



Microsoft 365: Working with Excel Formulas and Functions

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365F/23/V1

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Microsoft 365: Working with Excel Formulas and Functions

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Course Description

Microsoft 365: Working with Excel Formulas and Functions is a three-lesson intermediate level course. This course guides you through creating, copying and pasting, reviewing, and correcting basic and complex formulas in Excel using step-by-step hands-on activities. This course emphasizes using a standard keyboard and mouse actions to perform tasks in Excel.

In Lesson 1, you learn about the syntax of formulas and about Excel's predefined formulas, called functions. Then you create basic formulas by entering the formulas into cells manually, by using the Sum (AutoSum) feature, and by copying and pasting existing formulas into other cells. You also learn how to use status bar options to quickly find the sum, average, minimum, maximum, and number of values for a range without creating a formula.

In Lesson 2, you learn how to use the Formula AutoComplete feature, how to enter formulas on grouped worksheets, and how to create formulas with 3-dimensional references—references that span worksheets and workbooks. Next you use the Function Library to add the current date and time to a worksheet and to create a formula that performs two logical tests. Then you learn to use defined names and column or row labels as function arguments. Finally, you learn how to apply conditional formatting to formulas.

In Lesson 3, you learn how to use tools that help you identify and correct errors in formulas and other kinds of worksheet errors including the Error Checking feature and the Trace Error icon, the Formula Auditing tools, the Watch Window, displaying a workbook in more than one window and splitting a worksheet into multiple viewing panes, and protecting a worksheet.

Course Prerequisite

The course *Microsoft 365: Getting Started with Excel* or equivalent experience working with Excel 365 or earlier versions in the Windows operating system environment is a prerequisite for this course.

Learning Objectives

After completing this course, you will be able to:

- Describe formula and function syntax and create basic formulas;
- Copy/paste and fill formulas;
- Enter formulas on grouped worksheets;
- Use multiple methods to build formulas;
- Apply conditional formatting to formulas' results; and
- Find and correct formula errors using a variety of tools, such as the Error Checking feature and Trace Error icon, the Formula Auditing tools, and the Watch Window.

Lesson Summary

Lesson 1: In this lesson, you learn to:

- identify basic formula and function syntax,
- recognize formulas pasted with relative references,
- select status bar options and Sum (AutoSum) for quick calculations,
- recognize formulas pasted with mixed or absolute references, and
- identify formula results pasted as values.

Lessons 2: In this lesson, you learn to:

- select worksheets for grouping, entering formulas, and formatting
- identify ways to link worksheets and workbooks with 3-D formulas,
- select the Insert Function button or Buttons from the Function Library to insert functions in formulas,
- recognize defined names as function arguments, and
- select conditional formatting for formulas' results.

Lesson 3: In this lesson, you learn to:

- identify and correct common errors using the Trace Error icon and the Formula Auditing tools,
- identify and correct a circular reference,
- select color-coded cell borders to correct a cell reference error in a formula,
- identify how to step through a nested formula, and
- identify how to use the Watch Window and other tools to analyze, protect, and hide formulas.

Throughout the course, tip boxes provide additional information:

NOTE boxes provide general information about course content.

NOTE

In this course you are told to activate a cell to view its contents or enter cell values or formulas. You may use the mouse pointer or an ARROW key to activate the cell as you prefer. You are also told to enter cell contents in a specific cell. You may use any method you prefer—the mouse pointer, the Enter button, the ENTER, ARROW, or TAB keys—to ‘enter’ the keyed contents.

KEYBOARD SHORTCUT boxes offer quick alternatives to performing tasks using the keyboard instead of the mouse.

KEYBOARD SHORTCUT

You can press the CTRL+` (grave accent) keyboard shortcut keys to show or hide formulas in their cells.

TIME-SAVER boxes offer alternative work methods.

TIME-SAVER

Using a separate area of a worksheet to enter variables used in formulas makes it easier to change those variables when performing a what-if analysis—what happens to the worksheet's calculated values if specific variables are changed. If you enter formula variables in a separate area of a worksheet, consider selecting an area to the right or below the primary worksheet area so that the variables are not affected if you insert rows or columns in the primary worksheet area.

WARNING! boxes provide tips on ways to avoid specific problems while working in Excel.

WARNING!

It is a good idea to frequently save your solution file workbook—either manually or by using the AutoSave feature—even when there are no specific steps to do so.

TOUCH TIP boxes provide tips on using touch-screen gestures while working in Excel with a touch-screen device.

TOUCH TIP

If you are using a touch-screen device, you can also use finger gestures, such as tapping, double-tapping, dragging, and swiping in Excel. For more information on finger gestures, check out Excel Help.

Author Biography

Ollie N. Rivers

Ollie N. Rivers has more than 20 years' business experience in financial and administrative management and more than 10 years' experience as a corporate trainer. She is a co-author of two e-business textbooks, an Internet textbook, and a Web design textbook, and is a contributing author on more than 15 software package textbooks. Ms. Rivers has also developed and delivered numerous classroom and online continuing education seminars for CPAs. Ms. Rivers holds an M.B.A. and a B.S. in Accounting and Management from Houston Baptist University.

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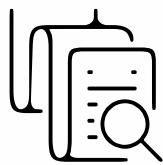
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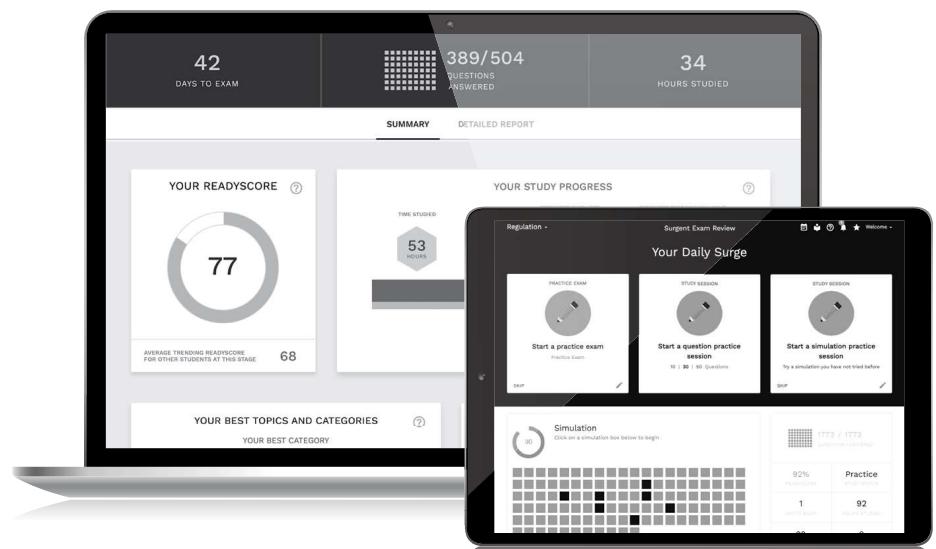
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Table of Contents

Creating, Copying, and Pasting Basic Formulas	1
Creating Complex Formulas.....	2
Identifying and Correcting Formula Errors	3

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Revised September 2023

NOTES

Creating, Copying, and Pasting Basic Formulas

Learning objectives	1
I. In general	1
II. Key terms	2
III. Hands on	2
A. Identifying basic formula and function syntax	2
1. Getting started	2
2. Formula syntax	2
3. Navigating in a worksheet using the Name Box	3
4. Navigating in a worksheet using a defined name	5
5. Order of precedence in calculations	5
6. Function syntax	8
7. Using functions	9
8. Viewing formulas in cells	9
9. Performing a what-if analysis	11
10. Creating formulas	12
B. Recognizing formulas pasted with relative references	18
1. Getting started	18
2. Copying and pasting formulas	18
3. Filling cells with formulas	20
4. Solving calculation precision and rounding errors	22
C. Selecting status bar options and Sum (AutoSum) for quick calculations	24
1. Getting started	24
2. Status bar calculation options	25
3. The Sum (AutoSum) button	26
D. Recognizing Formulas Pasted with Mixed or Absolute References	30
1. Getting started	30
2. Pasting and filling formulas with absolute references	31
E. Identifying formula results pasted as values	35
1. Getting started	35
2. Pasting formulas as values	35

Creating, Copying, and Pasting Basic Formulas

Learning objectives

After completing this lesson, you will be able to:

- Identify basic formula and function syntax;
- Recognize formulas pasted with relative references;
- Select status bar options and Sum (AutoSum) for quick calculations;
- Recognize formulas pasted with mixed or absolute references; and
- Identify formula results pasted as values.

I. In general

In Lesson 1, you first review the syntax required to construct worksheet formulas and to use Excel's predefined formulas, called functions. You also navigate in a worksheet using the Name Box and a defined name, toggle on and off the view formulas in their cells and perform a what-if analysis by changing formula variables. Next, you build several basic formulas using the keyboard and the mouse pointer. You also learn how to name a range of cells and use both Copy/Paste and the fill handle to copy formulas with relative references into adjacent cells.

Then you learn to use status bar options to quickly find the sum, average, minimum, maximum, or number of values in a range *without* creating a formula. You also learn how to use the Sum (AutoSum) button to quickly create formulas that find the sum, average, minimum, maximum, or number of values in a range. Finally, you learn to paste or fill formulas with mixed or absolute references and how to paste formulas' results as values.

NOTE

Depending on your Microsoft 365 updates, whether you are using Microsoft 365 for the Desktop or the Web version, and your Excel application preference settings, your Excel window may look slightly different from the illustrations in this course. You may also need to modify some instructions to accommodate these differences. The keyboard shortcuts demonstrated in this course are based on using a standard keyboard.

NOTE

In this course you are told to activate a cell to view its contents or enter cell values or formulas. You may use the mouse pointer or an ARROW key to activate the cell as you prefer. You are also told to enter cell contents in a specific cell. You may use any method you prefer—the mouse pointer, the Enter button, the ENTER, ARROW, or TAB keys—to 'enter' the keyed contents.

II. Key terms

absolute reference	mathematical operators
argument	mixed reference
customizable status bar	Name Box
defined name	operands
Defined Names group	Paste Values option icon
dependent formulas	relative references
error indicator symbol	Show Formulas button
fill handle	status bar calculation options
formula	Sum (AutoSum) button
Formula Auditing mode	Trace Error icon
Formula Bar	what-if analysis
function	

III. Hands on

A. Identifying basic formula and function syntax

1. Getting started

A **formula** is a mathematical expression. You create formulas in a worksheet to calculate values, such as the total revenues or total expenses in a budget worksheet.

The power of an Excel worksheet lies in its ability to recalculate its formulas when the values for the variables used by the formulas are changed. To exploit this automatic recalculation feature, you should use cell references instead of actual values in a formula whenever possible.

You begin by opening an existing workbook containing a single worksheet. Then you review the formulas behind the worksheet's calculated values.

To open an existing workbook:

Step 1

Open the **Lesson 1 Sample Formulas** data file

Step 2

Observe the active areas of the *Financial Forecast* worksheet, the ranges **A1:G14** and **L1:P3**

The *Financial Forecast* worksheet contains formatted titles, data, and calculations for a five-year operating income forecast.

2. Formula syntax

Excel formulas begin with an equal sign (=), which tells Excel that what follows the equal sign is a calculation. After the equal sign are the **operands** (numbers, text, or cell references) and **mathematical operators** (+, -, *, /) necessary for the calculation.

Although most formulas contain both operands and mathematical operators, a very simple formula, such as that found in cell B6, can contain just an operand.

NOTE

The values in the *Financial Forecast* worksheet are stated in \$000 (thousands).

For example, in the *Financial Forecast* worksheet, cell B6 should always contain the initial revenues value for Year 1. The initial value for Year 1 is located in cell M2. Thus, the formula in cell B6 (=M2) indicates that cell B6 always contains the value found in cell M2, currently \$100,000.

To view the formula behind a calculation, you first activate the cell that contains the formula. The result of the formula's calculation is visible in the cell, and the formula is visible in the **Formula Bar** above the worksheet area.

To view the formula in cell B6:

Step 1

Activate cell **B6** to view the result of a formula's calculation in the cell (\$100,000) and the corresponding formula (=M2) in the Formula Bar

Your cell B6 and Formula Bar should look similar to Figure 1-1.

	A	B	C	D
1	BioTech Enterprises			
2	Five-Year Financial Forec			
3	(\$000)			
4				
5		Year 1	Year 2	Year 3
6	Revenues	\$ 100,000	\$ 105,000	\$ 113,400
7				

FIGURE 1-1 Formula result in cell B6 and formula in the Formula Bar

TOUCH TIP

If you are using a touch-screen device, you can also use finger gestures, such as tapping, double-tapping, dragging, and swiping in Excel. For more information on finger gestures, check out *Excel Help*.

3. Navigating in a worksheet using the Name Box

The Years 2-5 Revenues are calculated based on each previous year's revenues plus a percentage of those revenues as a growth factor.

In the *Financial Forecast* worksheet, the initial Year 1 Revenues value and the revenue growth percentages for Years 2-5 are located in a separate area of the worksheet. They can be found to the right of the budget data and calculations in the range L1:P3.

TIME-SAVER

Using a separate area of a worksheet to enter variables used in formulas makes it easier to change those variables when performing a what-if analysis—what happens to the worksheet's calculated values if specific variables are changed. If you enter formula variables in a separate area of a worksheet, consider selecting an area to the right or below the primary worksheet area so that the variables are not affected if you insert rows or columns in the primary worksheet area.

To view the worksheet area that contains the initial Year 1 Revenues and revenue growth percentage variables, you can scroll the worksheet using the vertical or horizontal scroll bars until you find the cells containing the variables. However, because you know where the variables are located, you can quickly navigate to the area by using the **Name Box** to the left of the Formula Bar.

The Name Box generally contains the cell reference (row number and column letter) of the active cell. However, you also can key a desired cell reference or range reference in the Name Box to quickly view (and activate) a cell or view and select a range.

To view and select the range L1:P3 containing the formula variables for the *Financial Forecast* worksheet:

Step 1

Move the mouse pointer into the **Name Box**; the mouse pointer becomes the I-beam pointer

Step 2

Click the **Name Box** to select its contents

Step 3

Key L1:P3

Step 4

Press the **ENTER** key

Step 5

Observe the selected range **L1:P3**

Step 6

Observe the initial Year 1 Revenues value in cell **M2** and the Years 2-5 revenues growth percentages in the range **M3:P3**

The selected range on your worksheet should look similar to Figure 1-2.

K	L	M	N	O	P	Q
	Formula Variables					
	Year 1 Revenues	\$100,000				
		5%	8%	10%	12%	

FIGURE 1-2 Selected range L1:P3 containing formula variables

Step 7

Press the **CTRL+HOME** keys to activate cell **A1** (home cell)

NOTE

The Quick Analysis button appears when you select a range of cells in your worksheet. You can click the Quick Analysis button to see a gallery of options for analyzing the selected data. You learn more about using the Quick Analysis feature later in this course.

4. Navigating in a worksheet using a defined name

Defining a name for a worksheet range is useful when the worksheet contains multiple ranges in which you frequently work.

For example, suppose you need to frequently access an area of a worksheet that contains formula variables. In this situation, it may be more useful to define a name for the range of cells that contains the variables. Then you can simply key the **defined name** in the Name Box and press the ENTER key to select the range. (You learn how to create a defined name in the next section.)

In the *Financial Forecast* worksheet, the range of cells containing the formula variables is named “var.”

To quickly view and select the range containing the formula variables using the range’s defined name:

Step 1

Click the **Name Box** to select its contents

Step 2

Key **var**, if necessary

Step 3

Press the **ENTER** key

Step 4

Observe the selected range named **var**, cells **L1:P3**

Step 5

Activate cell **A1**

5. Order of precedence in calculations

When a formula contains multiple operators, Excel performs the formula’s calculations following a strict order of precedence for the operators as Excel reads the formula from left to right. Table 1-1 illustrates the mathematical operators you use in this course and their order of precedence.

Action	Operator
Parentheses	()
Multiplication or Division, <i>in the order in which the calculations appear from left to right</i>	* or /
Addition or Subtraction, <i>in the order in which the calculations appear from left to right</i>	+ or -

TABLE 1-1 Mathematical operators and order of precedence

Let's review a very simple calculation to see how the rules of precedence order work. Figure 1-3 illustrates a worksheet that has a value of 5 in cell A1, a value of 5 in cell B1, and a value of 2 in cell C1.

	A	B	C	D	E
1	5	5	2		
2					

FIGURE 1-3 Sample worksheet

Assume that you want to create a formula in cell D1 that first adds the values in cells A1 and B1 ($5+5$) and then divides the result of the addition calculation (10) by the value in cell C1 (2). The result of this calculation is, of course, 5.

Using cell references as operands and the + and / mathematical operators to build your formula, you could enter $=A1+B1/C1$ in cell D1, as shown in Figure 1-4.

	A	B	C	D	E
1	5	5	2	7.5	
2					

FIGURE 1-4 Sample formula

To perform this calculation:

1. Excel reads the formula from left to right, and following the rules of precedence, performs the division calculation first ($B1/C1$).
2. Then it adds the result of the division calculation (2.5) to the value in cell A1 (5) for a result of 7.5.

This result is obviously in error—it is not the expected result of 5! To get the expected and correct result from the sample formula, Excel must perform the addition calculation *before* it performs the division calculation. To control the order in which Excel performs the mathematical operations, you use parentheses.

Following the order of precedence in calculations, Excel performs calculations inside parenthesis first; therefore, the edit of the sample formula to be $=(A1+B1)/C1$ forces Excel to add the values in cells A1 and B1 and then divide the result of the addition calculation by the value in cell C1.

Editing the formula to force Excel to perform the addition calculation first returns the expected and correct result of 5, as shown in Figure 1-5.

	A	B	C	D	E
1	5	5	2	5	
2					

FIGURE 1-5 Revised sample formula

In the *Financial Forecast* worksheet, the formulas that calculate the Revenues for Years 2–5 are found in the range C6:F6. These formulas are slightly more complex than the formula in cell B6 and contain multiple operands and operators. Parentheses are used in the formulas to control the order of calculations.

To view the formula for the Year 2 Revenues calculation:

Step 1

Activate cell **C6**

Step 2

Observe the formula $=B6+(M3*B6)$ in the Formula Bar

The Year 2 Revenues formula in cell C6 should look similar to Figure 1-6.

BioTech Enterprises				
Five-Year Financial Forecast (\$000)				
	Year 1	Year 2	Year 3	
6	Revenues	\$ 100,000	\$ 105,000	\$ 113,400
7				
8	Expenses			
9	Employee Expenses	10,000	10,700	11,449
10	Rent and Utilities	4,000	4,000	4,000
11	Computing Services	1,200	1,260	1,323
12	Supplies, Other	1,000	1,030	1,061
13	Total Expenses	16,200	16,990	17,833
14	Operating Income	\$ 83,800	\$ 88,010	\$ 95,567
15				

FIGURE 1-6 Year 2 Revenues formula in cell C6

Excel reads the formula from left to right.

1. Excel performs the calculation inside the parentheses ($M3*B6$) by multiplying the growth rate in cell M3 (5%) by the Year 1 Revenues in cell B6. This part of the formula calculates the amount by which Year 2 Revenues are projected to grow over Year 1.
2. Then Excel reads the formula from left to right and adds the result of the first calculation to Year 1 Revenues to generate Year 2 Revenues, \$105,000.

The formulas for Years 3-5 Revenues follow this model.

To review the Year 3-5 Revenues calculations:

Step 1

Activate cell **D6**

Step 2

Observe the formula $=C6+(N3*C6)$ in the Formula Bar

Step 3

Activate cell **E6**

Step 4

Observe the formula $=D6+(O3*D6)$ in the Formula Bar

Step 5

Activate cell **F6**

Step 6

Observe the formula $=E6+(P3*E6)$ in the Formula Bar

The formula that calculates the total forecasted Revenues for all five years contains a function.

NOTE

As is common in Excel, you can often structure formulas, such as the Revenue formulas illustrated in this section, in more than one way. If time permits, you may choose to explore additional ways to structure the formulas.

6. Function syntax

A **function** is a predefined Excel formula you can use to perform common calculations such as calculating the sum, average, minimum, or maximum value in a range of cells.

You must follow a strict syntax when using a function, as shown in Figure 1-7.

- If the function is used alone or if it is the first calculation in a complex formula, it must be preceded by an equal sign (=) just as any other formula.
- A function name is required.
- An open parenthesis must follow the function name.

- Text, numbers, or cell references are entered as the function's **argument**—what the function acts upon; multiple arguments are separated by a comma.
- A closing parenthesis must follow the function's arguments. Some functions do not have arguments; however, the opening and closing parentheses must be included.



FIGURE 1-7 SUM function syntax

7. Using functions

In the *Financial Forecast* worksheet, you could calculate the total forecasted Revenues by entering the formula `=B6+C6+D6+E6+F6` in cell G6. However, a much faster way to add the range of values in B6:F6 is to use the SUM function.

To view the formula containing a function that calculates the total Years 1-5 Revenues:

Step 1

Activate cell **G6**

Step 2

Observe the formula `=SUM(B6:F6)`

Step 3

Activate cell **A1**

NOTE

Both cell references and function names can be entered in uppercase or lowercase characters. In this course cell references and function names are shown in uppercase for readability.

8. Viewing formulas in cells

One way to review a worksheet's formulas is to show all formulas in their cells instead of the formulas' calculated values.

You can show formulas instead of formula results in worksheet cells in **Formula Auditing mode**. To turn Formula Auditing mode on or off, click the **Show Formulas** button in the Formula Auditing group on the ribbon Formulas tab, as shown in Figure 1-8.

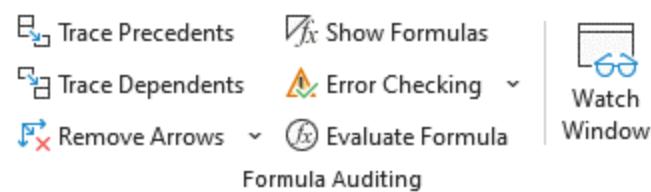


FIGURE 1-8 Formula Auditing group on the Formulas tab

KEYBOARD SHORTCUT

You can press the **CTRL+`** (grave accent) keyboard shortcut keys to show or hide formulas in their cells.

To turn on Formula Auditing Mode:

Step 1

Click the **Formulas** tab on the ribbon; then locate the Formula Auditing group

Step 2

Click the **Show Formulas** button in the Formula Auditing group

The left side of your worksheet in Formula Auditing mode should look similar to Figure 1-9.

	A	B	C	D
1			BioTech Enterprises	
2			Five-Year Financial Forecast	
3			(\\$000)	
4				
5		Year 1	Year 2	Year 3
6	Revenues	=M2	=B6+(M3*B6)	=C6+(N3*C6)
7				
8	Expenses			
9	Employee Expenses	10000	10700	11449
10	Rent and Utilities	4000	4000	4000
11	Computing Services	1200	1260	1323
12	Supplies, Other	1000	1030	1061
13	Total Expenses	=SUM(B9:B12)	=SUM(C9:C12)	=SUM(D9:D12)
14	Operating Income	=B6-B13	=C6-C13	=D6-D13
15				
16				

FIGURE 1-9 Worksheet in Formula Auditing mode

Step 3

Scroll the worksheet, if necessary, to view all the formulas

Step 4

Click the **Show Formulas** button to turn off Formula Auditing mode

9. Performing a what-if analysis

A **what-if analysis**, which is an analysis of what happens when you change values or calculations in your worksheet, is a good way to illustrate the power of worksheet recalculation.

Suppose you change one or more of the *Financial Forecast* worksheet's formula variables, such as the Year 1 Revenues value in cell M2 or a growth percentage in the range M3:P3. By default, Excel automatically recalculates all the worksheet's **dependent formulas**—those formulas that rely on the changed variable.

To change the Year 1 Revenues in cell M2 and observe the changes to the Years 1-5 Revenues, Years 1-5 Operating Income, and the category totals:

Step 1

Enter **var** in the Name Box to quickly select and view the range of cells that contain the worksheet variables, if necessary

Step 2

Activate cell **M2**

Step 3

Enter **110000**

Step 4

Activate cell **A1**

Step 5

Observe the changes to the calculated Revenues and other formula calculations

Step 6

Locate the Undo button in the Undo/Redo group on the Home tab

Step 7

Click the **Undo** button face to undo the 110,000 entry in cell M2; the calculated Revenues, Operating Income, and category (row) totals return to their original values

Step 8

Activate cell **A1**

Step 9

Close the workbook

NOTE

*Excel provides a variety of additional tools to create complex what-if analyses of your data using buttons located on the ribbon Data tab. A discussion and demonstration of these tools is beyond the scope of this course. For more information, see **Excel Help**.*

NOTE

In the remaining activities in this lesson and in Lessons 2 and 3, you are simply instructed to click ribbon tabs, locate button groups, and identify specific buttons in a group. Remember to use the mouse pointer and ScreenTips, if necessary, to locate and identify specific buttons. No additional instructions to use the mouse pointer and ScreenTips are provided.

Next, you create your own formulas in a variety of ways.

10. Creating formulas

You can create a formula by activating a cell and then entering all the formula's elements, such as the equal sign, the operands, and the mathematical operators, in the cell. However, keying cell reference operands may increase the risk of formula errors. To reduce this risk, you can use the mouse pointer or ARROW keys to select cell references instead of keying them.

You begin this section by opening a workbook, saving it with a new name, and then activating the worksheet in which you enter your formulas. Before entering your formulas, you define a name for the range of cells containing the formula variables to make it easier to navigate to the range.

To open a workbook and save it with a new name:

Step 1

Open the **Lesson 1 Data File** workbook

Step 2

Save the workbook as **Max Properties** in the location in which you store your solution files

Step 3

Click the **Financial Forecast** sheet tab to activate the worksheet, if necessary

Step 4

Locate and review the two areas of the worksheet: the data and calculations area and the formula variables area

The *Financial Forecast* worksheet on your screen should look similar to Figure 1-10.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
6	Max Properties														
7	Five-Year Financial Forecast														
8	(\$000)														
9	Revenues	Year 1	Year 2	Year 3	Year 4	Year 5	Total								
10	Employee Expenses	10,000	12,000	14,000	16,000	18,000									
11	Rent and Utilities	5,000	5,000	5,000	5,000	5,000									
12	Computing Services	2,000	2,200	2,500	3,000	3,500									
13	Supplies, Other	1,000	1,030	1,061	1,093	1,126									
14	Total Expenses														
15	Operating Income														
16															
17	Formula Variables														
18	Year 1 Revenues	\$ 80,000													
19	Revenue Growth		Year 2	Year 3	Year 4	Year 5									
20		5%	8%	10%	12%										
21															

FIGURE 1-10 *Financial Forecast* worksheet

The *Financial Forecast* worksheet contains formatted worksheet titles, column and row titles, expense data, and formula variables. The formula variables are located in the range L17:P20.

You need to enter formulas to calculate the Revenues, Total Expenses, Operating Income, and the category totals. Before you create your formulas, you can select the range that contains the variables and define a unique name for the range. This makes it easier to navigate to the range when you want to change the variables to perform a what-if analysis.

You can define a unique name for a selected cell or range of cells in the New Name dialog box by clicking the Define Name button in the **Defined Names** group on the Formulas tab, as shown in Figure 1-11.

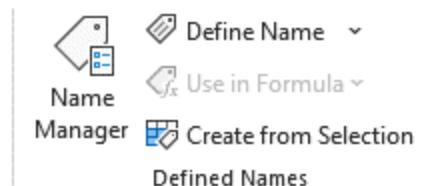


FIGURE 1-11 Defined Names group on the Formulas tab

In the New Name dialog box, you key the name, select the scope of the name (entire workbook or specific worksheet), and specify the range to which the name applies.

TIME-SAVER

You can also preselect a range of cells and click the **Create from Selection** button in the **Defined Names** group to launch the **Create from Selection** dialog box; then select the defined name from row or column labels. You can edit or delete a defined name in the Name Manager dialog box launched by clicking the **Name Manager** button in the **Defined Names** group.

A quick way to name a range is to select a range of cells and then key the defined name in the Name Box to the left of the Formula Bar.

To select the range L17:P20 and define a name for the range:

Step 1

Key **L17:P20** in the Name Box

Step 2

Press the **ENTER** key to select the range

Step 3

Key **var** in the Name Box

Step 4

Press the **ENTER** key

You can test the defined name by using the Name Box to navigate to the range.

Step 5

Activate cell **A1**

Step 6

Key **var** in the Name Box

Step 7

Press the **ENTER** key; the range that contains the formula variables is selected

Step 8

Activate cell **A1**

WARNING!

It is a good idea to frequently save your solution file workbook—either manually or by using the AutoSave feature available to Microsoft 365 users—even when there are no specific steps to do so.

TIME-SAVER

You can also click the Name Box arrow to view a list of range names in the workbook; then click a name in the list to select the range.

Now you are ready to create the formulas that calculate each year's Revenues. To reduce the risk of keying errors, you use the mouse pointer to select the cell references used in the formulas.

For Year 1 Revenues in cell B6, you use the Year 1 Revenues variable located in cell M18.

To create the formula for Year 1 Revenues:

Step 1

Activate cell **B6**

Step 2

Key = (an equal sign)

Step 3

Scroll to view cell **M18**, if necessary

Step 4.

Click cell **M18** to add the cell reference to the formula

Step 5

Scroll to view cell **B6**, if necessary

Step 6

Observe the highlighted cell M18, the new formula in cell B6, and the new formula in the Formula Bar. Note that the insertion point in cell B6 and the thin dark border around the cell indicate that the formula has not yet been entered

Cell B6, the Formula Bar, and cell M18 on your screen should look similar to Figure 1-12.

Max Properties																
Five-Year Financial Forecast																
(\$000)																
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1																
2																
3																
4																
5			Year 1	Year 2	Year 3	Year 4	Year 5									
6	Revenues		=M18													
7																
8	Expenses															
9	Employee Expenses	10,000	12,000	14,000	16,000	18,000										
10	Rent and Utilities	5,000	5,000	5,000	5,000	5,000										
11	Computing Services	2,000	2,200	2,500	3,000	3,500										
12	Supplies, Other	1,000	1,030	1,061	1,093	1,126										
13	Total Expenses															
14	Operating Income															
15																
16																
17																
18																
19																
20																
21																

FIGURE 1-12 Year 1 Revenues formula in cell B6

Step 7

Press the **ENTER** key to enter the formula

Step 8

Activate cell **B6**

Step 9

Observe the Year 1 Revenues value, \$80,000, in cell B6 and the formula, =M18, in the Formula Bar

Years 2-5 Revenues are the previous year's Revenues incremented by a growth variable in the range M20:P20. You use the same technique—keying the equal sign and mathematical operators and using the mouse pointer to select cell reference operands—to create the Year 2 Revenues formula.

To create the Year 2 Revenues formula:

Step 1

Activate cell **C6**

Step 2

Key =

Step 3

Click cell **B6** to add the cell reference to the formula

Step 4

Key + to add a plus sign

Step 5

Key (to add the open parenthesis

Step 6

Click cell **B6** to add the cell reference to the formula

Step 7

Key * to add an asterisk

Step 8

Scroll to view cell **M20**, if necessary

Step 9

Click cell **M20** to add the cell reference to the formula

Step 10

Key) to add the close parenthesis

Step 11

Scroll to view cell **C6**, if necessary

The formula's cell references are shown in different colors and correspond to the colored borders that appear around each cell. These colors provide a visual cue to the cell references you added to the formula. The formula in cell C6 on your screen should look similar to Figure 1-13.

	A	B	C	D
1			Max Properties	
2			Five-Year Financial Forec	
3			(\$000)	
4				
5		Year 1	Year 2	Year 3
6	Revenues	\$ 80,000	=B6+(B6*M20)	
7				

FIGURE 1-13 Year 2 Revenue formula in cell C6

Step 12

Press the **ENTER** key

Step 13

Activate cell **C6** and drag the right column header boundaries slightly to the right, if necessary, to widen the column if ##### appears in the cell

Step 14

Observe the Year 2 Revenues, \$84,000 in cell C6 and the formula, =B6+(B6*M20) in the Formula Bar

KEYBOARD SHORTCUT

You can also double-click a column header's right boundary to widen the column to best fit.

WARNING!

Many things can go wrong as you create your formulas. For example, you might key the wrong value, cell reference, or operand. You might insert the wrong cell reference using the mouse pointer selection method or you might omit necessary parentheses. We strongly recommend you evaluate each new formula for correct references, operands, and calculated results manually and/or using the formula evaluation tools you learn to use in this course.

Don't forget to use one of the most effective formula evaluation tools you have—your knowledge and expertise! Often a basic visual evaluation of your formulas' calculations can point out unexpected formula errors.

You can manually create the Year 3 Revenues formula in cell D6 just like you created the Year 2 Revenues formula. However, it is much faster to simply copy the Year 2 Revenues formula and paste it in cell D6.

Before beginning the next section, you should take Quiz 1-A.

B. Recognizing formulas pasted with relative references

1. Getting started

By default, Excel pastes and fills formulas with **relative references**. This means that Excel automatically adjusts the column or row references based on the location of the pasted formula's destination cell.

For example, when you copy the Year 2 Revenues formula from cell C6 and paste it in cell D6, Excel automatically changes the B6 reference to C6 and the M20 reference to N20. Thus, the pasted formula that appears in cell D6 is **=C6+(C6*N20)**.

When you copy the Year 3 Revenues formula **=C6+(C6*N20)** from cell D6 and paste it in cell E6, the pasted formula is **=D6+(D6*N20)**, and so forth.

2. Copying and pasting formulas

You can copy a formula by activating the cell containing the formula and clicking the Copy button face in the Clipboard group on the ribbon Home tab. To paste the formula, activate the destination cell or cells, and click the Paste button face in the Clipboard group.

KEYBOARD SHORTCUT

*You can press the **CTRL+C** keyboard shortcut keys to copy a formula and then press the **CTRL+V** keys to paste the formula into the active cell. Try it!*

NOTE

The ribbon may have a slightly different appearance when you resize the Excel window to a smaller size or use different monitor resolutions. For example, a smaller Excel window might show one Font group button on the Home tab with a down arrow you can click to see the various Font group options. The hands-on activities in this course assume all the buttons in each ribbon button group are visible.

You can also click the Paste button arrow to view a gallery of paste option icons, as shown in Figure 1-14.

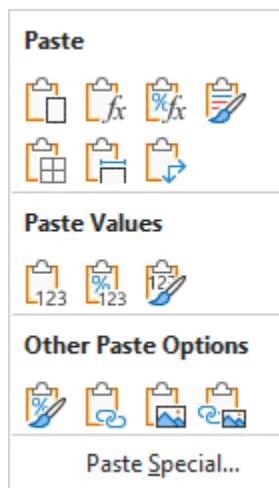


FIGURE 1-14 Paste options gallery

When using the paste options gallery, use the mouse pointer and ScreenTips, as necessary, to identify each icon.

To copy the Year 2 Revenues formula in cell C6 and paste it in cell D6:

Step 1

Activate cell **C6**, if necessary

Step 2

Click the **Home** tab on the ribbon, if necessary; then locate the Clipboard group

Step 3

Click the **Copy** button face

Step 4

Activate cell **D6**

Step 5

Click the **Paste** button arrow to view the paste options gallery

Step 6

Point to the **Paste** icon in the paste options gallery (use ScreenTips, if necessary to identify the button) to view the pasted formula's formatted results in cell D6; the Paste icon pastes cell contents and formatting

Step 7

Point to the **Formulas** icon in the paste options gallery; the Formulas icon pastes formulas without formatting

Step 8

Point to the **Formulas & Number Formatting** icon in the paste options gallery; the Formulas & Number Formatting icon pastes formulas and formatting

Step 9

Explore other paste options, if desired

Step 10

Click the **Formulas & Number Formatting** icon to paste the copied formula and formatting in cell D6; widen column D, if necessary

Step 11

Observe the Year 3 Revenues, \$90,720, in cell D6 and the formula, $=C6+(C6*N20)$ in the Formula Bar

Cell C6 is now surrounded by a dashed-line marquee indicating its contents are copied to the Clipboard and the Paste Options button or icon appears to the right of the cell containing the pasted contents. You can click the Paste Options button to view the paste options gallery and change the paste option, if necessary.

Cell D6 on your screen should look similar to Figure 1-15.

A	B	C	D	E
1				
2				Max Properties
3				Five-Year Financial Forecast
4				(\$000)
5		Year 1	Year 2	Year 3
6	Revenues	\$ 80,000	\$ 84,000	\$ 90,720
7				
8	Expenses			
9	Employee Expenses	10,000	12,000	14,000
				16,000

FIGURE 1-15 Year 3 Revenues formula pasted from cell C6

You can clear the Clipboard and hide the Paste Options button by pressing the ESC key.

Step 12

Press the **ESC** key

NOTE

You can use the Copy and Paste buttons to copy and paste formulas with relative references to both adjacent and nonadjacent cells.

A faster way to insert formulas with relative references in adjacent cells, however, is to use the fill handle to “fill” the adjacent cells with the formulas.

3. Filling cells with formulas

The dark border around the active cell or selected range includes the **fill handle**, which is a small square in the border’s lower-right corner. When the mouse pointer is positioned on the fill handle, it becomes a black crosshair fill pointer.

You can use the fill handle to fill a range of adjacent cells with text or numbers or formulas by dragging the fill handle with the fill pointer.

TOUCH TIP

When working with touch-screen finger gestures, you should first display the Mini Toolbar by tapping the cell. Then tap the AutoFill button on the Mini Toolbar to attach the AutoFill icon (an arrow shape) to the cell. Drag the AutoFill icon down or to the right to fill adjacent cells with formulas.

When you fill a cell or range using the fill handle, the results depend on the content of the active cell or cells.

- If the active cell contains text or a number, the text or number is copied into the adjacent cells.
- If the active cell contains a combination of text and numbers (such as Quarter 1) the text is copied but the number increases by 1 as Quarter 2, Quarter 3, and so forth.
- If the active cell contains a number, such as a year, you can press and hold down the CTRL key as you fill adjacent cells and the number increments by one.
- If the active cell contains a formula, the formula is copied with relative references by default (you learn more about copying and pasting formulas with other types of references later in this course).
- Cell formatting is also copied from the active cell to adjacent cells.

To copy the Year 3 formula to Years 4 and 5 using the fill handle:

Step 1

Activate cell **D6**, if necessary

Step 2

Move the mouse pointer to the fill handle

The fill pointer and fill handle on your screen should look similar to Figure 1-16.

	A	B	C	D	E	F
1	Max Properties					
2	Five-Year Financial Forecast					
3	(\$000)					
4						
5		Year 1	Year 2	Year 3	Year 4	Year 5
6	Revenues	\$ 80,000	\$ 84,000	\$ 90,720		
7						

FIGURE 1-16 Fill pointer on Cell D6 fill handle

Step 3

Drag the fill handle to the right to cell **F6**

Step 4

Observe that when you release the mouse button the formula in D6 is pasted or filled in cells E6 and F6; widen the columns, if necessary

TIME-SAVER

An Auto Fill Options button appears when you release the mouse button. You can click the Auto Fill Options button to view a gallery of fill options.

Step 5

Activate cell **A1**

The Year 1-5 Revenues in the range B6:F6 on your screen should look similar to Figure 1-17.

5		Year 1	Year 2	Year 3	Year 4	Year 5
6	Revenues	\$ 80,000	\$ 84,000	\$ 90,720	\$ 99,792	\$ 111,767
7						

FIGURE 1-17 Years 1-5 Revenues

4. Solving calculation precision and rounding errors

Because the numeric data in financial budgets or forecasts is often shown as whole (integer) numbers, the cells containing numeric values in the range B6:G14 are already formatted with the Accounting number format with zero decimal places.

However, using formatting alone to change the number of decimal places in a formula's calculation *DOES NOT* change the actual calculated value stored in the cell. Excel calculates a formula with up to 15 significant digits of precision and then stores the result of the calculation in the cell containing the formula. For example, the visible value in cell F6 is \$111,767; the actual stored value is \$111,767.04. By default, the zero decimals format rounds up or down from the .50 decimal value to a whole number.

Because Excel uses a cell's stored value in its worksheet calculations, you might accidentally introduce small rounding errors when you create and manipulate your worksheet formulas.

It is a good practice to avoid rounding errors in your complex calculations by building your formulas to agree with the number of displayed decimal places using the ROUND function.

Figure 1-18 illustrates the general form of the ROUND function, which has two arguments: *number* and *num_digits*.

- The *number* argument is the specific value or formula to be rounded.
- The *num_digits* argument is the number of digits to which to round. For example, setting the *num_digits* argument to zero rounds the value or formula's calculation to whole numbers.

=ROUND(number, num_digits)

FIGURE 1-18 ROUND function syntax

You edit a formula in the same way you edit text or numbers: by rekeying the formula, by editing the formula in the Formula Bar, or by editing the formula in the cell. You begin by editing the Year 2 revenue formula in the Formula Bar, and then you copy the edited formula to Years 3 and 4.

To edit the Year 2 revenue calculation:

Step 1

Activate cell **C6**

Step 2

Move the **mouse pointer** to the **Formula Bar** between the equal sign (=) and the existing formula

Step 3

Click in the Formula Bar to position the insertion point

Step 4

Observe that the cell references in the formula being edited and the cell borders for the related cells in the worksheet area are color-coded providing a quick visual reference

Your worksheet should look similar to Figure 1-19.

IF	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1																
2																
3																
4																
5				Max Properties												
6				Five-Year Financial Forecast												
7				(\$000)												
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																

FIGURE 1-19 Formula being edited in the Formula Bar

Now you add the ROUND function to the existing formula. You key in the function name, the open parenthesis, a comma, a zero for the *num_digits* argument, and the closing parenthesis. The existing formula, B6+(B6*M20), is the ROUND function's *number* argument.

To add the ROUND function to the existing formula:

Step 1

Key **ROUND(**

Step 2

Press the **END** key to move the insertion point to the end of the existing formula

Step 3

Key a **comma**, a **zero**, and a **closing parenthesis**

Your Formula Bar should look similar to Figure 1-20.



FIGURE 1-20 Edited formula with the ROUND function

To enter the edited formula and copy it to the range D6:F6 using the fill handle:

Step 1

Press the **ENTER** key

Step 2

Activate cell **C6**

Step 3

Drag the fill handle to **column F**

Step 4

Deselect the range

Step 5

Observe the edited formula results in the range **C6:F6**

The stored revenue values in the range C6:F6 are now calculated with zero decimal places, which is the same number of decimal places displayed in the worksheet.

NOTE

For more information on using the ROUND, ROUNDUP, ROUNDDOWN, and MROUND functions to round formula calculations, see Excel Help.

Next, you enter formulas to calculate totals.

Before beginning the next section, you should take Quiz 1-B.

C. Selecting status bar options and Sum (AutoSum) for quick calculations

1. Getting started

You can enter the formula `=B6+C6+D6+E6+F6` in cell G6 to calculate the Total of the Years 1-5 Revenues; but it is much faster to use the SUM function for this calculation.

You can manually key and enter a formula containing the SUM function or you can let Excel do all the work by using status bar calculations or the Sum (AutoSum) button.

2. Status bar calculation options

The **customizable status bar** contains options (sometimes called the AutoCalculate feature) you can use to calculate common values, such as the sum or average of values in a range, *without* adding a formula to the worksheet. You can select which of these common calculations' results appear on the status bar by right clicking the status bar to view the Customize Status Bar shortcut menu and then clicking a calculation option in the menu to turn that option on or off.

To turn on the Sum and Average calculation options, if necessary:

Step 1

Right-click the **status bar** to display the Customize Status Bar shortcut menu

Step 2

Click the **Sum** option, if necessary, to insert a check mark

Step 3

Click the **Average** option, if necessary, to insert a check mark

Step 4

Press the **ESC** key, if necessary, to close the menu

To calculate the total Revenues and average Revenues values:

Step 1

Select the range **B6:F6**

Step 2

Observe the average Revenues (\$93,256) and the total Revenues (\$466,279) values on the status bar

Your AVERAGE and SUM function status bar calculations, plus other calculation options that remained turned on, should look similar to Figure 1-21.

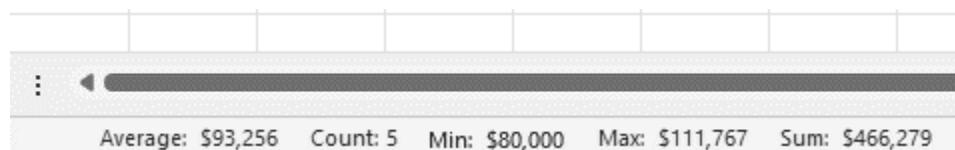


FIGURE 1-21 Revenues calculations on the customized status bar

The **status bar calculation options** are handy tools when you need a quick answer.

When you need to add a formula to your worksheet that uses the SUM function (or one of the other commonly used statistical functions such as AVERAGE, MAX, or MIN), you can use the Sum (AutoSum) button.

TOUCH TIP

To show a shortcut menu for a button or other screen element, tap and hold your finger on the screen element until you see a square shape; then lift your finger off the screen element. A shortcut menu, if available, should appear.

3. The Sum (AutoSum) button

The **Sum (AutoSum)** button, located in the Editing group on the Home tab, is used to quickly enter a formula containing the commonly used SUM, AVERAGE, MAX, and MIN functions. You can also click the Sum (AutoSum) button in the Function Library group on the Formulas tab. You learn more about working with the Function Library on the Formulas tab in Lesson 2.

Clicking the Sum (AutoSum) button face inserts an equal sign and the default SUM function in the active cell. To insert one of the other functions, you must click the Sum (AutoSum) button arrow and select a function from the menu.

The Sum (AutoSum) button ‘guesses’ the argument to be included inside the function’s parentheses. To make this ‘guess,’ the Sum (AutoSum) button:

1. first looks above the active cell containing the function to locate the cells for the function’s argument, or
2. if there are less than two cells containing values above the active cell, Sum (AutoSum) looks to the left to locate the cells for the function’s argument.

It is a good idea to carefully review each formula you create using the Sum (AutoSum) button to make certain that the Excel argument ‘guess’ is correct.

TIME-SAVER

You can double-click the Sum (AutoSum) button face to insert the SUM function formula in the cell and enter the formula all at one time. Warning! Because the AutoSum feature is ‘guessing’ the function’s argument—and its ‘guess’ may not be correct—this method is not recommended.

To calculate the Total five-year forecasted revenues using the Sum (AutoSum) button:

Step 1

Activate cell **G6**

Step 2

Click the **Home** tab on the ribbon, if necessary; then locate the Editing group

Step 3

Click the **Sum (AutoSum)** button face

Step 4

Observe the formula =SUM(B6:F6) in cell **G6** and the marquee around the range **B6:F6**

Sum (AutoSum) looks above the active cell, finds no cells containing numbers, and then looks to the left to find the cells that become the argument for the function, B6:F6. The argument cells are surrounded by a marquee.

Cell G6 in your worksheet should look similar to Figure 1-22.

4	Year 1	Year 2	Year 3	Year 4	Year 5	Total
5						
6	Revenues	\$ 80,000	\$ 84,000	\$ 90,720	\$ 99,792	\$ 111,767
7						=SUM(B6:F6)
8	Expenses					SUM(number1, [number2], ...)
9	Employee Expenses	10,000	12,000	14,000	16,000	18,000

FIGURE 1-22 Formula inserted using Sum (AutoSum)

Step 5

Press the **ENTER** key to enter the formula

When using the Sum (AutoSum) button to insert a function, you can remove the 'guess' factor by preselecting a range for the function's argument *plus* an empty cell in which to store the formula and its results.

For example, you can calculate the Total Expenses for Years 1-5 *plus* the expense category totals at one time by selecting the range that contains the data plus empty cells to contain the SUM function formulas. To use Sum (AutoSum) to calculate Total Expenses for each year and the five-year Total for each expense category:

Step 1

Select the range **B9:G13**; the range contains both the data to be summed and blank cells for the formulas

Step 2

Click the **Sum** (AutoSum) button face

Step 3

Observe that the formulas that calculate the Total Expenses for each year and each expense category are inserted

Step 4

Activate cell **G13**

Step 5

Observe the formula **=SUM(B13:F13)** in the Formula Bar

Your worksheet should look similar to Figure 1-23.

	A	B	C	D	E	F	G
1	Max Properties						
2	Five-Year Financial Forecast						
3	(\$000)						
4							
5		Year 1	Year 2	Year 3	Year 4	Year 5	Total
6	Revenues	\$ 80,000	\$ 84,000	\$ 90,720	\$ 99,792	\$ 111,767	\$ 466,279
7							
8	Expenses						
9	Employee Expenses	10,000	12,000	14,000	16,000	18,000	70,000
10	Rent and Utilities	5,000	5,000	5,000	5,000	5,000	25,000
11	Computing Services	2,000	2,200	2,500	3,000	3,500	13,200
12	Supplies, Other	1,000	1,030	1,061	1,093	1,126	5,310
13	Total Expenses	18,000	20,230	22,561	25,093	27,626	113,510
14	Operating Income						
15							

FIGURE 1-23 Total Expenses by year and expense category

KEYBOARD SHORTCUT

You can also insert a formula containing the **SUM** function by pressing the **ALT+=** (equal) keyboard shortcut keys. Try it!

You can quickly complete the formulas in the *Financial Forecast* worksheet by keying the formula that calculates the Year 1 Operating Income and then using the fill handle to fill the formula in the adjacent cells.

To create a formula to calculate Year 1 Operating Income:

Step 1

Activate cell **B14**

Step 2

Key =

Step 3

Click cell **B6**

Step 4

Key –

Step 5

Click cell **B13**

Your Operating Income formula should look like Figure 1-24.

	A	B	C
1			Max Pro
2			Five-Year Finan
3			(\$0)
4			
5		Year 1	Year 2
6	Revenues	\$ 80,000	\$ 84,000
7			
8	Expenses		
9	Employee Expenses	10,000	12,000
10	Rent and Utilities	5,000	5,000
11	Computing Services	2,000	2,200
12	Supplies, Other	1,000	1,030
13	Total Expenses	18,000	20,230
14	Operating Income	=B6-B13	
15			

FIGURE 1-24 Operating Income formula

Step 6

Press the **ENTER** key

Step 7

Activate cell **B14**

Step 8

Drag the fill handle to cell **G14**; widen column G, if necessary

Step 9

Activate cell **A1**

Your completed *Financial Forecast* worksheet should look similar to Figure 1-25.

A	B	C	D	E	F	G
1	Max Properties					
2	Five-Year Financial Forecast					
3	(\$000)					
4						
5		Year 1	Year 2	Year 3	Year 4	Year 5
6	Revenues	\$ 80,000	\$ 84,000	\$ 90,720	\$ 99,792	\$ 111,767
7						
8	Expenses					
9	Employee Expenses	10,000	12,000	14,000	16,000	18,000
10	Rent and Utilities	5,000	5,000	5,000	5,000	5,000
11	Computing Services	2,000	2,200	2,500	3,000	3,500
12	Supplies, Other	1,000	1,030	1,061	1,093	1,126
13	Total Expenses	18,000	20,230	22,561	25,093	27,626
14	Operating Income	\$ 62,000	\$ 63,770	\$ 68,159	\$ 74,699	\$ 84,141
15						

FIGURE 1-25 Completed *Financial Forecast* worksheet

In this section, you learned how to paste copied formulas with relative references — cell references that change in relation to a pasted formula’s destination cell location in the worksheet.

Next, you learn to paste formulas with cell references that do not change.

Before beginning the next section, you should take Quiz 1-C.

D. Recognizing Formulas Pasted with Mixed or Absolute References

1. Getting started

Inserting a \$ (dollar sign) in front of the row or column reference in a formula tells Excel that the cell reference should not change when the formula is pasted or filled into another cell.

You can insert a \$ by keying it or by pressing the F4 function key. The F4 function key has four settings which you can toggle through by pressing it multiple times.

- Press the F4 key once to insert a \$ in front of both the row and column reference (\$A\$5) to create an **absolute reference**. Both the column and the row reference are unchanged when the formula is pasted or filled.
- Press the F4 key again to insert a \$ in front of the row reference (A\$5) to create a **mixed reference**. The column reference changes but the row reference is unchanged when the formula is pasted or filled.
- Press the F4 key again to insert a \$ in front of the column reference (\$A5) to create a mixed reference. The row reference changes but the column reference is unchanged when the formula is pasted or filled.
- Press the F4 key again to remove any \$ (A5) to create a relative reference. Both the column and row references change when the formula is pasted or filled.

2. Pasting and filling formulas with absolute references

One example in which you may want to paste or fill a formula with absolute references is when you calculate the percentage of each value in a range has to the total of all values in the range.

The *Expense Analysis* worksheet in the open workbook contains the total five-year expense forecast by expense category. Suppose you need to calculate the Employee expense as a percentage of total expenses.

You can do this by dividing the Employee expense value in cell B6 by the Total Expenses value in cell B10. Then you can fill the formula in the other expense categories' cells using the fill handle.

To fill a formula that calculates a percentage into adjacent cells:

Step 1

Click the **Expense Analysis** sheet tab to activate the worksheet

Step 2

Activate cell **C6**

Step 3

Enter the formula **=B6/B10** using the keyboard and the mouse pointer

Step 4

Activate cell **C6**

Step 5

Drag the fill handle to cell **C9**

Step 6

Activate cell **C7**

The error value #DIV/0! appears in each cell in the range C7:C9 and a small, triangular-shaped **error indicator symbol** (⚠) appears in the upper-left corner of each cell containing an error.

Additionally, the **Trace Error icon** (⚠) should appear to the left of the active cell indicating an error. You can point to the Trace Error icon to view a ScreenTip describing the error or click the button to view a menu of error correction options. Your worksheet should look similar to Figure 1-26.

	A	B	C
Max Properties			
Five-Year Financial Forecast			
(\$000)			
5		Total	% of Total
6	Employee Expenses	\$ 70,000	62%
7	Rent and Utilities	25  0	#DIV/0!
8	Computing Services	13,200	#DIV/0!
9	Supplies, Other	5,310	#DIV/0!
10	Total Expenses	<u>\$ 113,510</u>	
11			

FIGURE 1-26 #DIV/0! error value in cells

To view the Trace Error icon ScreenTip:

Step 1

Point to the **Trace Error** icon

Step 2

Observe that the ScreenTip indicates the formula error is an attempt to divide by zero or an empty cell

Your ScreenTip should look similar to Figure 1-27.

	A	B	C	D
Max Properties				
Five-Year Financial Forecast				
(\$000)				
5		Total	% of Total	
6	Employee Expenses	\$ 70,000	62%	
7	Rent and Utilities	25  0	#DIV/0!	
8	Computing Services	13,2	#DIV/0!	
The formula or function used is dividing by zero or empty cells.				
10	Total Expenses	<u>\$ 113,510</u>		
11				

FIGURE 1-27 Trace Error icon ScreenTip

Step 3

Observe that the formula, =B7/B11, in cell C7 contains a reference to the empty cell B11

Because Excel pastes or fills formulas with relative references, the cell reference B10 in the original formula was automatically changed to B11 when the formula was pasted in cell C7, B12 when pasted in cell C8, and so forth—all referencing empty cells. Instead, all the formulas should contain a reference to cell B10, the cell that contains the Total Expenses value.

To fix this error, you must reverse the fill and then edit the original formula to make the B10 cell reference an *absolute reference*, one that will not change when the formula is filled to adjacent cells.

A quick way to reverse a fill is to drag the fill handle in the opposite direction, back to its original cell. You can edit a formula by changing the formula in the Formula Bar or by double-clicking the cell to move the insertion point into the cell.

To reverse the fill and then edit the formula in cell C6:

Step 1

Select the range **C6:C9**

Step 2

Drag the fill handle up until only cell C6 is active and the range C7:C9 no longer contains formulas

Step 3

Double-click cell **C6** to open the cell for editing and position the insertion point in the cell

Step 4

Press the **END** key to move the insertion point to the end of the formula (to make certain the insertion point is next to the B10 cell reference)

Step 5

Press the **F4** key once to add a \$ symbol to both the column and row references

The edited formula in your cell C6 should look similar to Figure 1-28.

	A	B	C
1			
2			
3			
4			
5		Total	% of Total
6	Employee Expenses	\$ 70,000	=B6/\$B\$10
7	Rent and Utilities	25,000	
8	Computing Services	13,200	
9	Supplies, Other	5,310	
10	Total Expenses	\$ 113,510	
11			

FIGURE 1-28 Edited formula in cell C5

Step 6

Press the **ENTER** key

Step 7

Activate cell **C6**

Step 8

Drag the **fill handle** to cell **C10**

Step 9

Observe that the range C7:C10 is now filled with the correct formulas

Step 10

Click the **Increase Decimal** button in the Number group on the ribbon Home tab to add a decimal place to the formulas' results

Step 11

Activate cells **C7** through **C10** individually to review the correct formulas

Step 12

Activate cell **A1**

Your completed worksheet should look similar to Figure 1-29.

	A	B	C
1	Max Properties		
2	Five-Year Financial Forecast		
3	(\$000)		
4			
5		Total	% of Total
6	Employee Expenses	\$ 70,000	61.7%
7	Rent and Utilities	25,000	22.0%
8	Computing Services	13,200	11.6%
9	Supplies, Other	5,310	4.7%
10	Total Expenses	<u>\$ 113,510</u>	100.0%
11			

FIGURE 1-29 Completed worksheet

Step 13

Leave the workbook open for the next section

TIME-SAVER

Another quick way to fill a range is to double-click the fill handle. Try it!

In some circumstances, you may want a cell or cells to contain the result of a formula's calculation instead of the formula itself.

Before beginning the next section, you should complete Quiz 1-D.

E. Identifying formula results pasted as values

1. Getting started

Suppose you want the range C6:C10 on the *Expense Analysis* worksheet to contain the actual percentage value instead of the formula that calculates the percentage. You can change the cells' contents from formulas to the formulas' results by copying the formulas and pasting them *back into their cells* as values using an option in the Paste Special dialog box.

2. Pasting formulas as values

A fast way to paste formulas as values is to click a **Paste Values** option icon in the paste options gallery.

To paste the formulas in the range C6:C10 as values using a Paste Values command:

Step 1

Select the range **C6:C10**

Step 2

Click the **Copy** button in the Clipboard group on the Home tab

Step 3

Click the **Paste** button arrow to view the paste options gallery

Step 4

Click the **Values & Number Formatting** icon in the Paste Values group in the gallery

Step 5

Press the **ESC** key to clear the marquee

Step 6

Activate cell **C6**

Step 7

Observe that the original formula's *result* appears in the cell and Formula Bar; note that the formula's calculation has 15 places to the right of the decimal point, but the cell is formatted to show a whole number rounded up or down to one decimal point. By default, the formatting option rounds the result up or down to one position to the right of the decimal point

Step 8

Click cells **C7** through **C10** and review the formulas' results in the cells

Because the number of calculations is small, you can quickly observe that the formatted values in the range C6:C9 equal 100.0%. Another way to check is by selecting the range C6:C9 and using the status bar calculation options to verify that the sum of the four values is 100.0%.

Step 9

Activate cell A1

Step 10

Save and close the workbook

In this lesson, you reviewed the syntax of formulas and functions, learned to navigate in a worksheet using the Name Box, view all the formulas in a worksheet, create basic formulas with and without functions, create calculations using the status bar options and Sum (AutoSum), and copy, paste and fill formulas with relative and absolute references. In Lesson 2, you create more complex formulas.

Before continuing to Lesson 2, you should complete Quiz 1-E.

Creating Complex Formulas

Learning objectives	1
<i>I. In general</i>	1
<i>II. Key terms</i>	1
<i>III. Hands on</i>	1
A. Selecting worksheets for grouping, entering formulas, and formatting	1
1. Getting started	1
2. Grouping worksheets and entering formulas	2
3. Switching to Formula Auditing mode to review formulas	4
4. Changing column width	5
5. Ungrouping worksheets	6
B. Identifying ways to link worksheets and workbooks with 3-D formulas	7
1. Getting started	7
2. Linking worksheets with 3-D formulas	7
3. Using the Quick Analysis Feature to insert the SUM function	10
4. Using the Formula AutoComplete feature	13
5. Linking workbooks with 3-D formulas	17
C. Selecting the Insert function button or buttons from the function library to insert functions in formulas	22
1. Getting started	22
2. Using the Insert Function button	22
3. Using the Function library	26
D. Recognizing defined names as function arguments	31
1. Getting started	31
2. Reviewing the Name Manager dialog box	32
3. Using a defined name in a formula	33
4. Using Formula AutoComplete to insert a defined name	36
E. Selecting conditional formatting for formulas' results	39
1. Getting started	39
2. Using the Quick Analysis feature to apply conditional formatting	39
3. Setting conditional formatting rules manually	40

Creating Complex Formulas

Learning objectives

After completing this lesson, you will be able to:

- Select worksheets for grouping, entering formulas, and formatting;
- Identify ways to link worksheets and workbooks with 3-D formulas;
- Select the Insert Function button or buttons in the Function Library to insert functions in formulas;
- Recognize defined names as function arguments; and
- Select conditional formatting for formulas' results.

I. In general

In this lesson, you learn how to enter formulas on grouped worksheets, how to use the Formula AutoComplete feature, and how to create formulas with 3-dimensional references, which span worksheets and workbooks.

Next, you use the Function Library to add the current date and time to a worksheet and to create a formula that performs two logical tests. Then, you learn to use defined names and column or row labels as function arguments and apply conditional formatting to formulas' results.

II. Key terms

3-D references

Arrange All button

Arrange Windows dialog box

conditional formatting

Conditional Formatting button

CTRL+click

Formula AutoComplete feature

Function Arguments dialog box

Function Library

grouping worksheets

Insert Function button

Insert Function dialog box

Name Manager button

Name Manager dialog box

nesting IF functions

Quick Analysis feature

SHIFT+click

ungroup worksheets

Use in Formula button

III. Hands on

A. Selecting worksheets for grouping, entering formulas, and formatting

1. Getting started

Grouping worksheets allows you to perform the same task on multiple worksheets at one time. For example, you can quickly apply formatting to multiple worksheets or enter the same formula on multiple worksheets at one time by first grouping two or more worksheets.

You start this lesson by opening an existing workbook and saving it with a new name. Then you review the workbook's worksheets.

To open and save a workbook:

Step 1

Open the **Lesson 2 Data File** workbook

Step 2

Save the workbook as **Rivers Call Center**

Step 3

Click **each sheet tab** and review the active area of the worksheet; use the sheet tab scroll buttons to the left of the sheet tabs, if necessary, to scroll the sheet tabs and view any hidden sheet tabs

The workbook contains six worksheets: a *Summary* worksheet that contains formatted titles, row, and column labels and five *Call Center* worksheets that have identical layouts including formatted titles, row, and column labels. Each worksheet contains forecasted call volume data in the range B7:F12.

KEYBOARD SHORTCUT

You can quickly scroll through multiple worksheets by pressing the **CTRL+PAGEUP** and **CTRL+PAGEDOWN** keyboard shortcut keys. Try it!

2. Grouping worksheets and entering formulas

In this section you add formulas to the *Call Center* worksheets to calculate the total forecasted calls by client and by year. You create the *Summary* worksheet formulas in the next section.

As you learned in Lesson 1, you can use the Sum (AutoSum) button to quickly foot and cross-foot a range of values by selecting the range plus blank cells below and to the right to contain the SUM function formulas.

Because the *Call Center* worksheets have an identical layout, you can use this technique to insert SUM function formulas to calculate the forecasted call volume by year and by client on all five worksheets at one time. You do this by grouping the worksheets before you select the range and blank cells.

You can use the **SHIFT+click** selection method to group adjacent worksheets. Just press and hold down the SHIFT key and click a sheet tab to group the currently active worksheet, the worksheet you click next, and all the worksheets in between.

To group nonadjacent worksheets, use the **CTRL+click** selection method. Press and hold down the CTRL key as you click the sheet tabs. To group all the worksheets in a workbook, right-click a sheet tab and click Select All Sheets on the shortcut menu.

When worksheets are grouped, the notation ‘Group’ appears at the end of the workbook’s name in the title bar at the top of the Excel window. All the grouped sheet tabs’ names are bolded, indicating the worksheets are active.

WARNING!

Be careful working with grouped worksheets. Remember that every entry you make or formatting action you take appears on all worksheets in the group.

To group all the *Call Center* worksheets:

Step 1

Click the **Call Center 1** sheet tab to activate the worksheet, if necessary

Step 2

Press and hold the **SHIFT** key

Step 3

Click the **Call Center 5** sheet tab

Step 4

Release the **SHIFT** key

Step 5

Observe that all the *Call Center* sheet tabs are white and the tab names are bold, indicating the sheet tabs are active

Step 6

Observe the Group indicator at the end of the workbook name

The title bar on your screen should look similar to Figure 2-1, and your sheet tabs should look similar to Figure 2-2.



FIGURE 2-1 Workbook name and Group indicator



FIGURE 2-2 Grouped worksheets

Now, every action you take on the *Call Center 1* worksheet is also taken on the *Call Center 2* through *Call Center 5* worksheets.

To select the range and enter the SUM function formulas:

Step 1

Select the range **B7:G13** on the *Call Center 1* worksheet

Step 2

Click the **Home** tab on the ribbon, if necessary

Step 3

Click the **Sum** (AutoSum) button face in the Editing group to insert total formulas

Step 4

Activate cell **A1**

Your *Call Center 1* worksheet with year and client totals should look similar to Figure 2-3.

Rivers Call Center Services							
Call Center 1							
Call Volume by Client (000)							
6	Client	Year 1	Year 2	Year 3	Year 4	Year 5	Total
7	Client A	1,250	1,375	1,540	1,771	2,090	8,026
8	Client B	6,489	7,138	7,994	9,194	10,848	41,663
9	Client C	258	284	318	366	431	1,657
10	Client D	3,459	3,805	4,261	4,901	5,783	22,209
11	Client E	2,587	2,846	3,187	3,665	4,325	16,610
12	Client F	2,358	2,594	2,905	3,341	3,942	15,140
13	Total	16,401	18,042	20,205	23,238	27,419	105,305
14							

FIGURE 2-3 *Call Center 1* worksheet with year and client totals

3. Switching to Formula Auditing mode to review formulas

In Lesson 1, you learned that you could switch to Formula Auditing mode to view the formulas in cells.

To review the formulas in Formula Auditing mode using the keyboard shortcut:

Step 1

Press **CTRL+`** to turn on Formula Auditing mode

Step 2

Scroll the worksheet to view all the formulas, if necessary

Step 3

Press **CTRL+`** to turn off Formula Auditing mode

The identical formulas were also entered in the *Call Center 2* through *5* worksheets.

To view the formulas in the *Call Center 2* through *5* worksheets:

Step 1

Click the ***Call Center 2*** sheet tab to view the worksheet

Step 2

Press **CTRL+`**

Step 3

Scroll to view all the formulas, if necessary

Step 4

Press **CTRL+`**

Step 5

Continue by viewing each of the remaining *Call Center* worksheets and reviewing each worksheet's formulas in their cells. You resize columns as necessary in the next section

Step 6

Activate the ***Call Center 1*** worksheet

NOTE

Remember from Lesson 1 that you can also click the Show Formulas button in the Formula Auditing group on the Formulas tab to toggle on or off the display of formulas in cells.

4. Changing column width

Some of the cells in the *Call Center* worksheets are not wide enough to contain the formatted results of the formulas' calculations. You will see pound symbols (# #####) in the cells when this occurs.

You can fix this by widening columns B:G to fit their cells' contents. Because the worksheets are still grouped, you can change the column widths for B:G on all the worksheets at one time.

An easy way to change a column's width to fit its cells' contents is to double-click the column heading's right boundary with the sizing pointer.

To resize the width of columns B:G on the grouped *Call Center* worksheets for best fit:

Step 1

Select columns **B:G** using the SHIFT+click method

Step 2

Move the mouse pointer to the right boundary of the column G heading; the mouse pointer becomes a sizing pointer

Your selected columns and sizing pointer should look similar to Figure 2-4.

	A	B	C	D	E	F	G	H
1		Rivers Call Center Services						
2		Call Center 1						
3		Call Volume by Client (000)						
4								
5								
6	Client	Year 1	Year 2	Year 3	Year 4	Year 5	Total	
7	Client A	1,250	1,375	1,540	1,771	2,090	8,026	
8	Client B	6,489	7,138	7,994	9,194	10,848	41,663	
9	Client C	258	284	318	366	431	1,657	
10	Client D	3,459	3,805	4,261	4,901	5,783	22,209	
11	Client E	2,587	2,846	3,187	3,665	4,325	16,610	
12	Client F	2,358	2,594	2,905	3,341	3,942	15,140	
13	Total	16,401	18,042	20,205	23,238	27,419	105,305	
14								

FIGURE 2-4 Selected columns B:G and sizing pointer

Step 3

Double-click the column **G** heading boundary

Step 4

Observe that columns B:G on the *Call Center 1* worksheet are resized, as necessary, for best fit

Step 5

Activate cell **A1**

Step 6

Activate each of the remaining *Call Center* worksheets to verify that the columns are resized for best fit and no ##### symbols appear in the cells

Now, you are ready to ungroup the *Call Center* worksheets.

5. Ungrouping worksheets

To **ungroup worksheets**, you can click a sheet tab that is not part of the group or right-click a grouped sheet tab and Click **Ungroup Sheets** on the shortcut menu.

To ungroup the *Call Center* worksheets and view the *Summary* worksheet:

Step 1

Right-click any grouped **Call Center** sheet tab

Step 2

Click the **Ungroup Sheets** command on the shortcut menu

Step 3

Observe that only the sheet tab you right clicked is active and that the Group indicator no longer appears on the title bar

Step 4

Click the **Summary** sheet tab to activate the worksheet; use the sheet tab scroll buttons, if necessary, to view the sheet tab

Next, you need to add formulas to the *Summary* worksheet to summarize the call center volume by center and by year.

Before beginning the next section, you should complete Quiz 2-A.

B. Identifying ways to link worksheets and workbooks with 3-D formulas

1. Getting started

The data you need to summarize are the call volume by year and call center located on each individual *Call Center* worksheet.

To summarize this data on the *Summary* worksheet, you create formulas with **3-D references**, which are formulas with range references that span two or more worksheets or workbooks.

NOTE

3-D formulas that span worksheets in the same workbook contain worksheet references in addition to cell references. 3-D formulas that span workbooks contain workbook, worksheet, and cell references.

2. Linking worksheets with 3-D formulas

You begin by creating 3-D formulas that link worksheets in the same workbook. To create your 3-D formulas, you work back and forth between the *Summary* and *Call Center* worksheets.

You enter a formula in cell B7 on the *Summary* worksheet to enter the Year 1 call volume for Call Center 1. To do this, you key the equal sign and use the mouse pointer to add the *Call Center 1* worksheet reference and appropriate cell reference to the formula.

To create a formula with a 3-D reference that enters the Call Center 1 call volume for Year 1:

Step 1

Activate cell **B7** on the *Summary* worksheet

Step 2

Key =

Step 3

Click the **Call Center 1** sheet tab to activate the worksheet

Step 4

Click cell **B13** on the *Call Center 1* worksheet

Step 5

Observe the marquee around cell B13 and the formula ='Call Center 1'!B13 in the Formula Bar

Step 6

Press the **ENTER** key to enter this formula in cell B7 on the *Summary* worksheet

Step 7

Activate cell **B7** on the *Summary* worksheet, if necessary, to view the completed formula in the Formula Bar

The formula ='Call Center 1'!B13 ensures that cell B7 in the *Summary* worksheet always contains the result of the formula's calculation in cell B13 on the *Call Center 1* worksheet.

Your *Summary* worksheet cell B7 formula result and formula in the Formula Bar should look similar to Figure 2-5.

	Call Center	Year 1	Year 2	Year 3	Year 4	Year 5	Total
7	Call Center 1	16,401					
8	Call Center 2						
9	Call Center 3						
10	Call Center 4						
11	Call Center 5						
12	Total Calls						

FIGURE 2-5 Formula result in cell B7 and formula in Formula Bar

To create a formula with a 3-D reference that enters the Call Center 2 call volume for Year 1:

Step 1

Activate cell **B8** on the *Summary* worksheet

Step 2

Key =

Step 3

Click the **Call Center 2** sheet tab to activate the worksheet

Step 4

Click cell **B13** on the *Call Center 2* worksheet

Step 5

Observe the marquee around cell B13 and the formula ='*Call Center 2*'!B13 in the Formula Bar

Step 6

Press the **ENTER** key to enter this formula in cell B8 on the *Summary* worksheet

Step 7

Activate cell **B8** on the *Summary* worksheet, if necessary, to view the completed formula in the Formula Bar

Step 8

Use Steps 1-6 above as your guide to enter the remaining formulas in cells **B9**, **B10**, and **B11**

Step 9

Activate cell **A1**

In Lesson 1, you learned how to fill formulas into adjacent cells using the fill handle. You can also use the fill handle to fill multiple formulas into adjacent cells at one time.

To fill the Year 1 formulas to Years 2-5:

Step 1

Select the range **B7:B11**

Step 2

Drag the fill handle to **F7:F11**

Step 3

Observe that the formulas are filled with relative references in all the cells in the range C7:F11; you widen the columns in the next section

Step 4

Activate cell **A1**

The top of your worksheet should look similar to Figure 2-6.

A	B	C	D	E	F
1		Rivers Call Center Services			
2		Call Volume Forecast			
3		Summary			
4					
5					
6	Call Center	Year 1	Year 2	Year 3	Year 4
7	Call Center 1	16,401	18,042	20,205	23,238
8	Call Center 2	128,222	141,045	157,969	181,664
9	Call Center 3	322,880	355,168	397,790	457,456
10	Call Center 4	715,006	786,506	880,888	#####
11	Call Center 5	557,239	612,964	686,519	789,496
12	Total Calls				
13					

FIGURE 2-6 Call Center 1 through Call Center 5 call volume for Year 1-5

Now, you need to insert the call volume totals. An alternate way to insert SUM function totals in a single worksheet is to use the Quick Analysis feature.

3. Using the Quick Analysis Feature to insert the SUM function

The **Quick Analysis** feature button appears to the right of selected data. You can click the Quick Analysis button to view a gallery of analysis options: Formatting, Charts, Totals, Tables, and Sparklines.

You can use the Totals category in the Quick Analysis gallery to live preview and then insert the calculations for the Totals column using the SUM function.

Begin by selecting the data to be totaled leaving a blank cell to the right and below the selection in which the total calculation and SUM function formulas are inserted.

To live preview and then insert SUM function totals:

Step 1

Select the range **B7:F11**, if necessary

Step 2

Observe the Quick Analysis button to the right of the selection

Step 3

Click the **Quick Analysis** button to display the Quick Analysis gallery; ignore the AutoFill button if it appears above the Quick Analysis button

The Quick Analysis button and gallery on your screen should look similar to Figure 2-7.

A	B	C	D	E	F	G	H	I	J
1	Rivers Call Center Services								
2	Call Volume Forecast								
3	Summary								
4									
5									
6	Call Center	Year 1	Year 2	Year 3	Year 4	Year 5	Total		
7	Call Center 1	16,401	18,042	20,205	23,238	27,419			
8	Call Center 2	128,222	141,045	157,969	181,664	214,365			
9	Call Center 3	322,880	355,168	397,790	457,456	539,800			
10	Call Center 4	715,006	786,506	880,888	#####	#####			
11	Call Center 5	557,239	612,964	686,519	789,496	931,605			
12	Total Calls								
13									
14									
15									
16	Client	Year 1	Year 2						
17	Client A								
18	Client B								
19	Client C								
20	Client D								
21	Client E								
22	Client F								
23	Total Calls								
24									

FIGURE 2-7 Quick Analysis feature

Step 4

Click **Totals** to view the **Totals** category of analysis tools in the Quick Analysis gallery

Step 5

Observe the **Totals** analysis tools

You can calculate the sum, average, count, percentage total, and running total for both horizontal and vertical selections using the **Totals** Quick Analysis buttons. To scroll the Quick Analysis gallery, click the left or right scrolling arrows.

The **Totals** Quick Analysis gallery on your screen should look similar to Figure 2-8.

A	B	C	D	E	F	G	H	I	J
1	Rivers Call Center Services								
2	Call Volume Forecast								
3	Summary								
4									
5									
6	Call Center	Year 1	Year 2	Year 3	Year 4	Year 5	Total		
7	Call Center 1	16,401	18,042	20,205	23,238	27,419			
8	Call Center 2	128,222	141,045	157,969	181,664	214,365			
9	Call Center 3	322,880	355,168	397,790	457,456	539,800			
10	Call Center 4	715,006	786,506	880,888	#####	#####			
11	Call Center 5	557,239	612,964	686,519	789,496	931,605			
12	Total Calls								
13									
14									
15									
16	Client	Year 1	Year 2	Totals					
17	Client A			Sum	Average	Count	% Total	Running...	Sum
18	Client B								
19	Client C								
20	Client D								
21	Client E								
22	Client F								
23	Total Calls								
24									

FIGURE 2-8 Totals Quick Analysis gallery

Step 6

Click the **Sum** (row) button in the Quick Analysis gallery to insert the Sum function formulas in the range B12:F12

Step 7

Select the range **B7:F12**

Step 8

Click the **Quick Analysis** button; click **Totals**, and then click the **Sum** (column) button in the Quick Analysis gallery to insert the SUM function formula in the range G7:G12

Step 9

Widen the columns to best fit

Step 10

Activate cell **A1**

The top of your worksheet should look similar to Figure 2-9.

A	B	C	D	E	F	G
1		Rivers Call Center Services				
2		Call Volume Forecast				
3		Summary				
4						
5						
6	Call Center	Year 1	Year 2	Year 3	Year 4	Year 5
7	Call Center 1	16,401	18,042	20,205	23,238	27,419
8	Call Center 2	128,222	141,045	157,969	181,664	214,365
9	Call Center 3	322,880	355,168	397,790	457,456	539,800
10	Call Center 4	715,006	786,506	880,888	1,013,020	1,195,365
11	Call Center 5	557,239	612,964	686,519	789,496	931,605
12	Total Calls	1,739,748	1,913,725	2,143,371	2,464,874	2,908,554
13						

FIGURE 2-9 Summary of call center volume with totals

Step 11

Turn on **Formula Auditing mode** to view the formulas in the cells; then turn off Formula Auditing mode

TIME-SAVER

For more information on using the Quick Analysis feature to quickly analyze your data, check out the Quick Analysis topics in Excel Help.

KEYBOARD SHORTCUT

You can also select a range of cells and then press the CTRL+Q keyboard shortcut keys to display the Quick Analysis gallery. Try it!

Now, you are ready to enter formulas in the range B17:F22 to summarize total call volume by client for each year.

4. Using the Formula AutoComplete feature

Each call center handles calls from Clients A-F; therefore, to summarize calls by client for each year, you must add the call volume data for each client across all five *Call Center* worksheets.

To do this, you use the SUM function and worksheet grouping. The **Formula AutoComplete feature** is a helpful tool that allows you to select a function from an alphabetical list of functions as you key the function's name.

To select a function from the list, double-click the function name in the list or press the DOWN ARROW to select the function name and press the TAB key. *The Formula AutoComplete feature is not case sensitive.*

To begin the formula using Formula AutoComplete:

Step 1

Activate cell **B17**

Step 2

Key **=SU**

Step 3

Observe the Formula AutoComplete list; the list is scrolled alphabetically based on the first two characters keyed

The partial formula in the cell and the Formula AutoComplete list on your screen should look similar to Figure 2-10.

16	Client	Year 1	Year 2	Year 3	Year 4	Year 5	Total
17	Client A	=SU					
18	Client B		SUBSTITUTE	Replaces existing text with new text in a text string			
19	Client C		SUBTOTAL				
20	Client D		SUM				
21	Client E		SUMIF				
22	Client F		SUMIFS				
23	Total Calls		SUMPRODUCT				
24			SUMSQ				
25			SUMX2MY2				
26			SUMX2PY2				
			SUMXMY2				

FIGURE 2-10 Active cell and Formula AutoComplete list

Step 4

Press the **DOWN ARROW** key twice to select the SUM function

Step 5

Press the **TAB** key to insert the function and open parenthesis

Step 6

Observe that =SUM(now appears in cell B17

Your partial formula should now look similar to Figure 2-11.

16	Client	Year 1	Year 2	Year 3
17	Client A	=SUM(
18	Client B		SUM(number1, [number2], ...)	
19	Client C			

FIGURE 2-11 Partial formula containing the SUM function and open parenthesis

To add the formula's argument:

Step 1

Click the **Call Center 1** sheet tab

Step 2

Group the **Call Center 1** through **Call Center 5** worksheets using the SHIFT+click method

Step 3

Click cell **B7** on the *Call Center 1* worksheet

Step 4

Press the **ENTER** key

Step 5

Activate cell **B17**, if necessary

Step 6

Observe the formula `=SUM('Call Center 1:Call Center 5'!B7)` in the Formula Bar

The formula in cell B17 adds the values in cell B7 across the range of worksheets *Call Center 1:Call Center 5*. Your cell B17 and your formula in the Formula Bar should look similar to Figure 2-12.

The screenshot shows a Microsoft Excel spreadsheet titled "Call Volume Forecast". The formula bar at the top displays the formula `=SUM('Call Center 1:Call Center 5'!B7)". The main table below has rows for Call Centers (1-5) and a total row. Column A lists Client names (Client A, Client B, Client C). Columns B-G represent years 1-5 and a Total column. Cell B17 contains the value 162,614, which is highlighted with a green border. The formula bar also shows the full formula =SUM('Call Center 1:Call Center 5'!B7)".`

	A	B	C	D	E	F	G
1							
2							
3							
4							
5							
6	Call Center	Year 1	Year 2	Year 3	Year 4	Year 5	Total
7	Call Center 1	16,401	18,042	20,205	23,238	27,419	105,305
8	Call Center 2	128,222	141,045	157,969	181,664	214,365	823,265
9	Call Center 3	322,880	355,168	397,790	457,456	539,800	2,073,094
10	Call Center 4	715,006	786,506	880,888	1,013,020	1,195,365	4,590,785
11	Call Center 5	557,239	612,964	686,519	789,496	931,605	3,577,823
12	Total Calls	1,739,748	1,913,725	2,143,371	2,464,874	2,908,554	11,170,272
13							
14							
15							
16	Client	Year 1	Year 2	Year 3	Year 4	Year 5	Total
17	Client A	162,614					
18	Client B						
19	Client C						

FIGURE 2-12 Formula result in cell B17 and formula in Formula Bar

You can use the fill handle to quickly fill the formula in cell B17 to the range B18:B22 to calculate Year 1 call volumes for Clients B-F; then fill the formulas to the range C17:F22 to calculate Years 2-5 call volumes for Clients A-F.

To fill the remaining cells with the formula in cell B17, add total formulas using Sum (AutoSum), and add underlining:

Step 1

Activate cell **B17**, if necessary

Step 2

Drag the fill handle to cell **B22**

Step 3

Select the range **B17:B22**, if necessary

Step 4

Drag the fill handle to the range **F17:F22**

Step 5

Reselect the range **B17:F22**, if necessary, to display the Quick Analysis button

Step 6

Click the **Quick Analysis** button, click **Totals**, and click the **Sum** (row) button to add totals in the range B23:F23

Step 7

Select the range **B17:F23**

Step 8

Click the **Quick Analysis** button, click **Totals**, and click the **Sum** (column) button to add totals in the range G17:G23

Step 9

Activate cell **A14**

Step 10

Observe that total call volume for each year by call center and the total call volume for each year by client are the same; the grand total by call center and by client are also the same

The call volume summaries on your *Summary* worksheet should look similar to Figure 2-13.

A	B	C	D	E	F	G
1	Rivers Call Center Services					
2	Call Volume Forecast					
3	Summary					
4						
5						
6	Call Center	Year 1	Year 2	Year 3	Year 4	Year 5
7	Call Center 1	16,401	18,042	20,205	23,238	27,419
8	Call Center 2	128,222	141,045	157,969	181,664	214,365
9	Call Center 3	322,880	355,168	397,790	457,456	539,800
10	Call Center 4	715,006	786,506	880,888	1,013,020	1,195,365
11	Call Center 5	557,239	612,964	686,519	789,496	931,605
12	Total Calls	1,739,748	1,913,725	2,143,371	2,464,874	2,908,554
13						
14						
15						
16	Client	Year 1	Year 2	Year 3	Year 4	Year 5
17	Client A	162,614	178,875	200,341	230,392	271,862
18	Client B	228,309	251,140	281,277	323,468	381,693
19	Client C	62,879	69,168	77,468	89,087	105,123
20	Client D	537,382	591,121	662,055	761,362	898,408
21	Client E	647,679	712,447	797,940	917,632	1,082,806
22	Client F	100,885	110,974	124,290	142,933	168,662
23	Total Calls	1,739,748	1,913,725	2,143,371	2,464,874	2,908,554
24						

FIGURE 2-13 Call volume summaries on the *Summary* worksheet

Step 11

Save the workbook and leave it open for the next section

NOTE

A more difficult and cumbersome method of summarizing data from multiple worksheets is to consolidate data by position or category using the Consolidate button in the Data Tools group on the Data tab. You can learn more about consolidating data using this method in Excel Help.

5. Linking workbooks with 3-D formulas

You can also create formulas that span workbooks. For example, suppose you want to use the total call volume data in the *Summary* worksheet in the *Rivers Call Center* workbook to estimate the number of employees each call center will need for each of the five forecast years.

The employee estimates are maintained in a different workbook; you can create formulas in that workbook that reference cells on the *Summary* worksheet in the *Rivers Call Center* workbook.

You begin by opening a second workbook and saving it with a new name. Then you tile the workbooks on your screen to work more easily in both workbooks.

To open a workbook and save it with a new name:

Step 1

Open the **Lesson 2 Data File2** workbook

Step 2

Save the workbook as **Rivers Employees**

Step 3

Observe the layout of the *Employee Estimates* worksheet

The range B6:F10 in the *Employee Estimates* worksheet should contain the call volume totals found in the *Summary* sheet in the *Rivers Call Center* workbook.

It is easier to create the necessary formulas if you can see both workbooks on your screen at the same time.

You can quickly arrange both open workbooks' windows on your screen by clicking the View tab on the ribbon and clicking the **Arrange All button** in the Window group to launch the **Arrange Windows dialog box**. Choose the arrangement style option button you want, and click OK.

To tile the two open workbooks side-by-side on your screen:

Step 1

Verify that the **Rivers Employees** workbook is the active workbook

Step 2

Click the **View** tab on the ribbon

Step 3

Locate the Window group

Step 4

Click the **Arrange All** button to launch the **Arrange Windows dialog box**

Step 5

Click the **Tiled** option button, if necessary

Your Arrange Windows dialog box should look similar to Figure 2-14.

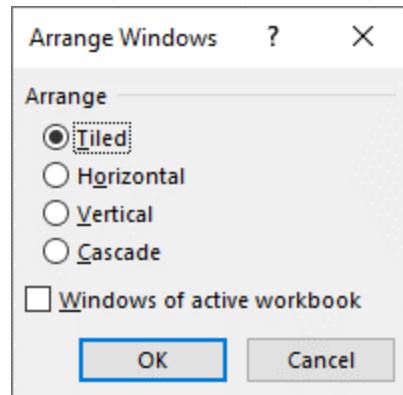


FIGURE 2-14 Arrange Windows dialog box

Step 6

Click OK

The two workbooks are tiled vertically with the *Rivers Employees* workbook on the left side of the screen. The workbook name plus the ribbon Display Options, Minimize, Restore Down, and Close buttons in the active workbook on the left are darker or “active” unlike in the inactive workbook on the right. Your tiled workbooks should look similar to Figure 2-15.

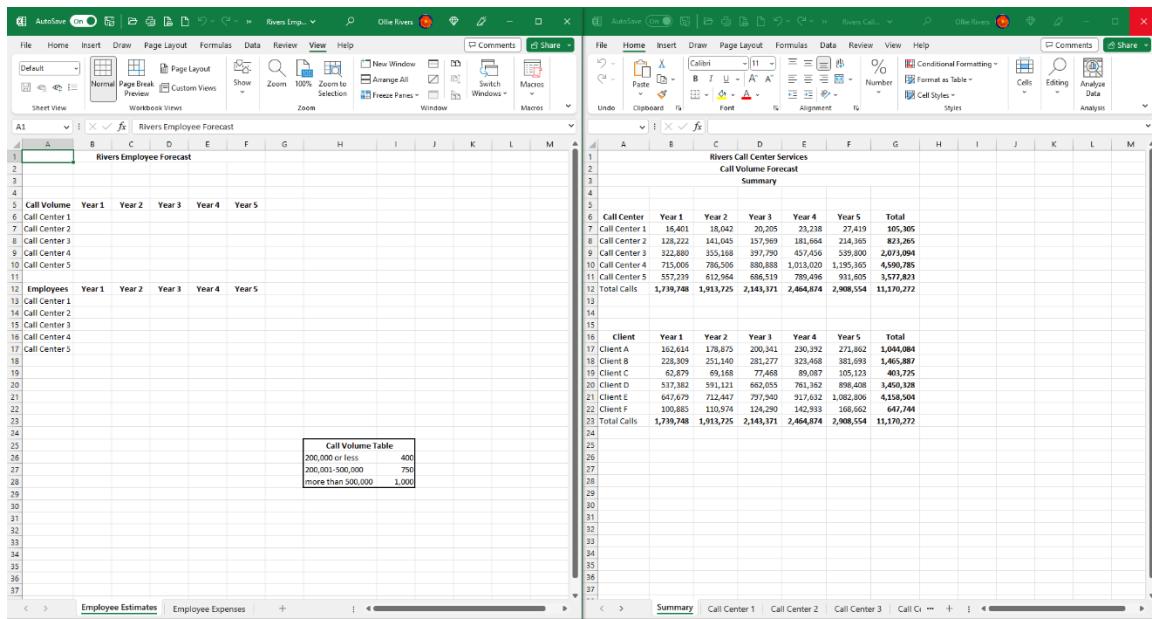


FIGURE 2-15 Tiled workbook windows

You begin by entering a formula in cell B6 in the *Employee Estimates* worksheet in the active *Rivers Employees* workbook that references cell B7 in the *Summary* worksheet in the *Rivers Call Center* workbook. To do this, you work back and forth between the two workbooks.

To enter a formula with a 3-D reference that spans workbooks:

Step 1

Activate cell **B6** in the *Employee Estimates* worksheet in the *Rivers Employees* workbook

Step 2

Key =

Step 3

Click the **Rivers Call Center** workbook name to activate the workbook window

Step 4

Click cell **B7** in the *Summary* worksheet in the *Rivers Call Center* workbook to add the workbook, worksheet, and cell references to the formula

Step 5

Press the **ENTER** key

Step 6

Activate cell **B6** in the *Rivers Employees* workbook

Step 7

Observe the formula result in cell **B6** and the formula in the Formula Bar

Cell B6 and the formula in the Formula Bar in your *Employee Estimates* worksheet should look similar to Figure 2-16.

	A	B	C	D	E	F	G	
1	Rivers Employee Forecast							
2								
3								
4								
5	Call Volume	Year 1	Year 2	Year 3	Year 4	Year 5		
6	Call Center 1	16,401						
7	Call Center 2							

FIGURE 2-16 *Employee Estimates* worksheet cell B6

The formula `=#[Rivers Call Center.xlsx]Summary!B7` indicates that cell B6 in the *Employee Estimates* worksheet always contains the contents of cell B7 in the *Summary* worksheet in the *Rivers Call Center* workbook. Note that the \$B\$7 cell reference is an absolute reference.

You are finished with the *Rivers Call Center* workbook for now.

Step 8

Maximize the **Rivers Employees** workbook, if necessary

You can copy the formula in cell B6 and paste it or fill it down to quickly enter the remaining formulas for Year 1; however, you must first change the \$B\$7 absolute reference to the B7 relative reference so that B7 can become B8, B9, and so forth.

To edit the formula and change the absolute reference to a relative reference:

Step 1

Double-click cell **B6** in the *Employee Estimates* worksheet to open the cell for editing

Step 2

Move the **insertion point** to the \$B\$7 reference, if necessary, and use the BACKSPACE or DELETE keys to remove the two \$ symbols

Step 3

Press the **ENTER** key

Step 4

Activate cell **B6** in the *Employee Estimates* worksheet, if necessary

Step 5

Observe the revised formula in the Formula Bar; note that Excel automatically adjusts the formula in cell B6 to reflect the saved location of the *Rivers Call Center* workbook (note: click the Expand Formula Bar arrow, which is the small downward pointing arrow on the far right side of the Formula Bar, if necessary to view the entire formula)

TIME-SAVER

You can also move the insertion point next to or into the \$B\$7 reference and press the F4 key three times to change the absolute references to relative references by removing the \$ symbols.

To use the fill handle to fill the ranges B7:B10 and C6:F10 with formulas:

Step 1

Drag the fill handle to **B10** and leave the range selected

Step 2

Drag the fill handle to **F10**

Step 3

Widen columns **E** and **F** to best fit

Step 4

Activate cell **A1**

In the next section, you use the Insert Function button to locate a function you can use to timestamp the *Employee Estimates* worksheet. You also create a conditional formula to calculate employee estimates.

Before beginning the next section, you should complete Quiz 2-B.

C. Selecting the insert function button or buttons from the function library to insert functions in formulas

1. Getting started

In Lesson 1, you learned about Excel's functions and how to use some of the most used functions, such as SUM, to create basic formulas.

Excel has several hundred functions you can use to perform a wide variety of calculations. Table 2-1 illustrates a sampling of the functions you might find useful:

Category	Function	Calculation
Financial	DISC	discount rate
	IRR	internal rate of return
	NPV	net present value
	DDB	double-declining balance depreciation
Date and Time	DATE	the serial number for a specific date
	NETWORKDAYS	number of work days between two dates
	WEEKDAY	day of the week
Statistical	AVERAGE	average of a range of numbers
	MIN	smallest number in a range of numbers
	MAX	largest number in a range of numbers
Logical	IF	logical test
Math & Trig	SUM	total of a range of numbers
	ROUND	rounds number to specific digits
	SUBTOTAL	subtotal of numbers in a database
Text	CONCATENATE	joins text strings
	TEXT	converts a number to formatted text

TABLE 2-1 Sample functions by category

With so many functions available, you are likely unfamiliar with many useful functions and their arguments. You can use the Insert Function button to the left of the Formula Bar to get help selecting and inserting unfamiliar functions. You can also select a function from the **Function Library** on the Formulas tab.

2. Using the Insert Function button

Clicking the **Insert Function** button launches the **Insert Function dialog box**. This dialog box offers tools you can use to search for an appropriate function, select from a list of recently used functions, select from a list of all functions in a specific category, or get Help for the selected function.

After you select a function, you then use the **Function Arguments dialog box** to add the appropriate arguments to the function and insert the completed function into a formula in the active cell.

For example, suppose you want to timestamp the *Employee Estimates* worksheet with the current system date and time that automatically updates each time the worksheet formulas recalculate. You can use the

Insert Function button to identify the Date and Time function you need and then insert it, together with its arguments, in the active cell.

To identify the Date and Time functions:

Step 1

Activate cell **A3**

Step 2

Click the **Insert Function** button to the left of the Formula Bar

Step 3

Observe that an equal sign is inserted in the cell and the Insert Function dialog box launches

Step 4

Key **current date and time** in the Search for a function text box

Step 5

Click the **Go** button

Step 6

Observe the list of current date and time functions in the Select a function box

Step 7

Click the **NOW** function in the Select a function list, if necessary

Step 8

Observe the syntax for the NOW function, a description of the function, and a link to Excel Help for this function below the Select a function list

The Insert Function dialog box on your screen should look similar to Figure 2-17.

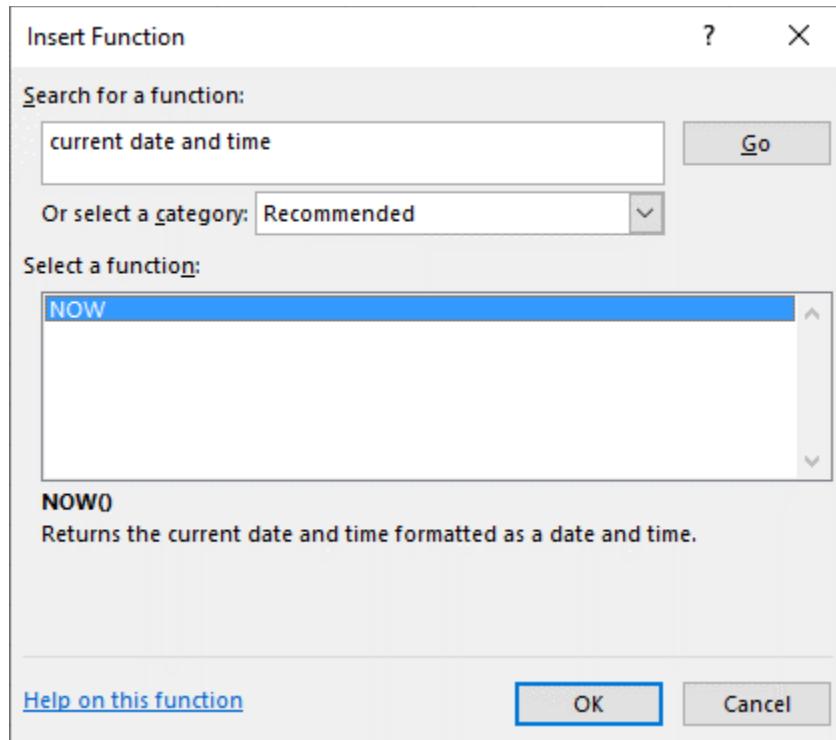


FIGURE 2-17 Insert Function dialog box

Step 9

Click **OK** to display the Function Arguments dialog box

In Lesson 1, you learned that a function consists of its name and a set of parentheses. Most functions also have arguments (i.e., what the function is to act upon) placed inside the parentheses.

The NOW function does not use arguments, as shown in the Function Arguments dialog box; however, you must still include a set of empty parentheses.

The NOW function returns the current system date and time when other worksheet formulas recalculate.

Step 10

Click **OK** to insert the formula =NOW() in cell A3

Step 11

Press the **ENTER** key

Step 12

Widen cell **A3** for best fit, if necessary, to view the current date and time

You can quickly format the date by clicking a date formatting option in the Number Format gallery.

To display the Number Format gallery and format the date and time in cell A3:

Step 1

Click the **Home** tab on the ribbon, if necessary; then locate the Number group

Step 2

Click the **Number Format** button arrow in the Number group to view the gallery of number formatting options

Step 3

Click **Long Date** in the gallery of date options to apply the Day of the Week, Month, Day, Year in Four Digits format

To merge and center the date over the range A3:F3 and add a formatted subtitle:

Step 1

Select the range **A3:F3**

Step 2

Click the **Home** tab on the ribbon, if necessary; then locate the Alignment group

Step 3

Click the **Merge & Center** button face in the Alignment group to center the date and time across the range

Step 4

Enter **Staff Requirements** in cell A2; the Bold font style and merge & center formatting is already applied

Step 5

Resize column **A** to fit, if necessary

Step 6

Activate cell **A1**

Except for the actual date, your worksheet should look similar to Figure 2-18.

A	B	C	D	E	F	
1	Rivers Employee Forecast					
2	Staff Requirements					
3	Monday, April 24, 2023					
4						
5	Call Volume	Year 1	Year 2	Year 3	Year 4	Year 5
6	Call Center 1	16,401	18,042	20,205	23,238	27,419
7	Call Center 2	128,222	141,045	157,969	181,664	214,365
8	Call Center 3	322,880	355,168	397,790	457,456	539,800
9	Call Center 4	715,006	786,506	880,888	1,013,020	1,195,365
10	Call Center 5	557,239	612,964	686,519	789,496	931,605
11						

FIGURE 2-18 Worksheet with current date in Long Date format

KEYBOARD SHORTCUT

You can insert a static date and time that does not change when the worksheet formulas are recalculated. Press the **CTRL+;** (semicolon) for the current date or **CTRL+SHIFT+:** (colon) for the current time. Press **CTRL+; [insert a space]** **CTRL+SHIFT+:** to insert both the current date and time. Try it!

3. Using the Function library

Next, you need to create a formula in cell B13 to calculate the employee estimates for Call Center 1 for Year 1. Table 2-2 contains the variables for the calculation based on call volume. This information is also located in the range H25:I28 in the *Employee Estimates* worksheet.

# of Calls	# of Employees
200,000 or less	400
200,001-500,000	750
more than 500,000	1,000

TABLE 2-2 Formula variables

To determine the number of call center employees based on the call volumes in Table 2-2, you must create a formula that performs logical tests.

The IF function is used to perform logical tests and has three arguments separated by commas: a logical test, the action to take if the test is true, and the action to take if the test is false, as shown in Figure 2-19.

=IF(Logical Test, Action if True, Action if False)

FIGURE 2-19 IF function syntax

When it is necessary to perform multiple logical tests, you can use an IF function as part of the original IF function's argument. This process is called **nesting IF functions**.

When developing a complex formula using one or more IF functions, it can be helpful to write down the calculations before you begin to create the formula in the cell.

For example, the Call Center 1 employee estimate calculation for Year 1 requires two logical tests performed on three employee estimates variables located in the range I26:I28. The calculation can be written in two sentences as:

IF the value in cell B6 is less than or equal to 200,000, *then* return the value located in cell I26, *otherwise* test again.

IF the value in cell B6 is greater than 200,000 and less than or equal to 500,000, *then* return the value located in cell I27. *Otherwise* (500,001 or more) return the value located in cell I28.

The actual formula using nested IF functions can be written as:

=IF(B6<=200000,\$I\$26,IF(B6<=500000,\$I\$27,\$I\$28))

The I26, I27, and I28 cell references that contain the employee estimate variables should be entered as absolute references (with the dollar symbol \$) to fill adjacent cells with the correct formulas.

You create a formula in cell B13 containing nested IF functions using the Insert Function and Function Arguments dialog boxes.

To begin the formula and open the Function Arguments dialog box:

Step 1

Activate cell **B13**

Step 2

Click the **Formulas** tab on the ribbon; then locate the Function Library group

Step 3

Click the **Logical** button in the Function Library to view a list of frequently used Logical functions

Step 4

Click **IF** in the function list to select the function and launch the Function Arguments dialog box

Step 5

Observe the three argument text boxes and the three Collapse buttons in the top half of the dialog box

Step 6

Observe the partial formula =IF() in cell **B13**

You work back and forth between the dialog box and the worksheet to build the formula. If it is necessary to view the entire active area of the worksheet, you can click the Collapse and Expand arrows in the dialog box.

To add the Logical_test argument:

Step 1

Click the Logical_test **Collapse** arrow, if necessary, to collapse the dialog box and increase the view of the worksheet

Step 2

Click cell **B6**

Step 3

Click the Logical_test **Expand** arrow, if necessary, to view the entire dialog box

Step 4

Key **<=200000** in the Logical_test text box

To add the Value_if_true argument:

Step 1

Press the **TAB** key to move the insertion point to the Value_if_true text box

Step 2

Click the Value_if_true **Collapse** arrow, if necessary

Step 3

Click cell **I26**; scroll to view the cell, if necessary

Step 4

Click the Value_if_true **Expand** arrow, if necessary

Step 5

Press the **F4** key one time to add the \$ symbols to the column and row references creating an absolute reference

To add the Value_if_false argument as another IF statement:

Step 1

Press the **TAB** key

Step 2

Key **IF(**

Step 3

Click the Value_if_false **Collapse** arrow, if necessary

Step 4

Click cell **B6**

Step 5

Click the Value_if_false **Expand** arrow, if necessary

Although it is generally preferable to select cell references with the mouse pointer when building a formula, it is sometimes more efficient to simply key the cell references. Remember to check any keyed cell references carefully for accuracy.

Step 6

Key **<=500000,\$I\$27,\$I\$28)** in the Value_if_false text box; don't forget to key the closing parenthesis

Your Function Arguments dialog box should look similar to Figure 2-20.

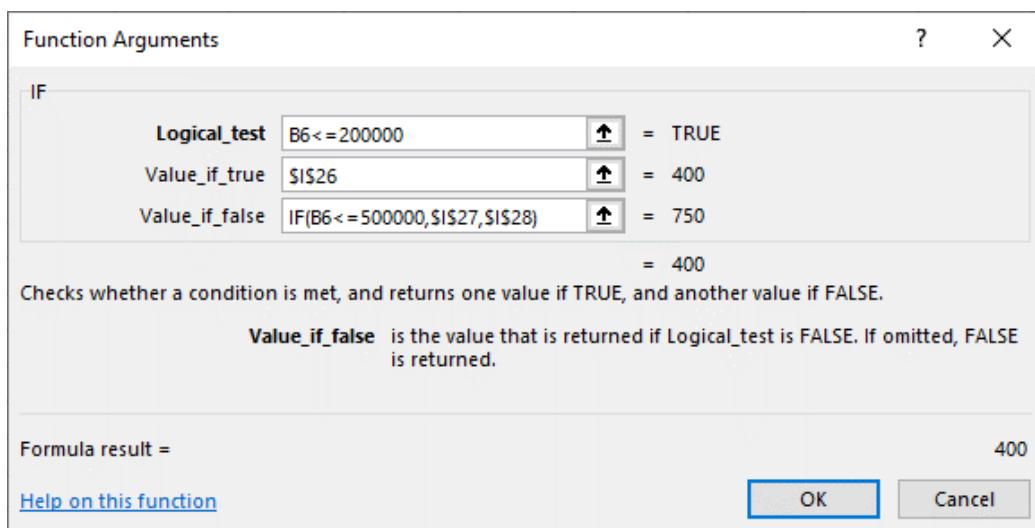


FIGURE 2-20 Function Arguments dialog box

Step 7

Click **OK**

Step 8

Observe the formula result, 400, in cell B13 and the formula

=IF(B6<=200000,\$I\$26,IF(B6<=500000,\$I\$27,\$I\$28)) in the Formula Bar

The Formula Bar and cell B13 on your worksheet should look similar to Figure 2-21.

The screenshot shows a Microsoft Excel spreadsheet titled "Rivers Employee Forecast" with a subtitle "Staff Requirements" and a date "Monday, April 24, 2023". The formula bar at the top contains the formula: =IF(B6<=200000,\$I\$26,IF(B6<=500000,\$I\$27,B6*\$I\$28)).

The table has columns labeled "Call Volume" and "Year 1", "Year 2", "Year 3", "Year 4", and "Year 5". Rows 6 through 10 show data for Call Center 1 through Call Center 5 respectively. Row 12 is a summary row for "Employees" with columns for "Year 1", "Year 2", "Year 3", "Year 4", and "Year 5". Row 13 shows the result "400" for Call Center 1 under the "Year 1" column.

FIGURE 2-21 Completed formula and formula result

WARNING!

When creating a formula with nested functions, don't forget to close all sets of parentheses.

To fill the adjacent cells with the Year 1 formula:

Step 1

Drag the fill handle to **B17**

Step 2

Drag the fill handle to **F17**

Step 3

Activate cell **A1**

Your completed worksheet should look similar to Figure 2-22.

A	B	C	D	E	F
1	Rivers Employee Forecast				
2	Staff Requirements				
3	Monday, April 24, 2023				
4					
5	Call Volume	Year 1	Year 2	Year 3	Year 4
6	Call Center 1	16,401	18,042	20,205	23,238
7	Call Center 2	128,222	141,045	157,969	181,664
8	Call Center 3	322,880	355,168	397,790	457,456
9	Call Center 4	715,006	786,506	880,888	1,013,020
10	Call Center 5	557,239	612,964	686,519	789,496
11					
12	Employees	Year 1	Year 2	Year 3	Year 4
13	Call Center 1	400	400	400	400
14	Call Center 2	400	400	400	750
15	Call Center 3	750	750	750	1,000
16	Call Center 4	1,000	1,000	1,000	1,000
17	Call Center 5	1,000	1,000	1,000	1,000
18					

FIGURE 2-22 Completed *Employee Estimates* worksheet

Step 4

Leave the workbook open for the next section

NOTE

You can use the **IF** function to hide a zero formula result by testing for zero and then returning a blank cell if the logical test is True or the calculated result if the logical test is False.

In the formula=IF(B6-C6=0," ",B6-C6), the two quote marks in the True argument indicate the cell should be left blank if the logical test is true.

You can also use defined names and labels as function arguments.

Before beginning the next section, you should complete Quiz 2-C.

D. Recognizing defined names as function arguments

1. Getting started

In Lesson 1, you learned how to define the name for a range and how to use defined names to navigate in a worksheet. You can also use a defined name as a function's argument.

For example, suppose the worksheet range B17:B22 contains expense data. You could give the range a unique name, such as *Expense*, and then enter the formula =SUM(*Expense*) in cell B23 to total the values in the range.

2. Reviewing the Name Manager dialog box

You need to add formulas to calculate total employee expenses by category to the Call Center Employees section of the *Employee Expenses* worksheet in the open workbook.

Defined names based on row and column labels have already been assigned to the range of values for each category. You use the SUM function with the range name arguments in your formulas.

You can review and, if necessary, edit defined names in the **Name Manager dialog box**. To launch the dialog box, click the **Name Manager button** in the Defined Names group on the ribbon Formulas tab.

To review the defined names in the *Employee Expenses* worksheet:

Step 1

Activate the *Employee Expenses* worksheet

Step 2

Click the **Formulas** tab on the ribbon, if necessary; then locate the Defined Names group

Step 3

Click the **Name Manager** button to launch the Name Manager dialog box

Step 4

Click **Benefits** in the Names in workbook list, if necessary

Step 5

Observe the worksheet and range reference in the Refers to text box

Your Name Manager dialog box should look similar to Figure 2-23.

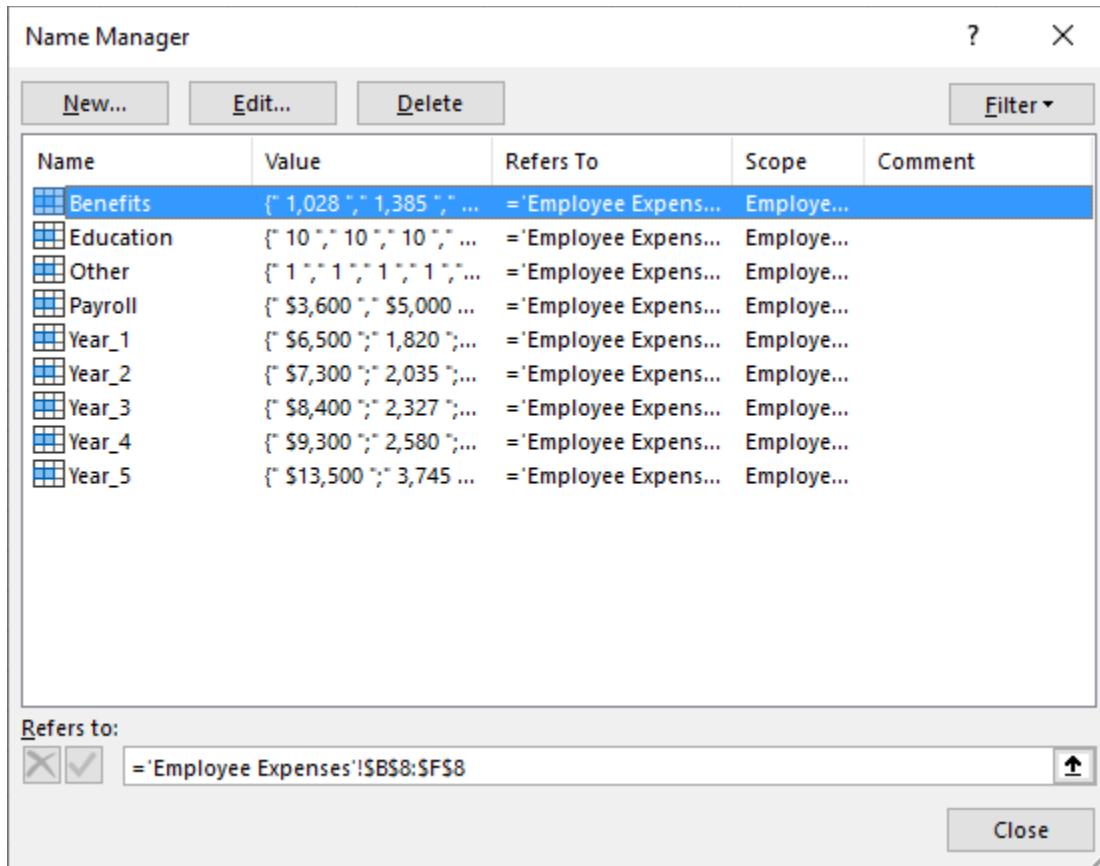


FIGURE 2-23 Name Manager dialog box

Step 6

Drag the dialog box down and to the right, if necessary, to view the worksheet range **B8:F8**; the range contains the five-year Benefits expense values

Step 7

Continue by selecting each range name in the list and comparing it to the actual range in the worksheet

Step 8

Close the dialog box

3. Using a defined name in a formula

As you build your formulas, it is not necessary to remember all the defined names in the *Employee Expenses* worksheet. You can click the **Use in Formula** button in the Defined Names group to view a list of available defined names. Clicking a defined name in the list inserts it into the formula.

To enter a formula to calculate the total five-year Payroll expenses using the SUM function and a defined name argument:

Step 1

Activate cell **G7**

Step 2

Key =SUM(

Step 3

Click the **Formulas** tab on the ribbon, if necessary; then locate the Defined Names group

Step 4

Click the **Use in Formula** button to view the list of available defined ranges

Your list of available defined names should look similar to Figure 2-24.

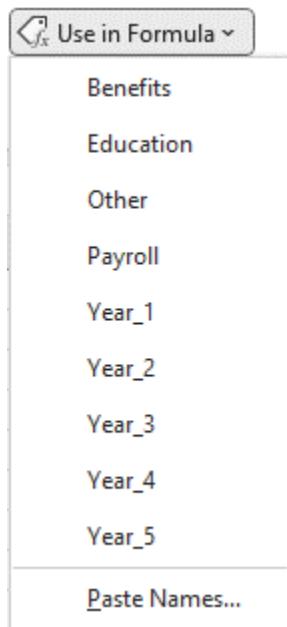


FIGURE 2-24 List of available defined names to use in a formula

Step 5

Click **Payroll** in the list

Step 6

Observe that the defined name Payroll is inserted as the formula's argument and the range B7:F7, the Payroll values, is shaded and surrounded by a colored border

Your formula in cell G7 should look similar to Figure 2-25.

	A	B	C	D	E	F	G	H
1	Rivers Call Center Services							
2	Employee Expenses (\$000)							
3								
4	Call Center Employees							
5								
6	Category	Year 1	Year 2	Year 3	Year 4	Year 5	Total	
7	Payroll	\$ 3,600	\$ 5,000	\$ 6,500	\$ 7,200	=SUM(Payroll)		
8	Benefits	1,028	1,385	1,801	1,994	SUM(number1, [number2], ...)		
9	Education	10	10	10	10	10		
10	Other	1	1	1	1	1		
11	Total	\$ 4,639	\$ 6,396	\$ 8,312	\$ 9,205	\$ 14,633		
12								

FIGURE 2-25 Formula with SUM function and defined name argument

Step 7

Press the **ENTER** key; Excel automatically adds the closing parenthesis

Step 8

Activate cell **G7**, if necessary

Step 9

Observe the formula result, \$33,750, in the cell and the formula, =SUM(Payroll), in the Formula Bar

You cannot copy this formula to adjacent cells because it contains a range name assigned to an absolute reference, \$B\$8:\$F\$8. You must manually create the remaining formulas.

Step 10

Continue using Steps 2-9 as your guide to enter the correct formulas in the range **G8:G10**

Step 11

Enter a formula in cell **G11** using the **Sum** function to calculate the Total call center employees expenses

Step 12

Use the status bar calculation options to verify the accuracy of your formulas in the Call Center Employees section

Your completed Call Center Employees section should look similar to Figure 2-26.

A	B	C	D	E	F	G
1		Rivers Call Center Services				
2		Employee Expenses (\$000)				
4	Call Center Employees					
6	Category	Year 1	Year 2	Year 3	Year 4	Year 5
7	Payroll	\$ 3,600	\$ 5,000	\$ 6,500	\$ 7,200	\$ 11,450
8	Benefits	1,028	1,385	1,801	1,994	3,172
9	Education	10	10	10	10	50
10	Other	1	1	1	1	5
11	Total	<u>\$ 4,639</u>	<u>\$ 6,396</u>	<u>\$ 8,312</u>	<u>\$ 9,205</u>	<u>\$ 14,633</u>
12						

FIGURE 2-26 Completed Call Center Employees section

4. Using Formula AutoComplete to insert a defined name

Earlier in this lesson, you learned how to use Formula AutoComplete to quickly select a function and insert it in your formula. You can also use Formula AutoComplete to select and insert a defined name.

You now need to enter formulas in the Sales and Management Employees section to calculate the totals for Years 1-5 and the grand total. You use the SUM function, defined names, and Formula AutoComplete to do this.

To enter formulas to calculate the total expenses by year and the grand total for sales and management employees:

Step 1

Activate cell **B23**

Step 2

Key =SUM(Y

Step 3

Observe the Formula AutoComplete list containing defined names Year_1 through Year_5 for the column ranges in the Sales and Management Employees section

Your cell B23 and the Formula AutoComplete list should look similar to Figure 2-27.

14		Sales and Management Employees						
15		Category	Year 1	Year 2	Year 3	Year 4	Year 5	Total
17	Payroll	\$ 6,500	\$ 7,300	\$ 8,400	\$ 9,300	\$ 13,500	\$ 45,000	
18	Benefits	1,820	2,035	2,327	2,580	3,745	12,507	
19	Travel	10	15	20	25	30	100	
20	Entertainment	15	25	35	45	50	170	
21	Education	5	7	10	12	15	49	
22	Other	5	5	5	5	5	25	
23	Total	=SUM(Y						
24		SUM(number1, [number2], ...)						
25		YEAR	Returns the year of a date, an integer in the range 1900 - 9999					
26		Year_1						
27		Year_2						
28		Year_3						
29		Year_4						
30		Year_5						
31		YEARFRAC						
32		YIELD						
33		YIELDDISC						
		YIELDMAT						

FIGURE 2-27 Cell B23 and Formula AutoComplete list with defined names

Step 4

Press the **DOWN ARROW** to select the Year_1 defined name

Step 5

Press the **TAB** key to insert the defined name in the formula

Your partial formula and colored range border should look similar to Figure 2-28.

14		Sales and Management Employees						
15		Category	Year 1	Year 2	Year 3	Year 4	Year 5	Total
17	Payroll	\$ 6,500	\$ 7,300	\$ 8,400	\$ 9,300	\$ 13,500	\$ 45,000	
18	Benefits	1,820	2,035	2,327	2,580	3,745	12,507	
19	Travel	10	15	20	25	30	100	
20	Entertainment	15	25	35	45	50	170	
21	Education	5	7	10	12	15	49	
22	Other	5	5	5	5	5	25	
23	Total	=SUM(Year_1						
24		SUM(number1, [number2], ...)						
25								

FIGURE 2-28 Partial formula containing a defined name

Step 6

Press the **ENTER** key

Step 7

Activate cell **B23**

Step 8

Observe the formula result, \$8,355, in the cell and the formula, =SUM(Year_1), in the Formula Bar

Step 9

Continue to create the total formulas for Years 2-5 using the SUM function, the defined name, and Formula AutoComplete

Step 10

Enter a formula in cell **G23** using the **SUM** function to calculate the grand total in cell **G23**

Step 11

Observe the totals for each year and the grand total

Step 12

Use the status bar calculation options to verify your column totals in the Sales and Management Employees section

The Sales and Management Expenses section of your worksheet should look similar to Figure 2-29.

Sales and Management Employees							
14	Category	Year 1	Year 2	Year 3	Year 4	Year 5	Total
15	Payroll	\$ 6,500	\$ 7,300	\$ 8,400	\$ 9,300	\$ 13,500	\$ 45,000
16	Benefits	1,820	2,035	2,327	2,580	3,745	12,507
17	Travel	10	15	20	25	30	100
18	Entertainment	15	25	35	45	50	170
19	Education	5	7	10	12	15	49
20	Other	5	5	5	5	5	25
21	Total	\$ 8,355	\$ 9,387	\$ 10,797	\$ 11,967	\$ 17,345	\$ 57,851
22							
23							
24							

FIGURE 2-29 Sales and Management Employees section

Step 13

Activate cell **A1**

Step 14

Leave the workbook open for the next section

When you want to draw attention to the result of a formula's calculation, you can apply conditional formatting.

Before beginning the next section, you should complete Quiz 2-D.

E. Selecting conditional formatting for formulas' results

1. Getting started

You can have Excel apply **conditional formatting**—special formatting, such as a cell border, colored cell background, or colored font—to a formula's result by specifying the circumstances or conditions, called a rule, under which the formatting is applied.

You can quickly apply conditional formatting, such as data bars or fill color, using the Quick Analysis feature. You can also manually specify conditional formatting rules by clicking the **Conditional Formatting button** in the Styles group on the Home tab.

2. Using the Quick Analysis feature to apply conditional formatting

Suppose you want to quickly add emphasis to the Call Center Employee estimates on the *Employee Estimates* worksheet by applying conditional formatting to a formula's result based on the formula variables in the range I26:I28.

To apply a fill color conditional formatting:

Step 1

Activate the **Employee Estimates** worksheet

Step 2

Scroll to view the ranges **B13:F17** and **I26:I28**, if necessary

Step 3

Select the range **B13:F17**

Step 4

Click the **Quick Analysis** button below and to the right of the selection

Step 5

Click the **Formatting** category, if necessary

Step 6

Click the **Color Scale** icon in the Formatting category group to apply a fill color formatting proportionally based on cell values

Step 7

Deselect the range

Your formatted range should look similar to Figure 2-30.

11						
12	Employees	Year 1	Year 2	Year 3	Year 4	Year 5
13	Call Center 1	400	400	400	400	400
14	Call Center 2	400	400	400	400	750
15	Call Center 3	750	750	750	750	1,000
16	Call Center 4	1,000	1,000	1,000	1,000	1,000
17	Call Center 5	1,000	1,000	1,000	1,000	1,000
18						

FIGURE 2-30 Quick Analysis feature Color Scale conditional formatting applied to selected range

You can clear the formatting from the range by clicking the Clear Format icon in the Formatting category in the Quick Analysis gallery.

To clear the conditional formatting:

Step 1

Reselect the range **B13:F17**

Step 2

Click the **Quick Analysis** button

Step 3

Click the **Formatting** category, if necessary

Step 4

Click the **Clear Format** icon in the Quick Analysis gallery to remove the conditional formatting

For more complex conditional formatting, you can establish your own formatting rules.

3. *Setting conditional formatting rules manually*

Now suppose you want to use both fill and font color to emphasize the calculated staffing requirement.

You begin by reviewing conditional formatting options; then you manually build the formatting rules necessary to apply the fill and font color.

To view conditional formatting options:

Step 1

Select the range **B13:F17**, if necessary

Step 2

Click the **Home** tab on the ribbon, if necessary; then locate the Styles group

Step 3

Click the **Conditional Formatting** button in the Styles group to view conditional formatting rule categories

Your gallery of conditional formatting categories should look similar to Figure 2-31.

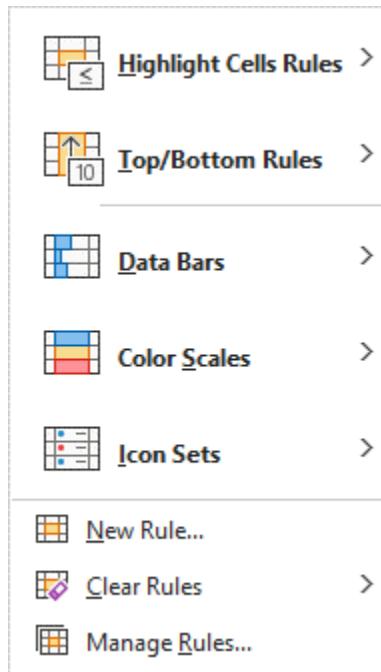


FIGURE 2-31 Conditional formatting categories

You can apply a variety of different conditional formatting rules using the following options:

- **Highlight Cells Rules** – add conditional formatting based on the value being greater than, less than, equal to, between, a text string, a date, or a duplicate.
- **Top Bottom Rules** – add conditional formatting to top values, bottom values, or above/below average values.
- **Data Bars** – add graphic bars in proportion to cell values.
- **Color Scales** – add background color in proportion to cell values.
- **Icon Sets** – add icons based on cell values.
- **New Rule** – create your own rule based on a logical formula.
- **Clear Rules** – delete conditional formatting from selected cells.
- **Manage Rules** – launch the Conditional Formatting Rules Manager dialog box with options for creating, editing, or removing conditional formatting rules.

You want to establish two different conditional formatting rules for the selected range.

1. Apply a red fill and font color to cells whose value is less than 750.
2. Apply a green fill and font color to cells whose value is greater than 750.

To establish the conditional formatting rules:

Step 1

Point to **Highlight Cells Rules** to see the list of rules for highlighting cells

Step 2

Click **Less Than** to open the Less Than dialog box

Step 3

Key **750** in the Format cells that are LESS THAN text box

Step 4

Click the **Light Red Fill with Dark Red Text** option in the with drop-down menu, if necessary

Your selected range and the Conditional Formatting Less Than dialog box on your screen should look similar to Figure 2-32.

FIGURE 2-32 Conditional Formatting Less Than dialog box

Step 5

Click **OK**

Step 6

Click the **Conditional Formatting** button in the Styles group

Step 7

Point to **Highlight Cells Rules**

Step 8

Click **Greater Than** to open the Greater Than dialog box

Step 9

Key **750** in the Format cells that are GREATER THAN text box

Step 10

Click the **Green Fill with Dark Green Text** option in the with drop-down menu

Your selected range and the Conditional Formatting Greater Than dialog box on your screen should look similar to Figure 2-33.

FIGURE 2-33 Selected range and Conditional Formatting Greater Than dialog box

Step 11

Click **OK**

Step 12

Deselect the range

Your cells with conditional formatting in the range B13:F17 should look similar to Figure 2-34.

11	Employees	Year 1	Year 2	Year 3	Year 4	Year 5
12	Call Center 1	400	400	400	400	400
13	Call Center 2	400	400	400	400	750
14	Call Center 3	750	750	750	750	1,000
15	Call Center 4	1,000	1,000	1,000	1,000	1,000
16	Call Center 5	1,000	1,000	1,000	1,000	1,000
17						
18						

FIGURE 2-34 Cells with conditional formatting

Step 13

Save and close the open workbooks

NOTE

Conditional formatting is a powerful tool with many useful applications. For more information about other ways to use conditional formatting, such as creating a formula to apply conditional formatting, search Excel Help.

In this lesson, you learned how to enter a formula on multiple grouped worksheets at one time and how to create 3-D formulas that span worksheets and workbooks.

You also learned how to use the Insert Function button to create formulas containing unfamiliar functions, how to use the IF function to create a calculation based on a logical test, how to use defined names and labels as function arguments, and how to apply conditional formatting to a formula's result.

In Lesson 3, you learn multiple ways to check for formula errors.

Before beginning the next lesson, you should complete Quiz 2-E.

Identifying and Correcting Formula Errors

Learning Objectives	1
I. In general	1
II. Key terms	1
III. Hands on	2
A. Identifying and correcting common errors using the Trace Error icon and the formula auditing tools	2
1. Getting started	2
2. Tracing errors	2
3. Correcting the 'Numbers Stored as Text' error	4
4. Correcting the #VALUE! error	6
5. Correcting the #NAME? error	8
6. Correcting the #REF! error	10
7. Correcting the 'Formula Omits Adjacent Cells' error	14
B. Identifying and correcting a circular reference	15
1. Getting started	15
2. Creating a circular reference	16
3. Correcting a circular reference	17
C. Selecting color-coded cell borders to correct a cell reference error in a formula	18
1. Getting started	18
2. Correcting a formula error using color-coded cell borders	18
D. Identifying how to step through a nested formula	21
1. Getting started	21
2. Evaluating a complex formula	21
E. Identifying how to use the Watch Window and other tools to analyze, protect, and hide formulas	25
1. Getting started	25
2. Working with the Watch Window	25
3. Displaying the active workbook in multiple windows	28
4. Splitting a single worksheet into multiple panes	32
5. Protecting and unprotecting cells	34
6. Hiding formulas	39

Identifying and Correcting Formula Errors

Learning Objectives

After completing this lesson, you will be able to:

- Identify and correct common errors using the Trace Error icon and the Formula Auditing tools;
- Identify and correct a circular reference;
- Selecting color-coded cell borders to correct a cell reference error in a formula;
- Identify how to step through a nested formula; and
- Identify how to use the Watch Window and other tools to analyze, protect, and hide formulas.

I. In general

In this lesson, you learn how to use tools that help you identify and correct errors in formulas and other kinds of worksheet errors. First, you learn how to identify and correct errors using the Error Checking feature and the Trace Error icon. Then you learn how to use the Formula Auditing tools to identify a formula's dependent and precedent cells and trace formula errors. You also learn how to use drag and drop to correct a cell reference error in a formula.

Next, you learn how to watch cells containing formulas as you enter or edit data using the Watch Window. You also learn how to use tools that allow you to visually verify formula results in large worksheets and multiple worksheets linked by formulas: by displaying a workbook in more than one window and by splitting a worksheet into multiple viewing panes.

Finally, you learn how to protect a worksheet so that the contents of certain cells cannot be accidentally or deliberately changed. You also learn how to hide formulas from view.

II. Key terms

#NAME? error value	horizontal split bar
#REF! error value	locked cells
#VALUE! error value	precedent cells
circular reference	Protect Sheet button
color-coded cell border	Protect Sheet dialog box
dependent cells	Remove (All) Arrows button
Error Checking button	Switch Windows button
Evaluate Formula button	Trace Dependents button
Find & Select button	Trace Precedents button
Format Cells dialog box	tracer arrows
Formula Auditing tools	vertical split bar
Go To Special dialog box	Watch Window
hidden formulas	Watch Window button

III. Hands on

A. Identifying and correcting common errors using the Trace Error icon and the formula auditing tools

1. Getting started

Despite taking care and following best practices when entering data and formulas—such as using the mouse pointer instead of the keyboard to add cell references to a formula—errors can sometimes occur. For example, it may sometimes simply be faster to key a formula in a cell although doing so may increase the risk of an error, such as misspelling a function name, forgetting to add a parenthesis, adding the wrong cell reference to a formula, or formatting a number as text.

In Lesson 1, you were introduced to the Error Checking feature that works in the background to check for errors, such as formatting a number as text or an attempt to divide by zero. If the Error Checking feature detects an error, a small triangle called an error indicator appears in the upper-left corner of the cell containing the error. When you activate a cell containing an error indicator, the Trace Error icon also appears.

2. Tracing errors

You can point to the Trace Error icon to view a ScreenTip that explains the reason for the error indicator. Clicking the Trace Error icon displays a menu containing a brief definition of the error and options for resolving it, getting Help, or viewing the Trace Error options in the Excel Options dialog box. You can turn the Trace Error tool and its checking options on or off in this dialog box.

You start this lesson by opening and saving an existing workbook containing two worksheets which contain deliberate formula errors. Then you review the Trace Error tool options and use the tool to resolve these errors.

To open and save a workbook:

Step 1

Open the **Lesson 3 Data File** workbook

Step 2

Save the workbook as **Resolving Errors**

Step 3

Activate the **Financial Forecast** worksheet, if necessary

To review Trace Error feature options:

Step 1

Click the **File** tab

Step 2

Click **Options** in the left pane to launch the Excel Options dialog box

Step 3

Click **Formulas** in the left pane

Step 4

Observe the Error Checking option and the Error checking rules options in the right pane

Step 5

Click the **Enable background error checking** checkbox, if necessary, to insert a check mark

Step 6

Turn on all the **error checking rules**, if necessary, by clicking each checkbox

Step 7

Click the **Reset Ignored Errors** button to ensure that all the errors in the open workbook are flagged

The Excel Options dialog box on your screen should look similar to Figure 3-1.

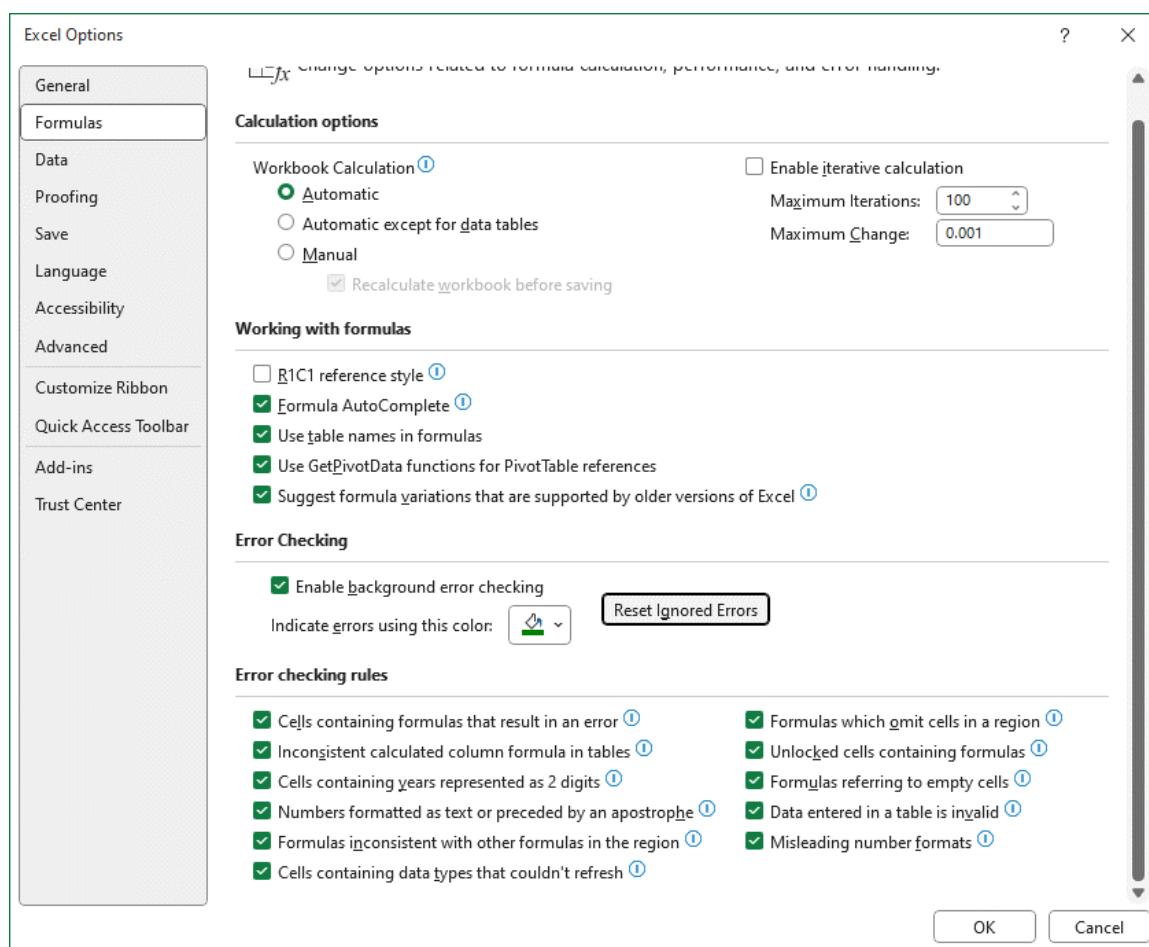


FIGURE 3-1 Error checking options in the Excel Options dialog box

Step 8

Click **OK**

The *Financial Forecast* worksheet, as shown in Figure 3-2, contains a number of errors as indicated by the error indicator symbol (✓) in the upper-left corner of various cells.

	A	B	C	D	E	F	G
1		Rivers Call Center Services					
2		Five-Year Financial Forecast					
3		(\$000)					
4							
5		Year 1	Year 2	Year 3	Year 4	Year 5	Total
6							
7	Revenues	\$ 75,000	\$ 80,250	\$ 88,275	\$ 98,868	#REF!	#REF!
8							
9	Expenses						
10	Employee Expenses	10,000	10,700	11,449	12,250	13,108	44,399
11	Rent and Utilities	3,000	3,000	3,000	3,000	3,000	15,000
12	Computing Services	1,200	1,260	1,323	1,389	1,458	6,630
13	Supplies, Other	1,000	1,030	1,061	1,093	1,126	5,310
14	Total Expenses	15,200	#NAME?	16,833	17,732	18,692	#NAME?
15	Operating Income	#VALUE!	#NAME?	\$ 71,442	\$ 81,136	#REF!	#REF!
16							

FIGURE 3-2 Worksheet with errors

Error values, such as the examples shown in Table 3-1, also appear in some cells containing formulas.

Error Value	Description
#VALUE!	Wrong operand or argument in formula
#DIV/0!	Attempt to divide by zero
#NAME?	Unrecognizable text in formula
#REF!	Invalid cell reference in formula

TABLE 3-1 Examples of common error values

3. Correcting the ‘Numbers Stored as Text’ error

Cell A3 contains commonly used text—‘(\$000)—that tells the user that the values in the worksheet are in thousands. Excel normally recognizes (\$000) as a number; therefore, an apostrophe has been used before the (\$000) to convert the number to text.

Because the *Numbers formatted as text or preceded by an apostrophe* option is turned on in the Error Checking options, the Error Checking feature detects that the number is preceded by an apostrophe, suspects an error, and flags the cell with the error indicator symbol you learned about in Lesson 1.

You can activate cell A3 and click the Trace Error icon to view a menu of options you can use to resolve this error. (Note that the options on the Trace Error menu vary depending on the type of error in the cell.)

To review the suspected error in cell A3:

Step 1

Activate cell **A3**

Step 2

Observe the **Trace Error** icon to the right of the active cell

Step 3

Point to the **Trace Error** icon to view the ScreenTip

Step 4

Click the **Trace Error** icon to view the menu

The Trace Error icon's menu of error checking options on your screen should look similar to Figure 3-3.

The screenshot shows a portion of an Excel spreadsheet titled "Rivers Call Center Services Five-Year Financial Forecast (\$000)". Cell A3 contains the value "Number Stored as Text". An orange exclamation mark icon is located to the right of cell A3, indicating an error. A context menu is open at this icon, listing the following options: "Number Stored as Text" (highlighted in blue), "Convert to Number", "Help on this Error", "Ignore Error", "Edit in Formula Bar", and "Error Checking Options...". The main part of the spreadsheet displays financial data for years 1 through 5, with columns for Year 1, Year 2, Year 3, Year 4, Year 5, and Total. Some cells contain errors like "#REF!" or "#NAME?".

	A	B	C	D	E	F	G
1		Rivers Call Center Services					
2		Five-Year Financial Forecast					
3		(\$000)					
4		Year 1	Year 2	Year 3	Year 4	Year 5	Total
5		000	\$ 80,250	\$ 88,275	\$ 98,868	#REF!	#REF!
6		000	10,700	11,449	12,250	13,108	44,399
7		000	3,000	3,000	3,000	3,000	15,000
8	Computing Services	1,200	1,260	1,323	1,389	1,458	6,630
9	Supplies, Other	1,000	1,030	1,061	1,093	1,126	5,310
10	Total Expenses	15,200	#NAME?	16,833	17,732	18,692	#NAME?
11	Operating Income	#VALUE!	#NAME?	\$ 71,442	\$ 81,136	#REF!	#REF!
12							
13							
14							
15							
16							

FIGURE 3-3 Trace Error icon menu

The first option on the Trace Error menu identifies the type of error. You can choose other options to correct the suspected error—in this case convert the text to a number—or to:

- get Help for the error type
- ignore the potential error
- edit the cell contents in the Formula Bar
- launch the Excel Options dialog box and view the Trace Error options

In this situation there is no actual error; the apostrophe was deliberately added before the number to indicate text. You can tell Excel to ignore the “error.”

To resolve the suspected error in cell A3:

Step 1

Click **Ignore Error** on the Trace Error icon menu

Step 2

Observe that the error indicator symbol is removed from the cell

4. Correcting the #VALUE! error

The **#VALUE! error value** appears in a cell when the wrong cell reference or operand is used in a formula. To resolve this error, you must correct the cell reference or operand.

To review the #VALUE! error in cell B15:

Step 1

Activate cell **B15**

Step 2

Observe the #VALUE! error value in the cell

Step 3

Observe the formula $=B7-A15$ in the Formula Bar

Step 4

Point to the **Trace Error** icon to the left of the cell

Step 5

Observe the ScreenTip; the #Value! error value appears in cell B15 because a wrong data type is referenced in the formula

The formula in cell B15, $=B7-A15$, is supposed to calculate the Operating Income for Year 1 by subtracting Total Expenses from Revenues. Cell B7 contains the revenue value for Year 1; however, cell A15 contains a text row label instead of the expense value, which is found in cell B14. The formula should actually be $=B7-B14$.

To resolve the error in cell B15:

Step 1

Click the **Trace Error** icon to the left of the cell

Step 2

Observe the Trace Error icon menu options; you can quickly resolve this error by correcting the cell reference from A15 to B14

Step 3

Click **Edit in Formula Bar** to move the insertion point into the Formula Bar; note the color-coded cell references in the formula

Step 4

Press the **BACKSPACE** key three times to remove the A15 cell reference

Step 5

Click cell **B14** to insert the correct cell reference in the formula; note that you can also key B14 in the formula, if desired

Step 6

Press the **ENTER** key

Step 7

Activate cell **B15**

Step 8

Observe the corrected formula in the Formula Bar and that the #VALUE! error value is replaced by the correct formula result, \$59,800

Your worksheet should look similar to Figure 3-4.

Rivers Call Center Services			
Five-Year Financial Forecast (\$000)			
	Year 1	Year 2	Year 3
7 Revenues	\$ 75,000	\$ 80,250	\$ 88,275
8			
9 Expenses			
10 Employee Expenses	10,000	10,700	11,449
11 Rent and Utilities	3,000	3,000	3,000
12 Computing Services	1,200	1,260	1,323
13 Supplies, Other	1,000	1,030	1,061
14 Total Expenses	15,200	#NAME?	16,833
15 Operating Income	\$ 59,800	#NAME?	\$ 71,442
16			

FIGURE 3-4 Corrected formula error in cell B15

5. Correcting the #NAME? error

The **#NAME? error value** appears in a cell when a formula contains text that Excel cannot recognize, for example, a misspelled function name or a range name that has not yet been defined.

Failing to use the correct punctuation in a formula—such as a colon between range references or single quotation marks around a worksheet reference—also triggers the #NAME? error value.

To review the #NAME? error value in cell C14:

Step 1

Activate cell **C14**

Step 2

Observe the #NAME? error value in the cell

Step 3

Observe the formula =@SM(C10:C13) in the Formula Bar

Step 4

Point to the **Trace Error** icon to the left of the cell

Step 5

Observe the ScreenTip; the #NAME? error value appears in cell C14 because the function name is misspelled

You can quickly fix this error by manually editing the formula to correct the function name or by using the Sum (AutoSum) button in the Function Library to enter the correct function name.

To resolve the error in cell C14 using the Sum (AutoSum) button:

Step 1

Click the **Formulas** tab on the ribbon, if necessary; then locate the Function Library group

Step 2

Click the **Sum** (AutoSum) button face in the Function Library group to insert the correctly spelled SUM function

Step 3

Press the **ENTER** key

Step 4

Activate cell **C14**, if necessary

Step 5

Observe the corrected formula appears in the Formula Bar and the correct value for Year 2 Expenses, \$15,990, appears in cell C14

Step 6

Observe that cell C15 now contains the correct value for Year 2 Operating Income

Your worksheet should look similar to Figure 3-5.

Rivers Call Center Services			
Five-Year Financial Forecast			
(\$000)			
	Year 1	Year 2	Year 3
7 Revenues	\$ 75,000	\$ 80,250	\$ 88,275
8 Expenses			
10 Employee Expenses	10,000	10,700	11,449
11 Rent and Utilities	3,000	3,000	3,000
12 Computing Services	1,200	1,260	1,323
13 Supplies, Other	1,000	1,030	1,061
14 Total Expenses	15,200	15,990	16,833
15 Operating Income	\$ 59,800	\$ 64,260	\$ 71,442
16			

FIGURE 3-5 Corrected formulas and values in cells C14 and C15

NOTE

You can click the **Error Checking** button in the **Formula Auditing** group on the **Formulas** tab to launch the **Error Checking** dialog box; then step through multiple cells containing errors and correct the errors.

NOTE

As you learned in Lesson 2, the ##### error value in a cell or cells indicates that the column is not wide enough to display formatted data or formulas' results. A common way to resolve this error is to widen the column for best fit by double-clicking the column's right boundary. For more information on other error values, such as #N/A, #NULL! and #NUM, see **Excel Help**.

The Formula Auditing tools are useful for identifying and correcting formula errors, especially in complex formulas.

6. Correcting the #REF! error

The **#REF! error value** appears when a formula contains an invalid cell reference, for example, when a cell referenced in the formula has been removed from the worksheet.

The formula in cell F7 should calculate the Year 5 Revenues based on the previous year's Revenues plus a growth factor. The Revenue growth factors are located in another area of the worksheet.

The #REF! error value in cell F7 indicates that the cell containing the Year 5 growth factor has been removed from the worksheet.

You can use the **Formula Auditing tools** to resolve an error in a complex formula, such as the formula in cell F7. To view the Formula Auditing tools, click the Formulas tab on the ribbon and locate the Formula Auditing group.

To review the #REF! error value in cell F7 and then view the Formula Auditing tools:

Step 1

Activate cell **F7**

Step 2

Observe the #REF! error value in the cell

Step 3

Observe the formula $=E7+(E7*#REF!)$ in the Formula Bar

Step 4

Point to the **Trace Error** icon to the left of the cell

Step 5

Observe the ScreenTip; the #REF! error value appears in cell F7 because an originally referenced cell in the formula has been moved or deleted from the worksheet

Step 6

Click the **Formulas** tab on the ribbon, if necessary; then locate the Formula Auditing group

Figure 3-6 illustrates the buttons in the Formula Auditing group, which you first learned about in Lesson 1.

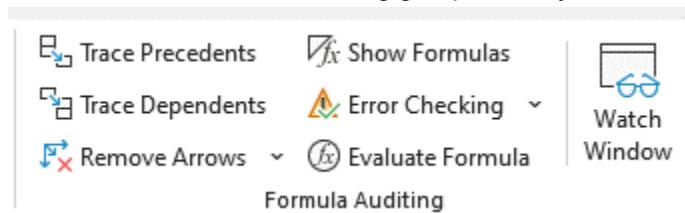


FIGURE 3-6 Formula Auditing tools

The Formula Auditing buttons are used to identify worksheet or formula errors.

- **Trace Precedents**—adds tracer arrows from **precedent cells** that provide data for the active cell to the active cell.
- **Trace Dependents**—adds tracer arrows from the active cell to **dependent cells** that depend on the active cell's contents.
- **Remove (All) Arrows**—provides options for removing tracer arrows.
- **Show Formulas**—toggles on or off the display of formulas in cells.
- **Error Checking**—launches the Trace Error dialog box that contains options similar to those on the Trace Error menu.
- **Evaluate Formula**—launches the Evaluate Formula dialog box used to step through a formula to find errors.
- **Watch Window**—launches the Watch Window you can use to watch changes to cell contents based on formula calculations.

To better understand the cause of the #REF! error value in cell F7, you first identify all the precedent cells to the formula in F7 and then all its dependent cells.

Many formulas have multiple precedent or dependent cells; each time you click the Trace Precedents or Trace Dependents buttons **tracer arrows** are shown from and to the closest level of precedent or dependent cells.

Clicking the buttons again displays arrows to the next closest cells and so forth until there are no more precedents or dependents to the active cell.

To identify the precedent cells to the formula in cell F7:

Step 1

Verify that cell **F7** is the active cell

Step 2

Click the **Trace Precedents** button in the Formula Auditing group

Step 3

Observe the tracer arrow from cell E7 to cell F7

Cell E7 contains data or a formula on which the formula in cell F7 relies. This is also called a direct precedent. Your worksheet should look similar to Figure 3-7.

4							
5		Year 1	Year 2	Year 3	Year 4	Year 5	Total
6							
7	Revenues	\$ 75,000	\$ 80,250	\$ 88,275	\$ 98 [!!] 8	#REF!	#REF!
8							

FIGURE 3-7 Tracer arrow from cell E7 to cell F7

Step 4

Continue to click the **Trace Precedents** button until no more tracer arrows appear

Step 5

Scroll, if necessary, to view the tracer arrows to the worksheet range (M19:O21) containing the revenue growth data; note that the data for Year 5 is missing which causes the #REF! error value in cell F7

Your worksheet, showing all precedents, should look similar to Figure 3-8.

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
7 Revenues	\$75,000	\$80,250	\$88,275	\$98,838	#REF!	#REF!
8 Expenses						
10 Employee Expenses	10,000	10,700	11,449	12,250	13,108	44,399
11 Rent and Utilities	3,000	3,000	3,000	3,000	3,000	15,000
12 Computing Services	1,200	1,260	1,323	1,389	1,458	6,630
13 Supplies, Other	1,000	1,030	1,061	1,093	1,126	5,310
14 Total Expenses	15,200	15,990	16,833	17,732	18,692	84,447
15 Operating Income	\$59,800	\$64,260	\$71,442	\$81,136	#REF!	#REF!
16						
17						
18						
19						
20						
21						
22						

Formula Variables
Year 1 Revenues \$75,000
Revenue Growth Year 2 7%
Year 3 10%
Year 4 12%

FIGURE 3-8 Precedent cell tracer arrows to the range M19:O21

Step 6

Click the **Remove (All) Arrows** button arrow in the Formula Auditing group to view the menu

Step 7

Click **Remove Precedent Arrows** to remove the last tracer arrow created

Step 8

Click the **Remove (All) Arrows** button face to remove all the tracer arrows at one time

To identify the dependent cells to the formula in cell F7:

Step 1

Verify that cell **F7** is the active cell

Step 2

Click the **Trace Dependents** button in the Formula Auditing group

Step 3

Observe the two tracer arrows from cell F7 to cells F15 and G7

The formulas in cells F15 and G7 rely on the result of the formula in cell F7. Your worksheet should look similar to Figure 3-9.

	A	B	C	D	E	F	G
1	Rivers Call Center Services						
2	Five-Year Financial Forecast						
3	(\$000)						
4							
5		Year 1	Year 2	Year 3	Year 4	Year 5	Total
6							
7	Revenues	\$ 75,000	\$ 80,250	\$ 88,275	\$ 98 ! 8	#REF!	#REF!
8							
9	Expenses						
10	Employee Expenses	10,000	10,700	11,449	12,250	13,108	44,399
11	Rent and Utilities	3,000	3,000	3,000	3,000	3,000	15,000
12	Computing Services	1,200	1,260	1,323	1,389	1,458	6,630
13	Supplies, Other	1,000	1,030	1,061	1,093	1,126	5,310
14	Total Expenses	15,200	15,990	16,833	17,732	18,692	84,447
15	Operating Income	<u>\$ 59,800</u>	<u>\$ 64,260</u>	<u>\$ 71,442</u>	<u>\$ 81,136</u>	<u>#REF!</u>	<u>#REF!</u>
16							

FIGURE 3-9 Red dependent cell tracer arrows from cell F7 to cells F15 and G7

Step 4

Continue to click the **Trace Dependents** button until no more tracer arrows appear

Step 5

Observe the tracer arrow from cell G7 to cell G15; the formula in cell G15 relies on the formula results in cells G7 and F7

Step 6

Click the **Remove (All) Arrows** button face in the Formula Auditing group to remove all the tracer arrows

You can resolve the error value in cell F7 by adding the Year 5 growth data in the range P20:P21 and then updating the formula in the Formula Bar.

To resolve the #REF! error value in cell F7:

Step 1

Activate cell **P20**

Step 2

Enter **Year 5**

Step 3

Center **Year 5** in the cell

Step 4

Activate cell **P21**

Step 5

Enter **17**; the Percent Style with zero decimal places format is automatically applied

Step 6

Activate cell **F7**

Step 7

Edit the formula to replace the #REF! error value with the cell P21 cell reference; then enter the revised formula

Step 8

Format the cell to display zero decimal places

Step 9

Resize columns **F** and **G** to best fit, if necessary

7. Correcting the ‘Formula Omits Adjacent Cells’ error

The remaining suspected error in the *Financial Forecast* worksheet is in cell G10; the formula in cell G10 calculates total Employee Expenses for Years 1-5.

To review and resolve the error in cell G10 using the Trace Error button in the Formula Auditing group:

Step 1

Activate cell **G10**

Step 2

Observe the formula **=SUM(B10:E10)** in the Formula Bar

Step 3

Click the **Error Checking** button face in the Formula Auditing group on the Formulas tab to launch the Error Checking dialog box

Your Error Checking dialog box should look similar to Figure 3-10.

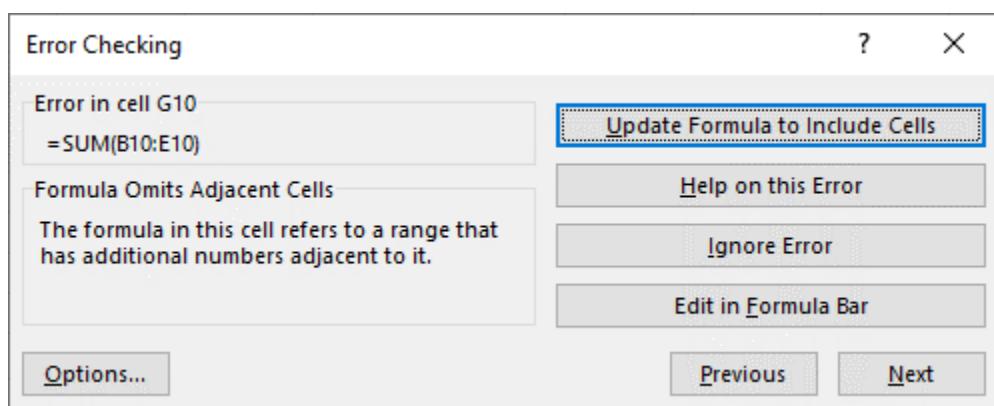


FIGURE 3-10 Error Checking dialog box

Step 4

Observe that the reason for the Error Indicator is that the formula does not include all the adjacent cells; the formula should be =B10:F10

Step 5

Click the **Update Formula to Include Cells** button in the dialog box

Step 6

Click **OK**; there are no more errors in the worksheet

Step 7

Observe the corrected formula in cell **G10**

Step 8

Activate cell **A1**

Step 9

Leave the workbook open for the next section

NOTE

You can also ‘go to’ or select precedent or dependent cells related to a formula using the Go To Special dialog box. Click the cell containing the formula; then click the Find & Select button in the Editing group on the Home tab and click Go To Special to launch the dialog box; then specify Precedents or Dependents options. Check it out!

NOTE

For more information on tracing formulas’ precedent or dependent cells, search Excel Help using the keywords “trace precedents.”

KEYBOARD SHORTCUTS

*You can click a cell containing a formula and then press the **CTRL+[,]** to select the formula’s direct precedent or the **CTRL+]** to select the formula’s direct dependents. Pressing **CTRL+SHIFT+{** or **CTRL+SHIFT+}** selects all precedents and dependents, respectively.*

Another common formula error is a circular reference.

Before continuing, however, you should complete Quiz 3-A.

B. Identifying and correcting a circular reference

1. Getting started

A **circular reference** in a formula is a cell reference that points to the cell that contains the formula. For example, suppose you accidentally enter the formula **=SUM(B6:B13)** in cell B13. This creates a circular

reference by attempting to add the values in the range B6:B13 and, at the same time, place the result of this addition in cell B13.

2. Creating a circular reference

If you create a circular reference, Excel displays a warning dialog box explaining the error, a Circular References: notation on the status bar, and adds a list of circular references to the **Error Checking button** menu in the Formula Auditing group.

To review this warning dialog box, status bar notation, and list of circular references, you deliberately create a formula containing a circular reference and then resolve that reference.

To create a formula containing circular reference:

Step 1

Activate the **Expense Analysis** worksheet

Step 2

Activate cell **A3** and then indicate that Excel should ignore the error indicator symbol

Step 3

Activate cell **B13**

Step 4

Key =SUM(

Step 5

Drag to select the range **B6:B13**; this range is incorrect and creates a circular reference error

Step 6

Press the **ENTER** key

A warning dialog box appears telling you that the formula you entered contains a circular reference. Your dialog box should look similar to Figure 3-11.

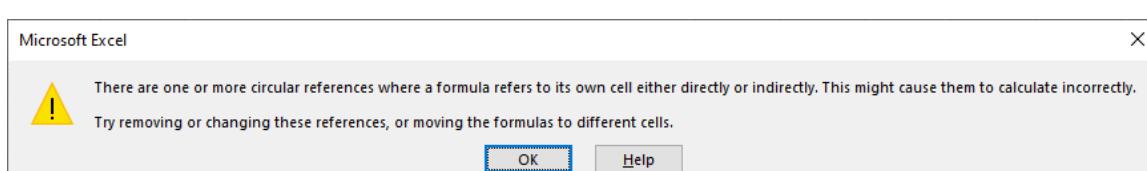


FIGURE 3-11 Circular reference warning dialog box

You can click OK to close the dialog box and view the circular reference notation on the status bar.

Step 7

Click **OK**

Step 8

Observe the circular references notation on the left side of the status bar

Step 9

Click the **Error Checking** button arrow in the Formula Auditing group

Step 10

Point to **Circular References** to view a submenu listing any circular references in the worksheet

Your list of circular references should look similar to Figure 3-12.

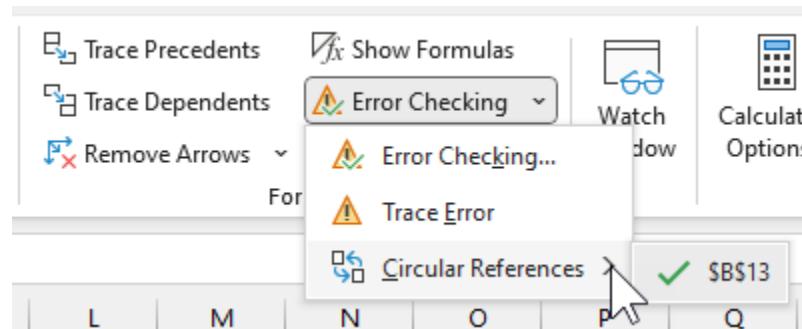


FIGURE 3-12 Circular References list

3. Correcting a circular reference

To resolve a circular reference, first click the cell reference in the Circular References list to activate the cell. Then trace the precedents to the cell to resolve the error.

To trace the precedent cells and resolve the error:

Step 1

Click the **\$B\$13** cell reference in the Circular References submenu to activate cell B13

Step 2

Click the **Trace Precedents** button in the Formula Auditing group

Step 3

Observe that the tracer arrow indicates that the cell B13 is a precedent cell to the calculation in cell B13—an obvious error; the formula in cell B13 should be $=SUM(B6:B12)$

Step 4

Click the **Remove (All) Arrows** button arrow in the Formula Auditing group

Step 5

Edit the formula in cell **B13** to replace the B13 cell reference with the B12 cell reference; then enter the formula

Step 6

Observe that the circular reference is resolved

NOTE

Excel provides a workaround if you want to retain a circular reference. See the circular reference Excel Help topics for more information on working with circular references.

You can quickly correct a cell reference error in a formula using drag and drop.

Before continuing, you should complete Quiz 3-B.

C. Selecting color-coded cell borders to correct a cell reference error in a formula

1. Getting started

When you edit a cell containing a formula, the formula's cell references and the borders of the corresponding cells are color-coded. You can drag a **color-coded cell border**, sometimes called the Range Finder, to a different cell, thereby changing the cell reference.

2. Correcting a formula error using color-coded cell borders

If the color-coded border surrounds a range, you can drag one of the border's corner "handles" or squares to add additional cells to the range or to remove cells from the range.

KEYBOARD SHORTCUT

You can press the F2 key to open a cell for editing. When the cell contains a formula, pressing the F2 key also displays the color-coded cell borders around the formula's cell references.

To create a formula with a cell reference error and then resolve the error by dragging a color-coded border to a different cell:

Step 1

Activate cell **C6**

Step 2

Enter the formula **=B6/B14**

Step 3

Observe that the cell contains the #DIV/0! error value

Step 4

Double-click cell **C6** to open the cell for editing

Step 5

Observe the blue and red color-coded cell references in the formula and the corresponding blue (B6) and red (B14) color-coded cell borders

Your worksheet should look similar to Figure 3-13.

	A	B	C
1	Rivers Call Center Services		
2	Five-Year Financial Forecast		
3		(\$000)	
4			
5		Expenses	Percent
6	Payroll	\$ 45,000	=B6/B14
7	Benefits	12,507	
8	Rent	10,000	
9	Utilities	5,000	
10	Computing Services	6,630	
11	Supplies	5,000	
12	Other	310	
13	Total Expenses	\$ 84,447	
14			
15			

FIGURE 3-13 Color-coded cells and cell references

Step 6

Move the mouse pointer to the red border of cell **B14**; the mouse pointer becomes a black, four-headed move pointer

Step 7

Drag the **red cell border** to cell **B13**

Step 8

Observe that the formula in cell C6 is now **=B6/B13**

Step 9

Press the **F4** key once to make the B13 cell reference an absolute reference

Step 10

Press the **ENTER** key

Step 11

Activate cell **C6**

Step 12

Apply the **Percent Style** with two decimal places using buttons in the Number group on the Home tab

Step 13

Drag the fill handle to copy the formula and formatting to the range **C7:C12**

To add a total percentage value and underline formatting to cells C12 and C13:

Step 1

Activate cell **C13**

Step 2

Click the **Sum** (AutoSum) button in the Function Library on the Formulas tab and press the **ENTER** key

Step 3

Activate cell **C12**

Step 4

Click the **Underline** button arrow in the Font group on the Home tab

Step 5

Click **Underline** to apply the Single Accounting underline format

Step 6

Activate cell **C13**

Step 7

Click the **Underline** button arrow

Step 8

Click **Double Underline** to apply the Double Accounting underline format

Step 9

Activate cell **A1**

Your worksheet should look similar to Figure 3-14.

A	B	C
1	Rivers Call Center Services	
2	Five-Year Financial Forecast	
3	(\$000)	
4		
5	Expenses	Percent
6	Payroll	\$ 45,000 53.29%
7	Benefits	12,507 14.81%
8	Rent	10,000 11.84%
9	Utilities	5,000 5.92%
10	Computing Services	6,630 7.85%
11	Supplies	5,000 5.92%
12	Other	310 0.37%
13	Total Expenses	\$ 84,447 100.00%
14		

FIGURE 3-14 Completed *Expense Analysis* worksheet

Step 10

Close the workbook

Sometimes it is useful to view a complex formula's calculations step by step.

You should complete Quiz 3-C before continuing.

D. Identifying how to step through a nested formula

1. Getting started

You learned how to create a complex formula using nested IF functions in Lesson 2. When an error occurs in a complex formula, it can be helpful to watch the formula's step-by-step calculations to find and correct the error.

2. Evaluating a complex formula

Watching a formula's step-by-step calculations is also a great way to learn more about a formula in an unfamiliar worksheet.

To step through a formula, click the **Evaluate Formula button** in the Formula Auditing group on the Formulas tab to launch the Evaluate Formula dialog box.

In this activity, you open a workbook that is linked to another workbook, you will see a Security Warning asking if you want to enable the content.

To open a workbook and launch the Evaluate Formula dialog box:

Step 1

Open the **Rivers Employees** workbook you created in Lesson 2

Step 2

Observe the Security Warning above the worksheet area

Step 3

Click the **Enable Content** button in the Security Warning to close the warning

Step 4

Activate cell **F17** on the *Employee Estimates* worksheet

Step 5

Click the **Formulas** tab on the ribbon, if necessary

Step 6

Click the **Evaluate Formula** button in the Formula Auditing group to launch the Evaluate Formula dialog box

The formula in cell F17 is shown in the Evaluation box in the Evaluate Formula dialog box. The dialog box on your screen should look similar to Figure 3-15.

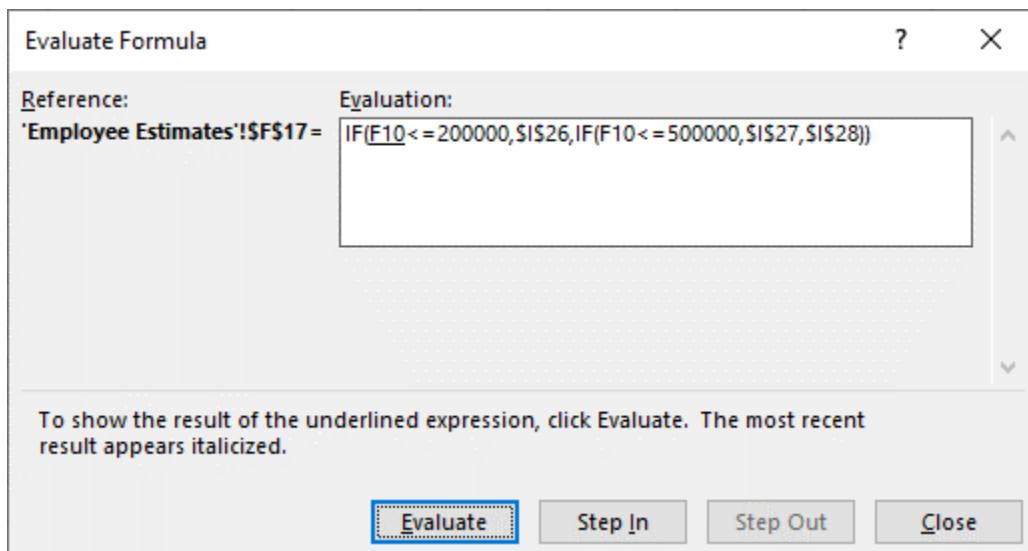


FIGURE 3-15 Evaluate Formula dialog box

You can click the dialog box Evaluate button to view the result of the expression that is underlined in the Evaluation box; continue clicking the Evaluate button to step through each expression in the formula. You can use the Step In and Step Out buttons to evaluate the result of a linked formula.

To step through the formula in cell F17:

Step 1

Observe that the cell reference F10 is underlined in the Evaluation box; F10 contains a 3-D formula that links to another workbook

Step 2

Click the **Step In** button; the formula which includes the path to the linked workbook appears in the Evaluation box

Step 3

Click the **Evaluate** button to replace the formula with its result—931,605—in the Evaluate dialog box

Step 4

Click the **Step Out** button to return to the evaluation of the original formula in F17

Step 5

Observe that the cell reference F10 has now been replaced by the formula result (931,605) and the entire mathematical expression is underlined

The Evaluate Formula dialog box on your screen should look similar to Figure 3-16.

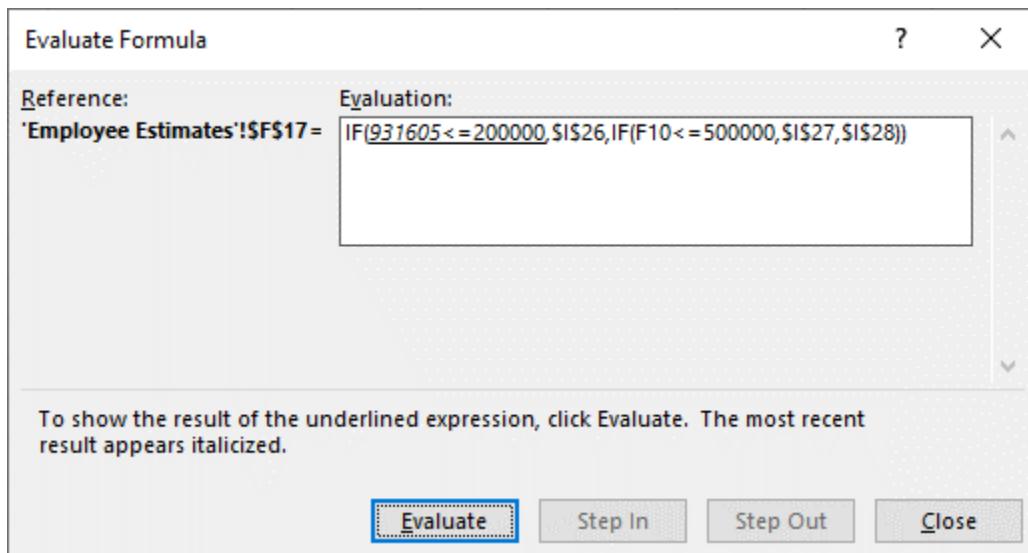


FIGURE 3-16 Evaluate Formula dialog box with F10 expression evaluated

Step 6

Click the **Evaluate** button to evaluate the mathematical expression as FALSE

Step 7

Observe that cell reference F10 in the nested IF function argument is now underlined; you can now evaluate this portion of the formula

The Evaluate Formula dialog box on your screen should look similar to Figure 3-17.

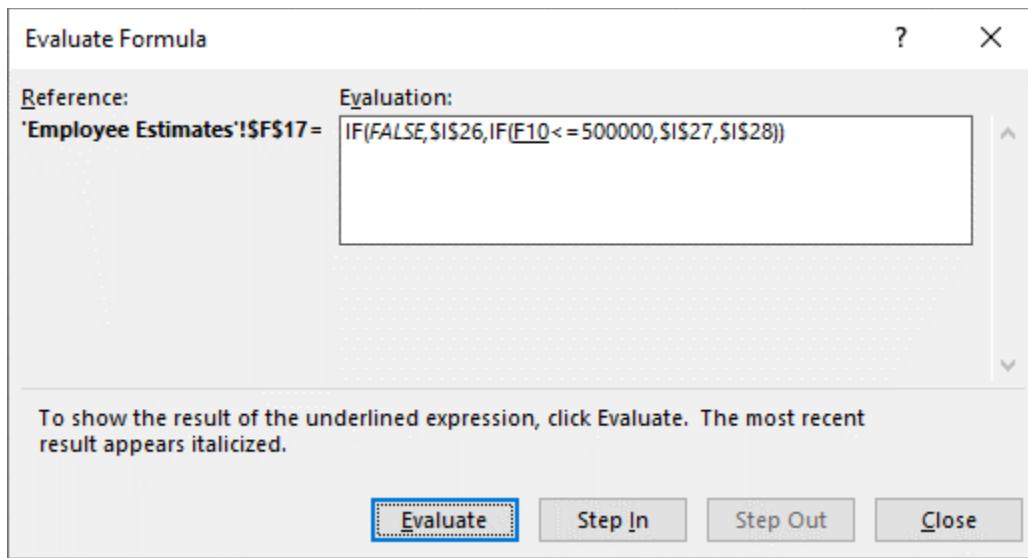


FIGURE 3-17 Evaluate Formula dialog box with mathematical expression evaluated as FALSE

Step 8

Click the **Evaluate** button

Step 9

Observe that the F10 cell reference is replaced with its value (931,605) and the entire mathematical expression is underlined

Step 10

Continue by clicking the **Evaluate** button to evaluate the remaining sections of the complex formula; when the evaluation is complete the Evaluate button becomes the Restart button and the formula's final result (1,000) appears in the Evaluation box

Step 11

Close the dialog box

Step 12

Close the workbook

The Trace Error feature, the Formula Auditing tools, manipulating cell reference borders, and stepping through nested formulas are all ways to identify and correct errors as you work in a worksheet.

Excel also offers great tools you can use to help you work with formulas in large worksheets, multiple worksheets linked by 3-D formulas, and multiple workbooks linked by 3-D formulas, including:

- the Watch Window,
- opening a workbook in multiple windows,
- splitting the worksheet view, and
- protecting or hiding formulas.

Before continuing, however, you should complete Quiz 3-D.

E. Identifying how to use the Watch Window and other tools to analyze, protect, and hide formulas

1. Getting started

It is helpful to be able to view the effect of changes to data in precedent cells on formulas' results; for example, when performing a what-if analysis or when you must revise the data.

Viewing the effect of your changes *as you make them* using the Watch Window can result in time-consuming worksheet or sheet tab scrolling when the active area of your worksheet is very large or when your worksheet is linked to other worksheets or workbooks with 3-D formulas.

An alternative to using the Watch Window to view the cells on more than one worksheet at a time is to display the active workbook in multiple windows; for example, when you are correcting an error or changing data in order to perform a what-if analysis.

Splitting a very large worksheet into separate viewing panes is another good way to visually review formula results or to watch changes to cells when performing a what-if analysis.

It is a good idea to protect formulas from change, especially when a workbook has more than one user. An alternative method of protecting formulas from change is to hide them.

2. Working with the Watch Window

You can prevent excessive scrolling by using the **Watch Window** to view changes to formulas' results as you change the contents of precedent cells in other areas of the worksheet or in other linked worksheets or workbooks.

You can display the Watch Window by clicking the **Watch Window button** in the Formula Auditing group on the Formulas tab.

To open and save a workbook and display the Watch Window:

Step 1

Open the **Lesson 3 Data File2** workbook

Step 2

Save the workbook as **Watching Cells**

Step 3

Activate the **Summary** worksheet, if necessary

Step 4

Click the **Formulas** tab on the ribbon, if necessary; then locate the Formula Auditing Group

Step 5

Click the **Watch Window** button in the Formula Auditing group

The Watch Window may appear anchored at the top or bottom of your screen or it may be floating on the top of the worksheet depending on where it was positioned the last time it was used.

Step 6

Drag the **Watch Window** up, if necessary, to anchor it below the ribbon

Your repositioned Watch Window should look similar to Figure 3-18.

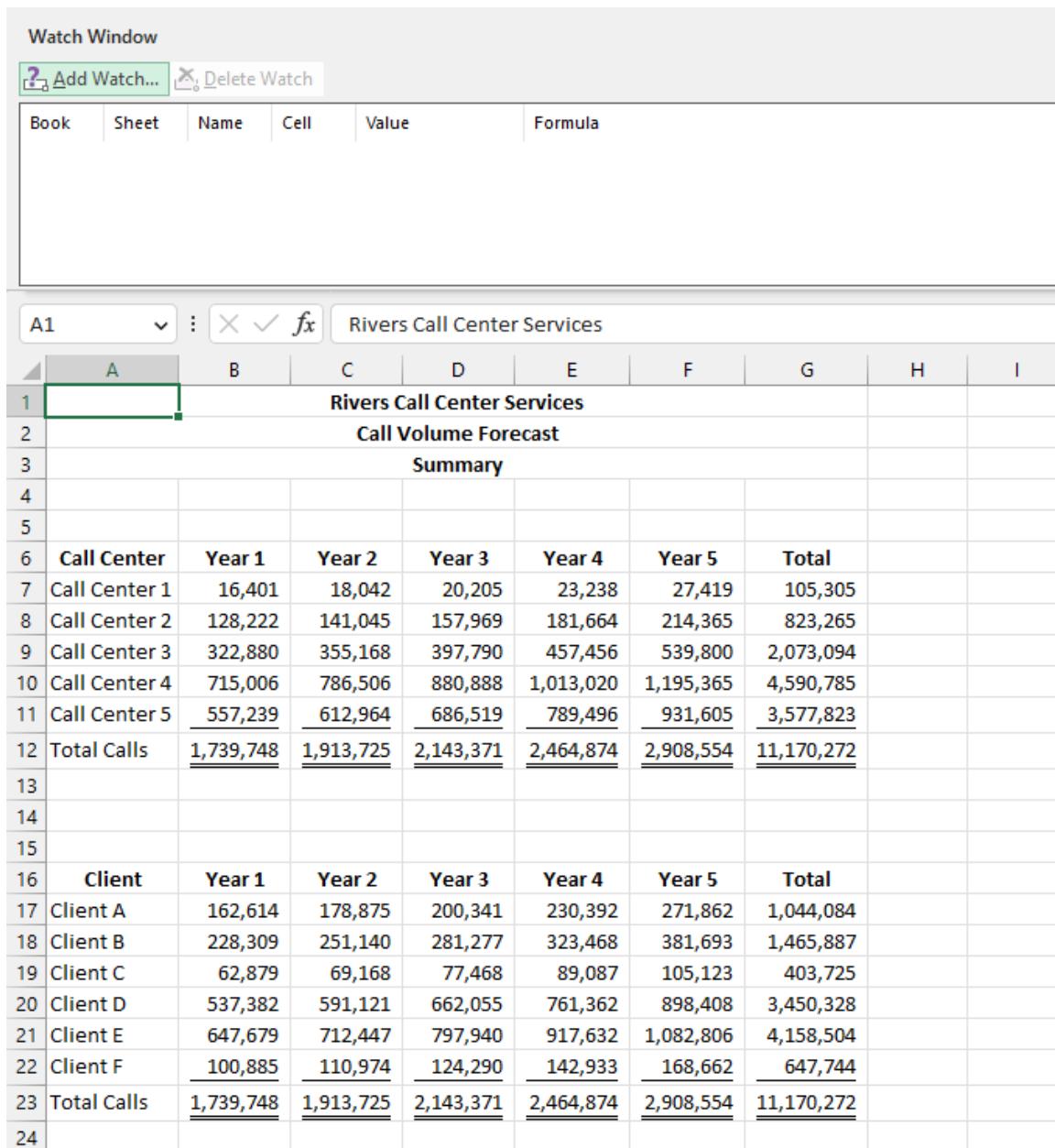


FIGURE 3-18 Watch Window

You can select the cells you want to watch and then click the Add Watch button in the Watch Window to add the cells to the toolbar. To remove cells from the Watch Window, first select the cell information in the toolbar and then click the Delete Watch button.

You can resize the columns in the Watch Window by dragging the column boundaries or double-clicking the column boundaries for the best fit. You can resize the Watch Window by dragging its boundaries with the black, double-headed sizing pointer.

To add the range B12:G12 to the Watch Window, resize the Book and Sheet columns to best fit, and resize the toolbar to display all the watched cells:

Step 1

Select the range **B12:G12** in the *Summary* worksheet

Step 2

Click the **Add Watch** button in the Watch Window

Step 3

Click the **Add** button in the Add Watch dialog box

Step 4

Double-click the **Book** column boundary in the Watch Window to resize the column to best fit

Step 5

Double-click the **Sheet** column boundary in the Watch Window to resize the column to best fit

Step 6

Move the mouse pointer to the bottom boundary of the Watch Window; the mouse pointer becomes a white, double-headed sizing pointer

Step 7

Drag the Watch Window's bottom boundary down as necessary until all the watched cell information is visible without scrolling the window

The partial Watch Window on your screen should look similar to Figure 3-19.

Book	Sheet	Name	Cell	Value	Formula
Watching Cells.xlsx	Summary		B12	1,739,748	=SUM(B7:B11)
Watching Cells.xlsx	Summary		C12	1,913,725	=SUM(C7:C11)
Watching Cells.xlsx	Summary		D12	2,143,371	=SUM(D7:D11)
Watching Cells.xlsx	Summary		E12	2,464,874	=SUM(E7:E11)
Watching Cells.xlsx	Summary		F12	2,908,554	=SUM(F7:F11)
Watching Cells.xlsx	Summary		G12	11,170,272	=SUM(B12:F12)

FIGURE 3-19 Resized Watch Window

The data and totals in the *Summary* worksheet are calculated using 3-D formulas that link to the data in cells in the *Call Center 1* through *Call Center 5* worksheets.

Now you change some of the data in the *Call Center 3* worksheet and, at the same time, watch the changes to the Years 1-5 totals on the *Summary* worksheet using the Watch Window.

To edit data and observe the changes to other cells using the Watch Window:

Step 1

Activate the *Call Center 3* worksheet

Step 2

Observe the *Summary* worksheet information in the Watch Window; the value of cell D12 is 2,143,371 and the value of G12 is 11,170,272

Step 3

Edit the contents of cell **D11** in the *Call Center 3* worksheet to be 192,154

Step 4

Observe the changes to the totals in the *Summary* worksheet as shown in the Watch Window; cell D12 is now 2,153,371 and G12 is now 11,180,272

When you are finished with the information in the Watch Window you should delete it before you close the toolbar.

To delete the information in the Watch Window and close the toolbar:

Step 1

Select all the information in the Watch Window using the SHIFT+click method

Step 2

Click the **Delete Watch** button in the Watch Window

Step 3

Click the **Close** button on the right side of the Watch Window to close the toolbar

Step 4

Activate cell **A1** on the *Summary* worksheet, if necessary

Step 5

Leave the workbook open for the next section

3. Displaying the active workbook in multiple windows

To open a new window containing the active workbook, click the New Window button in the Window group on the View tab.

Then click the Arrange All button in the Window group to open the Arrange Windows dialog box in which you can select an option for arranging the multiple workbook windows within the Excel window.

To display the *Summary* and *Call Center 5* worksheets in the active workbook in two separate workbook windows tiled within the Excel window:

Step 1

Click the **View** tab on the ribbon; then locate the Window group

Step 2

Click the **New Window** button in the Window group to create another document window with a copy of the same document

Step 3

Click the **Arrange All** button in the Window group on the View tab to open the Arrange Windows dialog box

Step 4

Click the **Tiled** option, if necessary

Step 5

Click **OK**

WARNING!

You should click the Windows of active workbook checkbox in the Arrange Windows dialog box to arrange only the multiple windows of the active workbook when more than one Excel workbook is open.

The workbook windows on your screen should look similar to Figure 3-20.

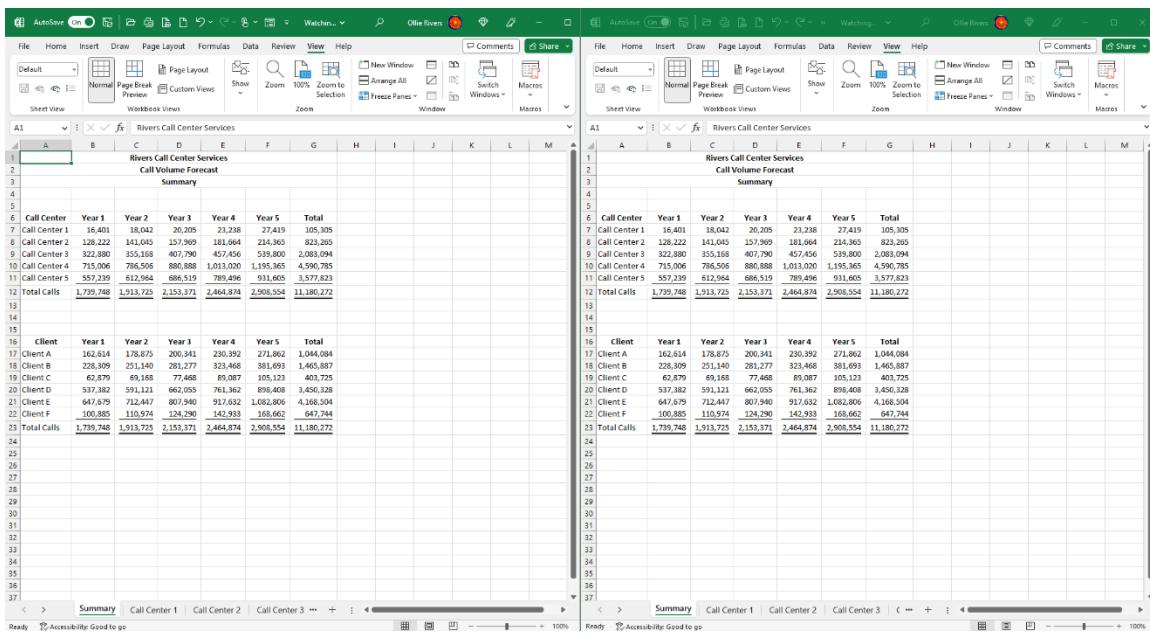


FIGURE 3-20 *Watching Cells* workbook displayed in two windows

When working with multiple workbook windows, only one window at a time is the active window and this is the window in which you can work. The name of the workbook on the title bar in the active window is darker than that in the inactive window. In Figure 3-20 the active window is *Watching Cells -2-* and the inactive window is *Watching Cells -1-*.

To work in another window, you must first activate that window by clicking the window, clicking the window's button on the taskbar, pressing the CTRL+F6 keys, or clicking the **Switch Windows** button in the Window group on the View tab.

To activate the workbook windows and the *Summary* worksheet in the *Watching Cells* workbook window:

Step 1

Click the **Watching Cells -2-** workbook window to make it the active window, if necessary

Step 2

Click the **Summary** sheet tab, if necessary, to make it the active worksheet

Next, you view the *Call Center 5* worksheet in the *Watching Cells -1-* workbook window.

Then you edit the data in cell B8 in the *Call Center 5* worksheet and, at the same time, watch the corresponding changes to the cells containing formulas—B11, B12, and B18—in the *Summary* worksheet. (Note: all the related formulas in the cells in the *Summary* worksheet recalculate; for this activity you just observe the changes to these three cells.)

To edit data in the *Call Center 5* worksheet and watch corresponding changes to some formulas' results in the *Summary* worksheet:

Step 1

Press the **CTRL+F6** keys to activate the *Watching Cells -1-* window

Step 2

Activate the **Call Center 5** worksheet; scroll the worksheet, if necessary, to view the worksheet

Step 3

Activate cell **B8**; this cell contains the Year 1 data for Client B

Step 4

Observe the cells B11, B12, and B18 in the *Summary* worksheet in the *Watching Cells 2* workbook window; these cells contain Year 1 total for Call Center 5 (B11) and Client B (B18) plus the grand total for Year 1 by call center (B12)

Step 5

Edit the contents of cell **B8** in the *Call Center 5* worksheet to be 34,789; observe the changes to the totals in the *Cell Center 5* worksheet

Step 6

Observe the changes to cells B11, B12, and B18 in the *Summary* worksheet

Your workbook windows should now look similar to Figure 3-21.

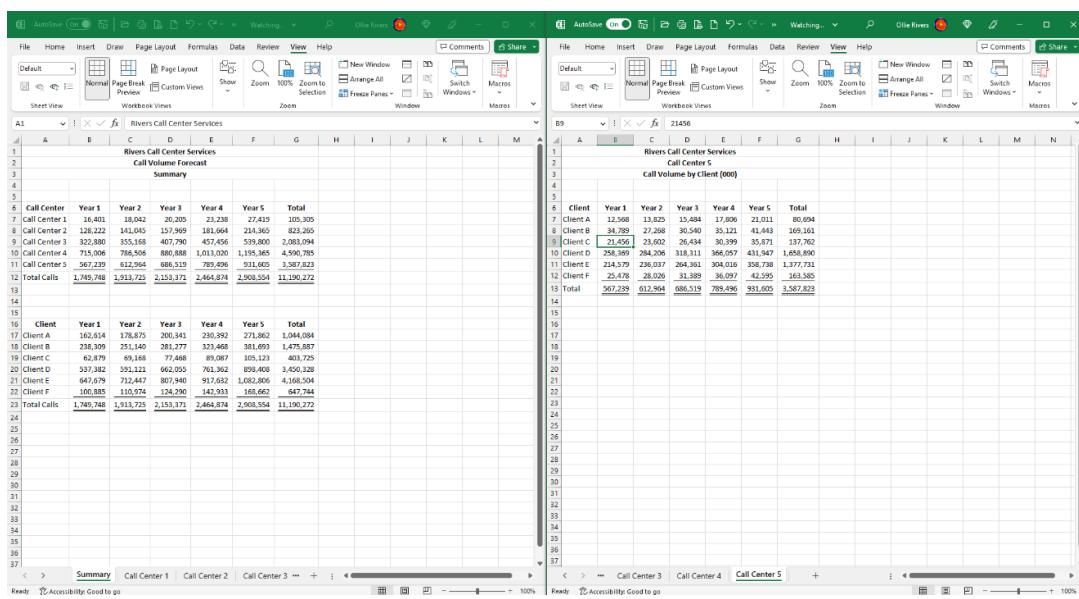


FIGURE 3-21 Edited Call Center 5 data and resulting changes to *Summary* worksheet

Step 7

Close the active workbook window; the remaining window now becomes the active window

Step 8

Maximize the remaining workbook window

Step 9

Close the workbook saving the changes, if asked

4. Splitting a single worksheet into multiple panes

Editing data, reviewing formulas, or performing a what-if analysis in a large worksheet can require excessive scrolling in order to view different areas of the worksheet.

One way to save time is to split the worksheet into scrollable viewing panes. You can then work in one pane and, at the same time, view the results of your changes in another pane.

You can split a worksheet into two or four viewing panes by clicking the Split button in the Window group on the View tab to insert **vertical** and/or **horizontal split bars**.

Whether one or two split bars are inserted depends on the position of the active cell.

- If the active cell is in column A (but not row 1), clicking the Split button inserts a horizontal split bar above the active cell resulting in two scrollable viewing panes.
- If the active cell is in row 1 (but not column A), clicking the Split button inserts a vertical split bar to the left of the active cell also resulting in two scrollable viewing panes.
- If the active cell is cell A1 (the home cell), clicking the Split button inserts both vertical and horizontal split bars, resulting in four viewing panes.
- If the active cell is not in column A or row 1—for example, cell C12—clicking the Split button also inserts both vertical and horizontal split bars at the position of the active cell.

To split a worksheet into four viewing panes from cell A1:

Step 1

Open the **Lesson 3 Data File3** workbook; verify that **A1** is the active cell

Step 2

Click the **View** tab, if necessary; then locate the Window group

Step 3

Click the **Split** button in the Window group

Step 4

Observe that the worksheet is now split into four viewing panes

Your worksheet split into four viewing panes should look similar to Figure 3-22.

FIGURE 3-22 Worksheet split into four viewing panes

You can drag a split bar with the mouse pointer to change the size of the viewing pane. You can also scroll the upper and lower left or right viewing panes to change your view of the worksheet's contents.

Step 5

Place the mouse pointer on the vertical split bar; the mouse pointer becomes a sizing pointer

Step 6

Drag the **vertical split bar** to the left and drop it between columns E and F so that only the Qtr 1 detail data are visible in the upper and lower viewing panes

Step 7

Observe the vertical and horizontal scrolling bars and buttons for the four panes

Step 8

Practice using the scroll bars or buttons to see how you can change the view of the data in the panes

Step 9

Scroll the **viewing panes** so that only the Total column, Column R, is visible in the right pane

Your split worksheet with resized viewing panes and scrolled content should now look similar to Figure 3-23.

	A	B	C	D	E	R	S
1							
2							
3							
4							
5	Client	January	February	March	Qtr 1	Total	
6	Client A	75	50	25	150	900	
7	Client B	50	35	40	125	900	
8	Client C	65	45	15	125	600	
9	Client D	125	75	100	300	1,425	
10	Client E	325	300	125	750	3,150	
11	Client F	55	70	125	250	1,925	
12	Total Call Center 1	695	575	430	1,700	8,900	
13							
14	Client A	50	65	35	150	1,250	
15	Client B	35	55	35	125	1,625	
16	Client C	25	65	35	125	1,225	
17	Client D	75	75	50	200	1,125	
18	Client E	125	100	125	350	2,700	
19	Client F	100	100	50	250	2,275	
20	Total Call Center 2	410	460	330	1,200	10,200	
21							
22	Client A	60	45	45	150	1,050	
23	Client B	35	40	50	125	525	
24	Client C	80	75	70	225	900	
25	Client D	65	60	75	200	1,025	
26	Client E	150	175	225	550	1,825	
27	Client F	95	75	80	250	1,375	
28	Total Call Center 3	485	470	545	1,500	6,700	
29							
30	Client A	15	25	35	75	925	
31	Client B	28	25	35	88	646	
32	Client C	100	75	50	225	985	
33	Client D	95	75	130	300	1,300	
34	Client E	325	325	275	925	3,580	
35	Client F	200	185	165	550	2,610	
36	Total Call Center 4	763	710	690	2,163	10,046	
37							

FIGURE 3-23 Split worksheet with resized viewing panes and scrolled data

You can now make changes to data visible in the upper-left pane and, at the same time, view the effect of your changes on the totals in both panes.

To change the data in cell C6 and watch the changes to the totals:

Step 1

Activate cell **C6** in the upper-left pane

Step 2

Enter **100** in the cell

Step 3

Observe the changes to month, call center, client, and grand totals

Step 4

Click the **Undo** button on the Quick Access Toolbar or the Undo/Redo group on the ribbon Home tab

You can quickly remove a split bar by double-clicking it or dragging it up above row 1 or to the left of column A.

TIME-SAVER

You can also remove a split bar by dragging it to the right of the last worksheet column (XFD) or below the last worksheet row (1048576). For more information about splitting a worksheet into viewing panes, see Excel Help.

To remove the split bars:

Step 1

Double-click the **vertical split bar** to remove it

Step 2

Double-click the **horizontal split bar** to remove it

Step 3

Close the workbook

NOTE

The Split button toggles on and off the split bars; you can remove both split bars at one time by clicking the Split button.

5. Protecting and unprotecting cells

Suppose you develop a workbook's structure, worksheets' layouts, and formulas and then pass the workbook on to someone else to enter or edit data in the worksheets. You may want to protect the

contents of certain worksheet cells—such as those containing formatted headings or formulas—so that the contents cannot be accidentally or deliberately changed or deleted.

You can do this by protecting a worksheet's locked cells. You can also hide the formulas in a worksheet by protecting the worksheet.

You can protect a worksheet's **locked cells** and **hidden formulas** by clicking the **Protect Sheet** button in the Protect group on the Review tab or the Format Cells menu in the Cells group on the Home tab.

If you want others to have access to certain cells for data entry, you must first select and unlock those cells before you protect the worksheet. You can unlock or lock cells and hide formulas using options in the Protection tab in the **Format Cells dialog box**. You can launch the Format Cells dialog box by pressing the **CTRL+1** keys using the **1** key at the top of the keyboard.

To open and save a workbook and then unlock cells for data entry:

Step 1

Open the **Lesson 3 Data File4** workbook

Step 2

Save the workbook as **Protecting Cells**

Step 3

Activate the **Financial Forecast** worksheet, if necessary

Step 4

Select the range **B10:F13**, cell **M19**, and the range **M21:P21** using the **CTRL+click** method; these are the cells containing variable data

Step 5

Press the **CTRL+1** keys to launch the Format Cells dialog box

Step 6

Click the **Protection** tab, if necessary

Step 7

Click the **Locked** checkbox to *remove* the check mark

Step 8

Click **OK** to unlock the selected cells

Step 9

Activate cell **A1**

Locking or unlocking cells has no effect on a worksheet until the worksheet is protected.

To protect the worksheet:

Step 1

Click the **Home** tab, if necessary, and locate the Cells group

Step 2

Click the **Format** button in the Cells group to view the Format menu

Step 3

Click the **Protect Sheet** command to open the Protect Sheet dialog box

You can add a password and select which tasks you want users to be able to perform on the worksheet in this dialog box. The Protect Sheet dialog box on your screen should look similar to Figure 3-24.

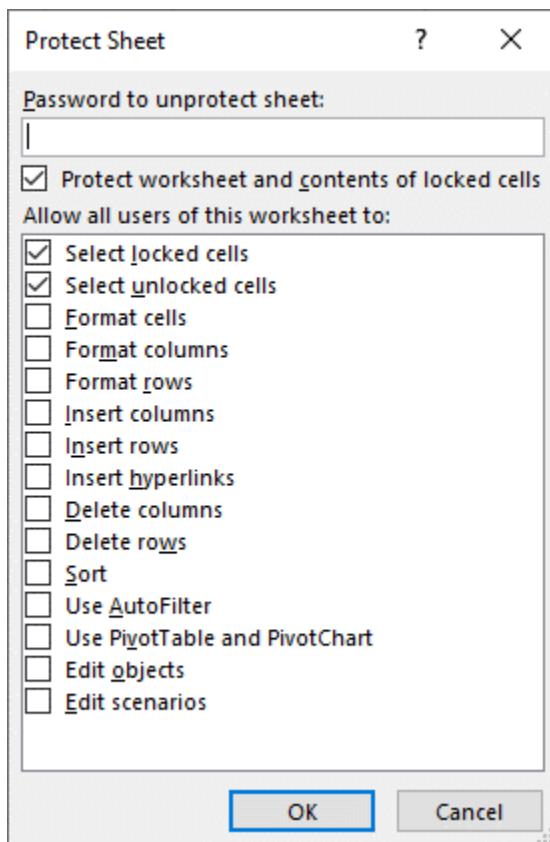


FIGURE 3-24 Protect Sheet dialog box

Using a password when you protect a worksheet prevents others from removing the protection.

WARNING!

Be very careful when password-protecting a worksheet. Be certain to use a password that is easy to remember and keep a record of the password. If you forget the password, you are unable to access the protected cells.

You assign a simple, easy-to-remember word as the password. However, the password you choose for your own worksheets should be both easy to remember and difficult for others to guess.

Step 4

Key **password** in all lowercase characters in the Password to unprotect sheet text box

Step 5

Click the **Select locked cells** checkbox to insert a check mark, if necessary

Step 6

Click the **Select unlocked cells** checkbox to insert a check mark, if necessary

Step 7

Click the remaining option checkboxes to remove the check marks, if necessary

Step 8

Click **OK**

Step 9

Key **password** in all lowercase characters to confirm it as the password

Step 10

Click **OK**

Now you are ready to test your cell protection by selecting cells and attempting to edit cell contents.

To attempt to edit locked cells:

Step 1

Double-click cell **A1** to open it for editing

Step 2

Observe the warning dialog box telling you that cell A1 is on a protected sheet

Step 3

Click **OK**

Cell A1 remained locked; therefore, it was protected as read-only when you protected the worksheet. You cannot edit or format the contents of cell A1.

Step 4

Activate cell **B7** which contains a visible formula

Step 5

Double-click cell **B7** to open it for editing

Step 6

Observe the warning dialog box

Step 7

Click **OK**

Cell B7 is a read-only cell; you cannot edit its contents. The formula in cell B7 is visible because you did not select the cell and hide the formula before you protected the worksheet.

Step 8

Double-click cell **D13**

Step 9

Observe that the cell opens for editing

Step 10

Edit the number 1,061 to be 1,051

Step 11

Press the **ENTER** key

Cell D13 is one of the cells you unlocked before you protected the worksheet; therefore, you can edit and format its contents.

NOTE

You can select and password protect specific ranges on a worksheet using the Allow Edit Ranges button in the Protect group on the Review tab. For more information on protecting your worksheets and workbooks, search for worksheet and workbook protection topics in Excel Help.

Suppose you also want to hide the formulas from view in the *Financial Forecast* worksheet. One way to do this is to turn off the option in the **Protect Sheet dialog box** that allows users to select locked cells. If users cannot select the locked cells containing formulas, then they cannot view the formulas in the Formula Bar.

Another way is to hide the formulas using the option in the Protection tab of the Format Cells dialog box. To make either of these changes, you must first unprotect the worksheet. Then make your changes and protect the worksheet again.

To unprotect the worksheet:

Step 1

Click the **Format** button in the Cells group on the Home tab

Step 2

Click **Unprotect sheet**

Step 3

Key **password** in all lowercase characters in the Password text box

Step 4

Click **OK** to unprotect the worksheet; the cells previously unlocked remain unlocked

6. Hiding formulas

To hide the formulas in the *Financial Forecast* worksheet, you must first select all the cells containing formulas. A quick way to do this is to click the **Find & Select** button in the Editing group on the Home tab and click Go To Special to launch the **Go To Special dialog box**; then click the Formulas option button.

To select all the cells containing formulas:

Step 1

Click the **Find & Select** button in the Editing group on the Home tab to view the Find & Select menu

Step 2

Click **Go To Special** to launch the Go To Special dialog box

Step 3

Click the **Formulas** option button

Step 4

Click **OK**

Step 5

Observe that all the cells containing formulas are selected

To hide the formulas:

Step 1

Press the **CTRL+1** keys

Step 2

Click the **Protection** tab, if necessary

Step 3

Click the **Hidden** checkbox to insert a check mark, if necessary

Step 4

Click **OK**

Step 5

Activate cell **A1**

To protect the worksheet again:

Step 1

Click the **Format** button in the Cells group on the Home tab

Step 2

Click **Protect Sheet**

Step 3

Key **password**

Step 4

Click **OK**

Step 5

Key **password**

Step 6

Click **OK**

Now you can still select a cell containing a formula; however, the formula itself is not visible.

Step 7

Activate cell **B7**

Step 8

Observe that the Formula Bar is empty

The locked cell B7 contains the formula =M19 and the formula result, \$75,000; protecting the worksheet both hides the formula from view and prevents the contents of the cell from being edited.

Step 9

Close the workbook; save it if asked

In this lesson, you learned how to use a variety of Excel tools to identify and correct errors, such as the Trace Error feature, the Formula Auditing tools, and color-coded cell borders.

You also learned how to visually evaluate formulas in large worksheets, workbooks with linked worksheets, and multiple linked workbooks.

Finally, you learned how to protect a worksheet in order to protect cell contents and hide formulas.

Now you are ready to complete Quiz 3-E and the Final Exam.

Microsoft 365: Working with Excel Formulas and Functions

Lesson 1 Quiz Questions

Quiz 1-A

1. You begin an Excel formula by keying _____.

A	an apostrophe	Incorrect: an apostrophe is not used to begin a formula in Excel.
B	a minus sign	Incorrect: the minus sign is used to indicate a subtraction operation in an Excel formula.
C	the equal sign	Correct: the equal sign tells Excel that what follows is a formula and not just text or a value (Section 1-A).
D	an open parenthesis	Incorrect: an open parenthesis is paired with a closing parenthesis to change the order of precedence of mathematical operations in an Excel formula.

2. You can quickly navigate to a cell or range by entering the cell or range reference in the _____.

A	Name Box	Correct: keying a cell or range reference in the Name Box and pressing the ENTER key scrolls through the worksheet, if necessary, and activates or selects the cell or range (Section 1-A).
B	Formula Bar	Incorrect: the formula bar shows you the contents of the active cell.
C	status bar	Incorrect: the status bar contains messages and the calculation options.
D	Navigate Box	Incorrect: there is no Navigate Box in the Excel window.

3. The Define Name button is located in the Defined Names group on the ribbon _____ tab.

A	Data	Incorrect; the Data tab on the ribbon does not contain the Defined Names group.
B	References	Incorrect; there is no References tab on the Excel ribbon.
C	Insert	Incorrect; the Insert tab on the ribbon does not contain the Define Name button.
D	Formulas	Correct; the Formulas tab on the ribbon contains the Defined Names group of related buttons (Section 1-A).

4. You can quickly name a range by selecting a range of cells and then keying the defined name in/on the _____.

A	Formulas text box in the Excel Options dialog box	Incorrect; you cannot define a range name in the Formulas text box in the Excel Options dialog box.
B	Name Box	Correct; keying a defined name for a selected range in the Name Box is a shortcut for naming a range (Section 1-A).
C	Quick Access Toolbar's Name Here tab	Incorrect; there is no Name Here tab on the Quick Access Toolbar.
D	Defined Name text box on the Formulas tab	Incorrect; there is no Defined Name text box on the Formulas tab.

Quiz 1-B

1. _____ references are used by default when Excel pastes or fills formulas.

A	Absolute	Incorrect; absolute references must be manually specified in a formula to be copied/pasted or filled.
B	Mixed	Incorrect; you must indicate a mixed reference by inserting a symbol in the row or column reference in a formula to be copied/pasted or filled.
C	Relative	Correct; by default, Excel pastes or fills formulas with relative references that automatically change based on the formula's destination cell (Section 1-B).
D	Fixed	Incorrect; the term "fixed" is not used to define copied and pasted formula cell references.

Quiz 1-C

1. Which of the following buttons on the ribbon Home tab is used to quickly insert a formula containing one of several commonly used functions, such as MIN, MAX, or AVERAGE?

A		Incorrect: the button is used to change the font color.
B		Correct: the button displays a list of commonly used functions, such as MIN and AVERAGE, which can be inserted in the active cell (Section 1-C).
C		Incorrect: the button is used to change the font.
D		Incorrect: the button is used to change the orientation of row headings.

2. The _____ contains options for performing quick calculations without creating a formula.

A	customizable status bar	Correct: you can use a shortcut menu to add common calculations to the status bar that do not require manually creating a formula. Then, you can select relevant data in the worksheet to view the calculated results (Section 1-C).
B	Quick Access Toolbar	Incorrect: you cannot add common calculations to the Quick Access Toolbar.
C	File tab	Incorrect: the File tab contains commands for creating, opening, and saving a workbook and printing worksheets.
D	Home tab	Incorrect: the Home tab does not contain any features for performing quick calculations without creating a formula.

Quiz 1-D

1. Which of the following formulas contains an absolute reference?

A	(B3+C3)/\$A3	Incorrect: the formula (B3+C3)/\$A3 contains a mixed reference: \$A3. The column reference will stay the same, but the row reference can change when the formula is copied and pasted into another cell.
B	(B3+C3)/A\$3	Incorrect: the formula (B3+C3)/A\$3 contains a mixed reference: A\$3. The row reference will stay the same, but the column reference can change when the formula is copied and pasted into another cell.
C	(B3+C3)/A3	Incorrect: the formula (B3+C3)/A3 contains only relative references that can change when the formula is copied and pasted into another cell.
D	(B3+C3)/\$A\$3	Correct: the formula (B3+C3)/\$A\$3 contains an absolute reference: \$A\$3. Neither the column reference nor the row reference will change when the formula is copied and pasted into another cell (Section 1-D).

2. The error value #DIV/0! indicates that a formula _____.

A	cannot be copied	Incorrect: Excel does not provide an error value to indicate that a formula cannot be copied.
B	is attempting to divide by zero	Correct: Excel displays the #DIV/0! error value when a formula attempts to divide by a zero value or a cell reference for a cell that is empty (Section 1-D).
C	contains a mixed reference	Incorrect: inserting a mixed reference in a formula does not result in an error condition.
D	contains a duplicate reference	Incorrect: Excel does not provide an error value when a cell reference is inserted—correctly or incorrectly—more than one time in a formula.

Quiz 1-E

1. You can copy formulas and then replace them with their calculated values using an option in the _____ dialog box.

A	Paste	Incorrect: there is no Paste dialog box.
B	Paste Special	Correct: you can permanently replace formulas with their calculated results by copying the formulas and pasting them into their original cells as values (Section 1-E).
C	Paste Formulas	Incorrect: there is no Paste Formulas dialog box.
D	Paste Calculations	Incorrect: there is no Paste Calculations dialog box.

Lesson 2 Quiz Questions

Quiz 2-A

1. To group adjacent worksheets, use the _____.

A	ENTER+click method	Incorrect: there is no ENTER+click method for grouping worksheets.
B	ALT+click method	Incorrect: there is no ALT+click method for grouping worksheets.
C	TAB+click method	Incorrect: there is no TAB+click method for grouping worksheets.
D	SHIFT+click method	Correct: you can activate a worksheet, press and hold down the SHIFT key, and then click another sheet tab to group all adjacent worksheets (Section 2-A).

Quiz 2-B

1. A 3-D formula that spans worksheets in the same workbook contains cell references and a _____.

A	workbook reference	Incorrect: a workbook reference appears in a 3-D formula that spans workbooks.
B	Formula Bar reference	Incorrect: there is no Formula Bar reference.
C	worksheet reference	Correct: a 3-D formula that spans worksheets contains a reference to the worksheet range, such as Call Center 1:Call Center 5, in addition to cell references (Section 2-B).
D	Name Box reference	Incorrect: there is no Name Box reference.

2. Which of the following is a valid linking formula?

A	D3*(A3/B3)	Incorrect: D3*(A3/B3) is a basic formula that does not link to another worksheet or workbook.
B	'Call Center 1'!B13	Correct: the formula 'Call Center 1'!B13 links the active cell to cell B13 on the Call Center 1 worksheet (Section 2-B).
C	'Call Center 5'?B15	Incorrect: the formula 'Call Center 5'?B15 is not a valid linking formula because of invalid syntax.
D	F8/(G8*H8)=link 'Summary'	Incorrect: the combination F8/(G8*H8)=link 'Summary' is not constructed as a valid formula.

Quiz 2-C

1. In the following IF statement example, which argument indicates the calculation to be performed if the primary IF statement's logical test is false?

=IF(B6<=200000,\$I\$26,IF(B6<=500000,\$I\$27,\$I\$28))

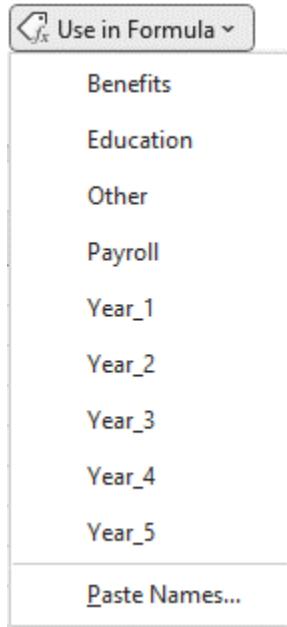
A	B6<=2000000	Incorrect: the B6<=2000000 argument is the statement's logical test.
B	\$I\$26	Incorrect: the \$I\$26 argument indicates the action to be taken if the statement's logical test is true.
C	IF(B6<=500000, \$I\$27, \$I\$28)	Correct: the IF(B6<=500000, \$I\$27, \$I\$28) argument indicates the action to be taken if the statement's logical test is false (Section 2-C).
D	\$I\$27	Incorrect: the \$I\$27 argument indicates the action to be taken if the nested IF statement's logical test is true.

2. Which of the following buttons can you click to collapse the Function Arguments dialog box?

A		Correct: the button in the Function Arguments dialog box is clicked to collapse the dialog box to view and select cells in the underlying worksheet (Section 2-C).
B		Incorrect: the button is used to view options for customizing the Quick Access Toolbar.
C		Incorrect: the button is clicked to launch the Insert Function dialog box.
D		Incorrect: the button launches the Macro dialog box.

Quiz 2-D

1. Which of the following best explains the list in the following figure which appears when you click a button in the Define Names group on the Formulas tab?



A	A list of data ranges in the worksheet.	Incorrect; there is no button in the Define Names group that displays a list of data ranges in the worksheet.
B	A list of sheet tabs.	Incorrect; the shortcut menu that lists sheet tab names does not include the Paste Names command.
C	A list of worksheet row and column labels that can be used as formula arguments.	Correct; you can select and define column and row labels as defined names; then you can click the Use in Formula button to view a list of column and row labels defined as names that can be used as formula arguments (Section 2-D).
D	A list of functions used in the worksheet.	Incorrect; the list in the figure does not represent a list of functions.

Quiz 2-E

1. You can specify conditional formatting rules by clicking the Conditional Formatting button in the Styles group on the _____ tab.

A	Apply	Incorrect: there is no Apply tab on the Excel ribbon.
B	Home	Correct: clicking the Conditional Formatting button in the Styles group on the Home tab displays a list of conditional formatting rule categories (Section 2-E).
C	Data	Incorrect: the Data tab does not contain the Conditional Formatting button.
D	View	Incorrect: the View tab does not contain the Conditional Formatting button.

2. You can quickly apply conditional formatting based on formula variables by clicking the Formatting category in the _____ gallery.

A	Quick Analysis	Correct: clicking Formatting in the Quick Analysis gallery displays conditional formatting options (Section 2-E).
B	Paste Options	Incorrect: the Paste Options gallery contains options for pasting copied cell contents.
C	Special Formatting	Incorrect: there is no Special Formatting button or gallery.
D	Set Formatting Rules	Incorrect: there is no Set Formatting Rules button or gallery.

Lesson 3 Quiz Questions

Quiz 3-A

1. Which of the following Trace Error icon menu commands should you click to quickly resolve the error indicated in cell A3 in the following figure?

A	B	C	D	E	F	G
1						
2						
3						

Rivers Call Center Services
Five-Year Financial Forecast
(\$000)

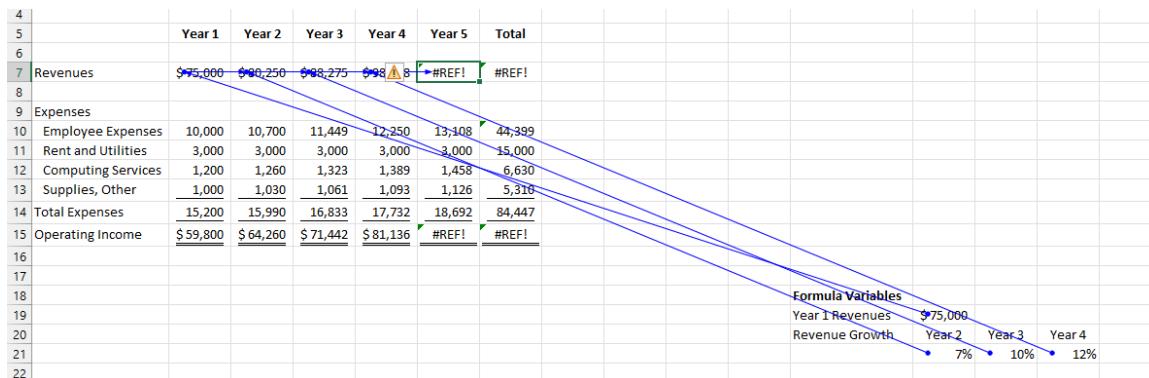
A	Convert to Number	Incorrect: you do not want to convert the contents of cell A3 to a number. The error indicator appears because an apostrophe is used to convert the commonly used financial notation (\$000) to text.
B	Edit in Formula Bar	Incorrect: the notation (\$000) is correct so there is no need to edit the contents of cell A3 in the formula bar.
C	Ignore Error	Correct: you should click the ignore error indicator, which indicates the notation (\$000) is shown as text instead of a number (Section 3-A).
D	Error Checking Options	Incorrect: there is no need to click Error Checking Options to launch the Formulas pane in the Excel Options dialog box based on this error indicator.

2. Which of the following solutions is the best approach to resolving the #NAME? error values in cell C14 and C15 in the following figure?

	A	B	C	D
1	Rivers Call Center Service			
2	Five-Year Financial Forecast			
3	(\$000)			
4				
5		Year 1	Year 2	Year 3
6				
7	Revenues	\$ 75,000	\$ 80,250	\$ 88,275
8				
9	Expenses			
10	Employee Expenses	10,000	10,700	11,449
11	Rent and Utilities	3,000	3,000	3,000
12	Computing Services	1,200	1,260	1,323
13	Supplies, Other	1,000	1,030	1,061
14	Total Expenses	15,200	#NAME?	16,833
15	Operating Income	\$ 59,800	#NAME?	\$ 71,442
16				

A	Correct the spelling of the function name in the formula in cell C14	Correct: a function name is misspelled in the formula in cell C14, and correcting its spelling resolves the error values in both cells (Section 3-A).
B	Correct the cell references in the formula in cell C14	Incorrect: the #NAME? error value does not indicate any invalid cell references in cell C14.
C	Replace the invalid argument in the formula in cell C14	Incorrect: the #NAME? error value does not indicate invalid arguments in the formula in cell C14.
D	Convert the text in cell C14 into a number	Incorrect: the #NAME? error value does not indicate a need to convert text to a number in the formula in cell C14.

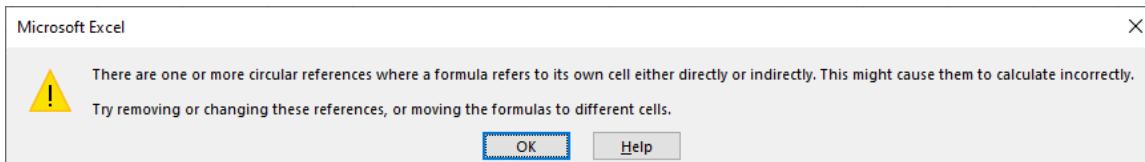
3. You should click the _____ button in the Formula Auditing group to achieve the results in the following figure.



A		Incorrect; the button is not clicked to show the relationships between cells.
B		Incorrect; the button does not use colored lines and arrows to illustrate the relationships between cells.
C		Incorrect; the button does produce the results shown in the figure.
D		Correct; the button adds blue tracer arrows to the active cell from cells that provide data to the active cell (Section 3-A).

Quiz 3-B

1. Which of the following formulas entered in cell A4 results in launching the dialog box illustrated in the following figure?



A	=SUM(A1:A3)	Incorrect; the formula =SUM(A1:A3) does not contain a circular reference.
B	=SUM(A1:J1)	Incorrect; the formula =SUM(A1:J1) adds the values in the range A1:J1 and does not create a circular reference.
C	=SUM(A1:A4)	Correct; the formula =SUM(A1:A4) creates a circular reference by including a cell reference for the cell in which the formula resides (Section 3-B).
D	=SUM(A1:A2)	Incorrect; the formula =SUM(A1:A2) does not create a circular reference.

2. You can resolve a circular reference by tracing the _____ cells to the cell that contains the circular reference and identifying what correction needs to be made.

A	precedent	Correct; tracing precedent cells can help identify the cause of a circular reference (Section 3-B).
B	formatted	Incorrect; formatting is not the cause of a circular reference.
C	empty	Incorrect; an empty cell is not the cause of a circular reference.
D	locked	Incorrect; by default, all worksheet cells are locked unless selected and unlocked. Whether or not a cell is locked has no bearing on a circular reference in a formula.

Quiz 3-C

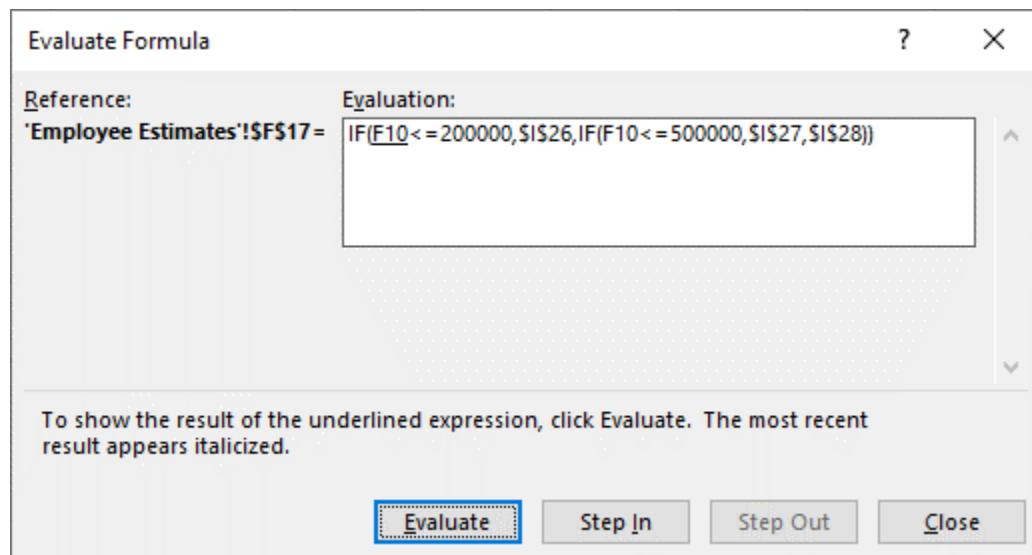
1. Which of the following is a quick way to resolve the formula error in the following figure.

	A	B	C
1	Rivers Call Center Services		
2	Five-Year Financial Forecast		
3	(\$000)		
4			
5		Expenses	Percent
6	Payroll	\$ 45,000	=B6/B14
7	Benefits	12,507	
8	Rent	10,000	
9	Utilities	5,000	
10	Computing Services	6,630	
11	Supplies	5,000	
12	Other	310	
13	Total Expenses	\$ 84,447	
14			
15			

A	Dragging the colored border around cell B14 to cell B13	Correct: a quick way to correct a cell reference error in a formula is to activate the cell that contains the formula to view the color-coordinated cell references and cell borders. Then drag a colored cell border to the correct cell to update the cell reference in the formula (Section 3-C).
B	Double-clicking cell B6	Incorrect: the error is not caused by the value in cell B6.
C	Dragging the colored border around cell B14 to cell C6	Incorrect: dragging the colored border from cell B14 to cell C6 creates a circular reference and an invalid formula.
D	Dragging the colored border around cell B6 to cell B13.	Incorrect: dragging the colored border from cell B6 to cell B13 does not correct the formula error in cell C6.

Quiz 3-D

1. Which of the following buttons can you click to launch the dialog box illustrated in the following figure?



A	Name Manager	Name Manager Incorrect: clicking the button launches the Name Manager dialog box.
B	Evaluate Formula	Evaluate Formula Correct: clicking the button launches the illustrated Evaluate Formula dialog box and allows you to step through a complex formula to identify errors (Section 3-D).
C	Calculate Now	Calculate Now Incorrect: clicking the button calculates all the formulas in a workbook when automatic calculation is turned off.
D	Calculation Options ▾	Calculation Options ▾ Incorrect: clicking the button does not launch the illustrated dialog box.

Quiz 3-E

1. You can display the _____, illustrated in the following figure, to view changes to formulas' results as you change the precedent data without excessively scrolling your worksheet.

Watch Window					
		Add Watch...	Delete Watch		
Book	Sheet	Name	Cell	Value	Formula
Watching Cells.xlsx	Summary		B12	1,739,748	=SUM(B7:B11)
Watching Cells.xlsx	Summary		C12	1,913,725	=SUM(C7:C11)
Watching Cells.xlsx	Summary		D12	2,143,371	=SUM(D7:D11)
Watching Cells.xlsx	Summary		E12	2,464,874	=SUM(E7:E11)
Watching Cells.xlsx	Summary		F12	2,908,554	=SUM(F7:F11)
Watching Cells.xlsx	Summary		G12	11,170,272	=SUM(B12:F12)

A	Watch Cells dialog box	Incorrect: there is no Watch Cells dialog box; additionally, the illustration does not have the standard dialog box Close and Help buttons.
B	Watch Changes list	Incorrect: there is no window named the Watch Changes list.
C	Watch Window	Correct: you can display the Watch Window to view changes to formulas' results as you change the formulas' precedent data (Section 3-E).
D	Watch Formulas toolbar	Incorrect: there is no Watch Formulas toolbar.

2. Which of the following buttons can you click to open another window for the same workbook?

A	 New Window	 New Window Correct: clicking the _____ button creates another window containing the same workbook (Section 3-E).
B	 Freeze Panes ▾	 Freeze Panes ▾ Incorrect: the _____ button does not open another workbook window.
C	 Custom Views	 Custom Views Incorrect: clicking the _____ button saves your display and print settings that can be reapplied later.
D	 Switch Windows ▾	 Switch Windows ▾ Incorrect: clicking the _____ button allows you to switch between open workbook windows.

3. Which of the following actions does NOT remove a split bar?

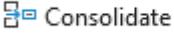
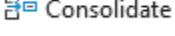
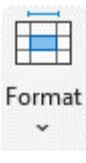
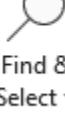
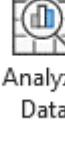
A	Double-clicking the horizontal split bar	Incorrect: double-clicking the horizontal split bar removes the split bar.
B	Dragging the horizontal split bar below row 1 and above row 1048576	Correct: dragging the horizontal split bar below row 1 and above the last row in the worksheet retains the split bar (Section 3-E).
C	Dragging the vertical split bar to the left of column A	Incorrect: dragging the vertical split bar to the left of column A removes the split bar.
D	Clicking the Split button	Incorrect: the Split button is a toggle; you can click it to turn on or off the horizontal and vertical split bars.

4. The Protect Sheet button is located in the Protect group on the _____ tab on the ribbon.

A	Page Layout	Incorrect: the Page Layout tab does not contain the Protect Sheet button.
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B	Format	Incorrect: there is no Format tab on the Excel ribbon.
C	Review	Correct: the Protect group containing buttons you can use to share and protect worksheets and workbooks is located on the Review tab (Section 3-E).
D	Home	Incorrect: the Home tab does not contain the Changes group of buttons.

5. Which of the following buttons can you click to launch the Protect Sheet dialog box?

A	 Consolidate	 Consolidate Incorrect: the button summarizes data from different ranges.
B	 Format	 Format Correct: you can click the button in the Cells group on the Home tab to click the Protect Sheet command and open the Protect Sheet dialog box (Section 3-E).
C	 Find & Select	 Find & Select Incorrect: the button menu does not contain the Protect Sheet command.
D	 Analyze Data	 Analyze Data Incorrect: the button is used to look for patterns in data.

Glossary

#NAME? error value	indicates a formula contains unrecognizable text
#REF! error value	indicates an invalid cell reference
#VALUE! error value	indicates a wrong cell reference or operand
3-D references	formulas with range references that span two or more worksheets or workbooks
absolute reference	a cell reference that does not change when a formula is copied; contains the \$ symbol for both the row and column reference
argument	what a function acts upon
Arrange All button	launches the Arrange Windows dialog box with options for arranging multiple worksheet or workbook windows
Arrange Windows dialog box	contains options for arranging multiple worksheet or workbook windows
circular reference	a cell reference that points to the cell that contains the circular formula
color-coded cell borders	indicate the cell references in a formula
conditional formatting	formatting applied to cells based on specific circumstances or conditions
Conditional Formatting button	a button in the Cells group on the Home tab that provides a menu of conditional formatting options
CTRL + click	a method of selecting multiple noncontiguous cells or ranges
customizable status bar	a bar below the worksheet area that can be customized to contain common calculations, View Shortcuts, Zoom button and Zoom slider, and so forth using a shortcut menu
defined name	a text name for a range of cells
Defined Names group	a group of buttons on the ribbon Formulas tab used to define and manage range names
dependent cells	cells that depend on the active cell's content
dependent formulas	formulas that rely on a variable that can be changed
Error Checking button	a button in the Formula Auditing group that launches the Error Checking dialog box
error indicator symbol	a triangular-shaped symbol in the upper-left corner of a cell that contains a possible formula error
Evaluate Formula button	a button in the Formula Auditing group that launches the Evaluate Formula dialog box
fill handle	the dark square in the lower-right corner on the border around the active cell or range
Find & Select button	a button in the Editing group on the Home tab that offers a number of find and select options
Format Cells dialog box	contains formatting and cell protection options
formula	mathematical expression
Formula Auditing mode	a viewing mode in which formulas are displayed in cells instead of formula results
Formula Auditing tools	buttons in the Formula Auditing group on the Formulas tab used to find and correct errors in complex formulas
Formula AutoComplete feature	a feature that allows you to select a function from an alphabetical list of functions
Formula Bar	a box above the worksheet area that contains the contents of the active cell, including text, values, or formulas
function	a predefined Excel formula used to perform common calculations
Function Arguments dialog box	a dialog box that contains options for entering a function's arguments
Function Library	a group on the Formulas tab that contains buttons for viewing and selecting functions by category

Go To Special dialog box	contains options for selecting specific worksheet elements, such as all cells that contain formulas
grouping worksheets	selecting multiple worksheets to apply common formatting or data entry on all the selected sheets at one time
hidden formulas	formulas that cannot be seen in a protected worksheet
horizontal split bar	a bar above the vertical scroll bar that allows you to split the view of a worksheet into two horizontal panes
Insert Function button	a button to the left of the Formula Bar that opens the Insert Function dialog box
Insert Function dialog box	a dialog box that contains a list of functions by category and features for selecting and using a function
locked cells	the default status of worksheet cells; locked cells can be protected from data entry
mathematical operators	for example, +, -, *, / symbols in a formula to indicate an addition, subtraction, multiplication, or division operation
mixed reference	a cell reference in which only the row or column reference is constrained by a \$ symbol so that it does not change when the formula is copied
Name Box	a box above the worksheet area that contains the cell reference or defined name of the active cell(s)
Name Manager button	a button in the Defined Names group on the Formulas tab that launches the name manager dialog box
Name Manager dialog box	contains options for editing and managing defined names
nesting IF functions	an IF statement whose arguments contain other IF statements
operands	numbers, text, or cell references in a formula
Paste Values option icon	a command on the Paste button menu that pastes calculated formula results as values
precedent cells	cells that provide data for the active cell
Protect Sheet button	a button in the Changes group on the Review tab or on the Format Cells menu in the Cells group on the Home tab; used to password-protect a worksheet against changes to data, formulas, or formatting
Protect Sheet dialog box	contains options to unlock cells or hide formulas
Quick Analysis feature	a feature you can use to analyze and format data, insert totals, and create charts and tables.
relative references	cell references automatically adjusted by Excel when copying, moving, and pasting formulas
Remove (All) Arrows button	a button in the Formula Auditing group that removes tracer arrows
SHIFT + click	a method of selecting a large range of contiguous cells
Show Formulas button	a toggle button that switches between showing and hiding formulas in cells
status bar calculation options	quick calculation tools available on the customizable status bar
Sum (AutoSum) button	used to quickly insert the SUM, AVERAGE, COUNT NUMBERS, MAX, and MIN functions in a formula
Switch Windows button	a button in the Windows group on the View tab that switches from one window to another when multiple workbook windows are displayed
Trace Dependents button	a button in the Formula Auditing group used to identify cells that depend on the active cell's content
Trace Error icon	a button or icon that appears to the left of a cell that contains a formula error; clicking the button or icon displays a menu of error-correction options
Trace Precedents button	a button in the Formula Auditing group used to identify cells that provide data for the active cell
tracer arrows	arrows from/to precedent or dependent cells from/to the active cell

ungroup worksheets	deselecting multiple selected sheets
Use in Formula button	provides a list of defined names
vertical split bar	a bar to the right of the horizontal scroll bar that allows you to split the view of a worksheet into two vertical panes
Watch Window	a window in which you view resulting changes to formula results when changes are made to data in precedent cells
Watch Window button	a button in the Formula Auditing group that launches the Watch Window toolbar
what-if analysis	changing specific variables in a worksheet to see different formula results

