

EXCEL 2016

Advanced Functions for Text and Analysis

In this chapter, you will learn new functions that give you greater ability for analysis and decision making. They include functions that either sum or count values that meet certain criteria. You will also explore functions that can be used to clean up or rearrange text on your worksheet, as well as learn what you can do when you find formula errors in your worksheet.

LEARNING OBJECTIVES

- Use functions to format text
- Create conditional functions using IF and IFS criteria
- Create formulas using nested functions
- Find and correct errors in formulas
- Use 3-D cell references in formulas

CHAPTER TIMING

- Concepts/Develop Your Skills: 2 hrs
- Self-Assessment: 1 hr 20 mins
- Total: 3 hrs 30 mins

PROJECT: ANALYZING SALES INFORMATION

The Airspace Travel monthly sales results are in, and the data has been compiled for all of the company agents and managers in a worksheet for your review. Because the data was imported from different sources, you need to do some clean up to fix the text entries, and then you will use various conditional functions to pull out important information about specific performance.

Using Functions to Modify Text

When workbook data comes from sources other than Excel, the data can sometimes be formatted incorrectly. Data may also have been entered by multiple users, with different methods of data entry. For example, one person might enter names into a worksheet using all capital letters, and another person might capitalize the first letter of the name only. Then when the two worksheets are combined, they won't match. Another problem can occur when data is either entered into too few or too many columns, such as entering First Name and Last Name together in one column when it is supposed to be entered in separate columns.

Although many people primarily think of Excel as working with numbers, there are quite a few text functions that allow you to work with text as well. Text functions can be used to fix the issues mentioned or to manipulate text data to be used for a different purpose. There are functions that let you change case, combine or separate text, remove spaces, and extract or even replace text.

Changing Case

PROPER, UPPER, and LOWER are three functions that allow you to change the case of the input text. PROPER converts the first letter of each word to uppercase (capital) and all other letters to lowercase. As you can probably guess, UPPER converts all letters to uppercase and LOWER converts all letters to lowercase.

	A	B	C
1	Text	Formula	Result
2	use your IMAGINATION	=PROPER(A2)	Use Your Imagination
3		=LOWER("AND")	and
4	make some magic!	=UPPER(A4)	MAKE SOME MAGIC!

As you can see, the function argument is simply the text to convert and can be a cell reference or the text itself.

Extracting Text

In some cases, only a part of the cell contents is needed, or there may be extra characters or spaces that you don't want. The LEFT, MID, and RIGHT functions will extract a certain number of characters from the text string. The TRIM function removes all spaces except for a single space between words.

The LEFT and RIGHT functions take two arguments: the text (which can be actual text or a cell reference) and the number of characters to extract.

	A	B	C
1	Text	Formula	Result
2	BASKabcdefg	=LEFT(A2,4)	BASK
3	abcdefgETB	=RIGHT(A3,3)	ETB
4	abcALLdefg	=MID(A4,4,3)	ALL
5	Who likes basketball?	=TRIM(A5)	Who likes basketball?

The TRIM function's only argument is the text from which to remove the spaces.

The MID function requires three arguments: the text, the position of the first character to extract, and then the number of characters to extract.

Combining and Separating Text

The CONCATENATE function allows you to combine two or more separate text entries into one cell. The Flash Fill feature is an even better option, as it can also combine multiple entries into one or extract text from one text string into multiple entries, in addition to having a number of other applications. By entering a couple of examples, Flash Fill will look for patterns and automatically fill in the remaining values.

For example, if you have a column with First Name and another column with Last Name, Concatenate can be used to combine the two names into one cell. Flash Fill could do this but could also do the opposite task; take one name and separate it into First and Last. You could use Flash Fill to extract one part of the cell only, such as the first three letters of the last name, or extract the area code from a phone number. Using these functions, you can also append or insert text, such as automatically creating email addresses from an employee list.

The main difference is that Flash Fill will use adjacent data only, whereas CONCATENATE uses a cell reference so the text could be anywhere on the worksheet or even on another worksheet.

Column C uses the CONCATENATE function to combine the text in column A and column B into one cell.

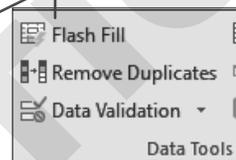
	A	B	C	D	E
1	First Name	Last Name	Name		
2	Jaime	Burgess	Jaime Burgess		
3	Ashley	Bradford	Ashley Bradford		
4	Deborah	Secrett	Deborah Secrett		
5	Steven	Samuel	Steven Samuel		

The function arguments are either cell references or actual text. Notice the second argument, " ", inserts the text inside quotations, which is a space, between the First Name in cell A2 and the Last Name in cell B2.

The original data is in column A.

	A	B
1	Phone Number	Area Code
2	232-555-1023	232
3	416-555-1024	416
4	905-555-1025	905
5	771-555-1026	771

The Area Code 232 was manually entered in cell B2, and the remaining area codes in column B were entered using Flash Fill (from the Data tab on the Ribbon).



The Flash Fill Options button can Undo or Accept the suggested entries.

Other Text Functions

Exploring some of the other text functions available in Excel can be useful in certain circumstances. There are text functions that allow you to replace or substitute text within a text string, functions for finding the text's position, or functions to calculate text length. You can even insert a function that will repeat a text character a specified number of times. Some of these examples of additional text functions are described in the table below.

TEXT FUNCTIONS		
Function	Description	Example
REPLACE	Replaces part of a text string with a different text string; for example, replacing digits in a credit card number to display 8181-xxxx-xxxx-1188	Cell B1: 8181-3011-1103-1188 Formula: =REPLACE(B1,6,9,"xxxx-xxxx") Result: 8181-xxxx-xxxx-1188
SUBSTITUTE	Looks for an exact match (case-sensitive) and replaces old text with new text if found; for example, replacing <i>Mgr</i> with <i>Manager</i>	Cell B4: Mgr Formula: =SUBSTITUTE(B4,"Mgr","Manager") Result: Manager
LEN	Determines the number of characters in a cell entry	Cell B7: 2223334444 Formula: =LEN(B7) Result: 10
REPT	Repeats text, for example, repeating the letter A five times	Formula: =REPT("A",5) Result: AAAAA

☰ Data→Data Tools→Flash Fill

☰ Formulas→Function Library→Text

DEVELOP YOUR SKILLS: E3-D1

In this exercise, you will use text functions to clean up the text entries in the *Airspace Sales Results* worksheet.

1. Start Excel, open **E3-D1-Sales** from your **Excel Chapter 3** folder, and save it as **E3-D1-SalesAnalysis**.
2. Insert a new column to the left of **column A**.
3. In **cell A5**, enter the formula **=PROPER (B5)** and then fill the formula down the column and **AutoFit** the column width.
4. With the **range A5:A33** still selected, choose **Home→Clipboard→Copy** .
5. Without changing the selection, choose **Home→Clipboard→Paste**  → **Values** to paste the values only (not the formulas) into the selected range.
6. Now delete the names from the **range B5:B33**.
7. Insert a column to the left of *Location* in **column E**.
8. In **cell E5**, enter the function **=LEFT (D5 , 6)** and then fill the formula down the column, making sure to use the **Auto Fill Options** to fill without formatting.
9. With the **range E5:E33** still selected, copy the formulas and then use **Paste Options** to paste the values only into **column D**.
10. Delete the formulas from the **range E5:E33**.

11. In **cell E5**, enter the function **=CONCATENATE (F5," ",G5)** and then fill the formula down the column (again fill without formatting).
12. With the **range E5:E33** still selected, copy the formulas and then paste the values only into **cell F5**.
13. Delete the formulas from the **range E5:E33** and the text in the **range G5:G33**.
14. In **cell B5**, enter the name **Alexander** and then complete the entry.
15. Now choose **Data**→**Data Tools**→**Flash Fill** to fill the first names down **column B**.
16. In **cell C5**, enter the name **Robertson**, complete the entry, and use **Flash Fill** to again fill in the rest of the last names down the column.
17. Delete **column A**, removing it entirely from the worksheet.
18. In **cell D4**, enter the heading **Email**.
19. In **cell D5**, enter the email address for Alexander, which is **Alexander.Robertson@airspace.com**.
20. Double-click the **fill handle** to copy the email address down **column D**; in the **Auto Fill Options**, choose **Flash Fill** to insert the proper email addresses for all other employees in the column.
21. In **cell F5**, type **Miami** without a space, complete the entry, and use **Flash Fill** to fill the rest of the column.
22. Move the **Location** heading from **cell E4** to **cell F4** and delete **column E**.
23. Save the file.

Creating Conditional Functions Using IF Criteria

Conditional functions allow you to sum, count, or find the average of a range of cells if the cells meet your desired criteria. One criterion is entered for the IF functions and multiple criteria are entered for the IFS functions.

IF CRITERIA FUNCTIONS	
Function	Arguments [Optional]
SUMIF	=SUMIF(range,criteria,[sum range])
AVERAGEIF	=AVERAGEIF(range,criteria,[average range])
COUNTIF	=COUNTIF(range,criteria)
SUMIFS	=SUMIFS(sum range,range1,criteria1,range2,criteria2...)
AVERAGEIFS	=AVERAGEIFS(average range,range1,criteria1,range2,criteria2...)
COUNTIFS	=COUNTIFS(range1,criteria1,range2,criteria2...)

Function Syntax

IF CRITERIA FUNCTION ARGUMENTS	
Arguments	Description
Range	These are the cells to be compared with the criteria.
Criteria	They can be a comparison value or text, or an expression using a comparison operator such as =, >, <, >=, <=, <> (not equal to).
Sum range	(Optional) This is the range to be summed, which can be different from the range being compared with the criteria. If Sum range is omitted, the range is summed.
Average range	(Optional) Like Sum range, this is the range to be averaged.

Using the conditional functions allows you to create formulas to find out information such as:

- How many of your customers live in Florida?
- How many employees in the Human Resources division have salaries greater than \$50,000?
- What are the total sales of product #2152?

For example, if you want to discover the total sales of product #2152 for employees in San Antonio, you would use the SUMIFS function because there are two criteria—the product and the city. The arguments would be the sum range: criteria1, range1, criteria2, range2.

The Sum Range refers to the sales, to be added together from column C. The formula in cell G3 is shown in the Formula Bar.

	A	B	C
1			
2	Product #	City	Sales
3	2151	Detroit	\$5,083
4	2152	Chicago	\$13,156
5	2152	San Antonio	\$10,096
6	2153	Detroit	\$12,684
7	2153	Chicago	\$5,655
8	2151	San Antonio	\$7,552

Function Arguments dialog box for SUMIFS:

- Sum_range: C3:C12 = {5083;13156;10096;12684;5655;7552}
- Criteria_range1: A3:A12 = {2151;2152;2152;2153;2153;2151}
- Criteria1: 2152 = 2152
- Criteria_range2: B3:B12 = {"Detroit";"Chicago";"San Antonio";"Detroit";"Chicago";"San Antonio"}
- Criteria2: "San Antonio" = "San Antonio"

Formula Bar: =SUMIFS(C3:C12,A3:A12,2152,B3:B12,"San Antonio")

Result in cell G3: = 18736

Annotations:

- Criteria_Range1 is the product #s in column A.
- Criteria_Range2 is the city, in column B.
- Criteria2 is "San Antonio", entered in quotations (or Excel adds quotes).
- Criteria1 is the product number 2152; no = sign is needed.
- The preview of the formula result is shown here.

The function arguments dialog box makes it easier to enter the arguments because it can be difficult to keep track of the arguments when entering them directly in a cell. The dialog box also shows a preview of the formula result as you add more conditions. The result of the formula above is shown in the worksheet here.

=SUMIFS(C3:C12,A3:A12,2152,B3:B12,"San Antonio")				
D	E	F	G	H
Summary				
	Product	City	Total	
	2152	San Antonio	18736	

DEVELOP YOUR SKILLS: E3-D2

In this exercise, you will use conditional functions to obtain information about the Miami sales team's performance.

1. Save your file as **E3-D2-SalesAnalysis**.
2. In **cell K5**, enter **Miami Employees**.
3. In **cell L5**, enter the formula **=COUNTIF (E5:E33, "Miami")**.
4. In **cell K6**, enter **Miami Employee Commissions**.
5. In **cell L6**, enter the formula **=SUMIF (E5:E33, "Miami", I5:I33)**.
6. Format **cell L6** as **Currency** with no decimals.
7. In **cell K7**, enter **Miami Average Sales**.
8. In **cell L7**, enter the formula **=AVERAGEIF (E5:E33, "Miami", H5:H33)**.
9. Format **cell L7** as **Currency** with no decimals.
10. In **cell K8**, enter **Miami Employees - Sales >\$10,000**.
11. In **cell L8**, enter the formula **=COUNTIFS (E5:E33, "Miami", H5:H33, ">10000")**.
12. In **cell K9**, enter **Toronto Employees - Sales >\$10,000** and adjust the width of **column K** using **AutoFit**.
13. In **cell L8**, enter the formula **=COUNTIFS (E5:E33, "Toronto", H5:H33, ">10000")**.
14. In **cell K10**, enter **Miami Mgr Comm's - Sales <\$10,000**.
15. In **cell L10**, enter the formula **=SUMIFS (I5:I33, E5:E33, "Miami", F5:F33, "Manager", H5:H33, "<10000")**. (Hint: Use the Function Arguments dialog box, if desired, to enter formulas with several criteria, such as this one.)

Function Arguments	
SUMIFS	
Sum_range	I5:I33
Criteria_range1	E5:E33
Criteria1	"Miami"
Criteria_range2	F5:F33
Criteria2	"Manager"

Criteria_range3	H5:H33
Criteria3	"<10000"

16. Format **cell L10** as **Currency** with no decimals.
17. Save the file.

Nested Functions

In Excel it is possible to use functions inside of other functions. This is called *Nesting* functions, or a *Nested* function. Although this can be quite challenging with some functions, it can be fairly simple with other functions.

For example, when you use the AVERAGE function, you often get a long set of decimal places in the result. While you can adjust the Number Format, which will change the display of the number, the formula will store those decimal places for future calculations. In some cases, you might want to remove the decimal places altogether from the stored value, and this can be done by using a second function, the ROUND function. Thus, in the same cell, you could nest the AVERAGE function inside of the ROUND function to achieve the desired result.



This formula would use the AVERAGE function for the range F5:F52, and then the ROUND function would round the results to zero decimal places.

Another example would be to create an IF function within an IF function if you needed more than one criterion to determine the result. For example, you could use the IF function to determine whether an employee achieved a sales goal and then inside that function place another IF function to determine if the employee also achieved a minimum number of sales.

In the first IF function, the Logical test determines IF C3>B3; are Sales greater than the Goal?

The value if this is also true is "Yes," meaning each employee must have more than 15 sales and achieved their goal to return a "Yes."

	A	B	C	D	E	F	G
1							
2	Name	Goal	Sales	# Sales			
3	Bert	\$ 1,000	\$ 900	18	No		
4	Ernie	1,200	1,300	12	No		
5	Jen	800	950	21	Yes		
6	Sarah	1,000	1,200	17	Yes		

Function Arguments

IF

Logical_test: C3>B3

Value_if_true: IF(D3>15,"Yes","No")

Value_if_false: No

If either of these is not true, the Value_If_False for both is "No."

If Sales are greater than the goal, the Value_If_True is another IF function, which is used to determine IF D3>15; does the employee have a minimum of 15 sales?

DEVELOP YOUR SKILLS: E3-D3

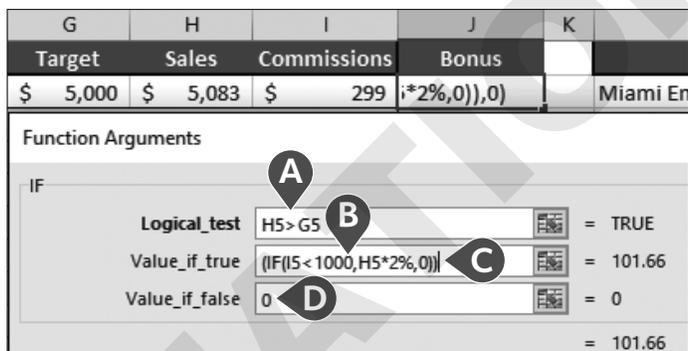
In this exercise, you will use nested functions to adjust the result of one formula and to calculate an employee bonus in another formula.

1. Save your file as **E3-D3-SalesAnalysis**.
2. Select the Miami Average Sales Amount in **cell L7**.

3. Increase the decimal to show 3 decimal places.
4. Now follow these steps to edit the formula:



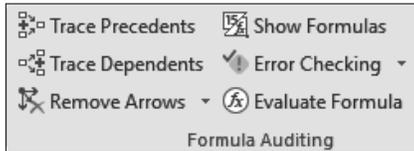
- A In the Formula Bar, click to place the insertion point before AVERAGE and type **ROUND (**.
 - B Click the right side of the Formula Bar and type **, 0)** at the end of the formula.
 - C Click **Enter** on the Formula Bar to complete the changes.
5. In **cell L7**, decrease the decimal to remove the decimals from the display.
6. Select **cell J4** and insert a new worksheet column.
7. In **cell J4**, enter the heading **Bonus**.
8. Open the **Insert Function** dialog box and select the **IF** function.
9. Follow these steps to create a nested **IF** function:



- A In the Logical_Test, enter **H5>G5** to determine whether sales were greater than the target.
 - B In the Value_If_True, for employees who did meet their target, you must determine whether their commission was less than \$1,000 by entering **(IF(I5<1000, .**
 - C In the same box, continue by entering **H5*2%, 0))**, which will return H5 (Sales) times 2% if this is also true and 0 if the second condition is not met.
 - D In the Value_If_False field, enter **0** if the first condition is not met.
10. Click **OK** to enter the formula.
11. Fill the formula down the column for all other employees.
12. Save and close the file.

Troubleshooting Formulas

As you can see, working with formulas can sometimes be challenging. Excel's auditing tools can make sense of your worksheet when it contains a complex set of formulas. The auditing tools can help you identify which cells were used to create a formula or where the current cell is being used in other formulas, as well as locating and correcting errors in formulas.



Trace Precedents and Dependents

The Trace Precedents command displays arrows pointing to the current active cell from any cells that were used to produce the result. Trace Precedents work backwards from the selected cell to show which cells affect the current result. Because the precedent cells could also use input from other cells to produce their results, there can be several layers of precedents. Repeating the Trace Precedents command will display the next level of precedents until a warning sound indicates there are no more levels.

Name	Goal	Sales	# Sales
Bert	\$ 1,000	\$ 900	18
Ernie	1,200	1,300	12
Jen	800	950	21
Sarah	1,000	1,200	17
Total	\$ 4,000	\$ 4,350	68
Sales Above Goal		\$ 350	
Average Sale		\$ 63.97	

With the current cell showing the Sales Above Goal, Trace Precedents is used to show that the Total Goal and Total Sales cells are used to calculate the amount of \$350.

Name	Goal	Sales	# Sales
Bert	\$ 1,000	\$ 900	18
Ernie	1,200	1,300	12
Jen	800	950	21
Sarah	1,000	1,200	17
Total	\$ 4,000	\$ 4,350	68
Sales Above Goal		\$ 350	
Average Sale		\$ 63.97	

Adding another level to Trace Precedents shows that the totals use the information in the Goal and Sales columns.

Although you can see which cells are used in a formula by looking at the formula in the Formula Bar, Tracing Precedents is much quicker and gives you an easier way to visualize the flow of data through the worksheet.

The Trace Dependents command shows the opposite of the precedents; it shows you any cells that use the current cell in a formula. Like Precedents, there can be layers of dependent cells, which are displayed by repeating the Trace Dependents command. Changing the value in the current cell will therefore have an effect on all of the dependent cells.

Name	Goal	Sales	# Sales
Bert	\$ 1,000	\$ 900	18
Ernie	1,200	1,300	12
Jen	800	950	21
Sarah	1,000	1,200	17
Total	\$ 4,000	\$ 4,350	68
Sales Above Goal		\$ 350	
Average Sale		\$ 63.97	

Name	Goal	Sales	# Sales
Bert	\$ 1,000	\$ 900	18
Ernie	1,200	1,300	12
Jen	800	950	21
Sarah	1,000	1,200	17
Total	\$ 4,000	\$ 4,350	68
Sales Above Goal		\$ 350	
Average Sale		\$ 63.97	

By adding another level, you see that total sales is then used to calculate the average sale.

The current cell shows Bert's number of sales, and by using Trace Dependents you see that Bert's sales amount is used to calculate total sales.

Another way to think of it is to think of tracing precedents as looking backward, to see where the information comes from, and tracing dependents as looking forward, to see where the information is being used. When you no longer need the arrows, you can simply use the Remove Arrows command to remove them.



View the video "Tracing Your Formulas."

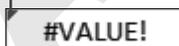
Checking for Errors

The Error Checking tool can help you spot and correct errors in formulas. This can be particularly useful if you are reviewing someone else's work, and you aren't sure where the errors are located. If it is your own work, you would usually fix errors as you go along.

Errors in cells are indicated by an indicator triangle, and sometimes by an error message in the cell instead of the formula result.

Some of the common errors found in formulas are given in the table below.

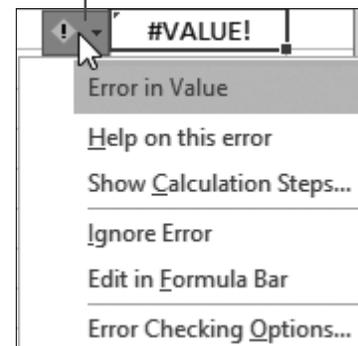
The green error indicator triangle displays in the top left of an unselected cell that contains an error.



Selecting a cell with an error displays the warning sign.



Clicking on the warning sign displays the options for dealing with the error.



COMMON EXCEL FORMULA ERRORS	
Error	Description
#DIV/0!	Dividing by zero is not possible, so this error displays if a formula attempts to divide by a cell that contains zero or divides by an empty cell.
#REF!	You will see this error if a formula contains an invalid cell reference; for example, if a formula refers to cell A1 and row 1 or column A is deleted.
#VALUE!	This is another common error, which usually occurs because the formula is attempting to perform a mathematical operation using a cell that contains text.
#NAME?	This error occurs when a formula contains an incorrect function name or an undefined name for a cell or range.
Formula Omits Adjacent Cells	This error does not display in the result cell but appears as a suggested error when a formula refers to a column or row of data but does not include all adjacent numerical values.

Evaluate a Formula

When reviewing a complex formula, it can be useful to break the formula down into steps and watch how Excel solves the formula. This can help to discover the source of an error or explain why the result does not look the way you expected it to. Not all mistakes are caught by Excel showing an error; sometimes a valid formula is simply showing the incorrect information because it was not created with the correct cell references, functions, or operations.

☰ Formulas→Formula Auditing

DEVELOP YOUR SKILLS: E3-D4

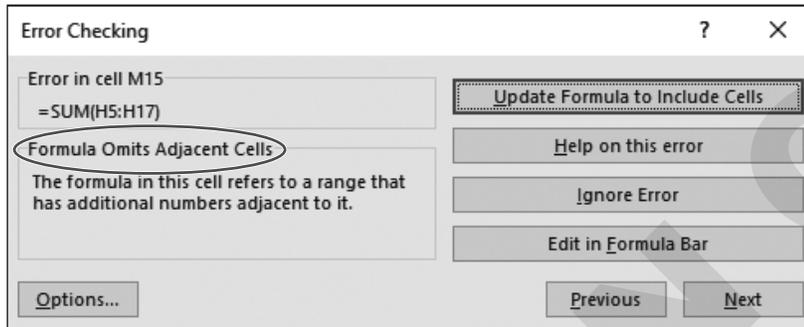
In this exercise, you will use the Formula Auditing tools to analyze and correct formula errors.

1. Open **E3-D4-Sales** from your **Excel Chapter 3** folder and save it as **E3-D4-SalesSummary**.
2. On the **Aug Sales** sheet, select **cell M10**.
3. Choose **Formulas→Formula Auditing→Trace Precedents** .

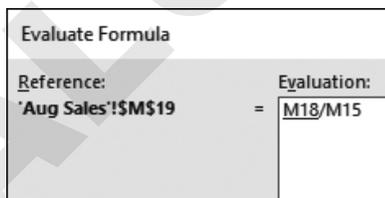
Location	Position	Target	Sales	Commissions	Bonus	Description	Amount
Miami	Agent	\$ 5,000	\$ 5,083	\$ 299	\$ 102	Miami Employees	9
Miami	Agent	10,000	13,156	1,196	\$ -	Miami Employee Commissions	\$6,876
New York	Agent	10,000	10,096	631	\$ 292	Miami Average Sales	\$10,643
New York	Manager	12,000	12,684	906	\$ 254	Miami Employees - Sales >\$10,000	4
Toronto	Agent	5,000	5,655	377	\$ 113	Toronto Employees - Sales >\$10,000	3
Vancouver	Manager	10,000	7,552	472	\$ -	Miami Mgr Comm's - Sales <\$10,000	\$2,012

4. With **cell M10** still selected, again choose **Formulas→Formula Auditing→Trace Precedents** .
5. With **cell M10** still selected, choose **Formulas→Formula Auditing→Trace Dependents** .
6. Click **OK** to close the warning box.

7. Choose **Formulas**→**Formula Auditing**→**Remove Arrows** .
8. Select **cell M18** and again choose **Formulas**→**Formula Auditing**→**Trace Precedents** .
9. Edit the formula in **cell M18** to be **=M16+M17**.
10. With **cell M18** still selected, again choose **Formulas**→**Formula Auditing**→**Trace Precedents**  and then click the button a second time.
11. Choose **Formulas**→**Formula Auditing**→**Trace Dependents** .
12. Select **cell A1** and choose **Formulas**→**Formula Auditing**→**Error Checking** .



13. Click **Update Formula to Include Cells**.
14. Again click **Update Formula to Include Cells**.
15. Click **Edit in Formula Bar**, delete the existing cell references, replace with the **range J5:J33** so the formula reads **=SUM(J5:J33)**, and then click **Resume** in the Error Checking dialog box.
16. Click **Edit in Formula Bar**, correct the formula by changing **cell M14** to **cell M15** so the formula is **=M18/M15**, and then click **Resume**.
17. Apply the **Percent** number format to **cell M19**.
18. With **cell M19** still selected, choose **Formulas**→**Formula Auditing**→**Evaluate Formula** .



19. Click **Evaluate**.



20. Click **Evaluate**.

Evaluate Formula	
Reference:	Evaluation:
'Aug Sales'!\$M\$19	= 22995.4/327493

21. Click **Evaluate** once more.
22. Click **Close**.
23. Save the file.
-

3-D Cell References

Excel formulas can refer to data on other worksheets or in other workbooks; however, sometimes a formula is required to refer to multiple sheets at the same time. For example, if cell A5 contains sales information for Product #1, and this information is on a different sheet for each month, you might want to summarize the sales data by finding the total in cell A5 across multiple sheets. This can be done by adding each cell individually or by using a 3-D reference in your formula.

Compare these two formulas.

=SUM(January!A5+February!A5+March!A5)

=SUM(January:March!A5)

Similar to using a range instead of referring to each cell individually, a 3-D reference is quicker because you can refer to the range of sheets January to March and all sheets between and then use the same cell (or range) from all sheets.

If you think of columns and rows as arranged left to right and up and down on a 2-D page, then stacking multiple worksheets on top of each other would be a third dimension, hence the 3-D reference. This is also useful because if a new sheet is inserted into the worksheet range, the data on the new sheet will automatically be included.

DEVELOP YOUR SKILLS: E3-D5

In this exercise, you will use 3-D cell references to create formulas that sum values from 3 worksheets.

1. Save your file as **E3-D5-SalesSummary**.
2. Go to the **Q3 Sales Summary** worksheet.
3. In **cell G5**, begin entering your formula by typing **=SUM (**.

4. Follow these steps to finish the formula using a 3-D reference:



- A** While editing the formula, click the **Jul Sales** worksheet tab.
 - B** On the Jul Sales worksheet, select **cell G5**, and the Formula Bar will display `=SUM('Jul Sales'!G5)`.
 - C** Hold down the **Shift** key on the keyboard and click the **Sep Sales** sheet tab to select the range of sheets Jul Sales:Sep Sales, which includes the Aug Sales sheet.
5. Complete the entry by clicking on the Formula Bar, which will automatically return you to the Q3 Sales Summary worksheet. (Do NOT click the Q3 Sales Summary tab as this will change the formula!)
 6. Now select **cell H5** and use the method from step 5 to create a formula to add **cell H5** on the Jul Sales, Aug Sales, and Sep Sales sheets; your formula should be `=SUM('Jul Sales:Sep Sales'!H5)` when finished.
 7. In **cell I5**, create a formula to add **cell I5** on the **Jul Sales**, **Aug Sales**, and **Sep Sales** sheets; your formula should be `=SUM('Jul Sales:Sep Sales'!I5)` when finished.
 8. Select the **range G5:I5**, copy the formulas down all 3 columns using the **fill handle**, and use **Auto Fill Options** to fill without formatting.
 9. Save your work and close the file.
-

Self-Assessment

Check your knowledge of this chapter's key concepts and skills by completing the Self-Assessment. The answers to these questions can be found at the back of this book.

1. If a worksheet looks messy because it contains names in either all capitals or lowercase letters, you can use the UPPER function to convert all the names to all capitals. True False
2. Flash Fill can be used like the CONCATENATE function to combine columns of data anywhere on a worksheet. True False
3. To find the sum of salaries for all sales staff in Toronto, the formula =SUMIF(H3:H90,C3:C90,"Toronto",B3:B90,"Sales") could be used to add all the salaries in the range H3:H90 that match the criteria in columns B and C. True False
4. Conditional formulas are useful for analyzing large amounts of data; to search for data that matches certain criteria; and to count, add, or find an average. True False
5. To perform more than one function, you must use more than one cell, column, or row. True False
6. If Tracing Precedents is compared to looking backward, Tracing Dependents would be comparable to looking forward. True False
7. You have created a formula using a 3-D reference that finds the sum of cell B5 across 4 sheets. To add the sum of cell B5 on a new 5th sheet, which was inserted into the worksheet range, you will have to edit the formula to include the sheet. True False
8. Geoff is having trouble with a list of product codes that need to be fixed by extracting the first 7 characters only and converting all letters to capitals as shown below. He could do this by manually retyping each code, but because there are hundreds of product codes, Geoff should use which two functions to accomplish this more quickly?

Old Product Code	New Product Code
aE3r4A9iv82s7	AE3R4A9
Cb3r17A9iv82s8	CB3R17A
x9iS8w2dllfn	X9IS8W2
raz4p23lv29zz	RAZ4P23

- A. PROPER and UPPER
- B. PROPER and RIGHT
- C. UPPER and LEFT
- D. UPPER and RIGHT

9. You want to know how many total cars in your inventory are red. Based on the image below, the formula =SUMIF(B2:B6,"Red",C2:C6) would return which result?

	A	B	C
1	Model #	Color	Available
2	21367	Red	3
3	211488	Black	1
4	1E4561	Red	0
5	7718384	Black	4
6	2173R8	Red	2

- A. 3
 B. 4
 C. 9
 D. 5
10. After marking all of your students' tests, you want to use a function that finds the average of each student's tests (the 5 test grades are entered in the range B2:F2), returns OVER if they averaged 70% or higher, and returns UNDER if they averaged under 70%. Which nested formula would be your best choice to obtain the desired result in cell G2?

	A	B	C	D	E	F	G
1	Student ID	Test 1	Test 2	Test 3	Test 4	Test 5	70% AVG
2	#23894	51%	73%	65%	66%	100%	OVER
3	#23895	83%	89%	80%	42%	81%	OVER
4	#23896	78%	57%	50%	77%	66%	UNDER
5	#23897	71%	66%	48%	57%	48%	UNDER

- A. =IF(AVERAGE(B2:F2)>=70%,"OVER","UNDER")
 B. =IF(ROUND(B2:F2)>=70%,"OVER","UNDER")
 C. =AVERAGE(IF(B2:F2)>=70%,"OVER","UNDER")
 D. =ROUND(PROPER(B2:F2)>=70%,"OVER","UNDER")
11. The #VALUE! Error is usually a result of a formula that attempts to perform a mathematical operation on a cell that:
- A. Has the wrong number format
 B. Is empty
 C. Contains text
 D. Has been deleted

12. To create a formula on the Total sheet that will add cell B3 from all of the other sheets shown below, you would use a 3-D reference such as:

	Troy	Shirley	Brita	Abed	Total

- A. Troy:Shirley:Brita:Abed!B3
- B. Troy:Abed!B3
- C. Troy:Shirley!B3
- D. Troy:Total!B3

EVALUATION ONLY

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