

# Microsoft® Office 2013

First Course

Second Course

Third Course

Excel 2013  
**UNIT B**

## Working with Formulas and Functions





# Objectives

- Create a complex formula
- Insert a function
- Type a function
- Copy and move cell entries
- Understand relative and absolute cell references



# Objectives

- Copy formulas with relative cell references
- Copy formulas with absolute cell references
- Round a value with a function



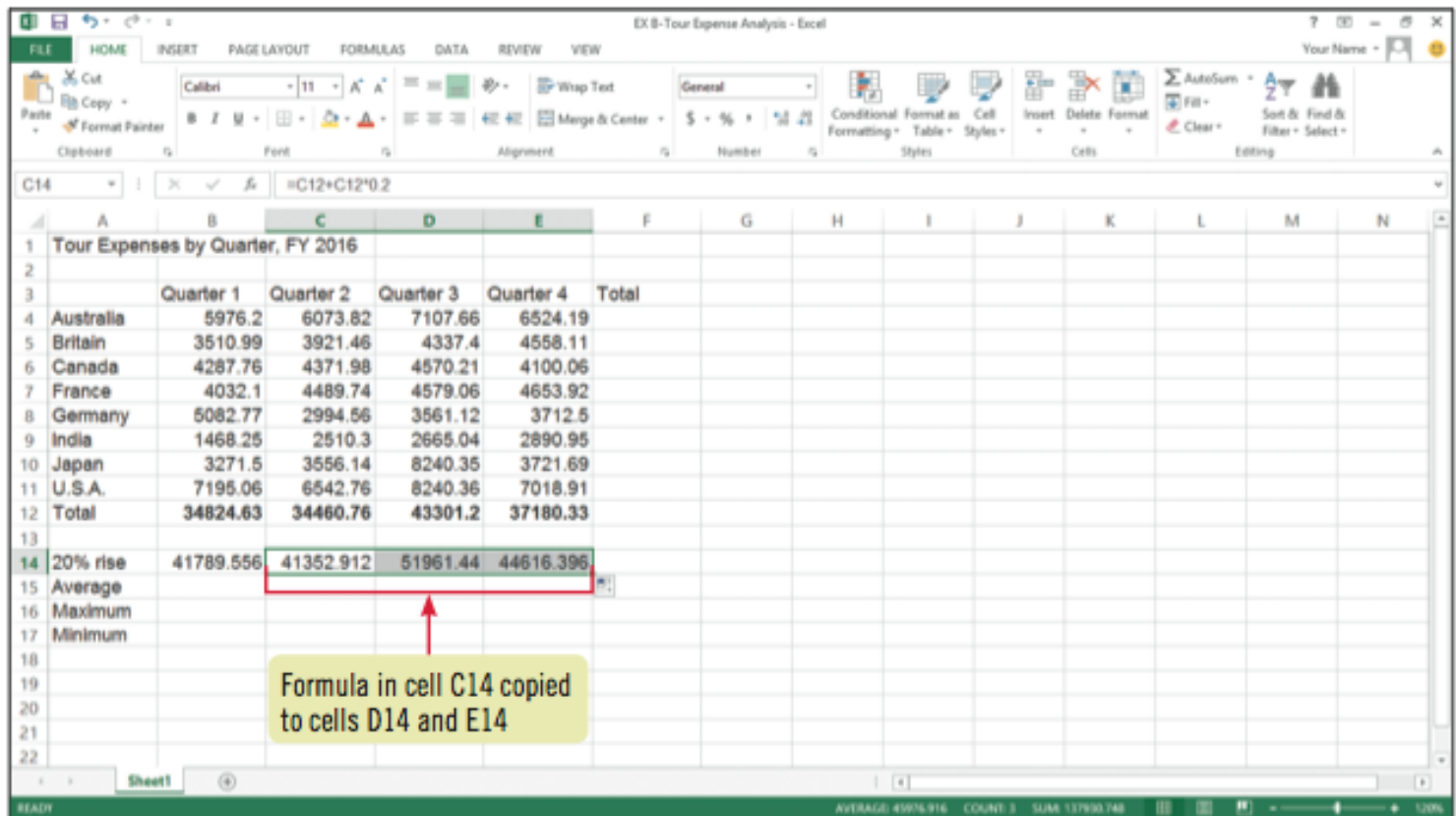
# Create a Complex Formula

- A **complex formula** is an equation that uses more than one type of arithmetic operator
  - Example: formula that uses both addition and multiplication
  - Arithmetic operations are performed according to the **order of precedence**



# Create a Complex Formula

## Complex formulas in worksheet



EX B-Tour Expense Analysis - Excel

Formula bar:  $=C12+C12*0.2$

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Tour Expenses by Quarter, FY 2016													
2														
3		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total								
4	Australia	5976.2	6073.82	7107.66	6524.19									
5	Britain	3510.99	3921.46	4337.4	4558.11									
6	Canada	4287.76	4371.98	4570.21	4100.06									
7	France	4032.1	4489.74	4579.06	4653.92									
8	Germany	5082.77	2994.56	3561.12	3712.5									
9	India	1468.25	2510.3	2665.04	2890.95									
10	Japan	3271.5	3556.14	8240.35	3721.69									
11	U.S.A.	7195.06	6542.76	8240.36	7018.91									
12	Total	34824.63	34460.76	43301.2	37180.33									
13														
14	20% rise	41789.556	41352.912	51961.44	44616.396									
15	Average													
16	Maximum													
17	Minimum													
18														
19														
20														
21														
22														

Formula in cell C14 copied to cells D14 and E14

Sheet1

READY AVERAGE: 45976.916 COUNT: 3 SUM: 137930.748 100%



# Create a Complex Formula

- Order of precedence in Excel formulas
  - Operations inside parentheses are calculated first
  - Exponents are calculated next
  - Multiplication and division are calculated next (from left to right)
  - Addition and subtraction are calculated next (from left to right)



# Insert a Function

- A **function** is a predefined worksheet formula that makes it easy to perform a complex calculation
  - Can be used by itself or within a formula
  - If used alone, begins with the formula prefix (=)

# Insert a Function

## Expanded Function Arguments dialog box

Function in formula bar

Insert Function button

AutoSum list arrow

Drag title bar of dialog box to move it if necessary

Argument

Collapse button

Description of function and arguments

Function Arguments

AVERAGE

Number1: B4:B11

Number2: [Empty]

Formula result = 4353.07875

Help on this function

OK Cancel

	Quarter 1	Quarter 2	Quarter 3
1			
2			
3			
4	5976.2	6073.82	7107.1
5	3510.99	3921.46	4332.1
6	4287.76	4371.98	4570.1
7	France	4032.1	4489.74
8	Germany	5082.77	2994.56
9	India	1468.25	2510.3
10	Japan	3271.5	3556.14
11	U.S.A.	7195.06	6542.76
12	Total	34824.63	34460.76
13			
14	20% rise	41789.556	41352.912
15	Average	(B4:B11)	
16	Maximum		



# Type a Function

- A function can be typed manually into a cell
  - You must know the name and initial characters of the function
  - Can be faster than using the Insert Function dialog box
  - Experienced Excel users often prefer this method





# Type a Function

- While manually typing a function, it is necessary to begin with the equal sign (=)
- Once you type an equal sign, each letter you type activates the AutoComplete feature

# Type a Function

MAX function in progress

13					
14	20% rise	41789.556	41352.912	51961.44	44616.396
15	Average	4353.0788	4307.595	5412.65	4647.5413
16	Maximum	=MAX(			
17	Minimum	MAX(number1, [number2], ...)			



# Copy and Move Cell Entries

- You can copy or move data within a worksheet or between worksheets using:
  - Cut, Copy, and Paste buttons
  - Fill handle in the lower-right corner of the active cell
  - Drag-and-drop feature
- **Clipboard** temporarily stores information that you copy or cut





# Copy and Move Cell Entries

- Pasting an item from the Clipboard
  - Only need to specify the upper-left cell of the range where you want to paste the selection

# Copy and Move Cell Entries

## Copied data in Office Clipboard

The screenshot shows the Microsoft Office 2013 interface. The Office Clipboard pane is open on the left, displaying a list of copied items. The main window shows a spreadsheet titled "Travel Expenses for Quarter, FY 2016". The spreadsheet contains a table with columns for "Quarter 2", "Quarter 3", "Quarter 4", and "Total". The data is as follows:

	Quarter 2	Quarter 3	Quarter 4	Total	
1	6073.82	7107.66		6524.19	
2	3921.48	4337.4		4558.11	
3	4207.76	4371.98	4570.21	4100.06	
4	4032.1	4489.74	4579.06	4653.92	
5	5062.77	2994.56	3561.12	3712.5	
6	1468.25	2510.3	2665.04	2890.95	
7	3271.5	3556.14	8240.35	3721.69	
8	7195.06	6542.76	8240.36	7018.91	
9	34824.63	34460.76	43301.2	37180.33	
10					
11	20% rise	41789.556	41352.912	51961.44	44616.396
12	Average	4353.0788	4307.595	5412.65	4647.5413
13	Maximum	7195.06	6542.76	8240.36	7018.91
14	Minimum	1468.25	2510.3	2665.04	2890.95

Annotations in the image include:

- Paste button**: Points to the Paste button in the ribbon.
- Copy button**: Points to the Copy button in the ribbon.
- Clipboard dialog box launcher**: Points to the clipboard icon in the ribbon.
- Item in Office Clipboard**: Points to an item in the Office Clipboard list.



# Copy and Move Cell Entries

- Use a **relative cell reference** when you want to preserve the relationship to the formula location
  - Calculations are performed based on cell relationship
  - When a formula is copied, the cell reference changes to preserve the relationship of the formula to the referenced cells
  - The Excel default

# Understand Relative and Absolute Cell References

## Formulas containing relative references

Expense Projections - Excel

Formula bar: `=SUM(B5:E5)`

Formula containing relative references

Copied formulas adjust to preserve relationship of formula to referenced cells

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Australia	5,800	6,000	6,200	6,400	\$ 24,400
Britain	4,000	5,000	4,800	4,800	\$ 18,600
Canada	4,900	4,600	4,900	4,800	\$ 19,200
France	4,500	4,800	4,900	4,900	\$ 19,100
Germany	3,300	3,300	3,900	400	\$ 10,900
India	1,900	2,800	2,900	3,200	\$ 10,800
Japan	3,600	3,900	3,900	3,600	\$ 15,000
U.S.A.	7,600	6,900	9,200	7,600	\$ 31,300
Total \$	35,500	37,300	40,700	35,600	\$ 113,500

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Australia	8,700	9,000	9,300	9,500	\$ 36,500
Britain	6,000	7,500	7,200	7,200	\$ 27,900
Canada	7,350	6,900	7,350	7,200	\$ 28,800
France	6,750	7,200	7,350	7,350	\$ 28,650
Germany	4,950	4,950	5,850	600	\$ 16,350
India	2,850	3,200	4,350	4,800	\$ 15,200
Japan	5,400	5,850	5,850	5,400	\$ 22,500
U.S.A.	11,250	10,350	13,800	11,250	\$ 46,650
Total \$	63,250	66,950	61,050	63,400	\$ 223,650



# Understand Relative and Absolute Cell References

- Use an **absolute cell reference** when you want to preserve the exact cell address in a formula
  - Reference does not change even if the formula is copied to another location
  - Created by placing a dollar sign (\$) before both the column letter and the row number for the cell's address



# Understanding Relative and Absolute Cell References

Formulas containing absolute and relative references

The screenshot displays two tables in an Excel spreadsheet. The first table, titled "Quest Specialty Travel Sales Expense Projections for 2016", uses absolute references for its formulas. The second table, which is a copy of the first, uses relative references. Annotations highlight the differences in how these references behave when formulas are copied.

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Australia	5000	6000	4200	5400	=SUM(\$E\$5:\$E\$13)
Britain	4000	5000	4800	4800	=SUM(\$E\$6:\$E\$13)
Canada	4900	4600	4300	4800	=SUM(\$E\$7:\$E\$13)
France	4500	4800	4300	4500	=SUM(\$E\$8:\$E\$13)
Germany	3300	3300	3900	400	=SUM(\$E\$9:\$E\$13)
India	1900	2800	2900	3200	=SUM(\$E\$10:\$E\$13)
Japan	3600	3900	2900	3600	=SUM(\$E\$11:\$E\$13)
U.S.A.	7500	6900	5000	7500	=SUM(\$E\$12:\$E\$13)
Total	=SUM(\$B\$12:\$B\$13)	=SUM(\$C\$12:\$C\$13)	=SUM(\$D\$12:\$D\$13)	=SUM(\$E\$12:\$E\$13)	=SUM(\$F\$12:\$F\$13)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Australia	=E5*20%\$16	=C5*20%\$16	=D5*20%\$16	=E5*20%\$16	=SUM(\$E\$19:\$E\$26)
Britain	=E6*20%\$16	=C6*20%\$16	=D6*20%\$16	=E6*20%\$16	=SUM(\$E\$20:\$E\$26)
Canada	=E7*20%\$16	=C7*20%\$16	=D7*20%\$16	=E7*20%\$16	=SUM(\$E\$21:\$E\$26)
France	=E8*20%\$16	=C8*20%\$16	=D8*20%\$16	=E8*20%\$16	=SUM(\$E\$22:\$E\$26)
Germany	=E9*20%\$16	=C9*20%\$16	=D9*20%\$16	=E9*20%\$16	=SUM(\$E\$23:\$E\$26)
India	=E10*20%\$16	=C10*20%\$16	=D10*20%\$16	=E10*20%\$16	=SUM(\$E\$24:\$E\$26)
Japan	=E11*20%\$16	=C11*20%\$16	=D11*20%\$16	=E11*20%\$16	=SUM(\$E\$25:\$E\$26)
U.S.A.	=E12*20%\$16	=C12*20%\$16	=D12*20%\$16	=E12*20%\$16	=SUM(\$E\$26:\$E\$26)
Total	=SUM(\$B\$19:\$B\$26)	=SUM(\$C\$19:\$C\$26)	=SUM(\$D\$19:\$D\$26)	=SUM(\$E\$19:\$E\$26)	=SUM(\$F\$19:\$F\$26)

**Annotations:**

- Absolute references in copied formulas do not change:** Points to the absolute references (e.g., \$E\$5) in the first table.
- Cell referenced in absolute formulas:** Points to the value 1.5 in cell B16, which is part of the absolute formula in the first table.
- Relative references in copied formulas adjust to the new location:** Points to the relative references (e.g., E5) in the second table.



# Understand Relative and Absolute Cell References

- Using a **mixed reference**
  - A mixed cell reference combines both relative and absolute cell referencing
    - Example: When you copy a formula, you may want to change the row reference but keep the column reference
  - Created using the [F4] function key



# Copy Formulas with Relative Cell References

- Reuse formulas you have created
- Use Copy and Paste commands or the fill handle to copy formulas
- Copying a formula to a new cell
  - Excel substitutes new cell references so that the relationship of the cells to the formula remains unchanged



# Copy Formulas with Relative Cell References

Formula pasted in a range

The screenshot shows the Microsoft Excel interface with the 'HOME' tab selected. The spreadsheet displays tour expenses by quarter for FY 2016. The following table represents the data shown in the spreadsheet:

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Australia	5976.2	6073.82	7107.66	6524.19	25681.87
Britain	3510.99	3921.46	4337.4	4558.11	16327.96
Canada	4287.76	4371.98	4570.21	4100.06	17330.01
France	4032.1	4489.74	4579.06	4653.92	
Germany	5082.77	2994.56	3561.12	3712.5	
India	1468.25	2510.3	2665.04	2890.95	
Japan	3271.5	3556.14	8240.35	3721.69	
U.S.A.	7195.06	6542.76	8240.36	7018.91	
Total	34824.63	34460.76	43301.2	37180.33	

Annotations in the image include:

- Paste button**: Points to the 'Paste' icon in the Clipboard group of the HOME tab.
- Paste button arrow**: Points to the 'Paste' icon in the Clipboard group of the HOME tab.
- Paste Options button**: Points to the 'Paste Options' button (labeled 'Paste Options') that appears after pasting into a range.



# Copy Formulas with Relative Cell References

- Auto Fill feature can be used for filling cells with sequential text or values
  - Months of the year; days of the week; or text plus a number (Quarter 1, Quarter 2, etc.)
  - Drag the fill handle to extend an existing sequence



# **Copy Formulas with Absolute Cell References**

- Apply absolute cell reference before copying a formula if you want one or more cell references to remain unchanged in relation to the formula

# Copy Formulas with Absolute Cell References

Absolute reference created in formula

EXB-Tour Expense Analysis - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW

Cut Copy Paste Format Painter Clipboard Font Alignment Number Conditional Formatting Styles Cells Editing

AVERAGE \* X ✓ ✗ =F4\*\$G\$2 Absolute cell reference in formula

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Tour Expenses by Quarter, FY 2016						Change							
2							1.1							
3		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total		What if?						
4	Australia	5976.2	6073.82	7107.66	6524.19	25681.87		=F4*\$G\$2						
5	Britain	3510.99	3921.46	4337.4	4558.11	16327.96								
6	Canada	4287.76	4371.98	4570.21	4100.06	17330.01								
7	France	4032.1	4489.74	4579.06	4653.92	17754.82								
8	Germany	5082.77	2994.56	3561.12	3712.5	15350.95								
9	India	1468.25	2510.3	2665.04	2890.95	9534.54								
10	Japan	3271.5	3556.14	8240.35	3721.69	18789.68								
11	U.S.A.	7195.06	6542.76	8240.36	7018.91	28997.09								
12	Total	34824.63	34460.76	43301.2	37180.33									
13														
14	20% rise	41789.556	41352.912	51961.44	44616.3									
15	Average	4353.0788	4307.595	5412.65	4647.54									
16	Maximum	7195.06	6542.76	8240.36	7018.91									
17	Minimum	1468.25	2510.3	2665.04	2890.95									
18														
19														
20		Quarter 1	Quarter 2	Quarter 3	Quarter 4									
21	30% rise	45272.019	44798.988	56291.56	48334.429									
22														

Incorrect values from relative referencing in previously copied formulas



# Round a Value with a Function

- Cells containing financial data are often easier to read if they contain fewer decimals
- Use the ROUND function to round down your results



# Round a Value with a Function

ROUND function added to an existing formula

ROUND function and opening parenthesis inserted in formula

Screen tip indicates needed arguments

Tour Expenses by Quarter, FY 2016						Change	What if?
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	1.2	
Australia	5976.2	6073.82	7107.66	6524.19	25681.87		30818.2
Britain	3510.99	3921.46	4337.4	4558.11	16327.96		19593.6
Canada	4287.76	4371.98	4570.21	4100.06	17330.01		20796
France	4032.1	4489.74	4579.06	4653.92	17754.82		21305.6
Germany	5082.77	2994.56	3561.12	3712.5	15350.95		18421.1
India	1468.25	2510.3	2665.04	2890.95	9534.54		11441.4
Japan	3271.5	3556.14	8240.35	3721.69	18789.68		22547.6
U.S.A.	7195.06	6542.76	8240.36	7018.91	28997.09		34796.5
Total	34824.63	34460.78	43301.2	37180.33			
20% rise	=ROUND(B	41352.912	51961.44	44616.396			
Average	4353.0788	4307.595	5412.65	4647.5413			
Maximum	7195.06	6542.76	8240.36	7018.91			
Minimum	1468.25	2510.3	2665.04	2890.95			
30% rise	45272.019	44798.988	56291.56	48334.429			



# Summary

- Create a complex formula
- Insert a function
- Type a function
- Copy and move cell entries
- Understand relative and absolute cell references



# Summary

- Copy formulas with relative cell references
- Copy formulas with absolute cell references
- Round a value with a function