Formulas

1. Introduction

One of the most powerful features in Excel is the ability to **calculate** numerical information using **formulas**. Just like a calculator, Excel can add, subtract, multiply, and divide. In this lesson, we'll show you how to use **cell references** to create simple formulas.

2. Mathematical operators

Excel uses standard operators for formulas: a **plus sign** for addition (+), **minus sign** for subtraction (–), **asterisk** for multiplication (*), **forward slash** for division (/), and **caret** (^) for exponents.

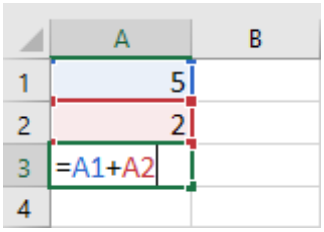
Addition	+
Subtraction	-
Multiplication	*
Division	/
Exponents	^

All formulas in Excel must begin with an **equals sign** (=). This is because the cell contains, or is equal to, the formula and the value it calculates.

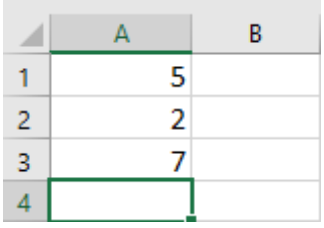
3.Understanding cell references

While you can create simple formulas in Excel using numbers (for example, =2+2 or =5*5), most of the time you will use **cell addresses** to create a formula. This is known as making a **cell reference**. Using cell references will ensure that your formulas are always accurate because you can change the value of referenced cells without having to rewrite the formula.

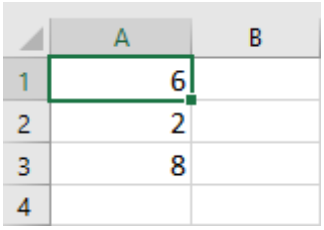
In the formula below, cell A3 adds the values of cells A1 and A2 by making cell references:



When you press Enter, the formula calculates and displays the answer in cell A3:



If the values in the referenced cells change, the formula automatically recalculates:



	A	B
1	6	
2	2	
3	8	
4		

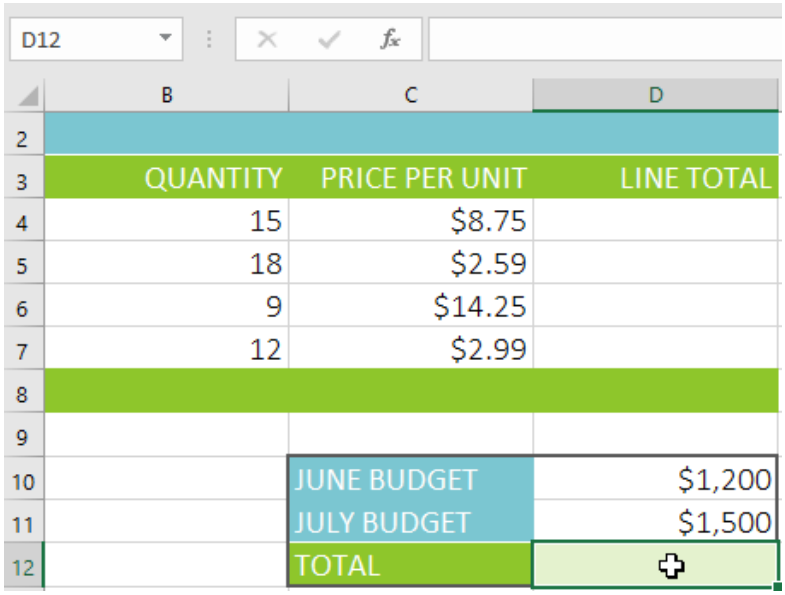
By combining a mathematical operator with cell references, you can create a variety of simple formulas in Excel. Formulas can also include a combination of cell references and numbers, as in the examples below:

=A1+A2	Adds cells A1 and A2
=C4-3	Subtracts 3 from cell C4
=E7/J4	Divides cell E7 by J4
=N10*1.05	Multiplies cell N10 by 1.05
=R5^2	Finds the square of cell R5

To create a formula:

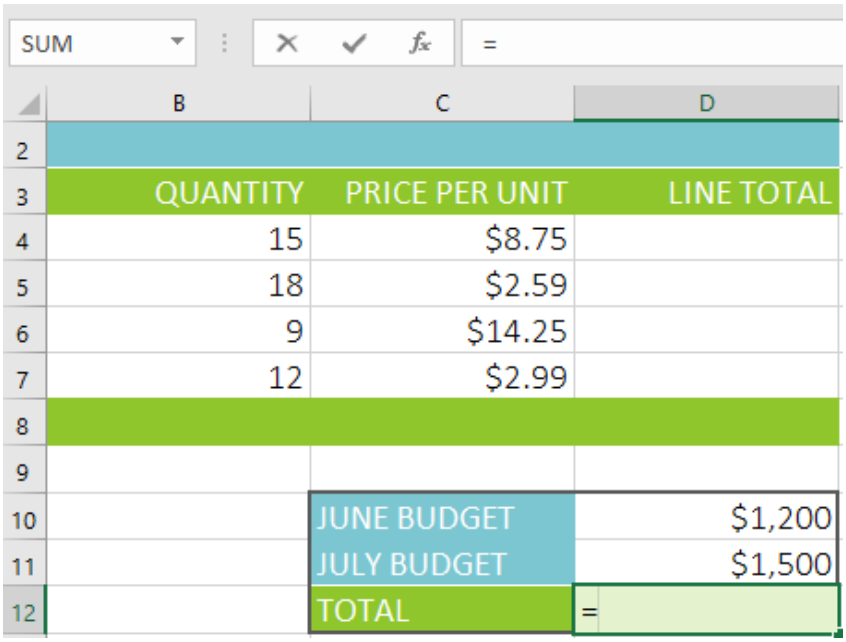
In our example below, we'll use a simple formula and cell references to calculate a budget.

1. Select the **cell** that will contain the formula. In our example, we'll select cell **D12**.



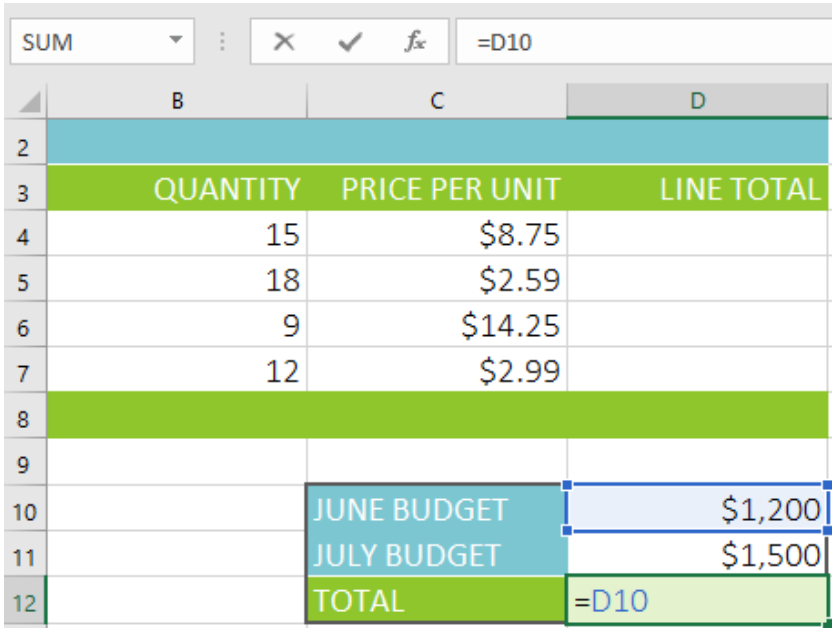
	B	C	D
2			
3	QUANTITY	PRICE PER UNIT	LINE TOTAL
4	15	$8.75	
5	18	$2.59	
6	9	$14.25	
7	12	$2.99	
8			
9			
10		JUNE BUDGET	$1,200
11		JULY BUDGET	$1,500
12		TOTAL	

2. Type the **equals sign (=)**. Notice how it appears in both the **cell** and the **formula bar**.



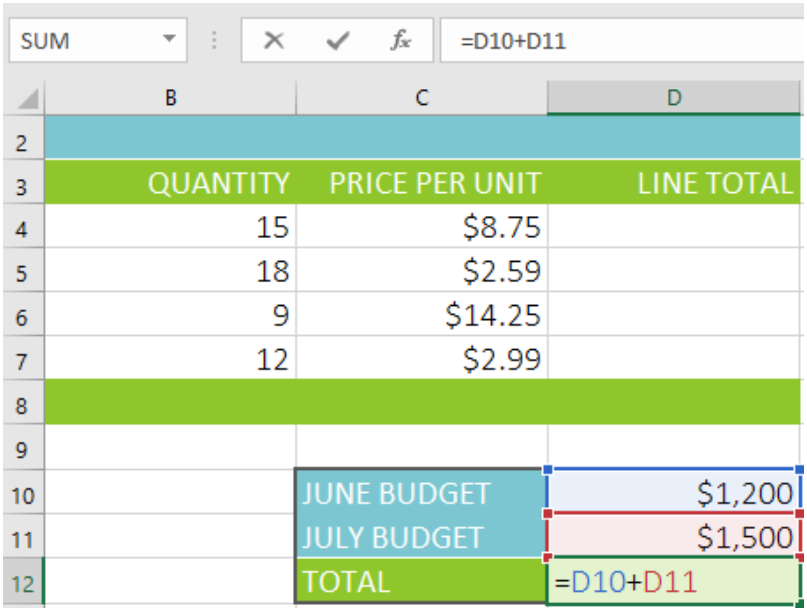
	B	C	D
2			
3	QUANTITY	PRICE PER UNIT	LINE TOTAL
4	15	$8.75	
5	18	$2.59	
6	9	$14.25	
7	12	$2.99	
8			
9			
10		JUNE BUDGET	$1,200
11		JULY BUDGET	$1,500
12		TOTAL	=

3. Type the **cell address** of the cell you want to reference first in the formula: cell **D10** in our example. A **blue border** will appear around the referenced cell.



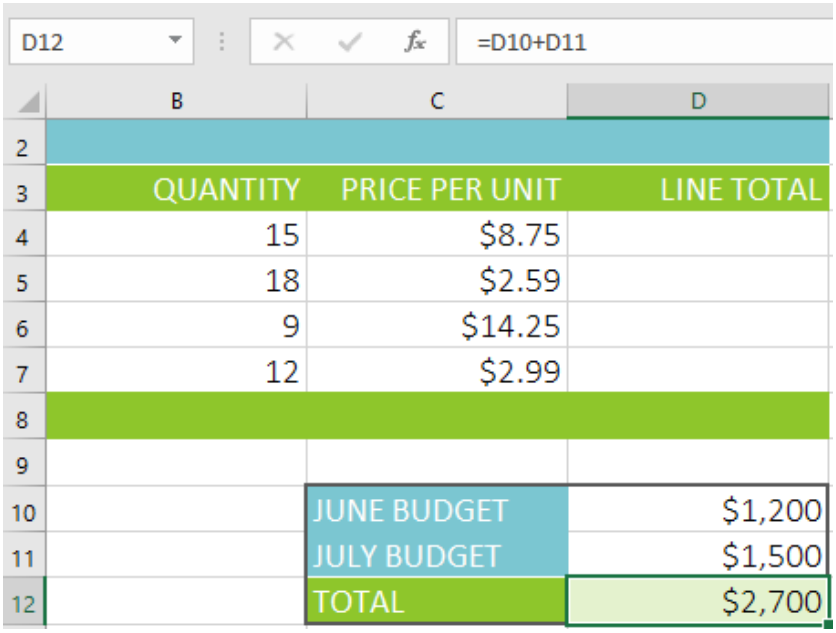
4. Type the **mathematical operator** you want to use. In our example, we'll type the **addition sign** (+).

5. Type the **cell address** of the cell you want to reference second in the formula: cell **D11** in our example. A **red border** will appear around the referenced cell.



6. Press **Enter** on your keyboard. The formula will be **calculated**, and the **value** will be displayed in the cell. If you select the cell

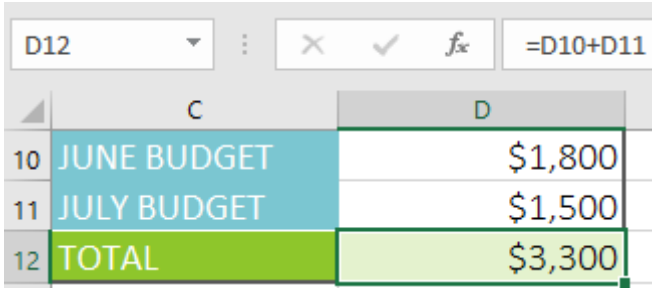
again, notice that the cell displays the result, while the formula bar displays the formula.



If the result of a formula is too large to be displayed in a cell, it may appear as **pound signs** (#######) instead of a value. This means the column is not wide enough to display the cell content. Simply **increase the column width** to show the cell content.

4. Modifying values with cell references

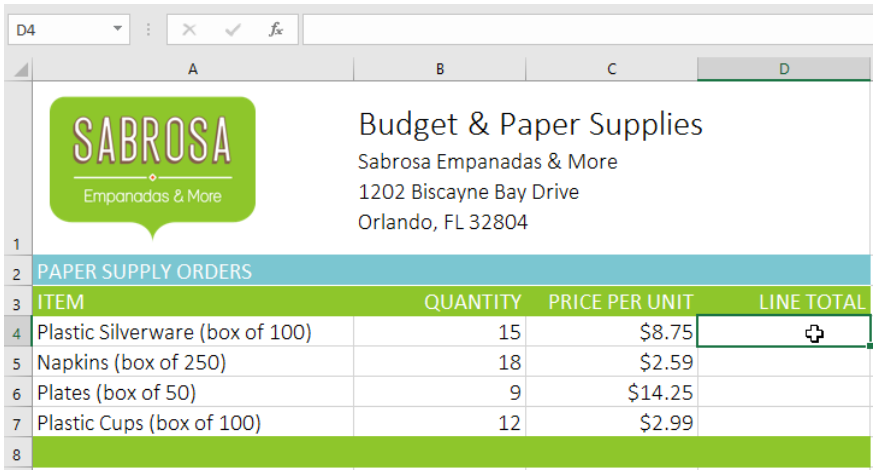
The true advantage of cell references is that they allow you to **update data** in your worksheet without having to rewrite formulas. In the example below, we've modified the value of cell D10 from $1,200 to $1,800. The formula in D12 will automatically recalculate and display the new value in cell D12.



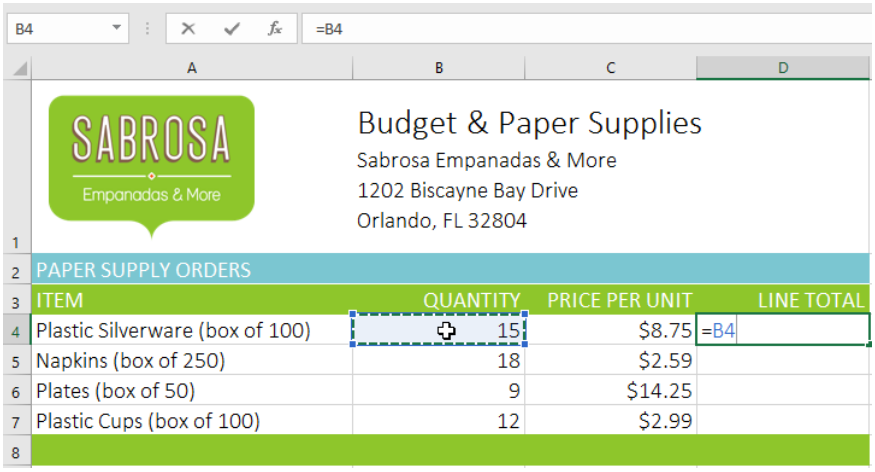
To create a formula using the point-and-click method:

Instead of typing cell addresses manually, you can **point and click** the cells you want to include in your formula. This method can save a lot of time and effort when creating formulas. In our example below, we'll create a formula to calculate the cost of ordering several boxes of plastic silverware.

1. Select the **cell** that will contain the formula. In our example, we'll select cell **D4**.

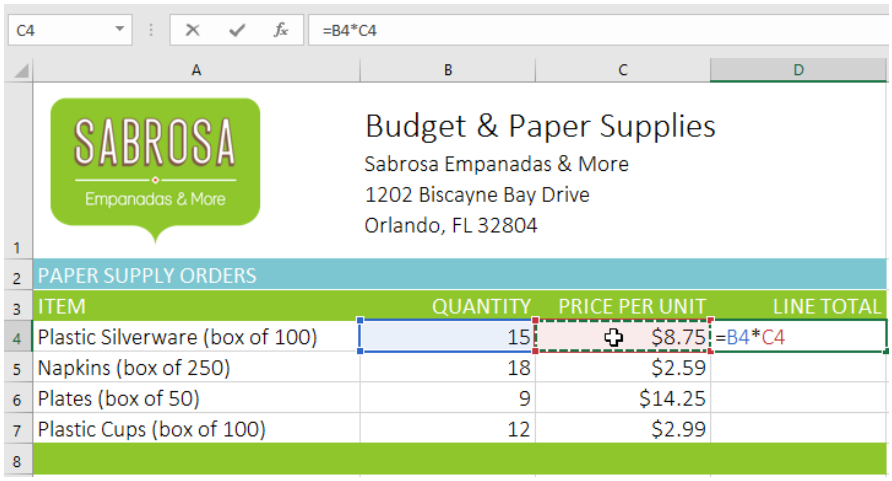


2. Type the **equals sign (=)**.
3. Select the **cell** you want to reference first in the formula: cell **B4** in our example. The **cell address** will appear in the formula.

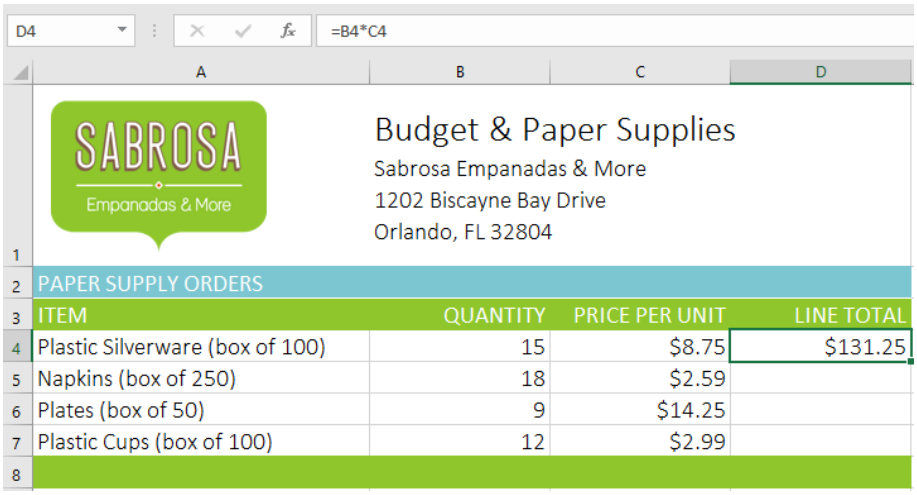


4. Type the **mathematical operator** you want to use. In our example, we'll type the **multiplication sign (*)**.

5. Select the **cell** you want to reference second in the formula: cell **C4** in our example. The **cell address** will appear in the formula.



6. Press **Enter** on your keyboard. The formula will be **calculated**, and the **value** will be displayed in the cell.

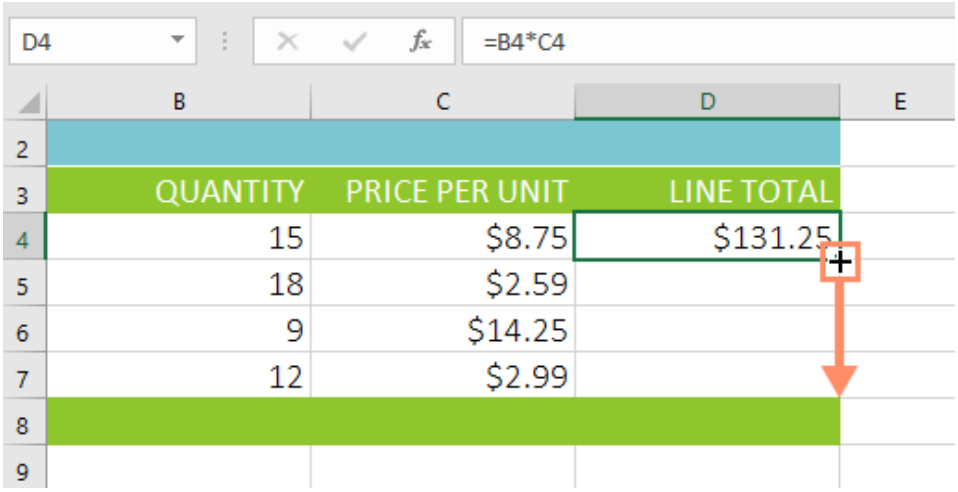


	A	B	C	D
1	SABROSA Empanadas & More	Budget & Paper Supplies Sabrosa Empanadas & More 1202 Biscayne Bay Drive Orlando, FL 32804		
2	PAPER SUPPLY ORDERS			
3	ITEM	QUANTITY	PRICE PER UNIT	LINE TOTAL
4	Plastic Silverware (box of 100)	15	$8.75	$131.25
5	Napkins (box of 250)	18	$2.59	
6	Plates (box of 50)	9	$14.25	
7	Plastic Cups (box of 100)	12	$2.99	
8				

Copying formulas with the fill handle

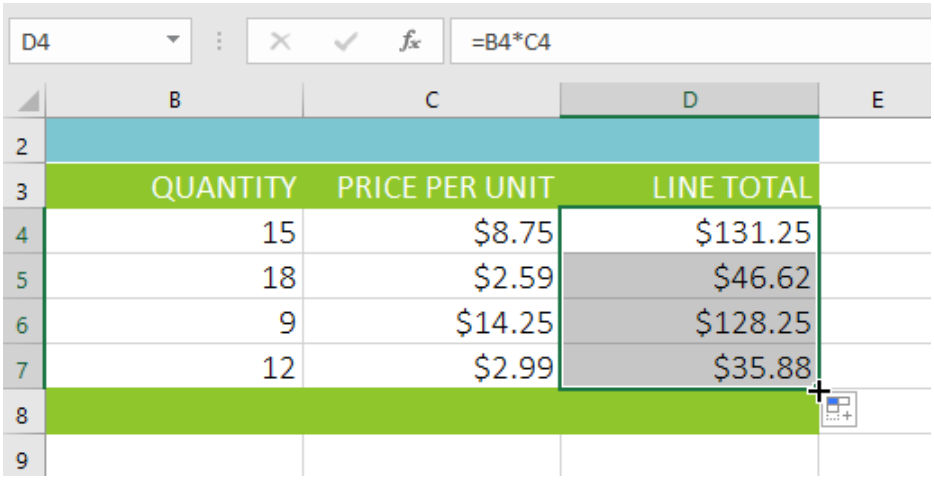
Formulas can also be **copied** to adjacent cells with the **fill handle**, which can save a lot of time and effort if you need to perform the **same calculation** multiple times in a worksheet. The **fill handle** is the small square at the bottom-right corner of the selected cell(s).

1. Select the cell containing the formula you want to copy. Click and drag the **fill handle** over the cells you want to fill.



	B	C	D	E
2				
3	QUANTITY	PRICE PER UNIT	LINE TOTAL	
4	15	$8.75	$131.25	
5	18	$2.59		
6	9	$14.25		
7	12	$2.99		
8				
9				

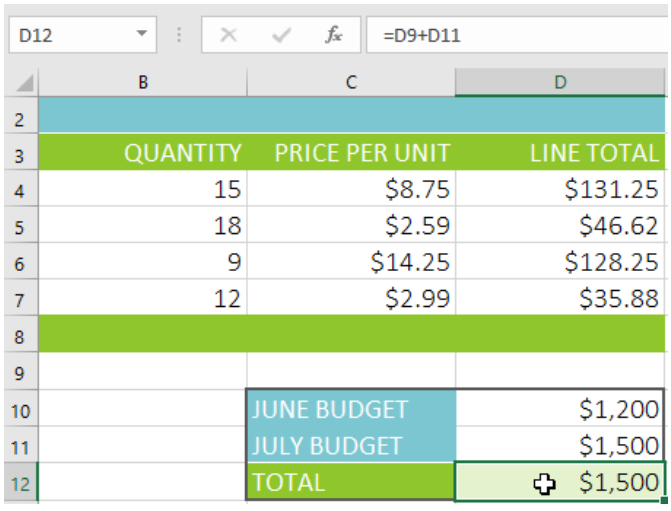
2. After you release the mouse, the formula will be copied to the selected cells.



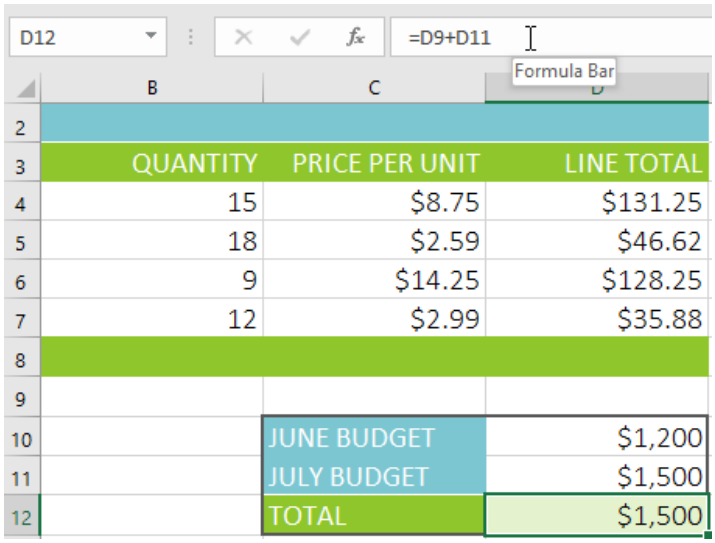
To edit a formula:

Sometimes you may want to modify an existing formula. In the example below, we've entered an incorrect cell address in our formula, so we'll need to correct it.

1. Select the **cell** containing the formula you want to edit. In our example, we'll select cell **D12**.

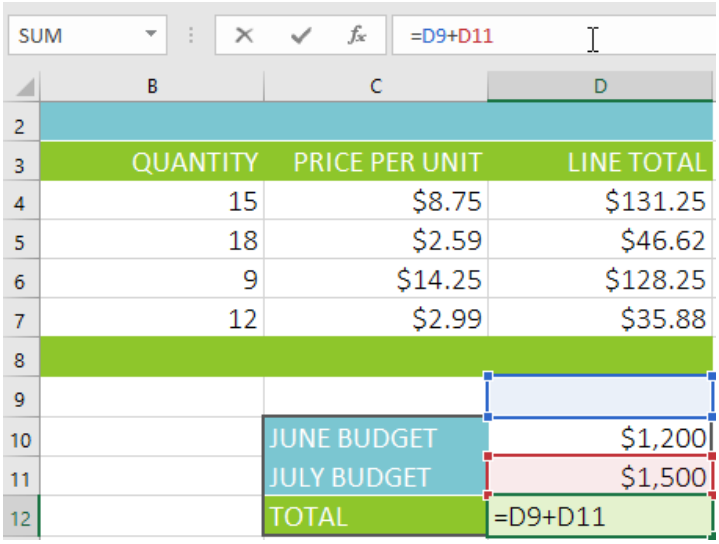


2. Click the **formula bar** to edit the formula. You can also **double-click** the cell to view and edit the formula directly within the cell.



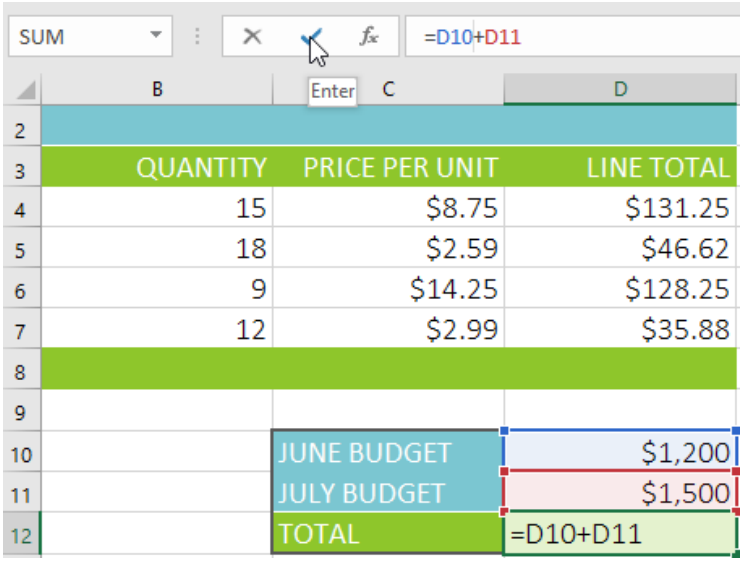
	B	C	D
2			
3	QUANTITY	PRICE PER UNIT	LINE TOTAL
4	15	$8.75	$131.25
5	18	$2.59	$46.62
6	9	$14.25	$128.25
7	12	$2.99	$35.88
8			
9			
10		JUNE BUDGET	$1,200
11		JULY BUDGET	$1,500
12		TOTAL	$1,500

3. A **border** will appear around any referenced cells. In our example, we'll change the first part of the formula to reference cell **D10** instead of cell **D9**.

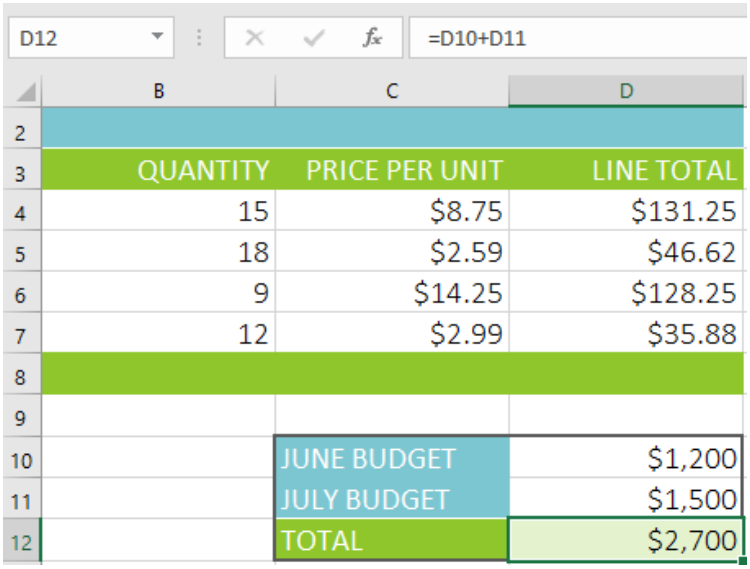


	B	C	D
2			
3	QUANTITY	PRICE PER UNIT	LINE TOTAL
4	15	$8.75	$131.25
5	18	$2.59	$46.62
6	9	$14.25	$128.25
7	12	$2.99	$35.88
8			
9			
10		JUNE BUDGET	$1,200
11		JULY BUDGET	$1,500
12		TOTAL	=D9+D11

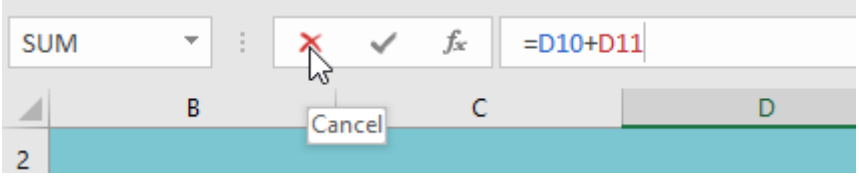
4. When you're finished, press **Enter** on your keyboard or select the **Enter** command in the formula bar.



5. The formula will be **updated**, and the **new value** will be displayed in the cell.



If you change your mind, you can press the **Esc** key on your keyboard or click the **Cancel** command in the formula bar to avoid accidentally making changes to your formula.



To show all of the formulas in a spreadsheet, you can hold the **Ctrl** key and press ` (grave accent). The grave accent key is usually located in the top-left corner of the keyboard. You can press **Ctrl**+` again to switch back to the normal view.

5. Creating More Complex Formulas

You may have experience working with formulas that contain only one operator, like **7+9**. More complex formulas can contain **several mathematical operators**, like **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.

- *The order of operations*

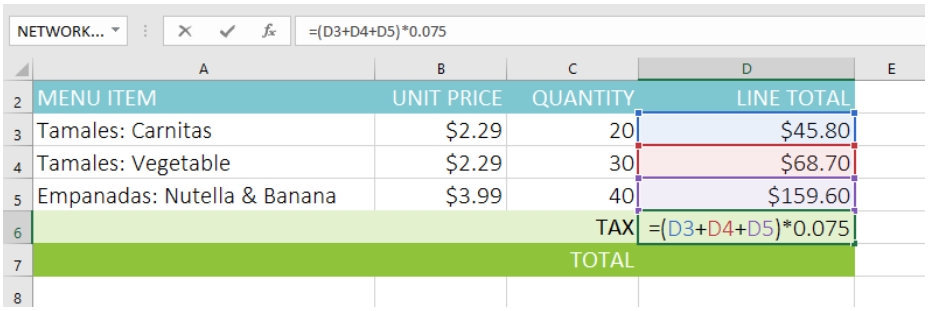
Excel calculates formulas based on the following **order of operations**:

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

- *Creating complex formulas*

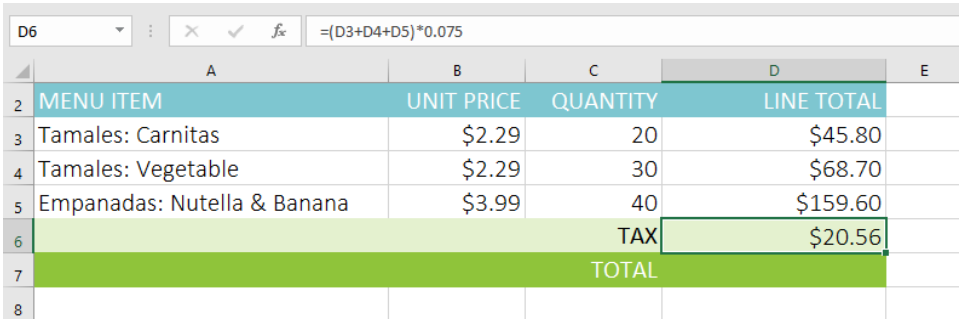
In the example below, we'll demonstrate how Excel uses the order of operations to solve a more complex formula. Here, we want to calculate the cost of **sales tax** for a catering invoice. To

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.



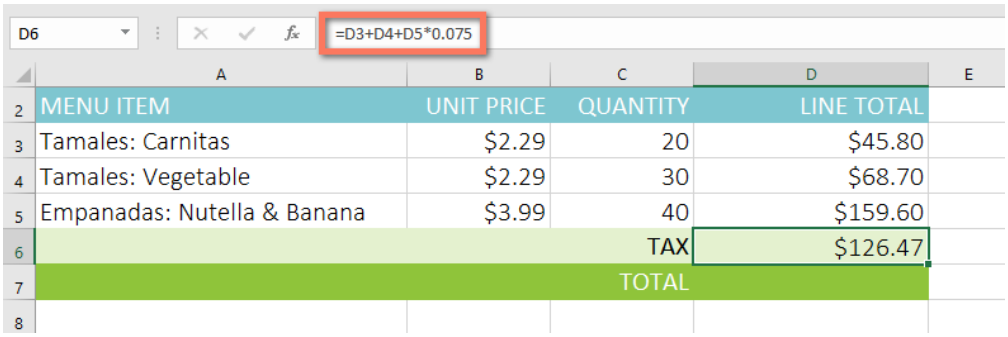
	A	B	C	D	E
2	MENU ITEM	UNIT PRICE	QUANTITY	LINE TOTAL	
3	Tamales: Carnitas	$2.29	20	$45.80	
4	Tamales: Vegetable	$2.29	30	$68.70	
5	Empanadas: Nutella & Banana	$3.99	40	$159.60	
6			TAX	=(D3+D4+D5)*0.075	
7			TOTAL		
8					

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**.



	A	B	C	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	$20.56	
7			TOTAL		
8					

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.

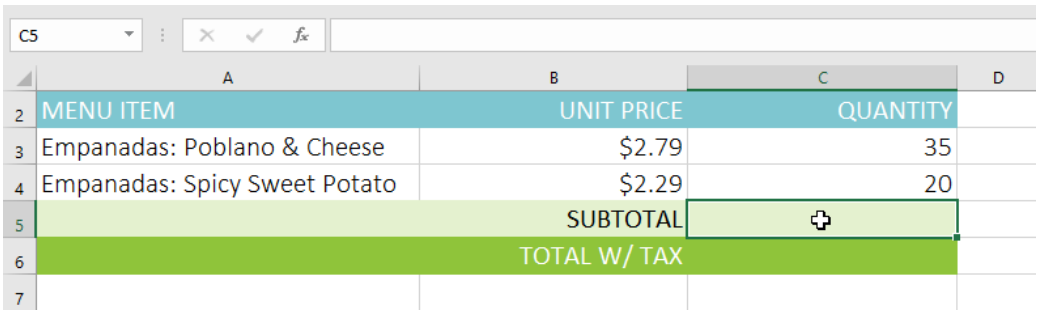


D6	=D3+D4+D5*0.075			
	A	B	C	D	E
2	MENU ITEM	UNIT PRICE	QUANTITY	LINE TOTAL	
3	Tamales: Carnitas	$2.29	20	$45.80	
4	Tamales: Vegetable	$2.29	30	$68.70	
5	Empanadas: Nutella & Banana	$3.99	40	$159.60	
6			TAX	$126.47	
7			TOTAL		
8					

- *To create a complex formula using the order of operations:*

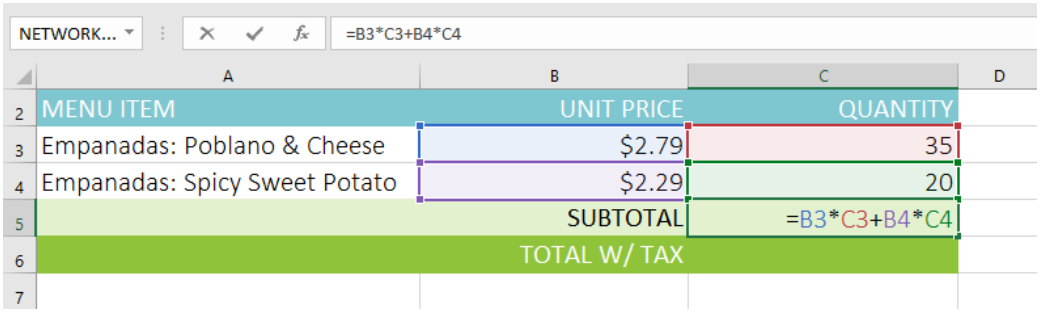
In the example below, we'll use **cell references** along with **numerical values** to create a complex formula that will calculate the **subtotal** for a catering invoice. The formula will calculate the cost of each menu item first, then add these values.

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

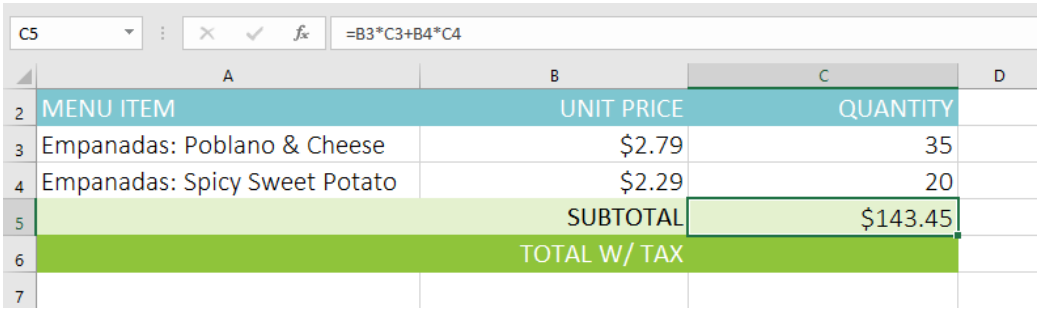


C5			
	A	B	C	D
2	MENU ITEM	UNIT PRICE	QUANTITY	
3	Empanadas: Poblano & Cheese	$2.79	35	
4	Empanadas: Spicy Sweet Potato	$2.29	20	
5		SUBTOTAL		
6		TOTAL W/ TAX		
7				

2. 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**.



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**.



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.