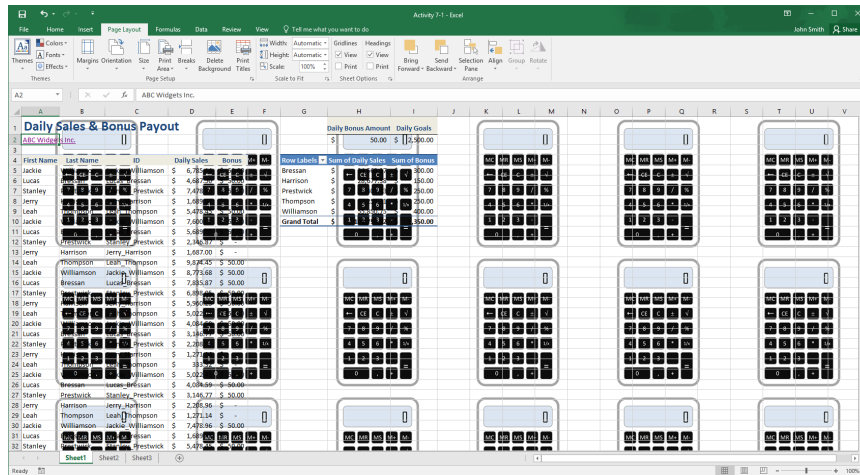
10. Save the current workbook as Activity 7-1 Complete to complete this exercise.

TOPIC B: Manage Themes

Themes control most of the visual aspects of any workbook and choosing the right theme is important to how your data is displayed. Over the course of this topic you will learn about themes in Excel 2016 and how they can be both changed and customized.

Topic Objectives
In this topic, you will learn:
- About themes and how to change them
- How to customize themes

ABOUT THEMES

Themes are a combination of preset colors, fonts, and effects. Each theme includes 12 colors, font selections for header and body text, as well as colors and effects for shapes and SmartArt.

To change a workbook's theme, click Page Layout → Themes:
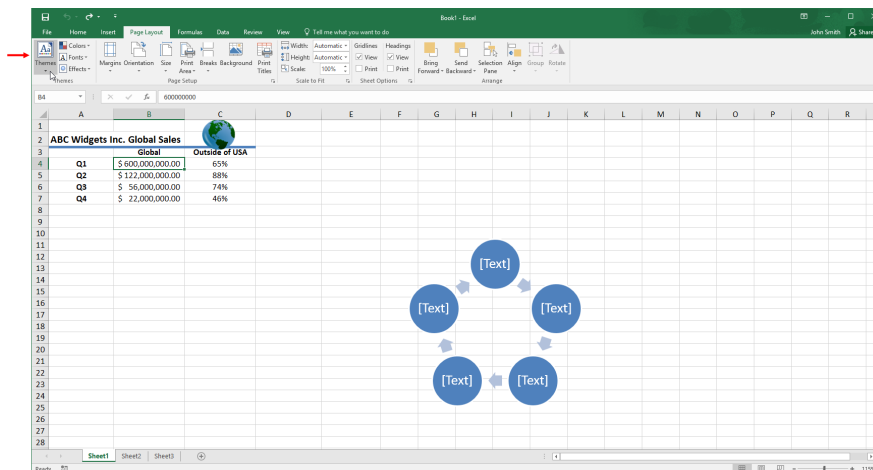
This will show a gallery of themes. As you mouse over each thumbnail in this gallery, you will see a preview applied to your workbook (if it has theme elements such as SmartArt, headers, or body text). Click the new theme to apply it:
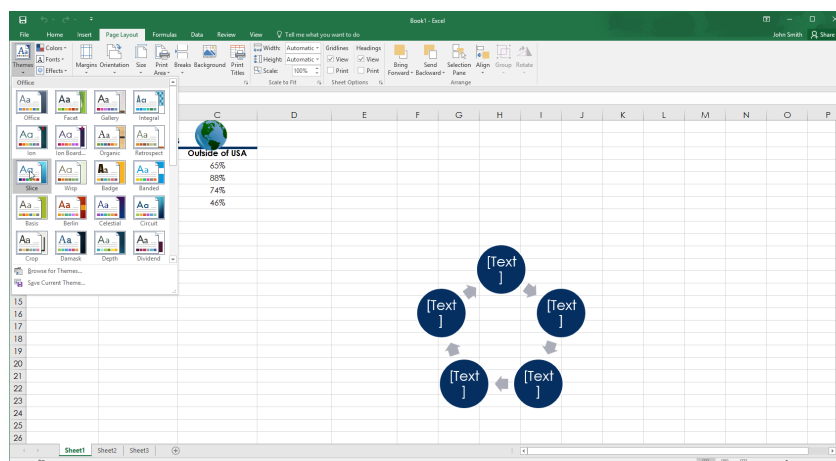
CUSTOMIZING THEMES

The default theme for new workbooks in Microsoft Excel 2016 is Office. You can customize the styles offered by this theme or any other theme that is currently applied by choosing a new style options from the Colors, Fonts, and Effects drop-down commands that are found inside the Themes group of the Page Layout tab.
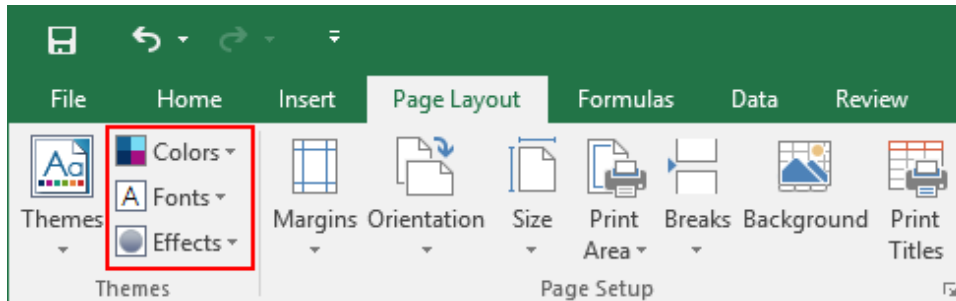
ACTIVITY 7-2

Managing Themes

You would like to apply a new theme to a workbook that you have been working on and then customize its colors.

1.   To begin, open Activity 7-2 from your Exercise Files folder:
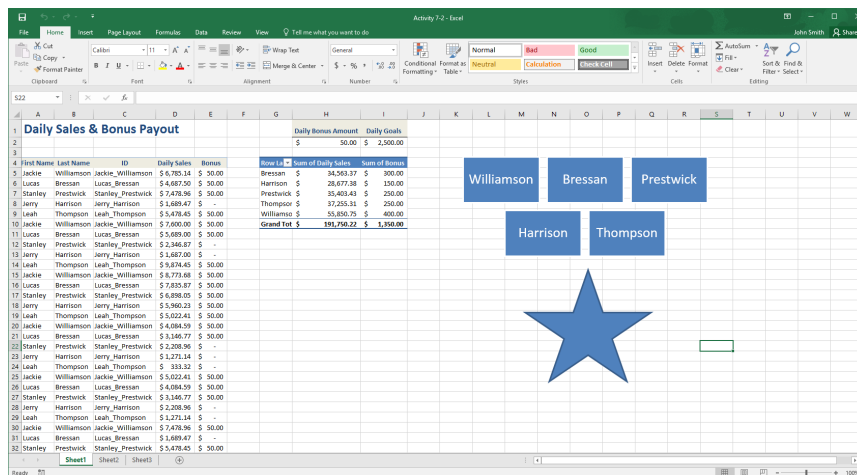
2. First, apply a new theme to this workbook by clicking Page Layout → Themes → Badge:
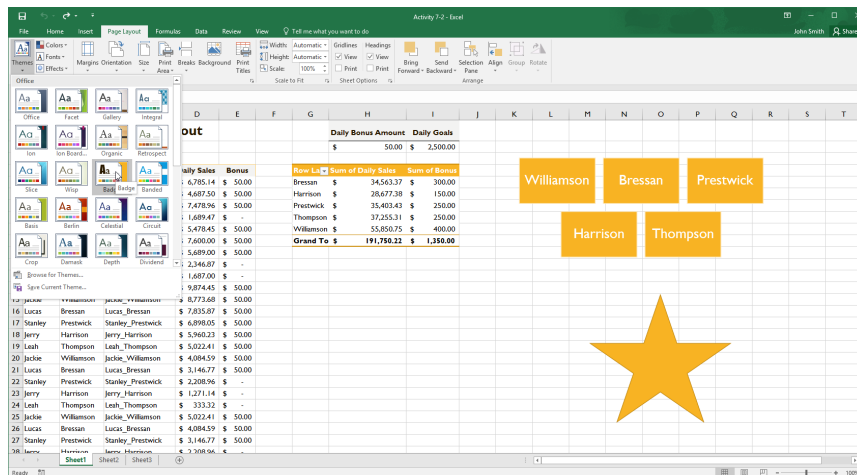
3. With the new theme applied, you will see that the primary colors and text have all been modified:
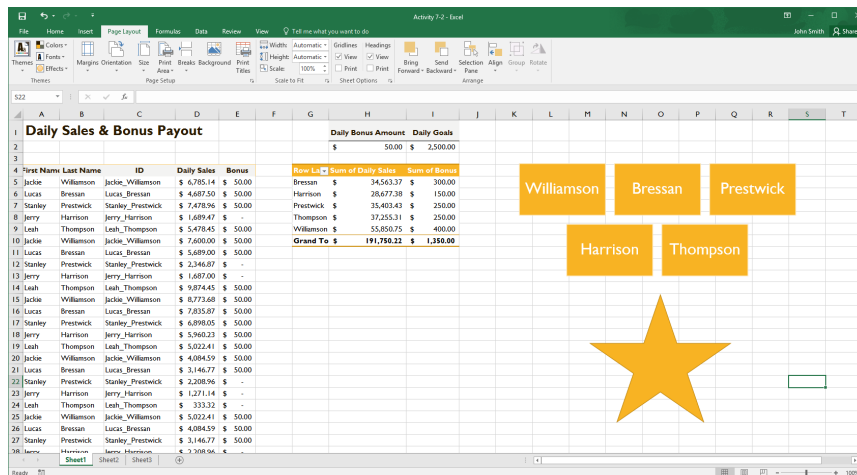
4. While you like the font change, you would prefer a different color scheme. Customize this theme by clicking Page Layout → Colors → Green:
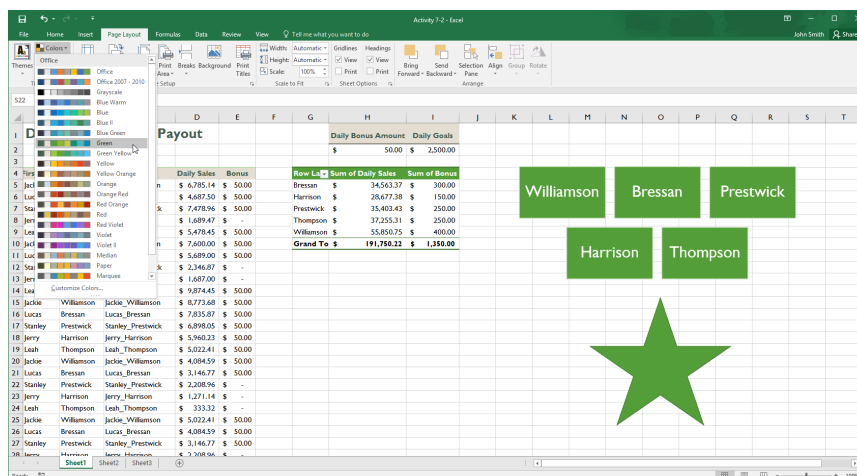
5. Examine the workbook and you will see that its colors have been updated:
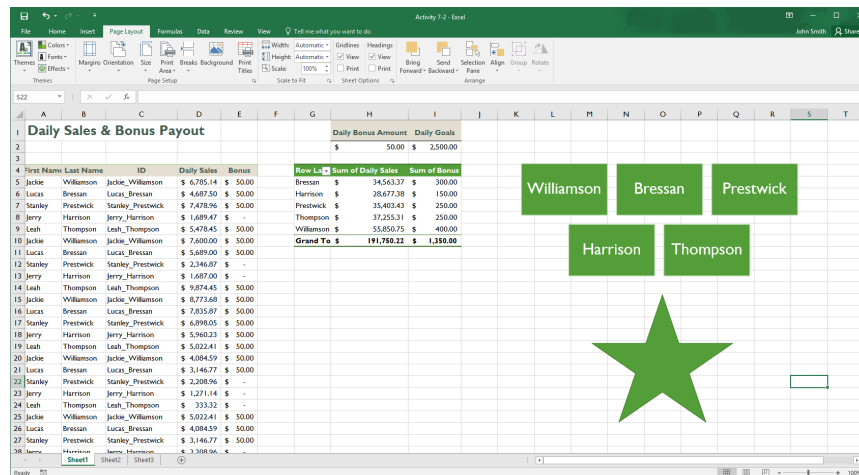
6. Save the current workbook as Activity 7-2 Complete to complete this activity.

TOPIC C: Create and Use Templates

Templates are an excellent resource that you can use to create workbooks much more quickly than having to create one from scratch. Over the course of this topic, you will learn more about templates and how to create them yourself.

Topic Objectives
In this topic, you will learn:
- About templates
- About template types
- How to create a template
- How to modify a template

TEMPLATES

A **template** is a workbook that contains preformatted styles, graphics, objects, and/or text. Its purpose is to provide a method of laying out content to save you time and help you keep your work consistent. Templates can be used with styles and themes to provide even more customization options.

Microsoft Excel templates are saved as **.xltx files**. This way, they can be re-used without overwriting the template contents. You can also save templates with macros using the **.xltm** extension.

TEMPLATE TYPES

Microsoft Excel 2016 includes many different predefined templates that you can choose from that cover a wide variety of different needs. If you can't initially find the exact template for your purposes, you can probably find it using the search function.
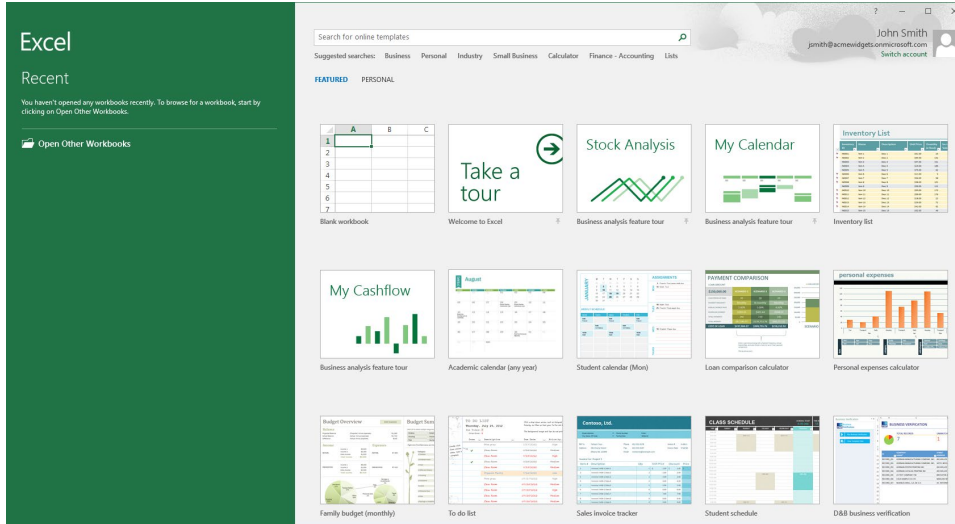
Custom templates are those that are created by yourself, your organization, or someone that you are working with. You can see these templates listed under the Personal heading of the new workbook window:
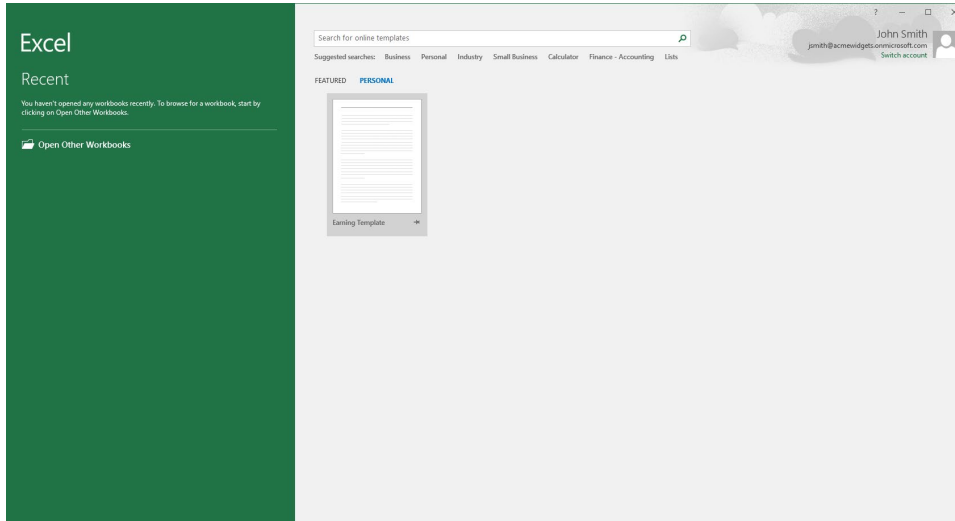
CREATING A TEMPLATE

If you want to create your own template, it's easy! First, create the workbook that you would like to use as a template in the future:
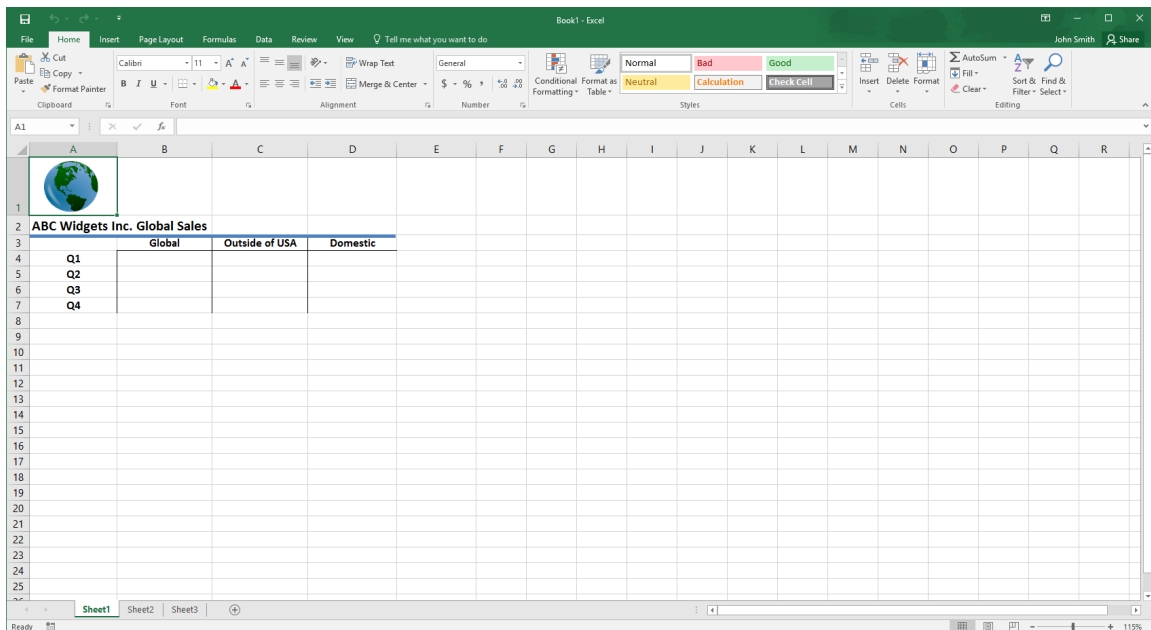
Once relevant information has been placed in the template, save it by clicking File → Save As → Browse:
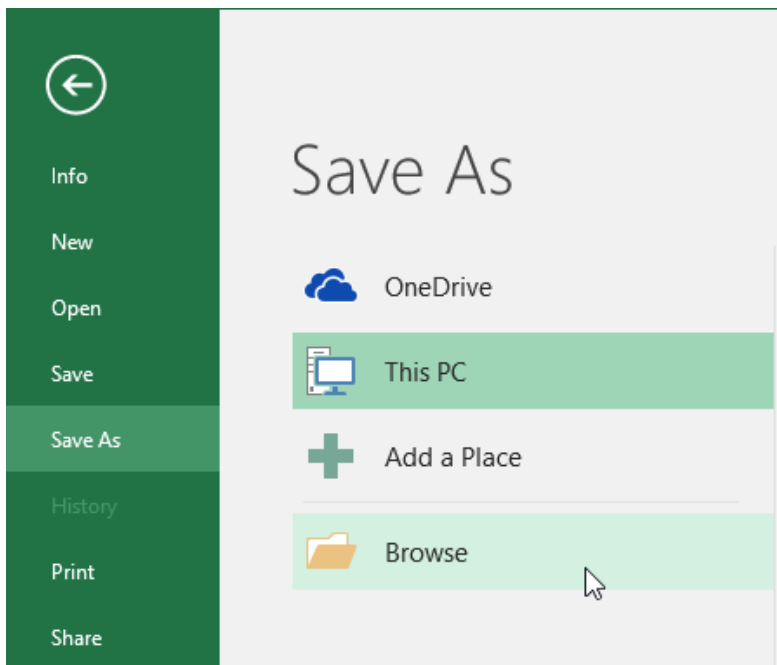
The Save As dialog will open. First, click the "Save as type" drop-down menu and choose Excel Template:
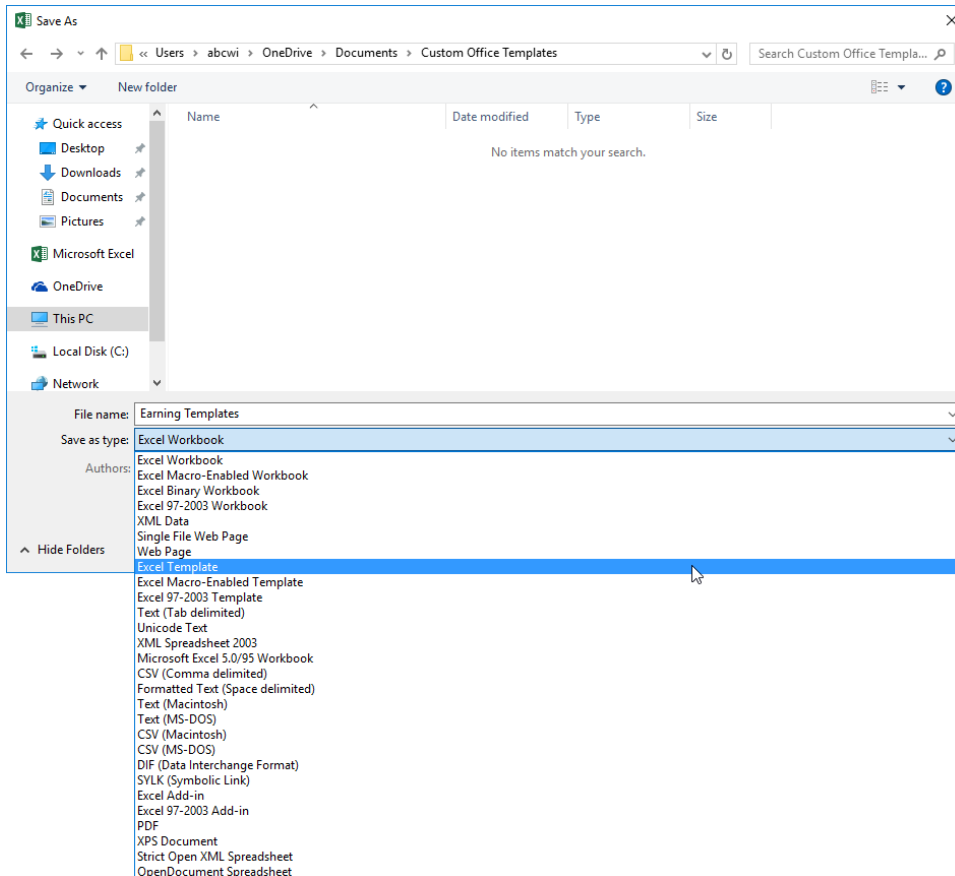
This will automatically display the default file location where all of your custom Microsoft Office templates are saved to. At this point you can then enter a file name for this new template and then click the Save button to complete the process:
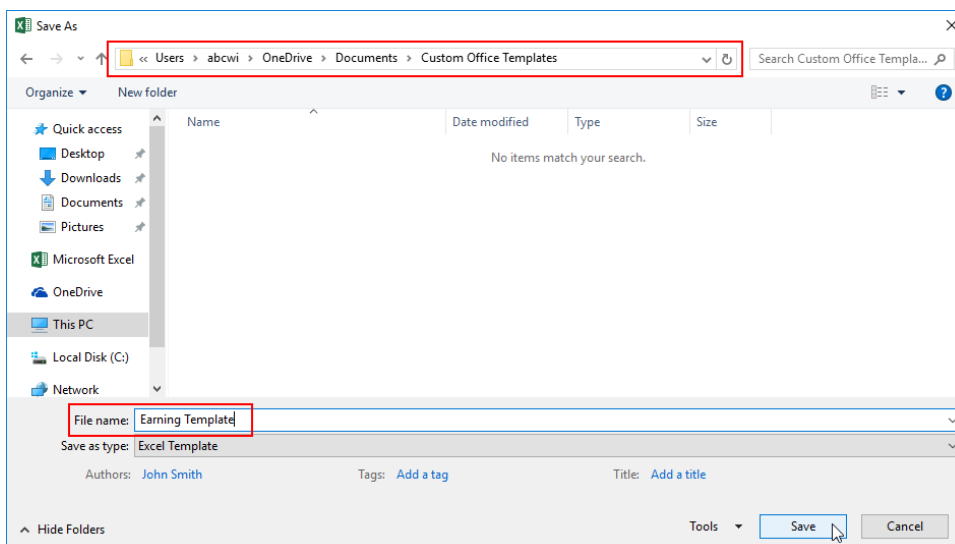
Saving the file in the default location will ensure that it is displayed in the Personal category of the New category in Backstage view:
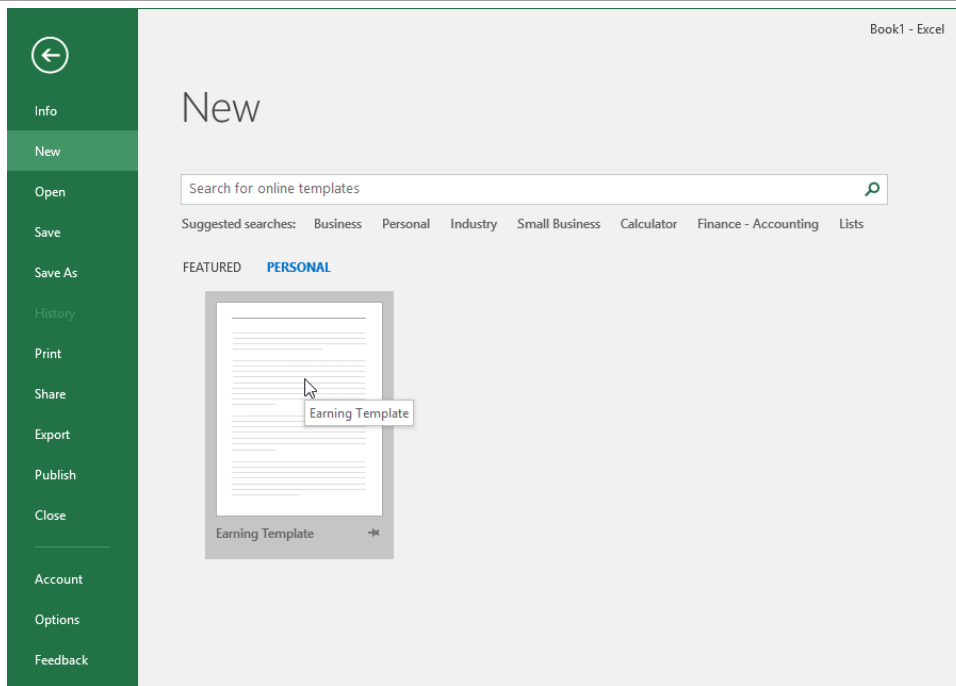
MODIFYING A TEMPLATE

To modify a template, click File → Open → Browse:
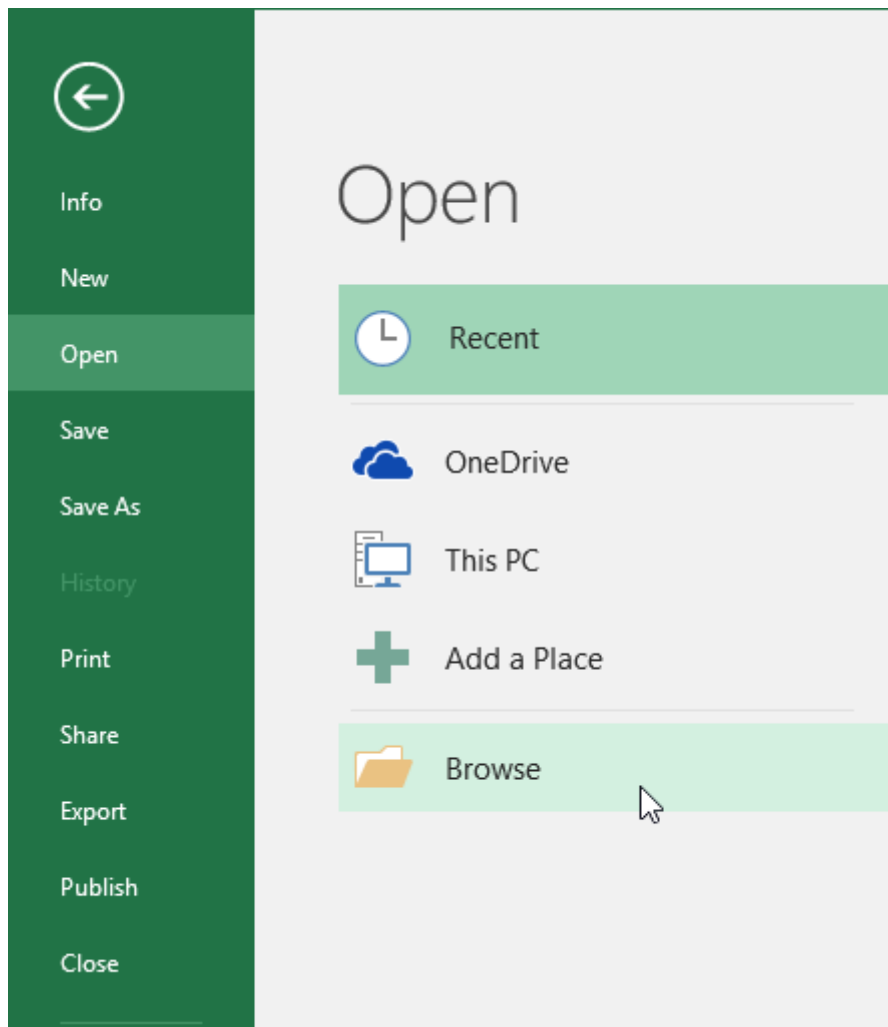
In the Open dialog box, navigate to the location of the template file, select it, and click Open:
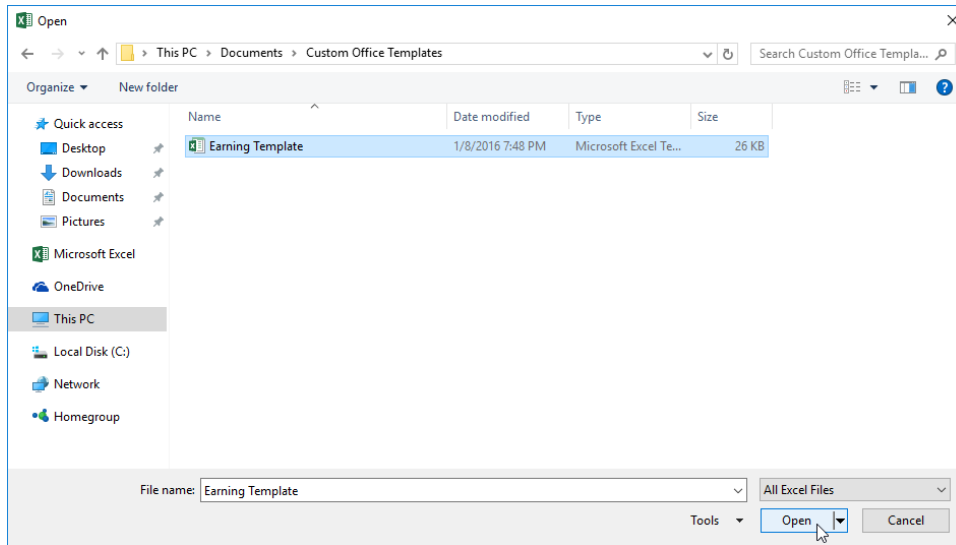
(If you cannot see your template file, ensure that the filter above the Open button is set to All Excel Files.)

If you are using File Explorer to open a template for modification, double-clicking a template will open a new Excel workbook based on the template and not the actual template itself. In order to open the template for modification, right-click the template file and click Open:
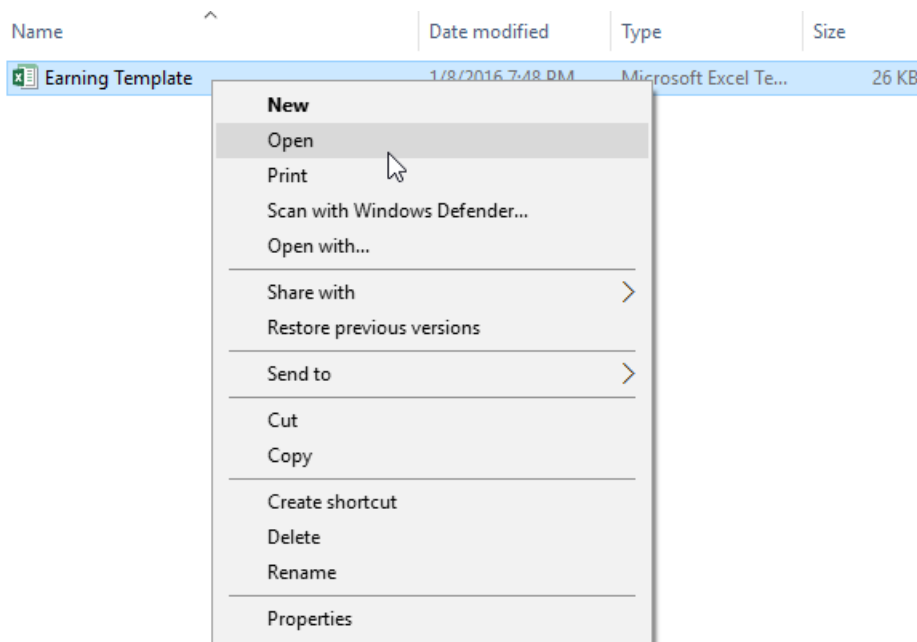
Once a template file is open for modification, Excel's title bar will display the template name (not Book1, Book2, etc.):
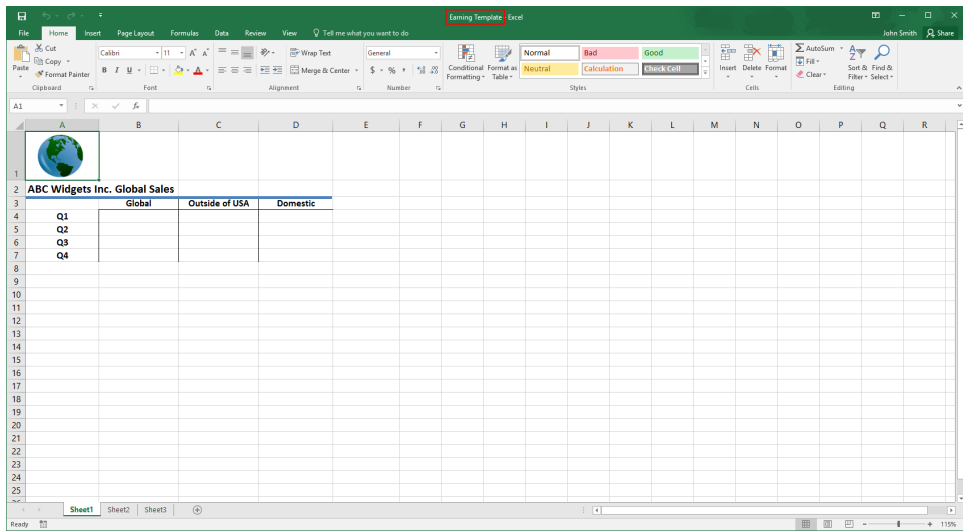
ACTIVITY 7-3

Creating a Template

To save time in the future, you would like to create a template based on an existing workbook.

1. To begin, open Activity 7-3 from your Exercise Files folder:
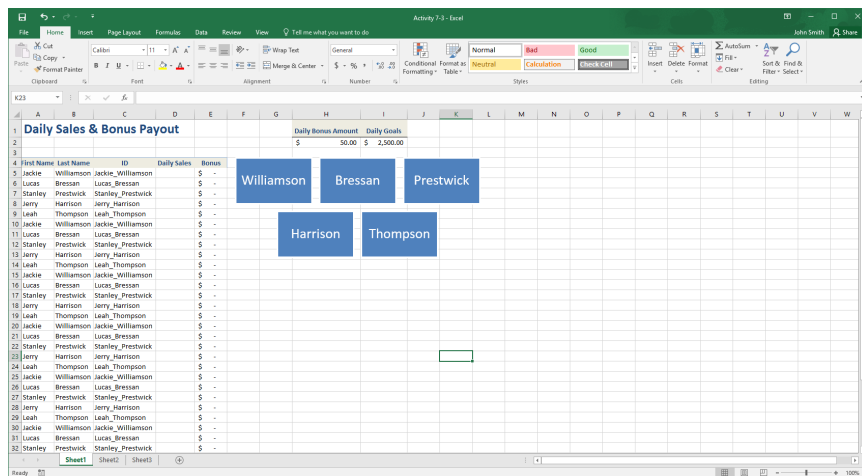
2. Click File → Save As → Browse:
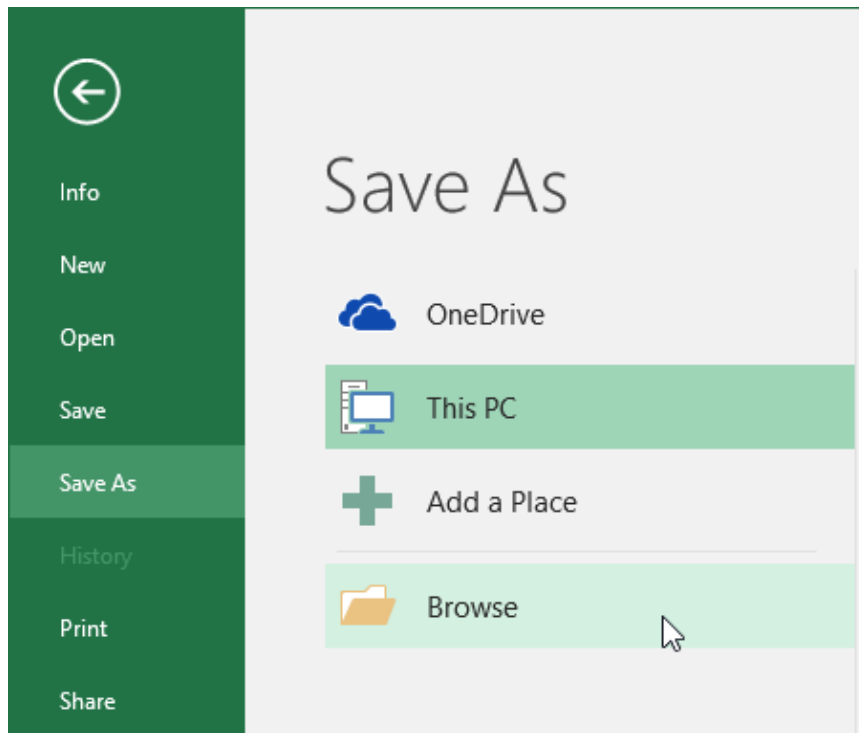
3. The Save As finder dialog will open. Click the "Save as type" drop-down menu and click the Excel Template option:
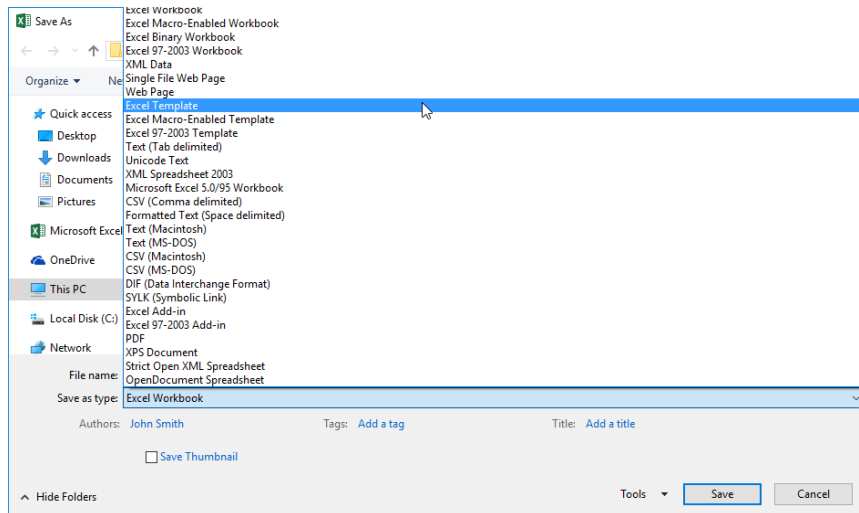
4. Once you select the Excel Template save option, the contents of the Custom Office Templates folder on your computer will be displayed. This is where your templates are stored. Ensure that "Activity 7-3" appears in the "File name" text box and then click Save:
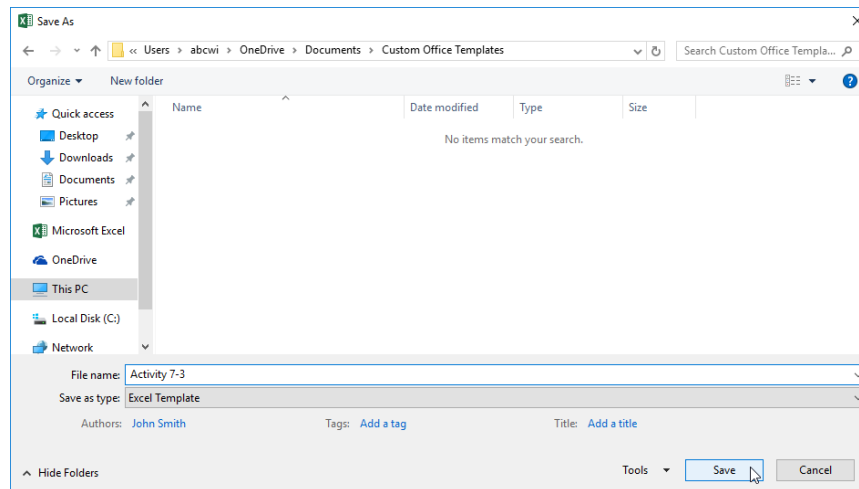
5. The template will now have been saved. Click File → New:
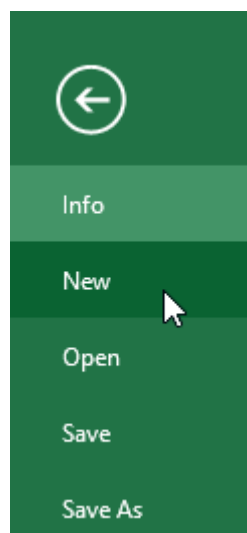
6. Listed will be many of the predefined templates that are available. Click the Personal heading:
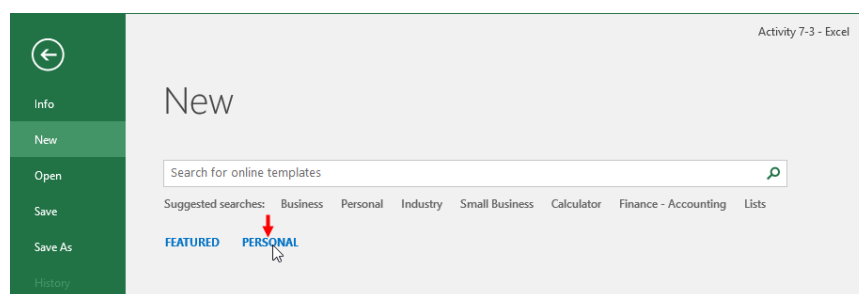
7. The template that you just saved will be listed:
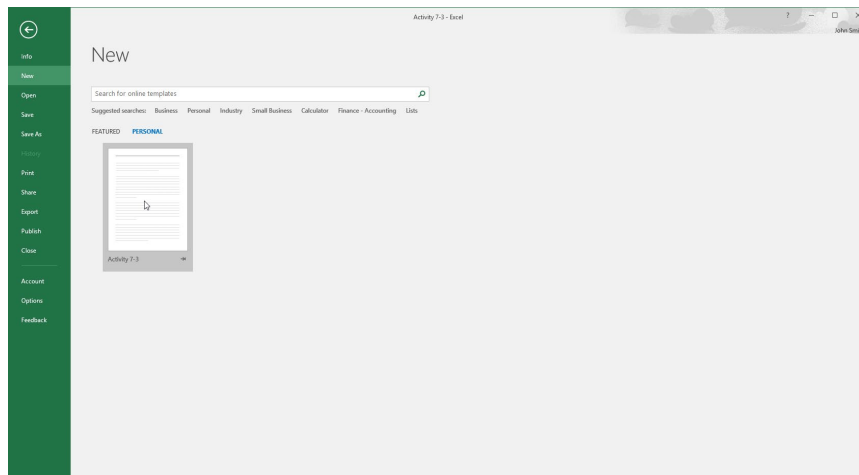
8. Close Microsoft Excel 2016 to complete this activity.

TOPIC D: Protect Files

One of the most important aspects that you need to understand while working with your data in Excel is how to protect Excel files from data loss, as well as unauthorized access. Over the course of this topic you will learn about the various ways that Excel 2016 can protect your work.

Topic Objectives
In this topic, you will learn:
- How to recover lost data
- About the Changes group on the Review tab
- About worksheet and workbook protection
- How to protect a worksheet
- How to protect a workbook

RECOVERING LOST DATA

The **AutoRecover** feature works in the background to automatically save the workbook that you are working on. This saved copy of the file is called a version and it can be recovered if Excel or your computer experiences an error. If you saved the file previously, you can find each version by clicking File → Info, and then examining the Manage Workbook section:
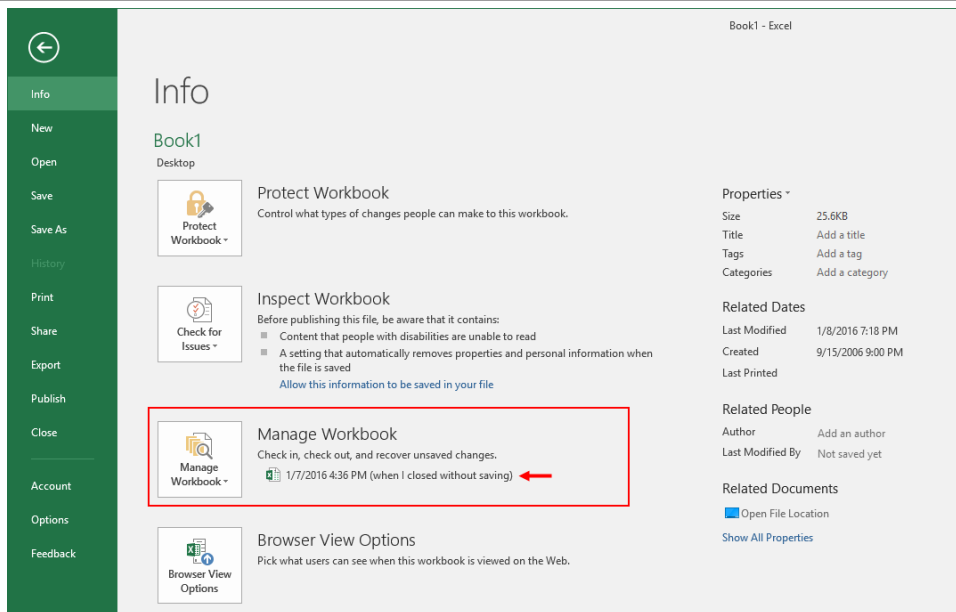
Each version listed here will include the date and time that it was saved, as well as the circumstances in which it was saved (such as closing Excel without saving the changes). Clicking on any version that is listed here will open it and you will be asked to overwrite any previously saved versions of this file by clicking the Restore button on the message bar:
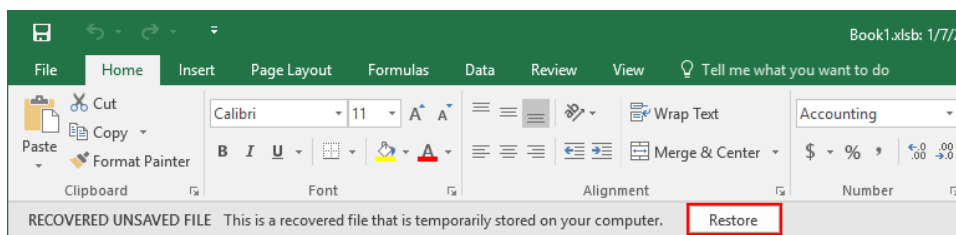
If you experience an error and have not previously saved the workbook that you have been working on at all, you may still be able to acquire a saved version of it by clicking File → Info → Manage Workbook → Recover Unsaved Workbooks:
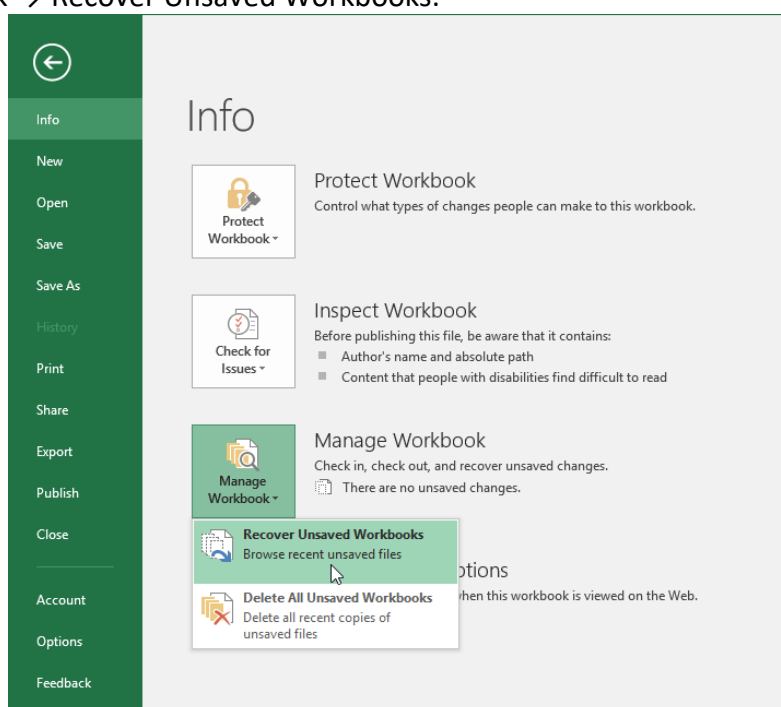
This action will open a finder dialog in which you can select an unsaved version and then click Open:
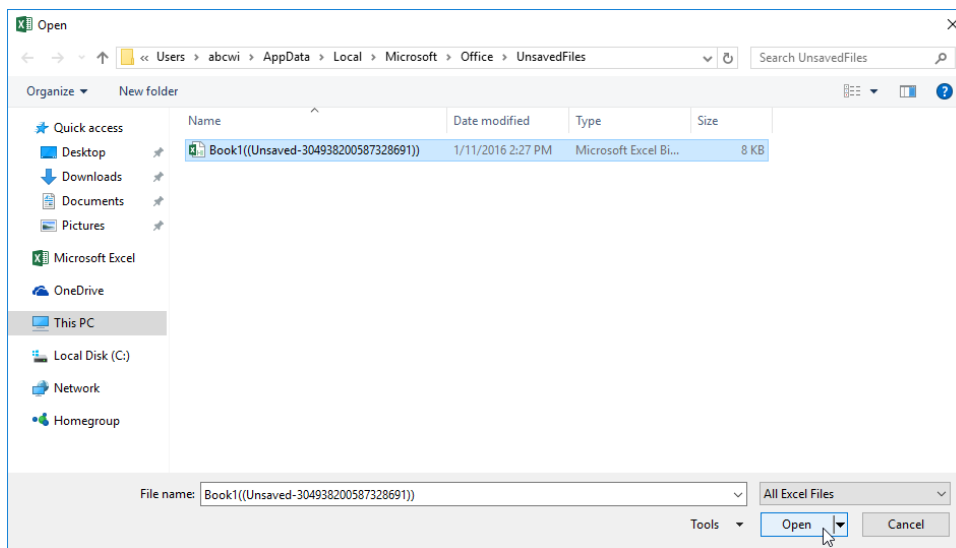
Once the version is open, you can save it to another location by clicking the Save As button on the message bar:
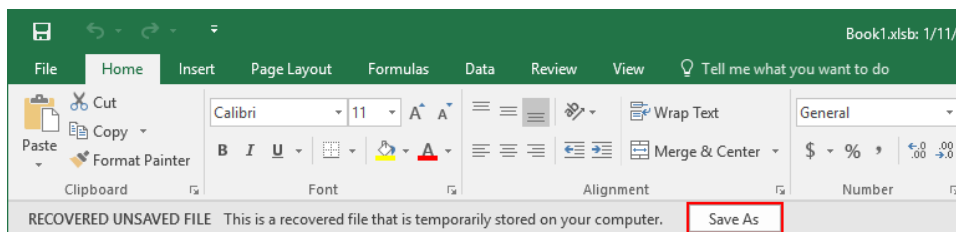
THE CHANGES GROUP

Most of the commands that you need to protect your files can be found within the Changes group on the Review tab:
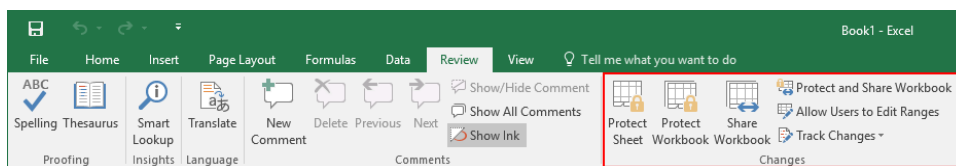
Let's breakdown the purpose of these commands:

- Protect Sheet – This command will prevent unwanted changes made by others to the current worksheet by limiting their editing options.
- Protect Workbook – Clicking this command will prevent others from making structural changes to the current workbook, such as adding or deleting worksheets.
- Share Workbook – Use this command to share the current workbook with others so that you can work with them at the same time.
- Protect and Share Workbook – This command will share the current workbook, while at the same time enabling tracking that cannot be disabled without a password.

- Allow Users to Edit Ranges – Clicking this command allows users to only be able to change range names when they provide the correct password to a protected sheet.
- Track Changes – This command will enable the Track Changes feature so that you can keep track of changes made to the current workbook.

WORKSHEET AND WORKBOOK PROTECTION

When you finish working with your workbook, you should consider marking it as final. This will alert others who may use your data that the work is complete, and it will help jog your memory if you haven't touched the workbook in a long time. To mark your work as final, click File → Info → Protect Workbook → Mark as Final:
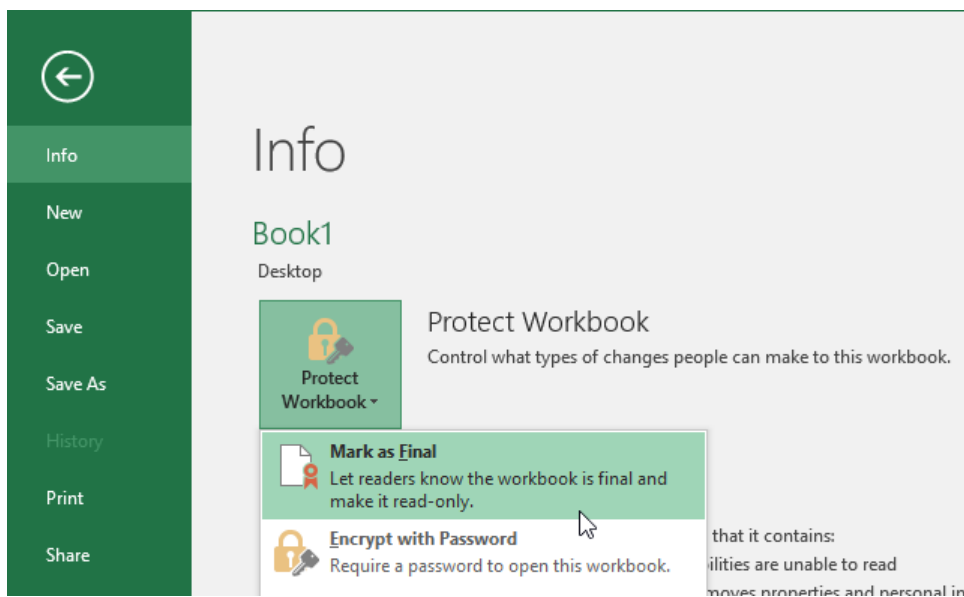
Click OK to confirm your choice and save the file:
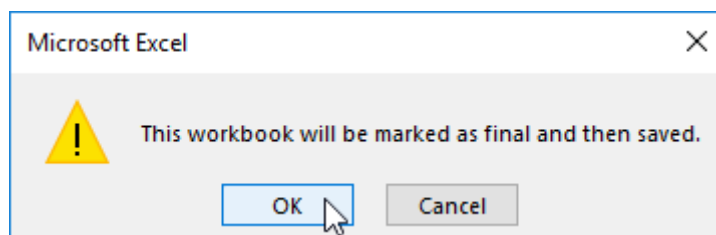
Your will receive a final notification explaining what this operation is designed to do:
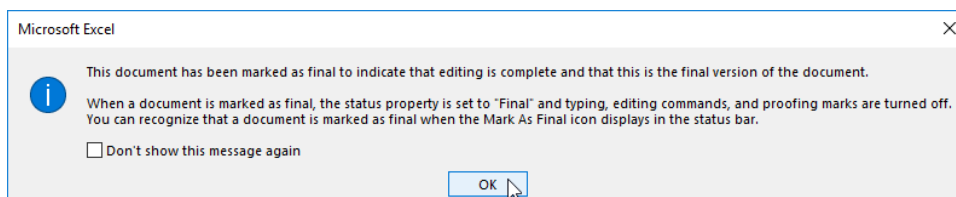
The Backstage menu will now display a visual warning stating the file has been marked as final:
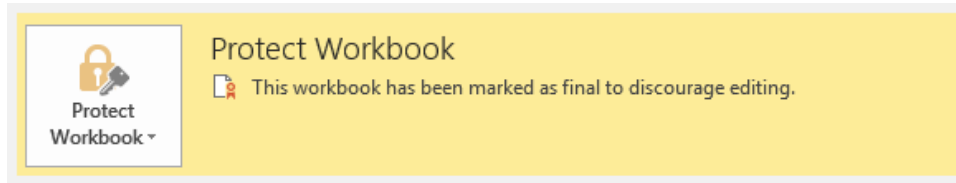
A similar warning is shown in the message bar, and the title bar shows that the file has been marked as Read-Only.
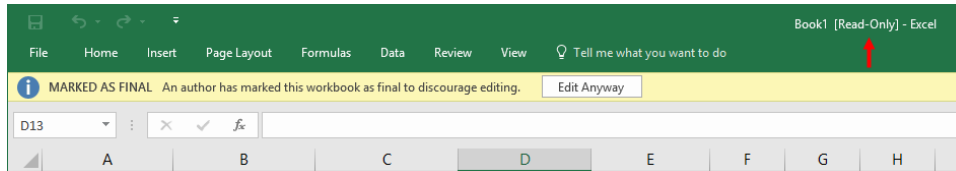
(You can click the Edit Anyway button on the message bar to release the read-only lock and edit the file as you see fit.)

There is also a small notification in the status bar:
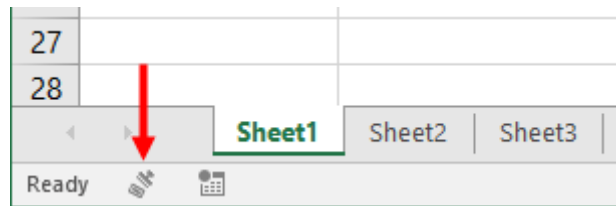
Keep in mind that you can mark a document as final as many times as you want; just remember that any changes will remove this notification

Encrypting a Workbook

Encrypting a document with Excel is very easy, despite the underlying encryption operation being quite complex. In fact, encrypting a workbook using a password is one of the easiest ways to protect sensitive information between two people. To lock a workbook using a password, click File → Info → Protect Workbook → Encrypt with Password:
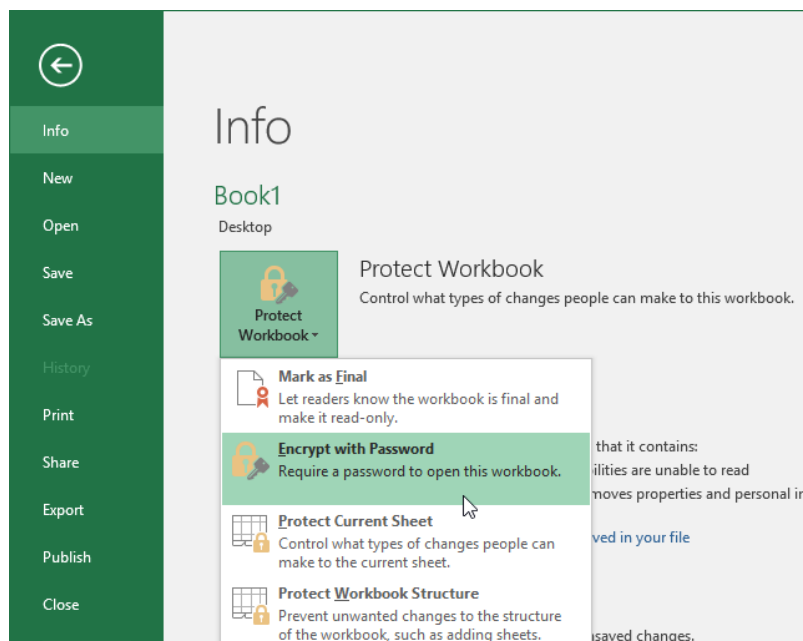
Enter a password and click OK:
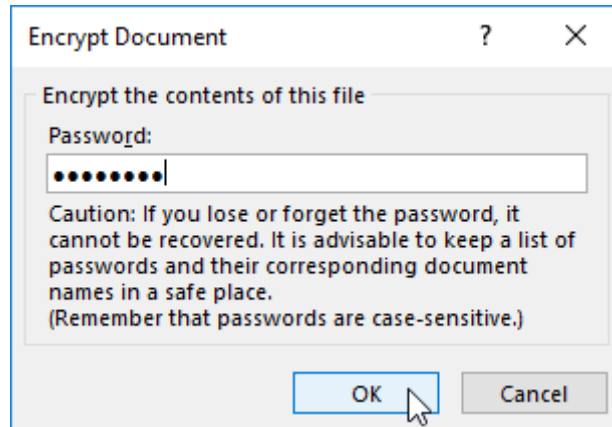
You will be asked to confirm the password:
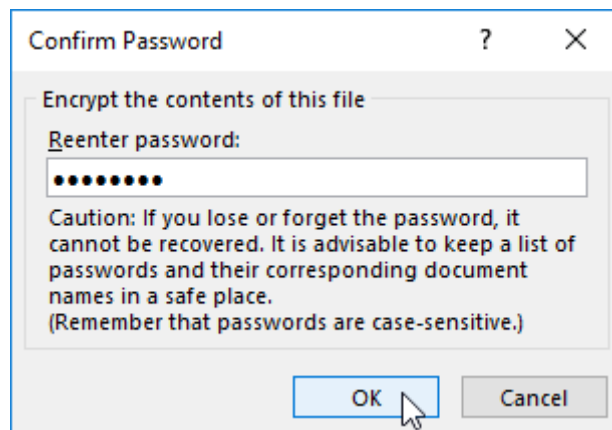
The Backstage menu will notify you that the workbook has been password-protected:
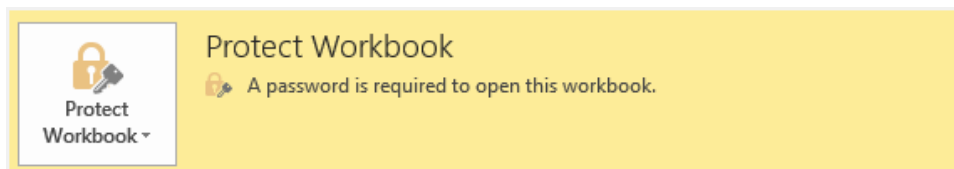
When it comes time to open the file, you (and anyone else) will be prompted for the password before you can even see the data. Enter the password and click OK:

To remove a password, click File → Info → Protect Workbook → Encrypt with Password:
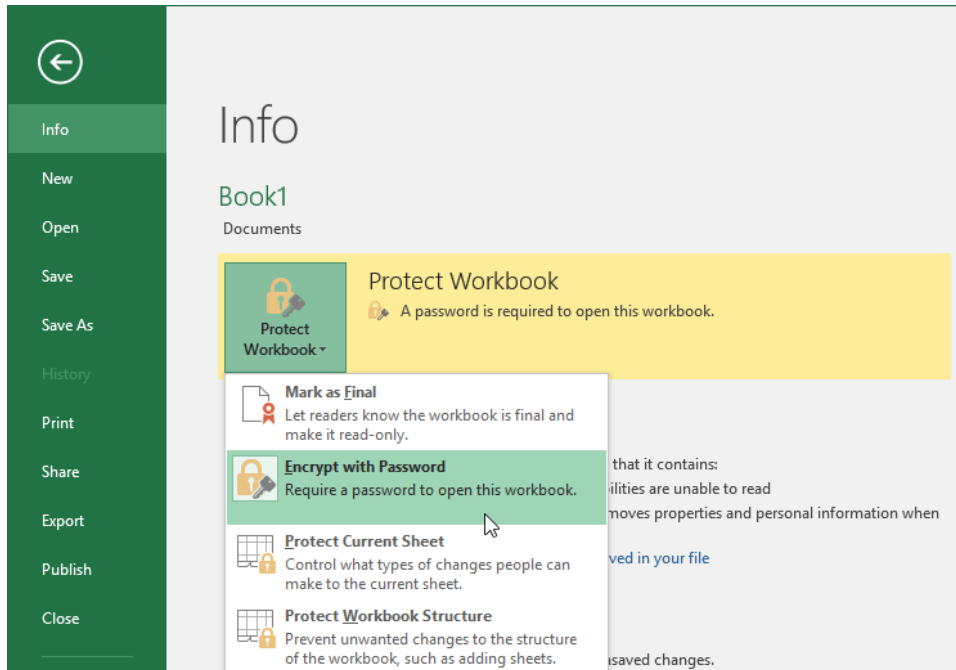
All you have to do is clear the Password field and click OK:
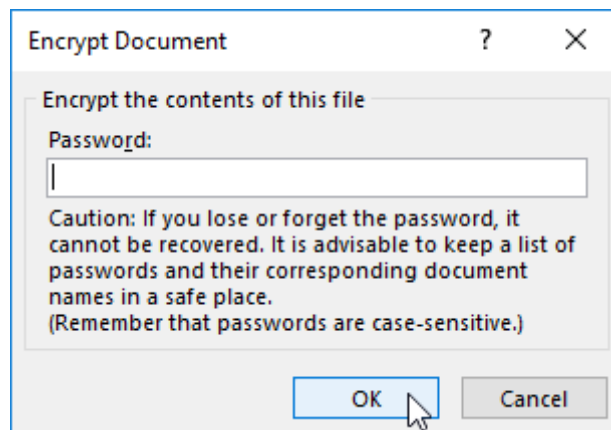
In a nutshell, encryption works by using the password as a way of jumbling up the contents of a file. Anyone who intercepts the encrypted file and examines the contents would only see a garbled mess. When the proper recipient enters the password, the "jumbling" process is performed backwards and the result is a perfectly readable and usable file.

Digitally Signing a Workbook

Another way of protecting your workbook is to digitally sign it. Digitally signing your work is like signing a check or a legal document: it confirms your identity. This signature provides reassurance to the recipient that the workbook really came from you. The actual makeup of the digital signature is directly linked to the structure of the file. If something in the file changes, the digital signature becomes corrupted. If the signature is corrupted, that means the data has somehow been intercepted and changed.

To add a digital signature, click File → Info → Protect Workbook → Add a Digital Signature:
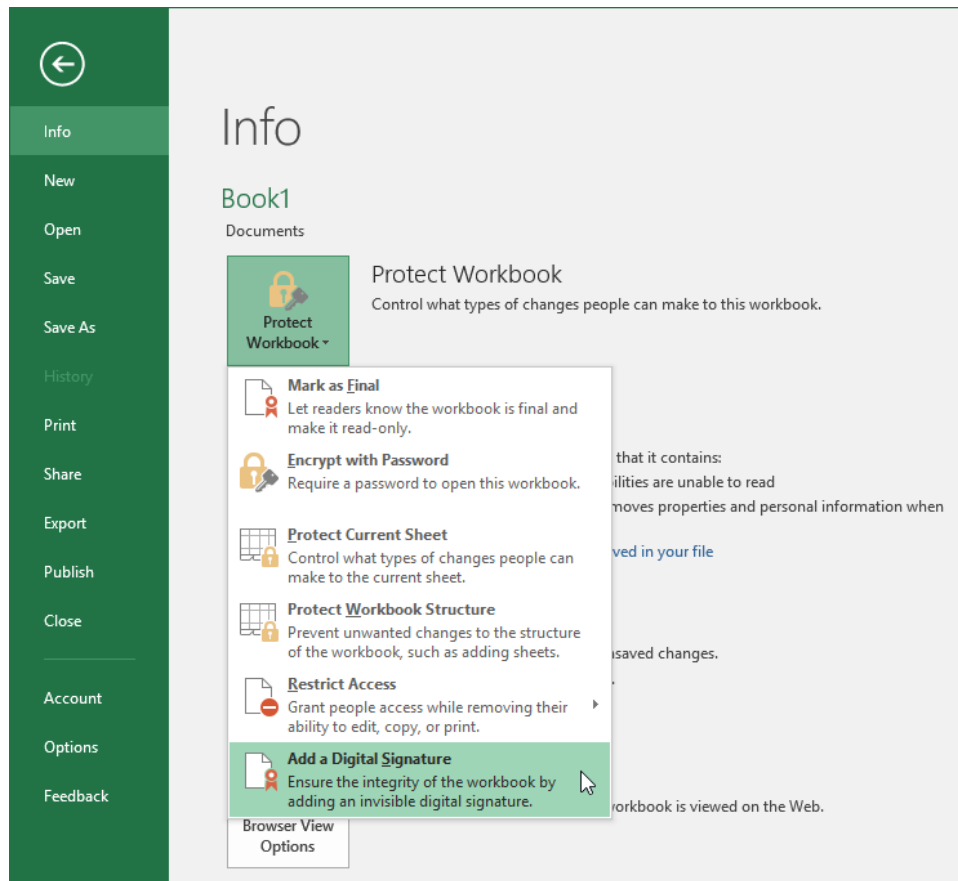
Excel will ask if you would like to obtain a digital ID from a Microsoft partner. Clicking No will cancel the entire action, while clicking Yes will open your default browser to a list of digital ID services:
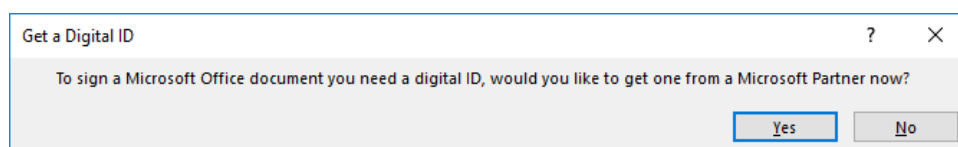
Speak with your IT department or contact a digital security company to determine what type of digital signature will be best for your needs.

THE PROTECT WORKSHEET OPTION

We know that workbooks (individual Excel files) are composed of one or more worksheets. Complex workbooks might make use of several worksheets, each of which might contain important data that is used by the rest of the workbook. In order to help protect your data, you can choose to protect a single worksheet in a workbook using the File menu.

To begin, make sure you are viewing the worksheet you want to protect and then click File → Info → Protect Workbook → Protect Current Sheet:
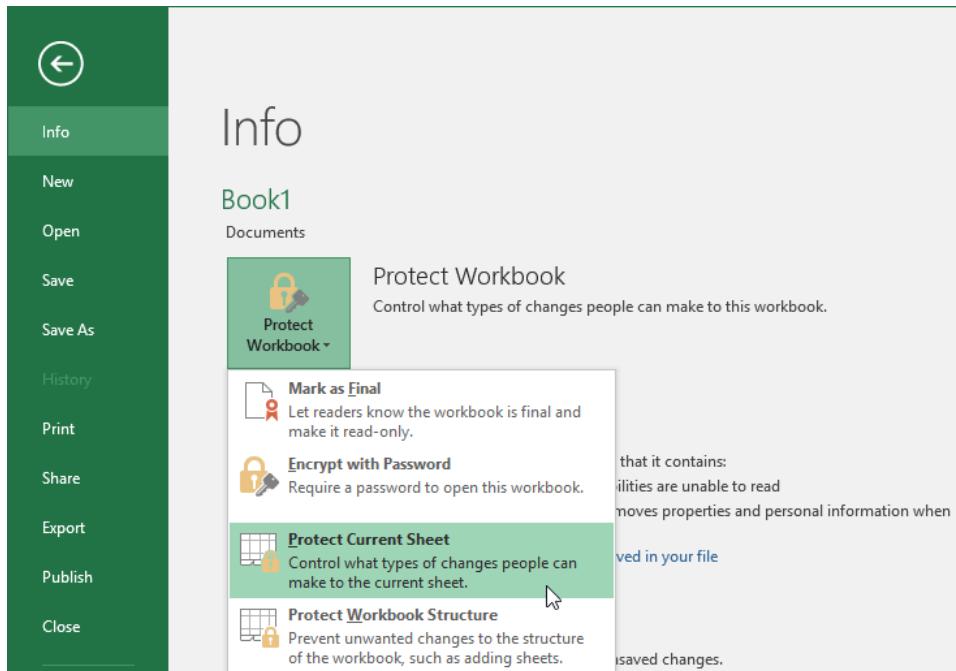
The Protect Sheet dialog box will appear and prompt you to specify what sort of editing actions will be permitted and not permitted after a worksheet has been locked.

There are fifteen types of editing restrictions that you can apply:
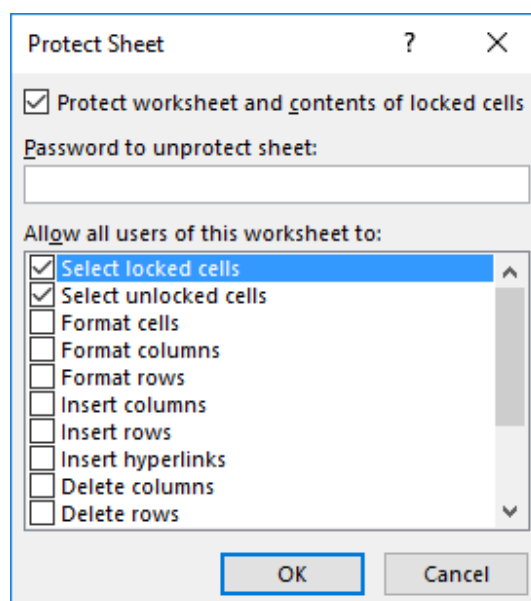
You can use this dialog in two ways: with or without a password. You can simply check items in the box and click OK to apply the restrictions without a password. For example, here we have checked Insert columns:
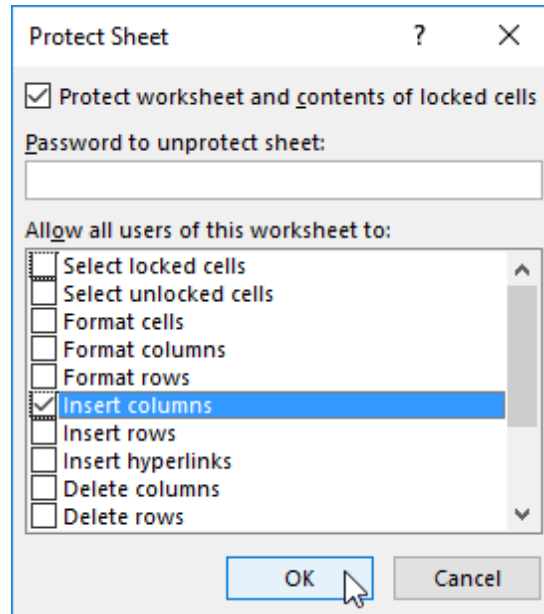
If this protection is applied, anyone that then tries to insert a column will find that the command is simply greyed out:
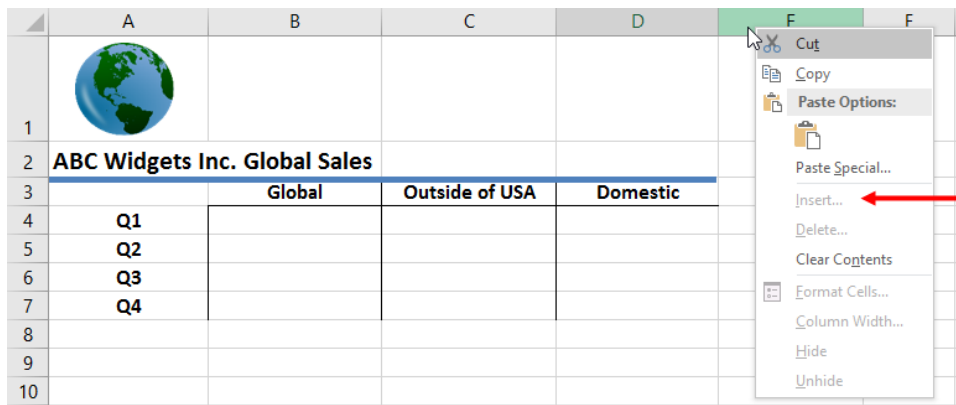
If a sheet is protected in this way, you can review the protection status by clicking File → Info:
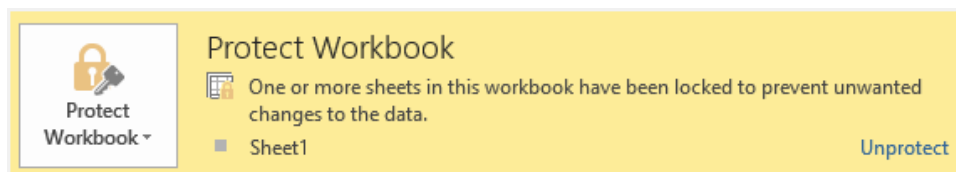
If you click Unprotect (lower right-hand corner) or click Protect Workbook → Protect Current Sheet, the restrictions will immediately be removed.

Now suppose that you would like to better protect the worksheet by assigning it a password in the Protect Sheet dialog:
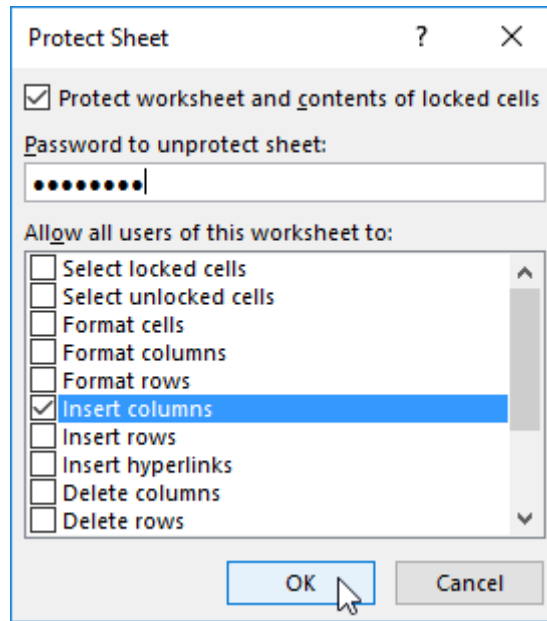
Upon clicking the OK button, a dialog box will appear in which you will be asked to confirm the password that you supplied:
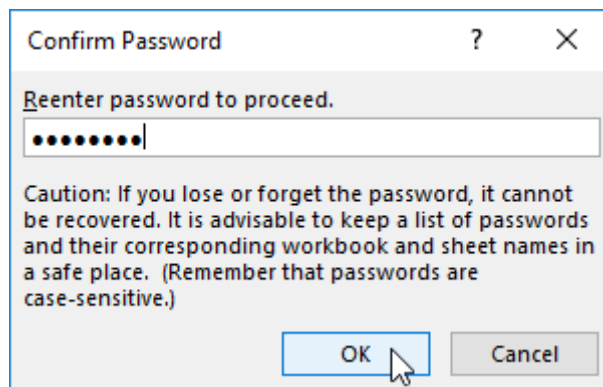
The command to perform the checked action(s) (in fact, all editing commands) will still be unavailable. However, because the sheet is also password protected, you will need to disable sheet protection before being able to do anything.

Click File → Info → Unprotect; you will be prompted to enter the password and then edit the sheet as necessary.

THE PROTECT WORKBOOK OPTION

To protect an entire workbook from changes, click File → Info → Protect Workbook → Protect Workbook Structure:
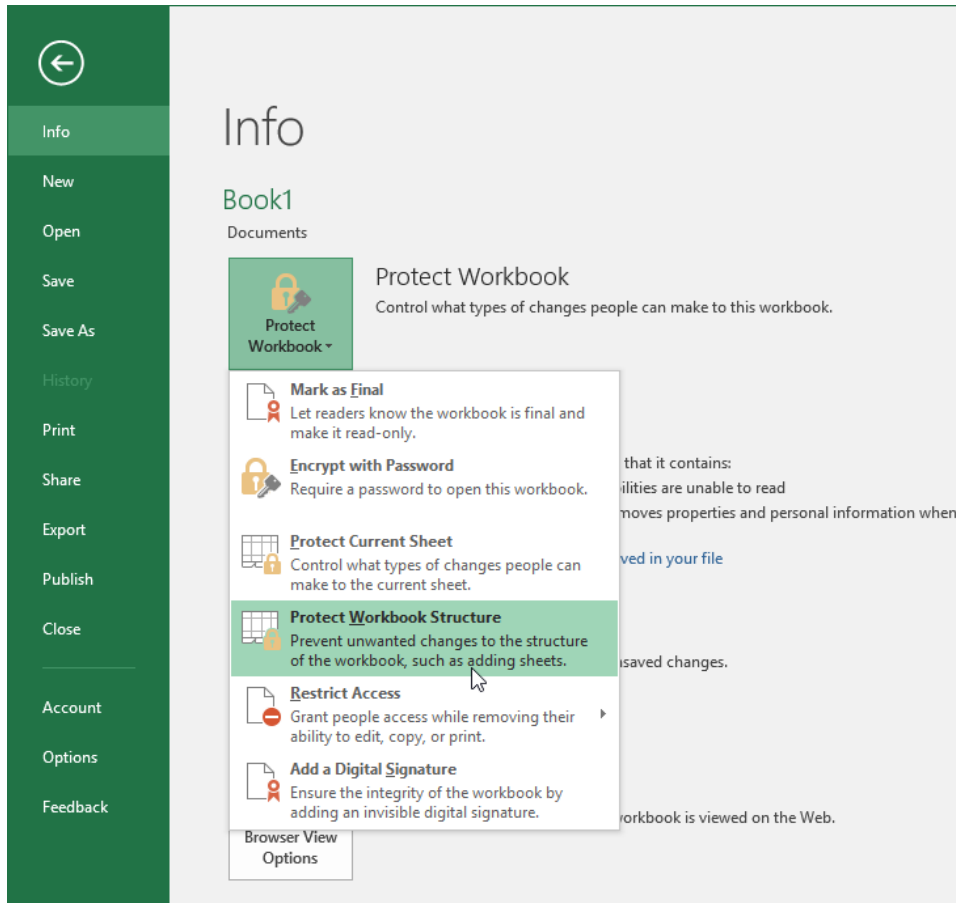
This action will display the Protect Structure and Windows dialog box. Here, you can choose how you would like to protect the workbook and apply a password to help prevent unauthorized changes:
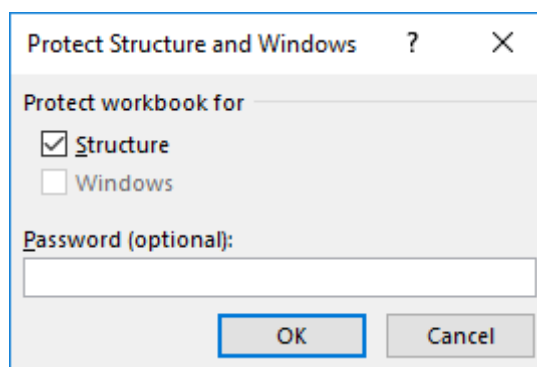
ACTIVITY 7-4

Protecting a Worksheet and a Workbook

You would like to protect a worksheet that you have been working with from unauthorized changes.

1. To begin, open Activity 7-4 from your Exercise Files folder:
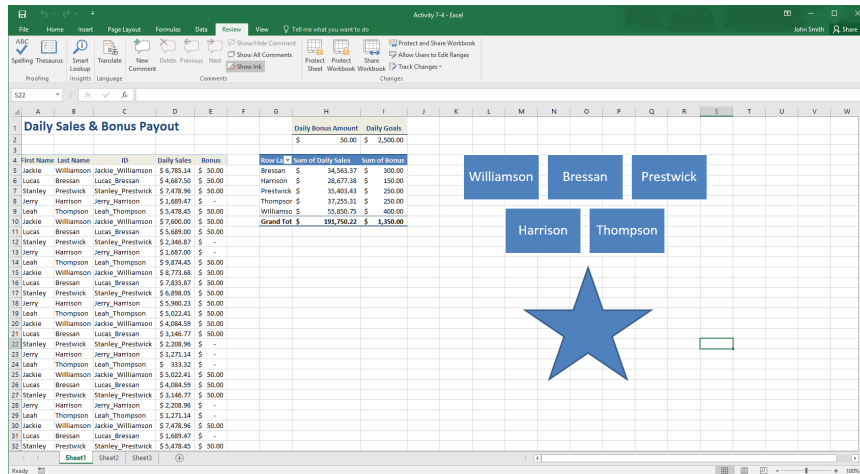
2. With the workbook open, ensure that Sheet1 is displayed. Click Review → Protect Sheet:
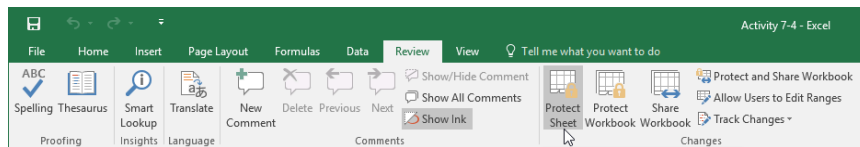
3. This action will display the Protect Sheet dialog box. Type a memorable password into the "Password to unprotect sheet" text box:
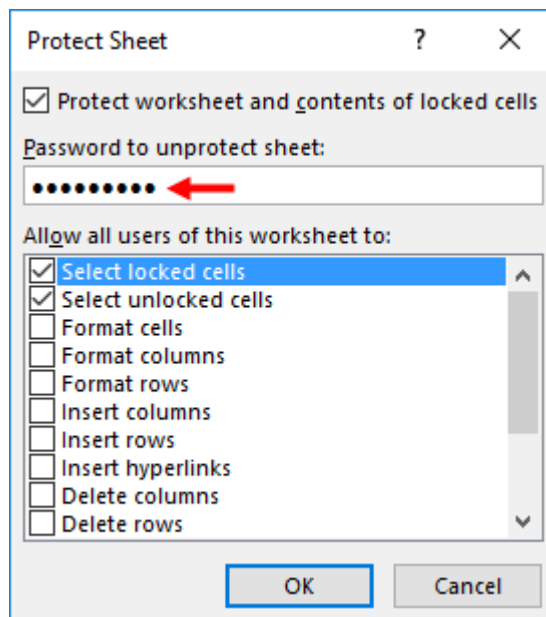
4. Check both the "Delete columns" and "Delete rows" check boxes and then click OK:
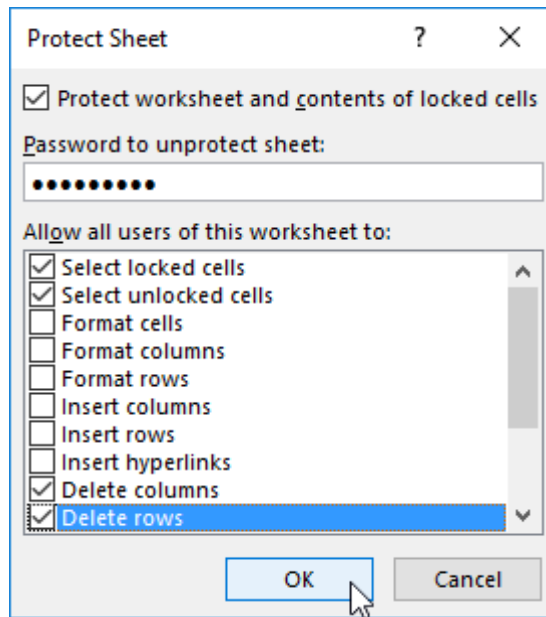
5. Next, you will be required to re-enter the password that you selected. Do so and then click the OK button:
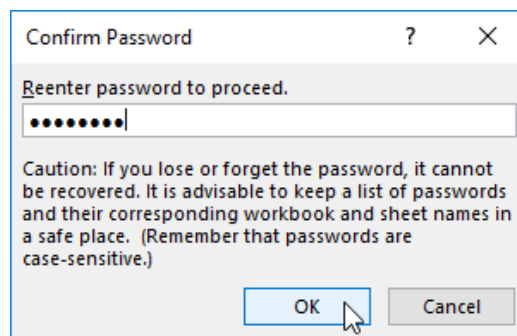
6. Returning to the worksheet, click the File tab. Here, you will see that the worksheet is now protected:
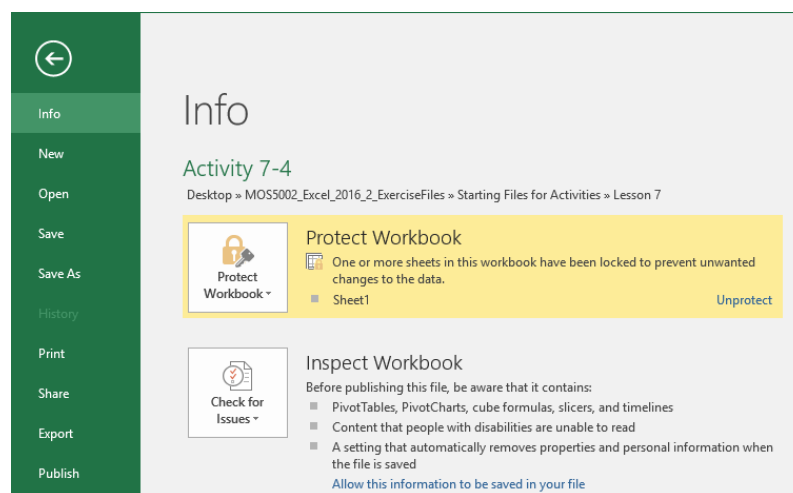
7. Save the current workbook as Activity 7-4 Complete to complete this activity.

TOPIC E: Preparing a Workbook for Multiple Audiences

One thing to keep in mind when working and managing workbooks created by Excel 2016, is that multiple audiences from other regions of the world may be required to use and understand them. For this reason it is important to ensure that your workbooks are suitable for multiple audiences when required.

Topic Objectives
In this topic, you will learn:
- How to display data in multiple international formats
- How to modify worksheets using the accessibility checker
- How to utilize international symbols
- How to manage fonts
- How to add alternative text to objects

DISPLAYING DATA IN MULTIPLE INTERNATIONAL FORMATS

If you encounter data that appears in a different language or unit of measurement, Excel can accommodate this information and modify it to suit your own preferences. When working with other languages, you have the option to change the languages that are used for editing, interface, ScreenTips, and help. You can find all of these settings within the Excel Options dialog box, in the **Language category**:
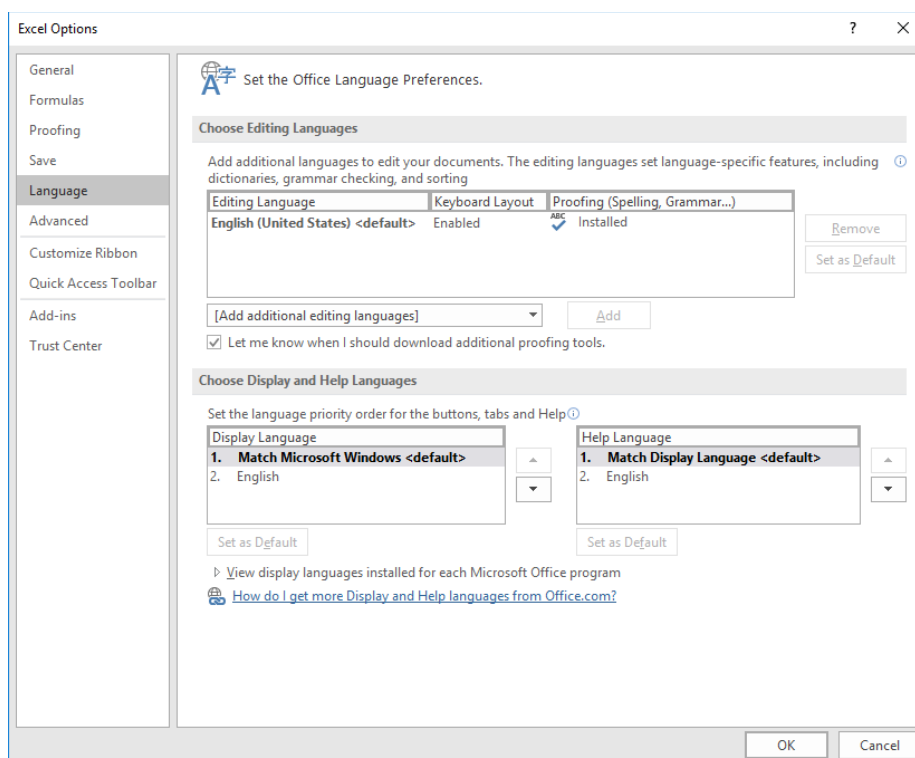
Within the Choose Editing Languages section, you can select the language that you would like from the list and click Set as Default. If you would like to change the display and help languages, choose a language from either of those two lists within that section and click the accompanying Set as Default button.

The **Proofing category** includes language settings that you can use to change what language is used when checking the spelling in your workbooks. Clicking the "Dictionary language" drop-down menu lists all of the languages that are available:
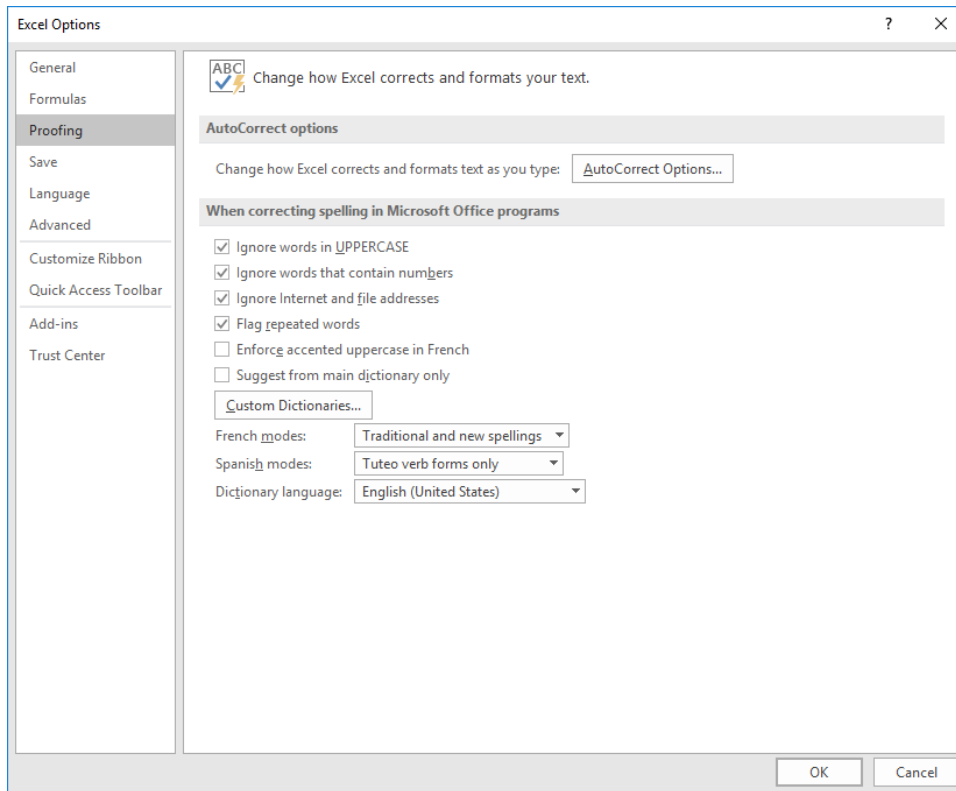
If you would like to translate any selected text in your workbook from one language to another, click Review → Translate:
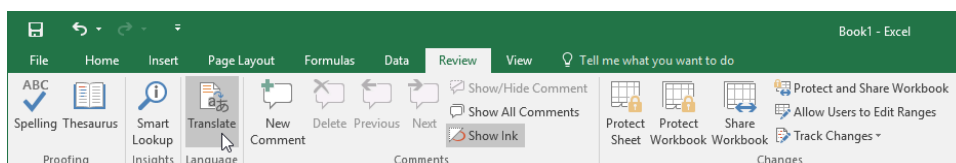
In the Translation area of the Research pane, select the languages you would like to translate the language in question to by clicking the To drop-down menu:
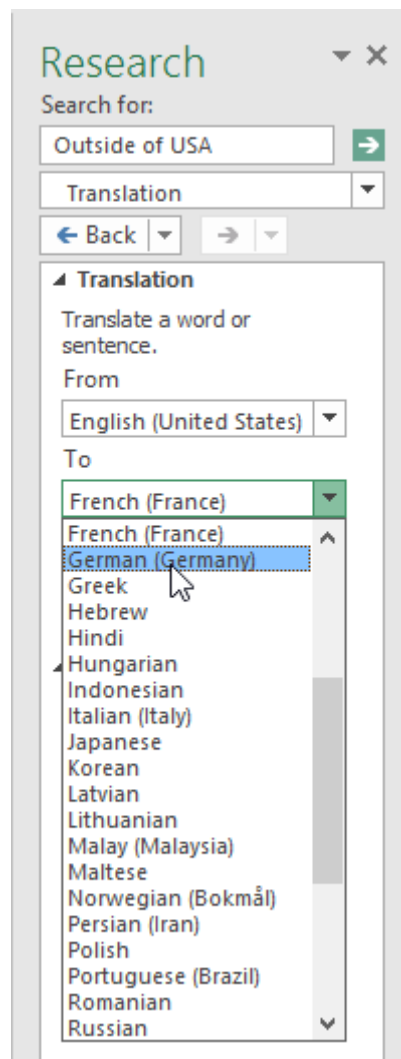
The result of the translation will be displayed in the lower portion of the Research pane. In some instances an Insert button may be provided that you can use to replace the selected text with the translated text.

Date and numerical formats can also be adjusted to international units. To do this, select the data that you would like to adjust and then click the Option button (⧉) within the Number group on the Home tab:
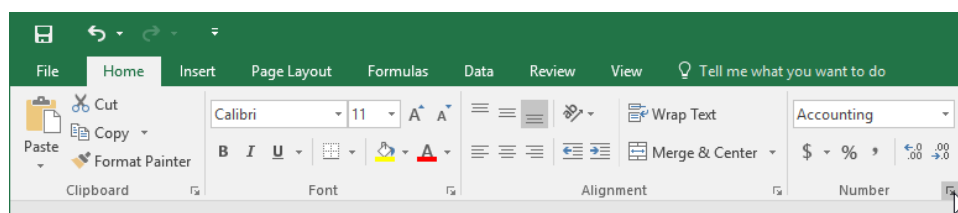
This action will display the Format Cells dialog box. From the list of categories on the left side of this dialog box, select the data that you are working with and you will see either the Symbol drop-down or the Locale (location) drop-down that you can use to choose a different regional option:
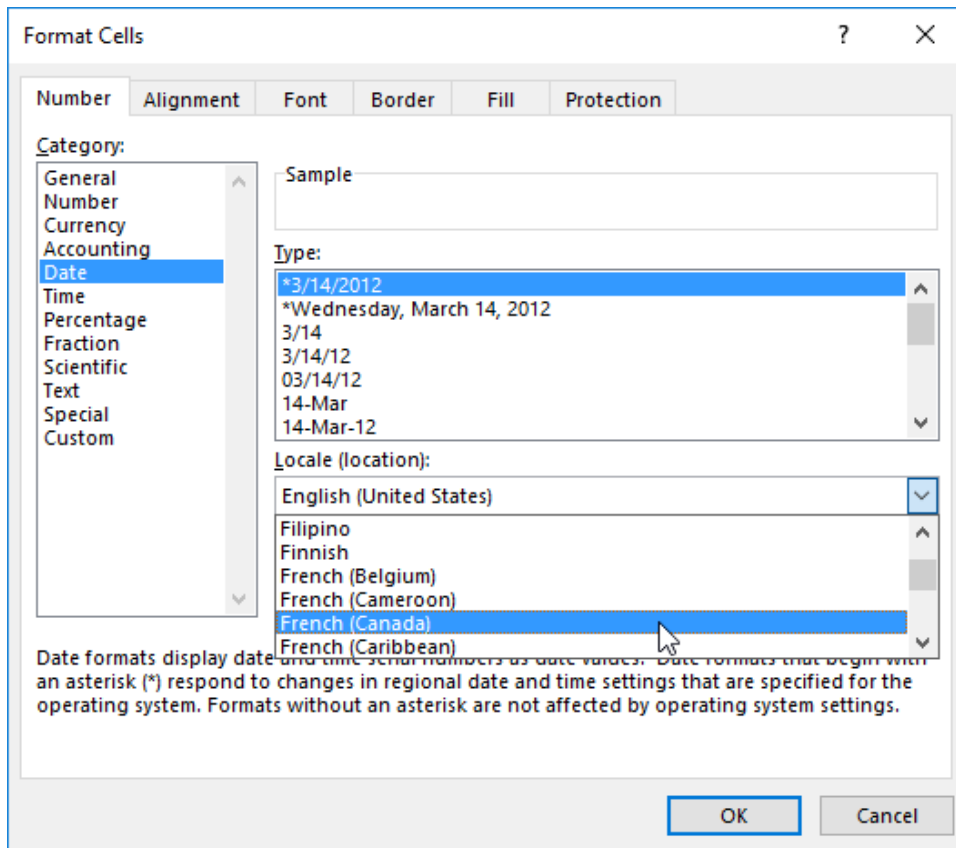
UTILIZE INTERNATIONAL SYMBOLS

Many languages can be entered using a standard keyboard, but some do require special international characters. To find and insert one of the symbols, click Insert → Symbol:
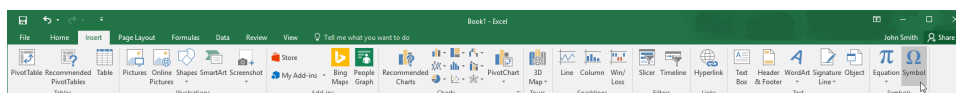

This action will display the Symbol dialog box to the Symbols tab. First, select the font that you would like to use from the Font drop-down menu. Next, double-click the symbol that you would like to insert into the last location that was selected on the current worksheet.
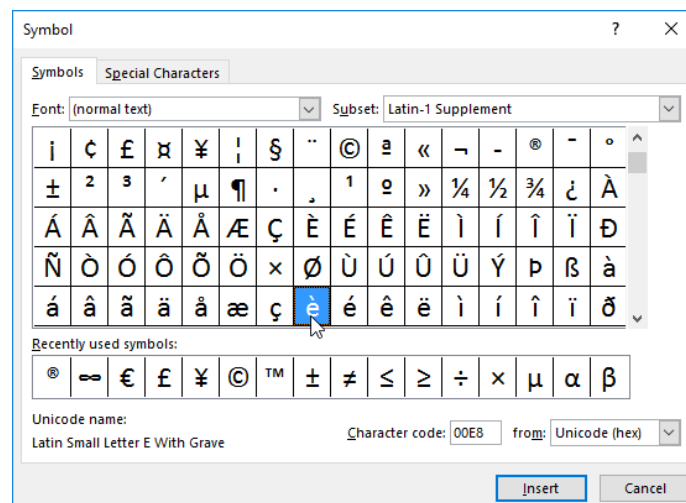
ADDING ALTERNATIVE TEXT TO OBJECTS

Alternative text is an important step in making documents accessible. To add alternative text to any object, right-click that object and click the appropriate Format command. Here, we are working with a chart so the command is Format Chart Area:
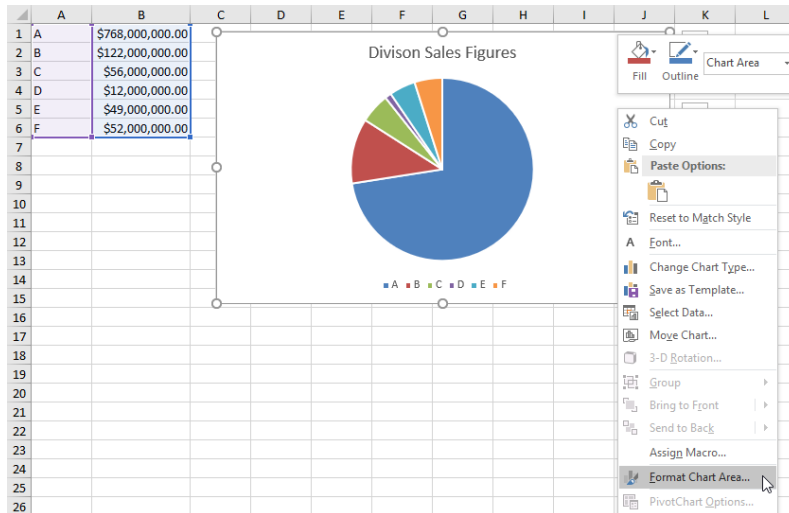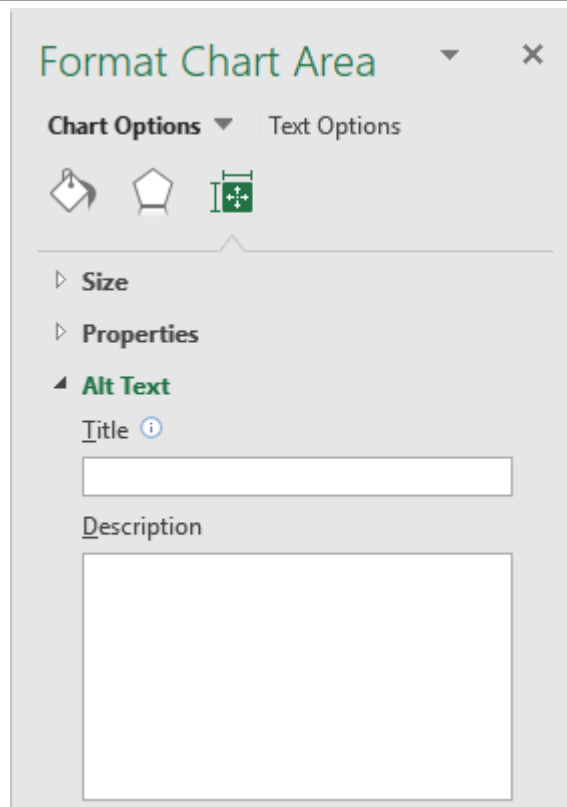

The related Format task pane will open. In this task pane, you should see a Size & Properties category. Click it:
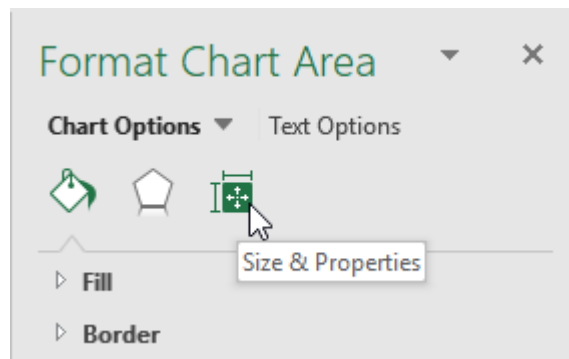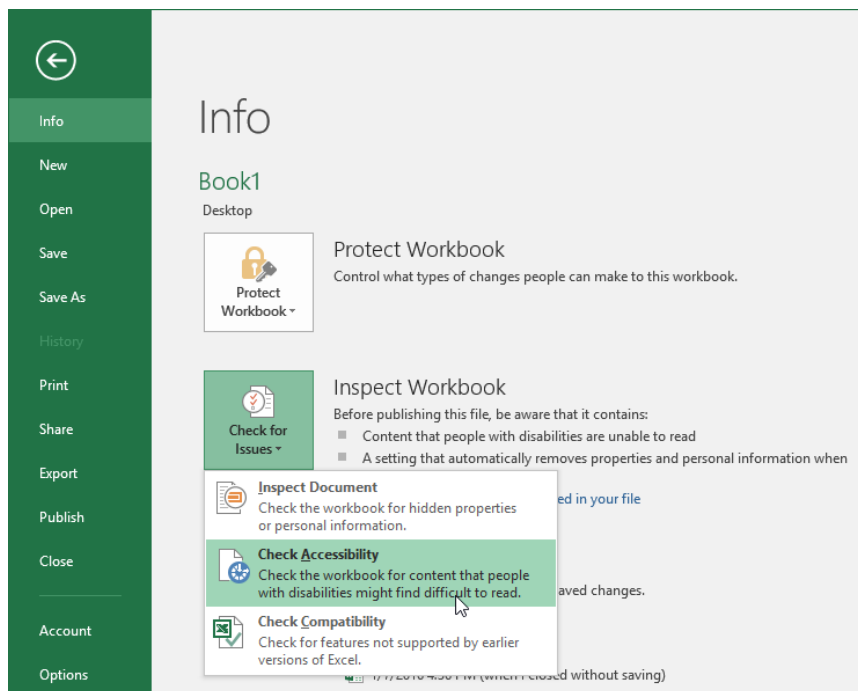

Next, click the Alt Text sub-category:
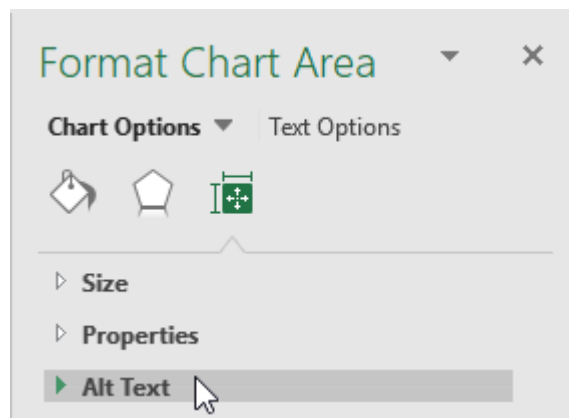
Here, you can enter a title and description for the object:

## MODIFYING WORKSHEETS USING THE ACCESSIBILITY CHECKER

The Accessibility Checker is designed to inspect your workbook for issues that might affect people who use screen readers. To open this tool, click File → Info → Check for Issues → Check Accessibility:

This command will open the Accessibility Checker pane on the right-hand side of the Excel window and list all of the errors and warnings related to accessibility:
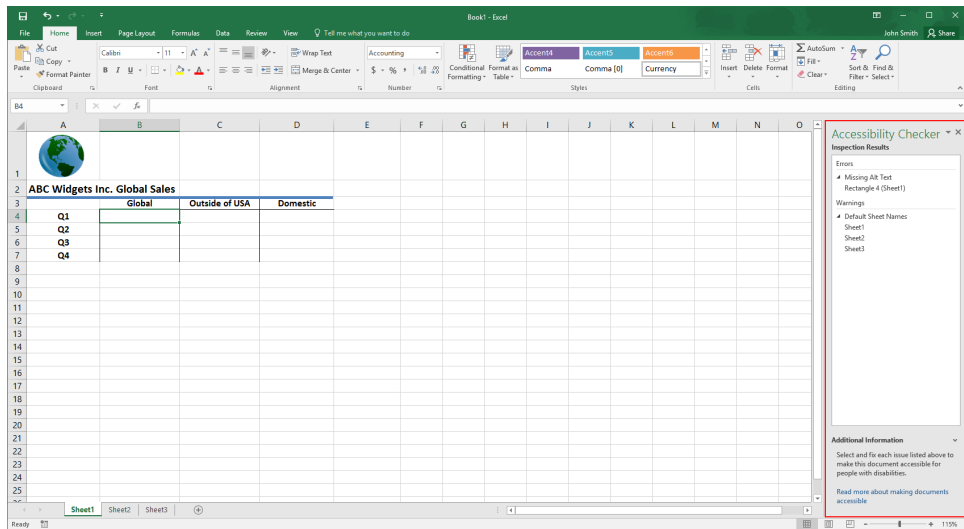
To view the details of an error or warning, simply select one from the list. Excel provides a brief explanation why the issue appeared and how to fix it in the Additional Information area that is shown at the bottom of the pane:
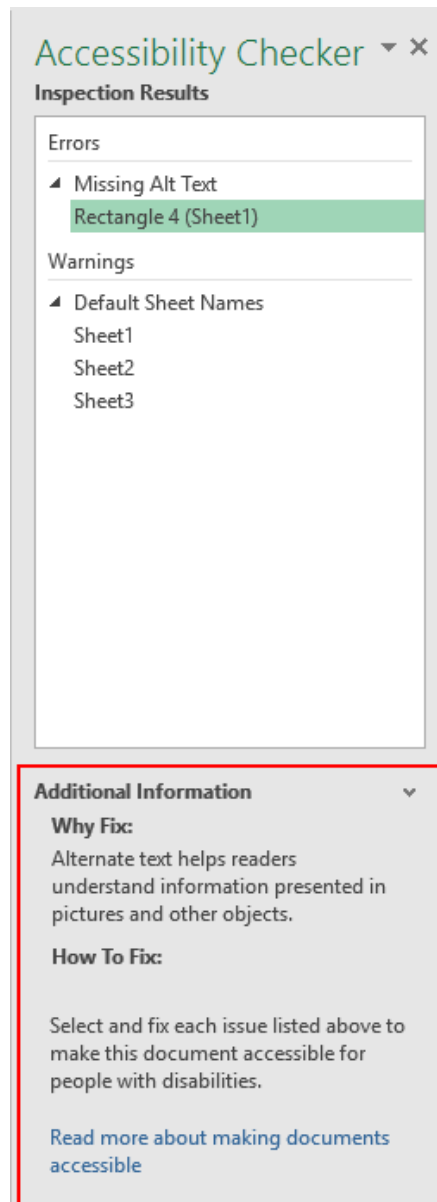
MANAGING FONTS

Body text and heading text that you add to Excel uses a specified font that you can customize. To do this, first click the Option button ( ) in the lower right-hand corner of the Font group on the Home tab:
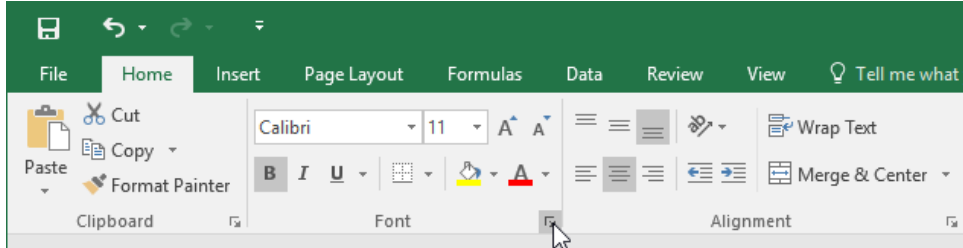
This action will open the Format Cells dialog box to the Font tab. By scrolling to the top of the Font list box you will see both the headings and body font listings:
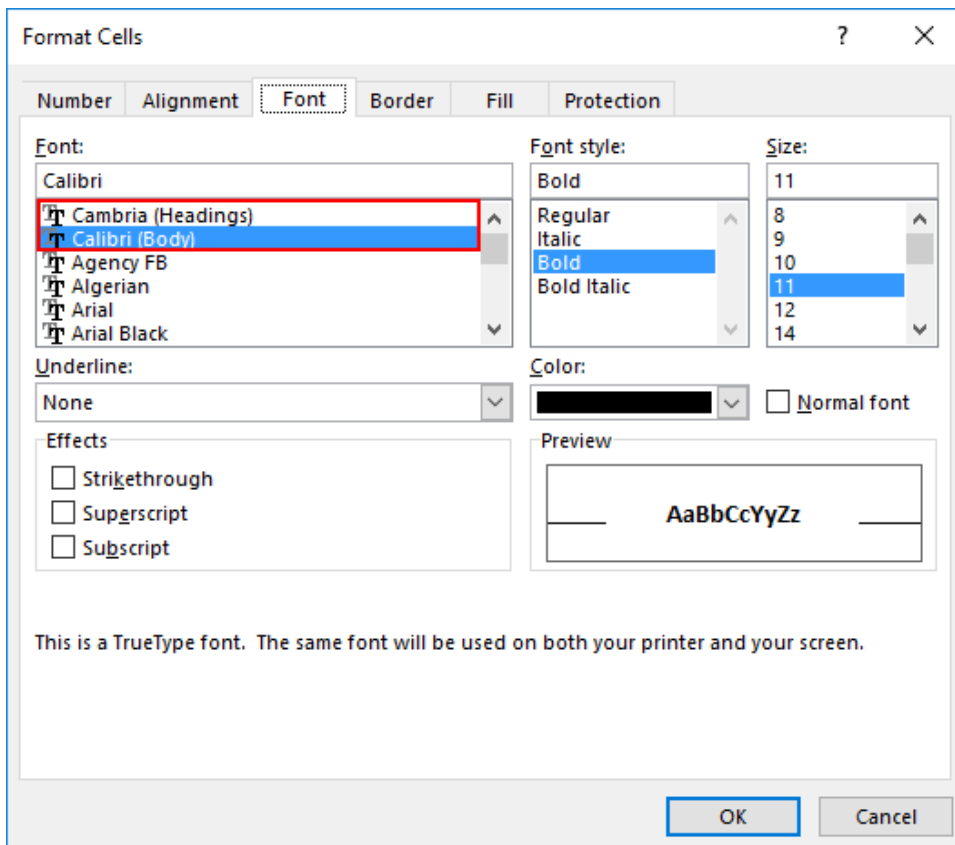
You can change how these basic fonts appear by selecting either of them and then choosing a font style, size, color, and font effect using the controls found on this tab:
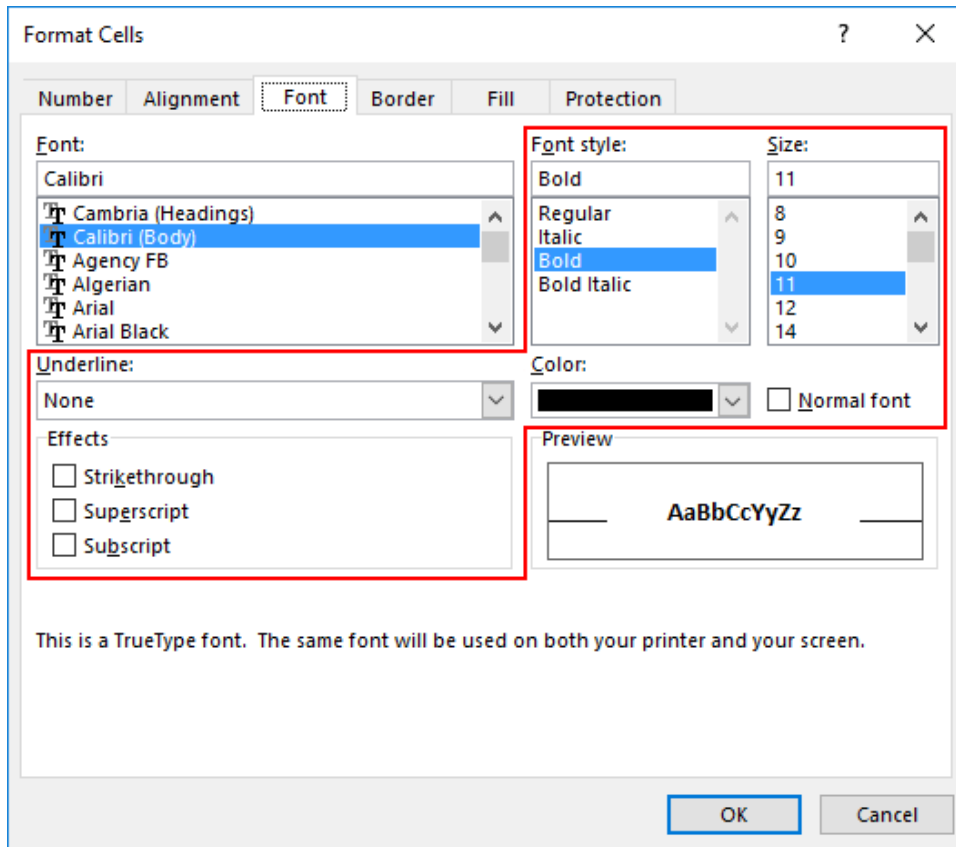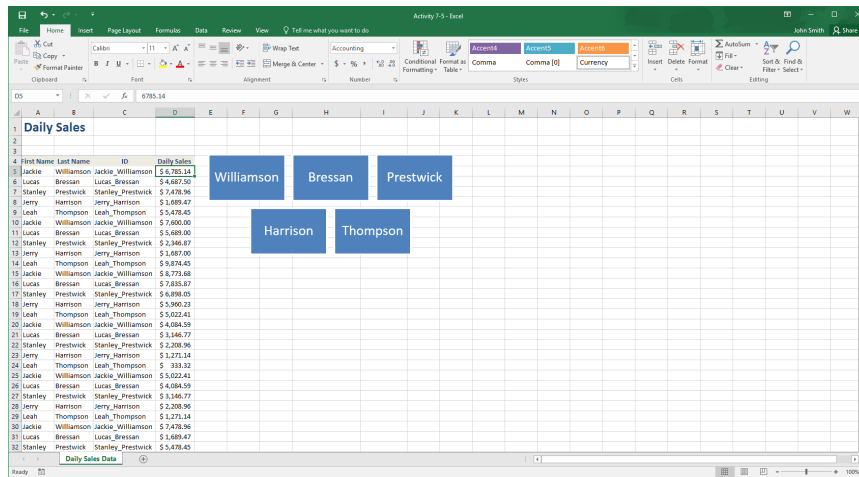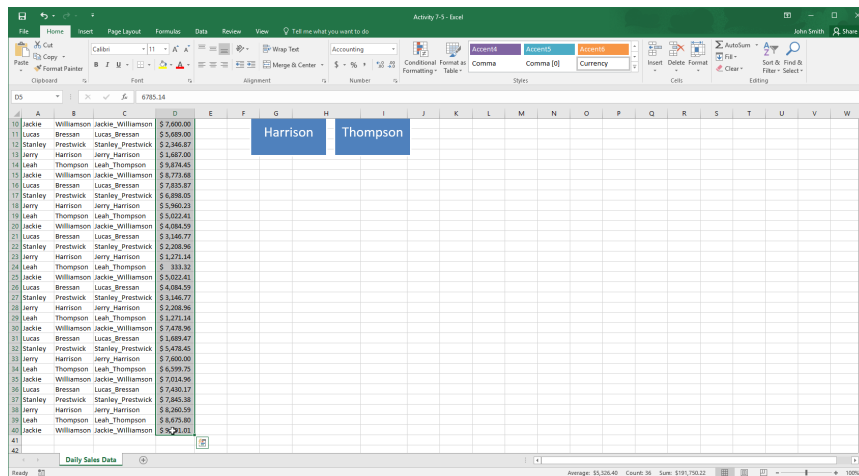
ACTIVITY 7-5

Preparing a Workbook for Multiple Audiences

The workbook that you have been working on needs to be checked by the Accessibility Checker for any errors, and you need to change every instance of the dollar symbol to the English pound symbol.
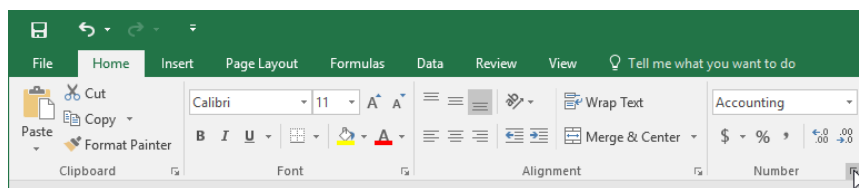
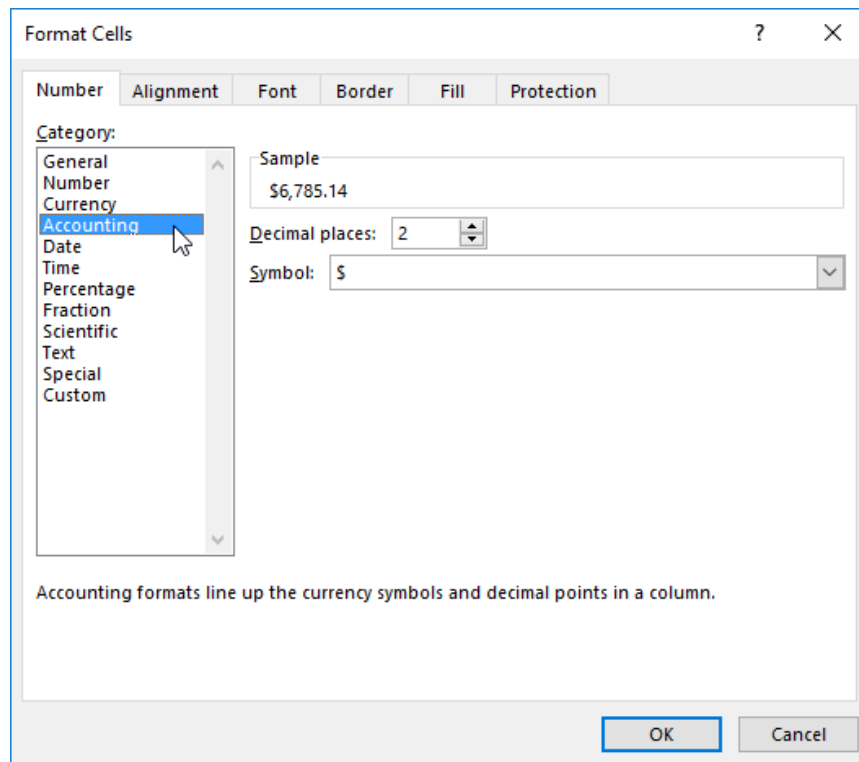**1.** To begin, open Activity 7-5 from your Exercise Files folder:

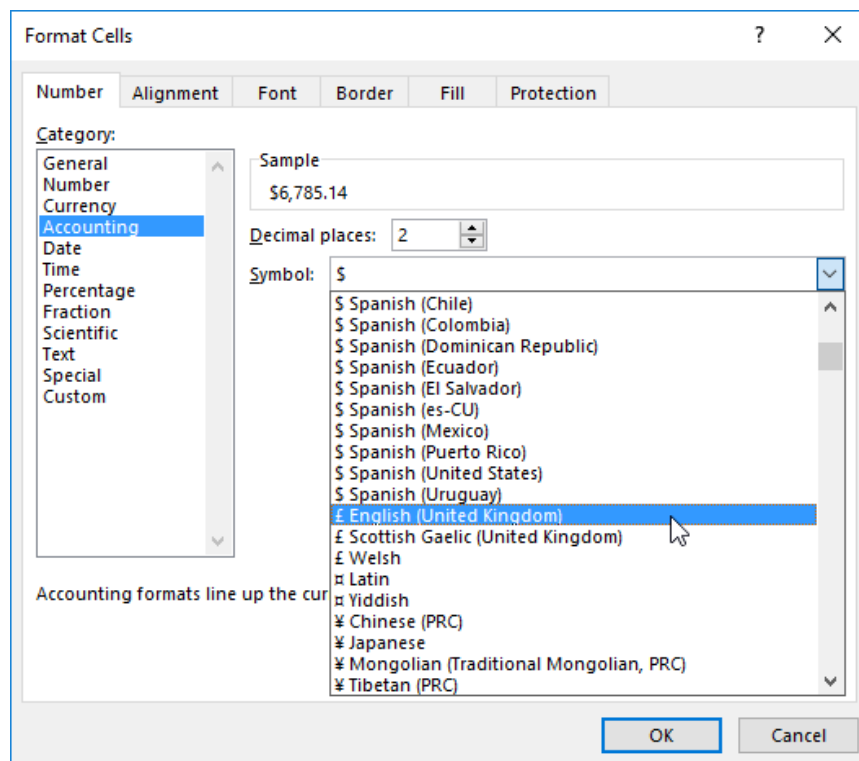**2.** Use your cursor to select cells D:5 to D40:

3. Next, click the Option button ( ) in the lower right-hand corner of the Number group on the Home tab:
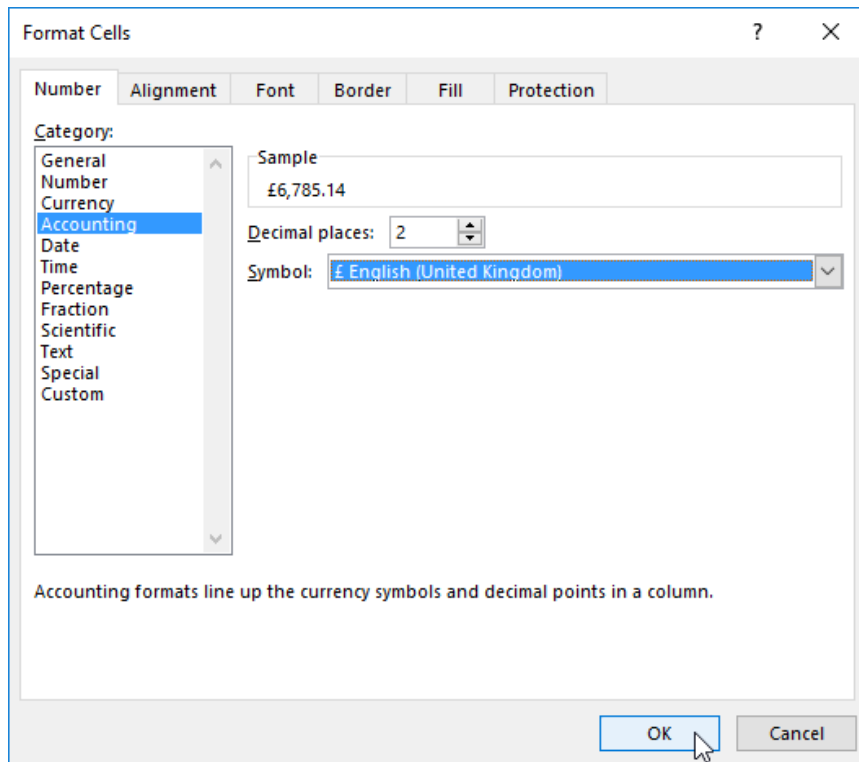
4. The Format Cells dialog box will now be displayed. Ensure that the Accounting category is selected from the Category list on the left:
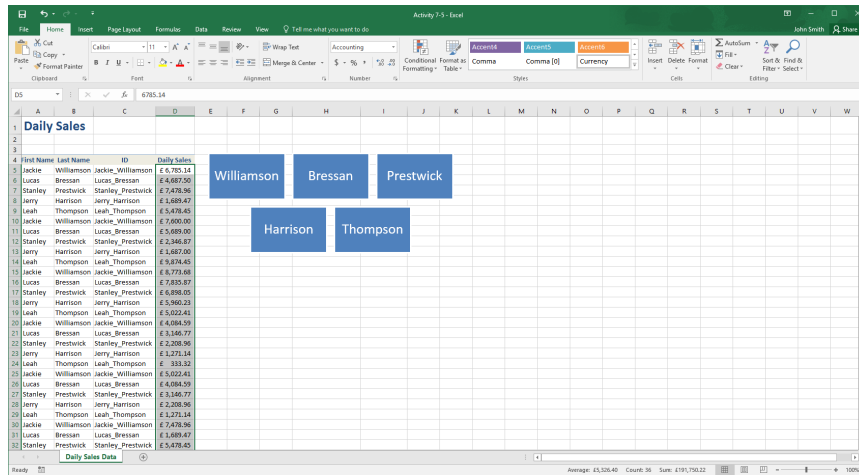

5. Next, click the Symbol drop-down menu and click the English (United Kingdom) option:
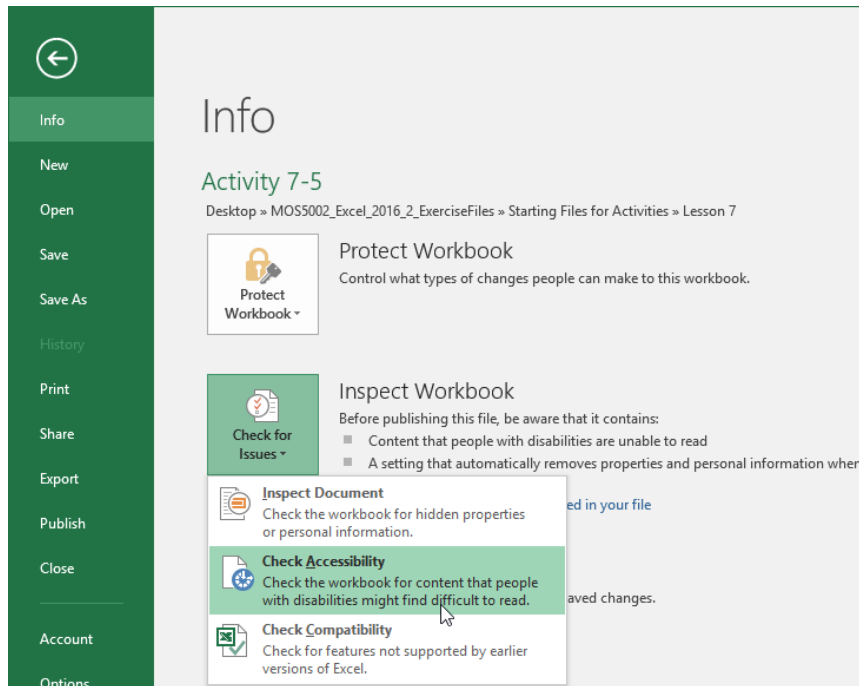
**6.** With the new currency symbol selected, click OK to apply your changes:

7. Back at the worksheet, you will see that the new currency symbol has replaced the dollar sign that was seen in the previously selected cells:

8. Now you need to run the Accessibility Checker. Click File → Info → Check for Issues → Check Accessibility:


9. Returning to the worksheet, the Accessibility Checker pane will be displayed on the right hand-side of the Excel window. Listed inside of this pane will be any issues identified by the checker. In this case you can see that only one such issue has been found:
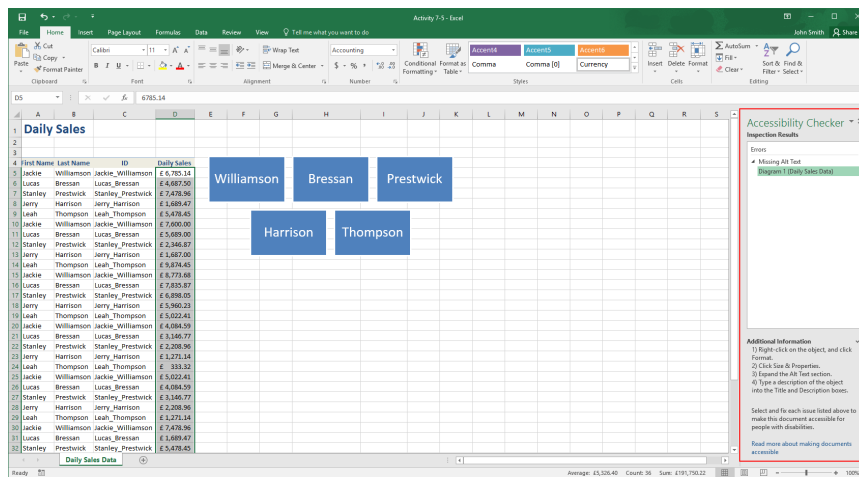
10. Click to select the issue that is listed and you will see more information about the problem and the problem element will also be selected on the worksheet – this is the SmartArt graphic in this case. Review the How to Fix information lower in this pane and use those instructions to add "Employees" as alternate text to this graphic:
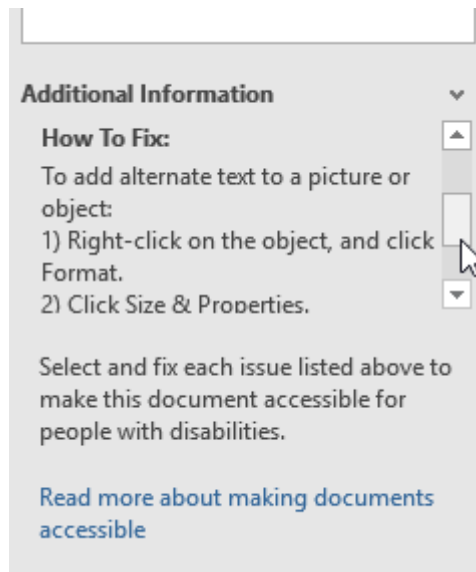
11. Once you have made the recommended changes, you will find that the Accessibility Checker will automatically indicate that no issues remain:
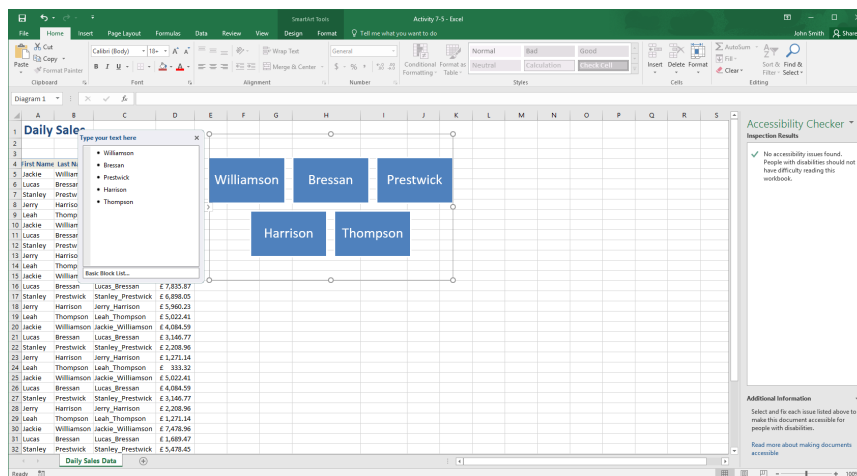
Summary

Over the course of this lesson you learned about the various different ways that you can enhance your workbooks in Excel 2016. You should now be familiar with the customization options that are available, as well as how to manage themes to control the appearance of your workbooks. At this point, you should also be comfortable creating and using templates, as well as protecting your workbooks against data loss and unauthorized access. Finally, you now know how to prepare your workbooks when working with multiple audiences.

APPENDICES

Keyboard Shortcut Quick Reference Sheet

File Management	**Open a new workbook**	Ctrl + N
	Save a file	Ctrl + S
	Open a file	Ctrl + O
	Print worksheet	Ctrl + P
	Close Microsoft Excel	Alt + F4
Worksheet Management	**Switch between worksheet tabs (left to right)**	Ctrl + Page Up
	Switch between worksheet tabs (right to left)	Ctrl + Page Down
	Insert cells	Ctrl + Shift + +
	Delete cells	Ctrl + -
	Hide the selected rows	Ctrl + 9
	Hide the selected columns	Ctrl + 0
	Select all items in current worksheet	Ctrl + A
	Select active PivotTable	Ctrl + Shift + *
	Toggle between displaying values/formulas	Ctrl + `
	Copy text	Ctrl + C
	Cut text	Ctrl + X
	Paste text	Ctrl + V
Insert Objects	**Insert current time**	Ctrl + Shift + ;
	Insert current date	Ctrl + ;
	Insert chart into new worksheet	F11
	Insert line break	Alt + Enter
Open Dialogs	**Open Find tab of Find and Replace dialog**	Ctrl + F
	Open Replace tab of Find and Replace dialog	Ctrl + H
	Open Go To dialog	Ctrl + G

	Open Format Cells dialog to last used tab	Ctrl + 1
	Open Create Table dialog	Ctrl + T
	Open Name Manager	Ctrl + F3
	Open Insert Hyperlink dialog	Ctrl + K
Text Formatting Tools	**Apply bold formatting**	Ctrl + B
	Apply underlining	Ctrl + U
	Apply italic formatting	Ctrl + I
	Apply border to selected cells	Ctrl + Shift + &
	Remove border from selected cells	Ctrl + Shift + _
	Check spelling	F7
	Undo last action	Ctrl + Z
	Redo last action	Ctrl + Y

Glossary

absolute reference
A type of reference that will not change even if it is moved or copied to another location.

add-in
Small components that can be added to Excel to add features and functionality.

array
Any grouping of two or more adjacent cells.

arguments
Data used by functions to complete calculations.

AutoFill
A feature that is used to automatically fill sequential data into a range of cells.

AutoFilters
Preconfigured filters that can be quickly applied or removed.

cell
The intersection of a row and column on a worksheet.

charts
Visual representations of numeric data in a dataset.

criteria range
Used in database functions or advanced filters, this refers to the range that contains criteria which is needed in order to perform an operation.

database functions
Functions that allow you to perform operations on multiple fields in an Excel database.

fields
Columns that appear in a dataset that is used for a PivotTable.

filtering
Removing data from view based upon set criteria.

formula
A mathematical relationship expressed through symbols.

Formula Bar
A part of the Excel interface that displays the cell name, as well as values and formulas in the selected cell.

function
A preconfigured formula that is used for a specific purpose.

logical operators
A type of operator that is used to compare values and determine if values meet specified criteria.

logical values
A type of value that expresses if data is TRUE or FALSE based on specified criteria.

multi-cell array formula
A type of array formula that performs multiple calculations on one or more arrays and then displays the results.

outline
A feature in Excel that allows you to organize datasets in a worksheet into hierarchical groups.

PivotChart
Similar to regular Excel charts, a PivotChart is a visual representation of data that is being displayed in a PivotTable.

PivotTable
A data analysis tool that dynamically allows you to pivot columns and rows of raw data without altering it.

range names
Meaningful names that can be added to cell ranges so that they can be easily referred to and understood later.

single-cell array formula
A type of array formula that performs multiple calculations on arrays and then displays the results in a single cell.

slicers
A type of data analysis tool that works in conjunction with PivotTables to sort data based on unique data entries.

SUBTOTAL functions
A type of Excel functions that are used to perform calculations on subsets of data.

subtotals feature
A feature that is used to quickly perform the SUBTOTAL function on a subset of data within a dataset.

summary functions
A feature that uses SUBTOTAL functions on subsets of data within a table.

table
A dataset that is comprised of rows and columns, but is treated as one object (unlike regular data ranges).

Text pane
Part of the interface when SmartArt is added or selected in Excel. Is typically used to add text to SmartArt.

transactional data
Data that represents each transaction (or event) in a series. It is not summarized in any way and is considered raw data without row labels.

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