

## **Purpose:**

This activity will guide you to create formulas and use some of the built-in math functions in EXCEL.

The three goals of the spreadsheet are:

- Given a triangle with two out of three angles known, find the missing angle.
- Convert the angles from degrees to radians.
- Find the sine and cosine of every angle.

Note: these directions assume you have used EXCEL before, so you should be able to open the program, enter data, and save your work. If you have difficulty, ask another student or the teacher for assistance.

## **Getting started:**

1. Open EXCEL or if EXCEL is open, create a new worksheet (click on **New** from the **File** menu).

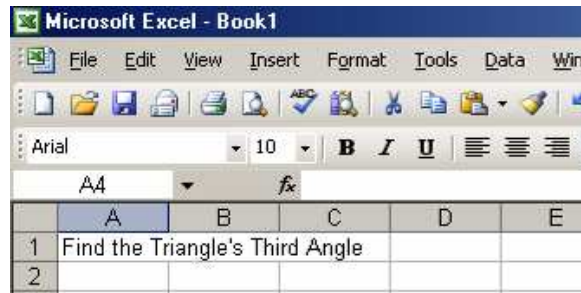
These instructions will refer to cells in terms of their EXCEL reference name (e.g., A1 is the cell in column A, row 1). The column and row names are at the top and left-hand side of the spreadsheet, respectively.

When the instructions tell you to type something in a cell, the words are given in quotations. The quotations are intended to separate what needs to be types from the rest of the sentence. Do not type in the quotes.

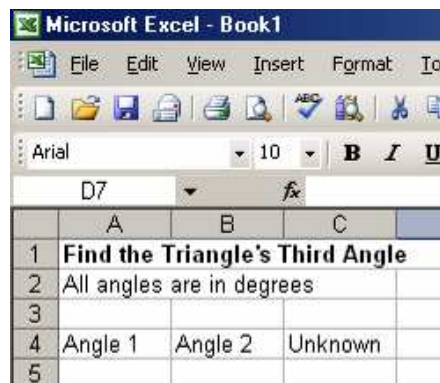
## Develop the spreadsheet:

2. Find the missing angle:

- a. In cell A1, type in “Find the Triangle’s Third Angle”.



- b. Do not stretch the cell to fit the text.
- c. Make the text bold:
  - i. Click anywhere else on the spreadsheet
  - ii. Click on cell A1.
  - iii. Press the CTRL and B keys at the same time to make the text bold.
- d. In cell A2, type in “All angles in degrees”.
- e. In cell A4, type in “Angle 1”
- f. In cell B4, type in “Angle 2”
- g. In cell C4, type in “Unknown”.

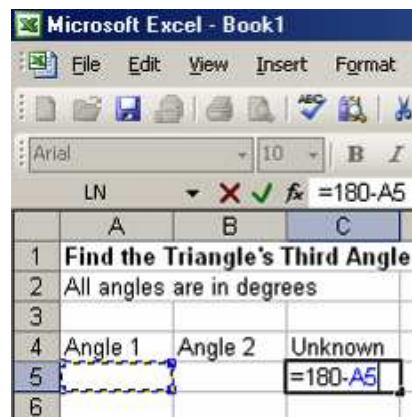


“Angle 1” and “Angle 2” are the two angles given on the triangle. “Unknown” is the third unknown angle in the triangle to be calculated by the spreadsheet.

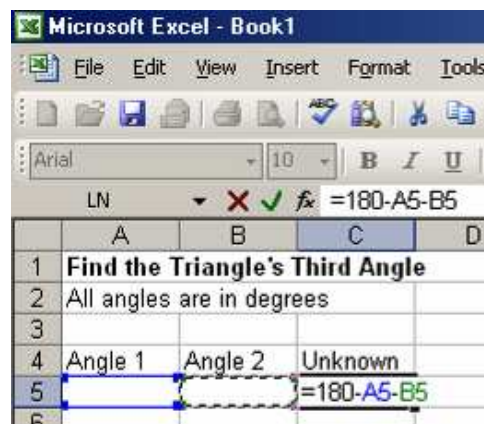
- h. Create the formula to calculate the unknown angle. At this point, all the angles are in degrees.

The formula is:  $\text{Unknown angle} = 180^\circ - \text{Angle 1} - \text{Angle 2}$

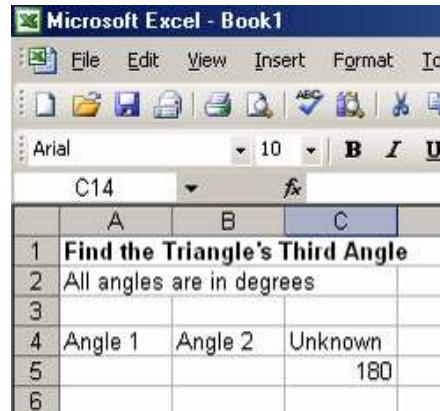
- i. Click on cell C5, just below the “Unknown” cell. You will now create the formula.
- ii. Type in “= 180 -”. The – is a minus sign.
- iii. Click on cell A5 (the cell’s border will start flashing and “A5” will appear next to the minus sign you just typed in). You are now subtracting Angle 1 from 180.



- iv. Without moving the cursor, continue typing “-” in the same cell.
- v. Click on cell B5. You are now subtracting Angle 2 from 180.



- vi. Press ENTER on the keyboard. *You've now written a formula to calculate the missing angle. Cell C5 will now have "180" in it because there are no values in cells A5 or B5.*



- vii. Practice changing the values of A5 and B5 to see the unknown value change. For example, type "60" in A5 and "30" in B5. Notice how the Unknown value changes after you enter each value for A5 and B5.

For this example, what is the value of the unknown angle? \_\_\_\_\_

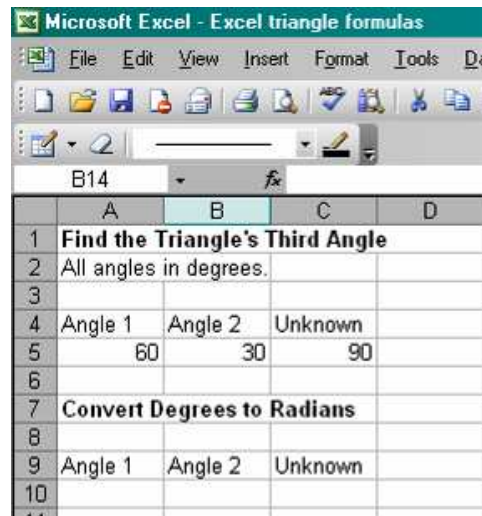
What is the total of all three angles? \_\_\_\_\_

3. Save your spreadsheet to your student directory under the name "Excel triangle formulas".
4. Convert the angle measurements from Degrees to Radians:

*The reason you are converting the angles from degrees to radians is that EXCEL needs the radian values to give us back the sine and cosine values.*

- a. In cell A7, type in "Convert Degrees to Radians"
- b. Make the text bold:
  - i. Click anywhere else on the spreadsheet
  - ii. Select A7 again.
  - iii. Press the CTRL and B keys at the same time to make the text bold.
- c. Copy cells A4, B4, and C4:
  - i. Click on cell A4.

- ii. Hold down the SHIFT key.
- iii. Click on cell B4
- iv. Click on cell C4.
- v. Release the SHIFT key.
- vi. Press the CTRL key and the C key at the same time to copy these cells.  
*The border around the cells will be a flashing dotted line.*
- vii. Click on cell A9.
- viii. Press the CTRL key and the V key at the same time to put a copy of the cells in A9, B9, and C9.
- ix. Press the ESC key (upper left-hand corner of the keyboard) to remove the copied cells from the clipboard.

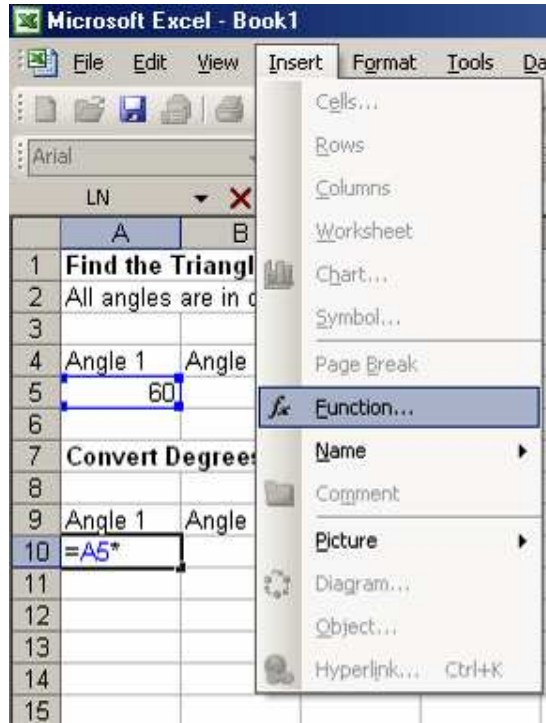


- d. To convert from degrees to radians, we use this formula:  
Radians = Degrees •  $\pi \div 180$

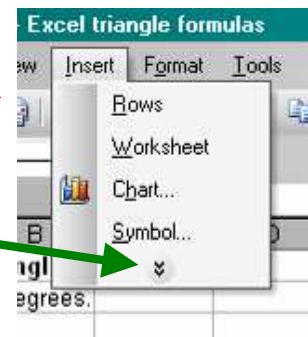
- i. Click on cell A10.
- ii. Type in “=”.
- iii. Click on cell A5.
- iv. Type in “\*”. (\* is on the 8 key, hold down the SHIFT key and press 8)

v. Select Pi from the EXCEL functions menu:

1. Select **Function** from the **Insert** menu. *A pop-up will appear.*

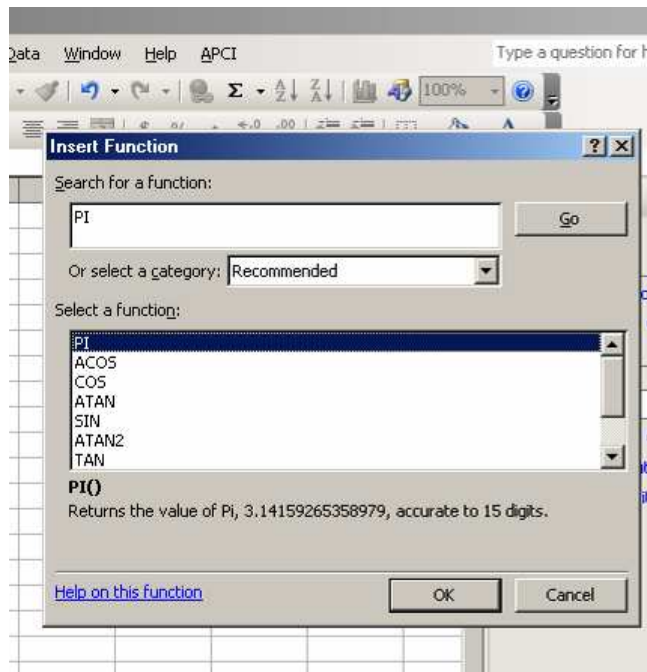


*Note:* if this entire drop down menu does not appear, it will look something like this →  
Click on the double arrow at the bottom of the list to see the entire list.



2. On the pop-up window, type in "PI" in the **Search for a Function** box at the top. *The text in that window should be all highlighted when the pop-up appears, so if you just start typing, only your words will appear in the box. If this does not happen, place your cursor inside the box and use the DELETE key or BACKSPACE to clear out the box, then type in "PI".*

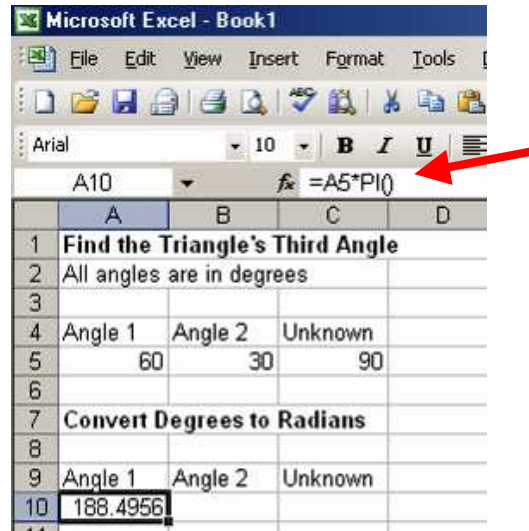
3. Click on **GO**.



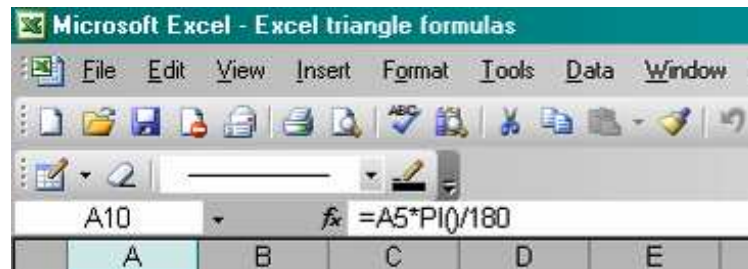
4. In the **Select a function** box on the pop-up, “PI” will be highlighted. Notice below the box is an explanation of what this function does. Click the **OK** button to insert this function into your formula.
5. The next pop-up will be titled “Function Arguments”. It’s a more detailed explanation on how the function works. Click **OK**.

- vi. Selecting this function automatically completes the formula, but we are not done yet. Click on cell A10.

*The formula bar will show the current status of our formula.*



- vii. Click to the right of the closed parenthesis in the formula bar. *The cursor will appear flashing in the formula bar. The formula will appear in cell A10.*
- viii. Type in "/180". The slash is a forward slash (next to the SHIFT key on the right side of the keyboard). *This is what your formula looks like in the formula bar.*



- ix. Press ENTER.



- x. Copy cell A10 to cells B10 and C10.
  1. If A10 is not currently selected, click on it.
  2. Press CTRL key and C key at the same time. *The border around A10 will be a flashing dotted line.*
  3. Click on cell B10.
  4. Press CTRL key and V key at the same time to copy A10's formula into B10.
  5. Click on cell C10.
  6. Press CTRL key and V key at the same time to copy A10's formula into C10.

*Look at the formula bar for C10. Notice how the formula in C10 has automatically adjusted to refer to the Unknown angle's corresponding cell.*

5. Save your work.
6. Determine the sine values for each angle.
  - a. Click on cell A12.
  - b. Type in "Sine Values for Angles".
  - c. Make the text bold:
    - i. Click anywhere else on the spreadsheet
    - ii. Select A12 again.
    - iii. Press the CTRL and B keys at the same time to make the text bold.
  - d. Copy cells A4, B4, and C4:
    - i. Click on cell A4.
    - ii. Hold down the SHIFT key.
    - iii. Click on cell B4
    - iv. Click on cell C4.
    - v. Release the SHIFT key.

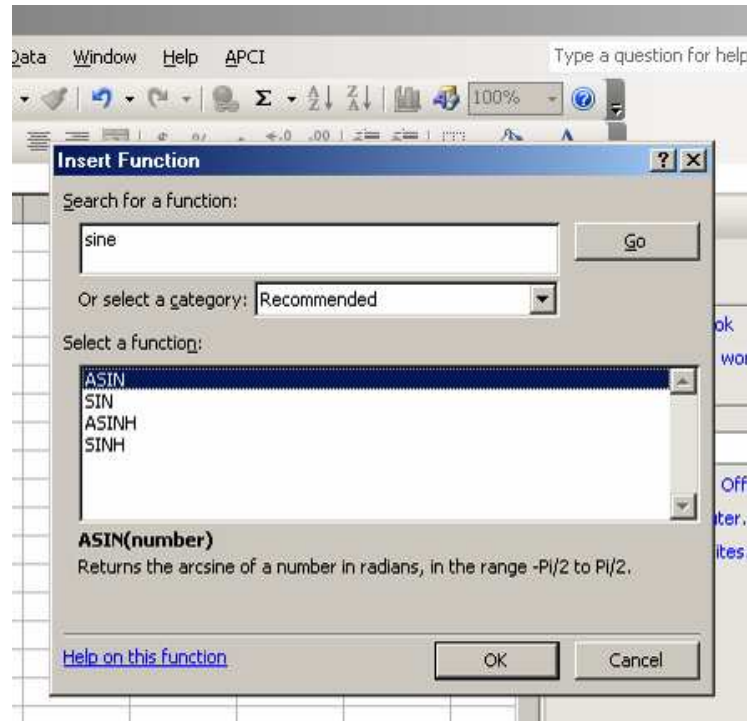
- vi. Press the CTRL key and the C key at the same time to copy these cells.  
*The border around the cells will be a flashing dotted line.*
- vii. Click on cell A14.
- viii. Press the CTRL key and the V key at the same time to put a copy of the cells in A14, B14, and C14.
- ix. Press the ESC key (upper left-hand corner of the keyboard) to remove the copied cells from the clipboard.

Your window should look like this:

	A	B	C
1	<b>Find the Triangle's Third Angle</b>		
2	All angles are in degrees		
3			
4	Angle 1	Angle 2	Unknown
5	60	30	90
6			
7	<b>Convert Degrees to Radians</b>		
8			
9	Angle 1	Angle 2	Unknown
10	1.047198	0.523599	1.570796
11			
12	<b>Sine Values for Angles</b>		
13			
14	Angle 1	Angle 2	Unknown
15			
16			

- e. Write a formula to determine the sine value of Angle 1
  - i. Click on cell A15.
  - ii. Type “=”
  - iii. Select SINE function from EXCEL functions menu:
    - 1. Select **Function** from the **Insert** menu. *A pop-up will appear.*
    - 2. Type in “SINE” in the upper-most box.
    - 3. Click **GO** on the pop-up.

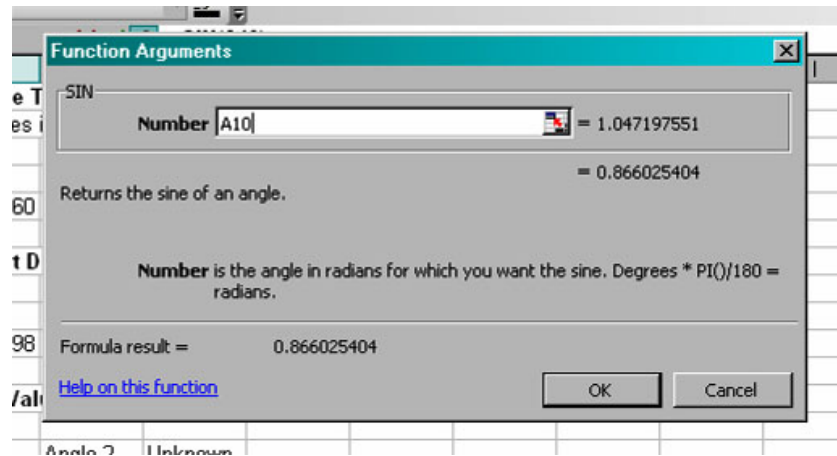
4. Several choices appear in the **Select a Function** box:



*Note: your list of functions may differ from the picture above depending on your version of EXCEL.*

5. Click on “SIN” in the box.
6. Click **OK** button on the pop-up. *The next pop-up, Function Arguments, appears.*

7. The function requires us to tell it for which cell we want to take the sine value. Click on cell A10. *The cell name will appear in the Number field on the pop-up. Notice the pop-up gives you a preview of the results.*



8. Click **OK** on the pop-up.
- f. Copy the sine formula for Angle 2 and the Unknown angle.
- Click on cell A15 if it's not already selected.
  - Press CTRL key and C key at the same time.
  - Click on cell B15.
  - Press CTRL key and V key at the same time.
  - Click on cell C15.
  - Press CTRL key and V key at the same time.

*Just like the previous formulas, the copied cells are updated for the other two angles*

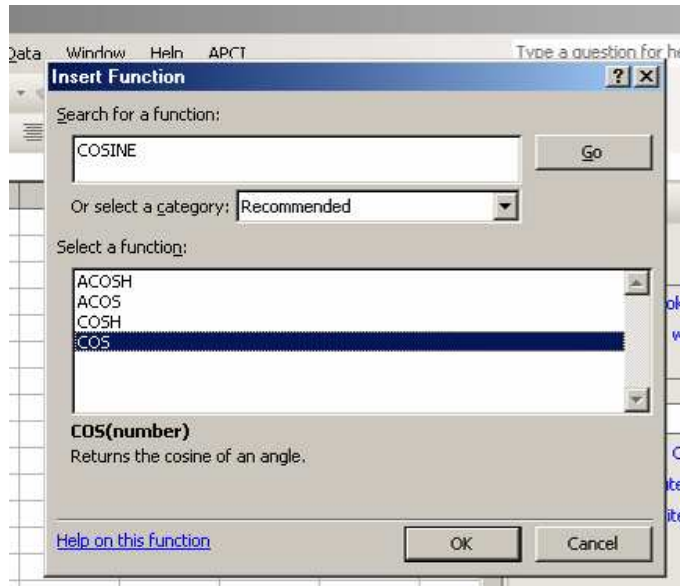
Your spreadsheet should look like this:

The screenshot shows a Microsoft Excel spreadsheet with the following content:

	A	B	C
1	<b>Find the Triangle's Third Angle</b>		
2	All angles are in degrees		
3			
4	Angle 1	Angle 2	Unknown
5	60	30	90
6			
7	<b>Convert Degrees to Radians</b>		
8			
9	Angle 1	Angle 2	Unknown
10	1.047198	0.523599	1.570796
11			
12	<b>Sine Values for Angles</b>		
13			
14	Angle 1	Angle 2	Unknown
15	0.866025	0.5	1
16			

7. Determine the cosine values for the angles.
  - a. Click on cell A17.
  - b. Type in “Cosine Values for Angles”.
  - c. Make the text bold.
  - d. Copy cells A4, B4, and C4:
  - e. Write a formula to determine the cosine value of Angle 1.
    - i. Click on cell A20.
    - ii. Type “=”
    - iii. Select COSINE function from EXCEL functions menu:
      1. Select **Function** from the **Insert** menu. *A pop-up will appear.*
      2. Type in “COSINE” in the upper-most box.
      3. Click **GO** on the pop-up.

4. Several choices appear in the Select a Function box:



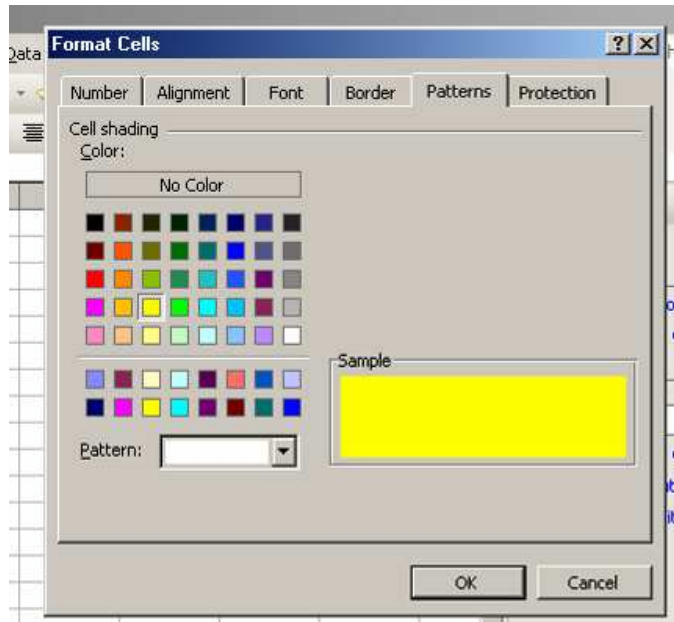
5. Click on “COS” in the box.
  6. Click **OK** button on the pop-up. *The next pop-up, Function Arguments, appears.*
  7. The function needs to know for which cell we want to take the cosine value. Click on cell A10. *The cell name will appear in the Number field on the pop-up. Notice the pop-up gives you a preview of the results.*
  8. Click **OK** on the pop-up.
- f. Copy the cosine formula for Angle 2 and the Unknown angle.
- i. Click on cell A20 if it’s not already selected.
  - ii. Press CTRL key and C key at the same time.
  - iii. Click on cell B20.
  - iv. Press CTRL key and V key at the same time.
  - v. Click on cell C20.
  - vi. Press CTRL key and V key at the same time.

Just like the previous formulas, the copied cells are updated for the other two angles.

	A	B	C	D
1	<b>Find the Triangle's Third Angle</b>			
2	All angles are in degrees			
3				
4	Angle 1	Angle 2	Unknown	
5	60	30	90	
6				
7	<b>Convert Degrees to Radians</b>			
8				
9	Angle 1	Angle 2	Unknown	
10	1.047198	0.523599	1.570796	
11				
12	<b>Sine Values for Angles</b>			
13				
14	Angle 1	Angle 2	Unknown	
15	0.866025	0.5	1	
16				
17	<b>Cosine Values for Angles</b>			
18				
19	Angle 1	Angle 2	Unknown	
20	0.5	0.866025	6.13E-17	
21				

8. Emphasize which fields require user input:
  - a. Highlight cells A5 and B5 as a reminder that these cells are the only two cells that you will be manipulating.
    1. Click on cell A5.
    2. Hold the SHIFT key down.
    3. Click on cell B5.
    4. Select **Cells** from the **Format** menu.
    5. Click on the Patterns tab.

6. Select any color by clicking on it.
7. Click **OK** on the pop-up.



Your spreadsheet should look like this:

Microsoft Excel - Excel Triangle Calcs.xls				
File Edit View Insert Format Tools				
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114				
	A	B	C	D
1	<b>Find the Triangle's Third Angle</b>			
2	All angles are in degrees			
3				
4	Angle 1	Angle 2	Unknown	
5	60	30	90	
6				
7	<b>Convert Degrees to Radians</b>			
8				
9	Angle 1	Angle 2	Unknown	
10	1.047198	0.523599	1.570796	
11				
12	<b>Sine Values for Angles</b>			
13				
14	Angle 1	Angle 2	Unknown	
15	0.866025	0.5	1	
16				
17	<b>Cosine Values for Angles</b>			
18				
19	Angle 1	Angle 2	Unknown	
20	0.5	0.866025	6.13E-17	
21				



- b. Save your work.
9. Test our worksheet formulas:
- a. For each of the following three triangles:
- Enter the two known angles into the spreadsheet (it does not matter which angle is Angle 1 or Angle 2).
  - Print out the worksheet to capture the results.
  - Write your name at the top of each print-out.

**Note:** Keep in mind there may be some rounding differences in EXCEL.

Notice in the worksheet's example, the cosine of  $90^\circ$  angle is  $6.13E-17$ . We would round this to 0.0.

