MICROSOFT EXCEL



Creating More Complex Formulas

Contents

2

Introduction

- The order of operations
- Creating complex formulas
- To create a complex formula using the order of operations
- Practice

3 Introduction

You may have experience working with formulas that contain only one operator, such as 7+9. More complex formulas can contain several mathematical operators, such as 5+2*8. When there's more than one operation in a formula, the order of operations tells Excel which operation to calculate first. To write formulas that will give you the correct answer, you'll need to understand the order of operations.

Excel calculates formulas based on the following order of operations:

- 1. Operations enclosed in **parentheses**
- 2. Exponential calculations (3^2, for example)
- 3. Multiplication and division, whichever comes first
- 4. Addition and subtraction, whichever comes first

A mnemonic that can help you remember the order is **PEMDAS**, or **P**lease **E**xcuse **M**y **D**ear **A**unt **S**ally.

Using	g the Order of Operations
P E M	10+(6-3)/2^2*4-1
D	
Α	
S	

5

While this formula may look complicated, we can use the order of operations step by step to find the right answer.

Using the O	order of Operations	
arentheses	10+(6-3)/2^2*4-1	

D

Parentileses	$10+(0-5)/2^{-2}$ 4-1
E	
Μ	
D	
Α	
S	

Using the Order of Operations

Ρ	10+(6-3)/2^2*4-1
E xponents	10+3/ <mark>2^2</mark> *4-1
Μ	
D	
Α	
S	

First, we'll start by calculating anything inside parentheses. In this case, there's only one thing we need to calculate: 6-3=3.

As you can see, the formula already looks simpler. Next, we'll look to see if there are any exponents. There is one: 2^2=4.

Using the Order of Operations

Ρ	10+(6-3)/2^2*4-1
E	10+3/2^2*4-1
M ultiplication	10+ <mark>3/4</mark> *4-1
Division Whichever comes first!	
Α	
S	

Next, we'll solve any multiplication and division, working from left to right. Because the division operation comes before the multiplication, it's calculated first: 3/4=0.75.

Using the Order of Operations

Ρ	10+(6-3)/2^2*4-1
E	10+3/2^2*4-1
M ultiplication	10+3/4*4-1
Division Whichever comes first!	10+0.75*4-1
Α	
S	

Now, we'll solve our remaining multiplication operation: 0.75*4=3.

Using the Order of Operations

Ρ	10+(6-3)/2^2*4-1
E	10+3/2^2*4-1
Μ	10+3/4*4-1
D	10+0.75*4-1
Addition Whichever comes first!	10+3-1
S ubtraction	

Next, we'll calculate any addition or subtraction, again working from left to right. Addition comes first: 10+3=13.

Using the O	Using the Order of Operations		
P E M D Addition Whichever comes first Subtraction	10+(6-3)/2^2*4-1 10+3/2^2*4-1 10+3/4*4-1 10+0.75*4-1 10+3-1 13-1		
/			

Finally, we have one remaining subtraction operation: 13-1=12.

Using the Order of Operations

Р	10+(6-3)/2^2*4-1
E	10+3/2^2*4-1
Μ	10+3/4*4-1
D	10+0.75*4-1
Α	10+3-1 🗖 🗖
S	13-1 🗖 🖊

Now we have our answer: 12. And this is the exact same result you would get if you entered the formula into Excel.

In the example below, we'll demonstrate how Excel uses the order of operations to solve a more complex formula. Here, we want to calculate the cost of **sales tax** for a catering invoice. To do this, we'll write our formula as **=(D3+D4+D5)*0.075** in cell **D6**. This formula will add the prices of our items, then multiply that value by the 7.5% tax rate (which is written as 0.075) to calculate the answer.

NETWORK ▼ : × ✓ f =(D3+D4+D5)*0.075						
	А	В	с	D	Е	
2	MENU ITEM	UNIT PRICE	QUANTITY	LINE TOTAL		
3	Tamales: Carnitas	\$2.29	20	\$45.80		
4	Tamales: Vegetable	\$2.29	30	\$68.70		
5	Empanadas: Nutella & Banana	\$3.99	40	\$159.60		
6	TAX =(D3+D4+D5)*0.075					
7	TOTAL					
8						

Excel follows the order of operations and first adds the values inside the parentheses: (45.80+68.70+159.60) = 274.10. It then multiplies that value by the tax rate: 274.10*0.075. The result will show that the sales tax is \$20.56.

D	D6 • : × · f _x =(D3+D4+D5)*0.075					
	А	В	С	D	Е	
2	MENU ITEM	UNIT PRICE	QUANTITY	LINE TOTAL		
3	Tamales: Carnitas	\$2.29	20	\$45.80		
4	Tamales: Vegetable	\$2.29	30	\$68.70		
5	Empanadas: Nutella & Banana	\$3.99	40	\$159.60		
6			TAX	\$20.56		
7	TOTAL					
8						
Ν						

It's especially important to follow the order of operations when creating a formula. Otherwise, Excel won't calculate the results accurately. In our example, if the **parentheses** are not included, the multiplication is calculated first and the result is incorrect. Parentheses are often the best way to define which calculations will be performed first in Excel.

D	D6 ▼ : × ✓ f _x =D3+D4+D5*0.075					
	А	В	с	D	E	
2	MENU ITEM	UNIT PRICE	QUANTITY	LINE TOTAL		
3	Tamales: Carnitas	\$2.29	20	\$45.80		
4	Tamales: Vegetable	\$2.29	30	\$68.70		
5	Empanadas: Nutella & Banana	\$3.99	40	\$159.60		
6			TAX	\$126.47		
7			TOTAL			
8						

In the example below, we'll use **cell references** along with **numerical values** to create a complex formula that will calculate the **subtotal** for a catering invoice. The formula will calculate the cost of each menu item first, then add these values.

 Select the cell that will contain the formula. In our example, we'll select cell C5.

$C5 \vdots \times \checkmark f_x$					
	А	В	С	D	
2	MENU ITEM	UNIT PRICE	QUANTITY		
3	Empanadas: Poblano & Cheese	\$2.79	35		
4	Empanadas: Spicy Sweet Potato	\$2.29	20		
5		SUBTOTAL	¢		
6		TOTAL W/ TAX			
7					
hí				CONTRACTOR OF STREET, S	

Enter your formula. In our example, we'll type =B3*C3+B4*C4. This formula will follow the order of operations, first performing the multiplication: 2.79*35 = 97.65 and 2.29*20 = 45.80. It then will add these values to calculate the total: 97.65+45.80.

NETWORK ▼ : × ✓ f _x =B3*C3+B4*C4					
	А	В	С	D	
2	MENU ITEM	UNIT PRICE	QUANTITY		
3	Empanadas: Poblano & Cheese	\$2.79	35		
4	Empanadas: Spicy Sweet Potato	\$2.29	20		
5		SUBTOTAL	=B3*C3+B4*C4		
6		TOTAL W/ TAX			
7					
1					

3. Double-check your formula for accuracy, then press **Enter** on your keyboard. The formula will calculate and display the **result**. In our example, the result shows that the subtotal for the order is **\$143.45**.

C5	C5 • : × \checkmark f_x =B3*C3+B4*C4					
	А	В	С	D		
2	MENU ITEM	UNIT PRICE	QUANTITY			
3	Empanadas: Poblano & Cheese	\$2.79	35			
4	Empanadas: Spicy Sweet Potato	\$2.29	20			
5		SUBTOTAL	\$143.45			
6		TOTAL W/ TAX				
7						

You can add parentheses to any equation to make it easier to read. While it won't change the result of the formula in this example, we could enclose the multiplication operations within parentheses to clarify that they will be calculated before the addition.

NETWORK ▼ : × ✓ f _x =(B3*C3)+(B4*C4)						
	А	В	С	D		
2	MENU ITEM	UNIT PRICE	QUANTITY			
3	Empanadas: Poblano & Cheese	\$2.79	35			
4	Empanadas: Spicy Sweet Potato	\$2.29	20			
5		SUBTOTAL	=(B3*C3)+(B4*C4)			
6		TOTAL W/ TAX				
7						
7						

Excel **will not always tell you** if your formula contains an error, so it's up to you to check all of your formulas.

15 Practice

Open our practice workbook.

- Click the Challenge worksheet tab in the bottom-left of the workbook.
- In cell D7, create a formula that calculates the tax for the invoice. Use a sales tax rate of 7.5%.
- In cell **D8**, create a formula that finds the total for the order. In other words, this formula should add cells **D3:D7**.

In cell **D9** create a formula that calculates the total after a **10%** discount. If you need help understanding how to take a percentage off of a total, check out our lesson on **Discounts**, **Markdowns**, **and Sales**.



	А	В	с	D
		Catering Invo	oice	
1		Sabrosa Empanadas 1202 Biscayne Bay E Orlando, FL 32804	s & More Drive	Invoice #: 6710A Date: 10/15/16
2	MENU ITEM	UNIT PRICE	QUANTITY	LINE TOTAL
3	Empanadas: Buffalo Chicken	\$2.98	20	\$59.60
4	Empanadas: Braised Short Rib	\$2.98	30	\$89.40
5	Empanadas: Fig and Goat Cheese	\$3.75	25	\$93.75
6	Sides: Black beans and rice	\$1.98	40	\$79.20
7			TAX	\$24.15
8			TOTAL	\$346.10
9		TOTAL AFTER DISCOUNT:		\$311.49

