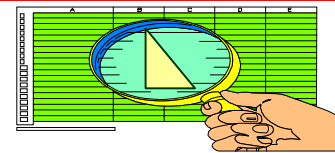




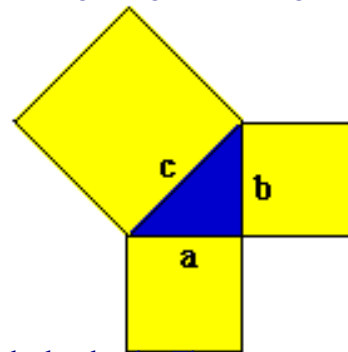
# Pythagorean Theorem With Excel



In math class, you learned that a right triangle has a right angle, which equals 90 degrees. The two sides that form the right angle are called legs. The side opposite the right angle is called the hypotenuse. Since the right angle is the largest angle, the hypotenuse is the longest side.

About 2,500 years ago, a Greek philosopher named Pythagoras discovered many properties about number, including the relationship among the sides of right triangles, called Pythagorean theorem.

The Pythagorean theorem states that, in a right triangle, the sum of the squares of the legs equals the square of the hypotenuse. The formula for the Pythagorean theorem is  $a^2 + b^2 = c^2$  where a and b are the legs of a right triangle and c is the hypotenuse. This is illustrated at the picture on the right.



We will leave the proofs for math class. You can find this theory in any basic geometry or algebra book. The Pythagorean theorem has many applications in calculating distance, height, construction, and a variety of indirect measurements. It is also one of the starting points for trigonometry, a mathematical science that is widely used in engineering and design. We can set up Excel to solve for any of the legs or the hypotenuse of a right triangle. Then, it is easy to plug in values and calculate the value we are solving for.

### Solving for the Hypotenuse.

**Example:** The lengths of the legs of a right triangle are 6 and 8 respectively. Find the length of the hypotenuse.

**Step 1.** Substitute 6 for a and 8 for b in the Pythagorean theorem formula

**Step 2.** Evaluate the left side of the equation

$$\begin{aligned} a^2 + b^2 &= c^2 \\ 6^2 + 8^2 &= c^2 \\ 36 + 64 &= c^2 \\ 36 + 64 &= c^2 \\ 100 &= c^2 \\ \sqrt{100} &= c \\ 10 &= c \end{aligned}$$

**Step 3.** Find  $\sqrt{100}$ . The Hypotenuse is 10 units long

### Excel Formulas/Functions

Excel uses a different system or notation for squaring a number or calculating a square root. Raising a number to some power in Excel is written as  $a^2$  (Use SHIFT + 6). Therefore, the Pythagorean theorem in Excel would be expressed:

$$a^2 + b^2 = c^2$$

Excel has a function for finding the square root of a number. =SQRT(*cell reference or number*).

### Assignment 1.

1. Create the spreadsheet on the back of this handout at the top.
2. Pay close attention to the cell addresses and cells references specified.
3. Apply bold in the headings as indicated.
4. Be sure to carefully enter the formulas and functions.
5. Fill all formulas down as indicated.
6. Your spreadsheet should return values for c (column A) that are all whole numbers.
7. **SAVE** your file as **PYTHAGOREAN**.

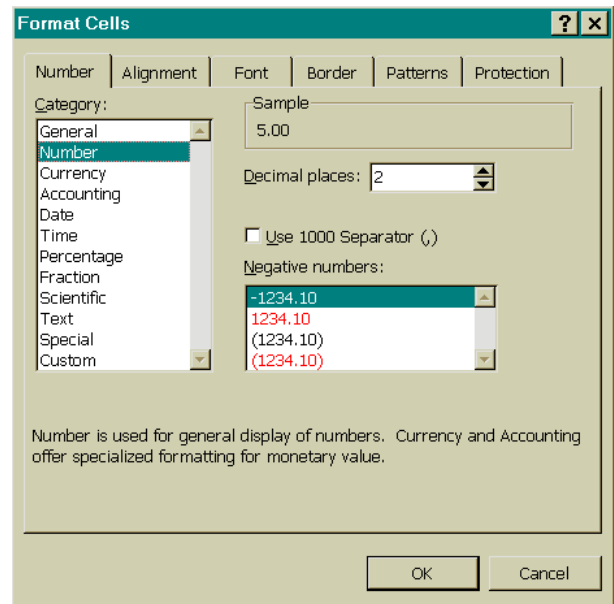
**Assignment 1**  
(Continues)

	A	B	C	D	E	F
1	<b>Pythagorean Theorem Calculations</b>					
2	<b><math>a^2 + b^2 = c^2</math></b>					
3	<b>By: Your Name</b>					
4						
5	<b><math>c=\text{SQRT}(b^2 + c^2)</math></b>					
6						
7	<b>c</b>	<b>a</b>	<b>b</b>	<b><math>a^2</math></b>	<b><math>b^2</math></b>	<b><math>a^2+b^2</math></b>
8	=SQRT(F8)	3		4 =B8^2	=C8^2	=D8+E8
9	Fill Down	6		8 Fill Down	Fill Down	Fill Down
10	Fill Down	12		16 Fill Down	Fill Down	Fill Down
11	Fill Down	7		24 Fill Down	Fill Down	Fill Down
12	Fill Down	100		240 Fill Down	Fill Down	Fill Down
13	Fill Down	300		400 Fill Down	Fill Down	Fill Down
14	Fill Down	120		160 Fill Down	Fill Down	Fill Down
15	Fill Down	25		60 Fill Down	Fill Down	Fill Down
16	Fill Down	100		240 Fill Down	Fill Down	Fill Down
17	Fill Down	50		120 Fill Down	Fill Down	Fill Down

**Assignment 2**

This first set of numbers was chosen so that the value we calculated for c (column A) would all be whole numbers. Of course, we would expect to find right triangles that did not contain all whole numbers. We will format the numbers in column A to show two decimal places and then we will add more data to our series.

1. Highlight **RANGE A8:F27**
2. Pull down the **FORMAT** menu; select **CELLS**.
3. The dialog box to the right should appear:
4. As shown, under **CURRENCY**, Select **NUMBER**. Set the **DECIMAL PLACES** at **2**. Accept the default **(-1234.10)** for **NEGATIVE NUMBERS**. Click **OK**.
5. Highlight the **RANGE A8:A27**. Pull down the **EDIT** menu and select **FILL DOWN**. Zeros will appear from **A18:A27**.
6. Highlight the **RANGE D8:F27**. Pull down the **EDIT** menu and select **FILL DOWN**. Zeros will appear from **D18:F27**.
7. Enter the following data in columns B and C:



	A	B
18	16.75	20.50
19	4.50	19.50
20	3.33	10.75
21	5.50	5.50
22	125.50	165.75
23	95.25	110.75
24	9.33	35.75
25	89.75	312.25
26	9.75	27.33
27	60.50	74.75

8. Columns A, D, E, and F should all recalculate and show 2 decimal places.
9. **PROOFREAD, SAVE, and PRINT** your file.