

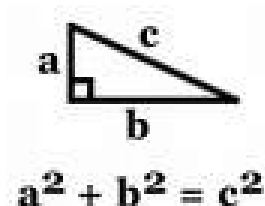
# Algebra Activity: Finding Pythagorean Triples, part 1

CALCULATORS: Casio: fx-9860G

## INTRODUCTION:

A Pythagorean Triple is a sequence of three positive integers

(  $a$ ,  $b$ ,  $c$  ) which satisfy the Pythagorean Theorem (  $a^2 + b^2 = c^2$  ).

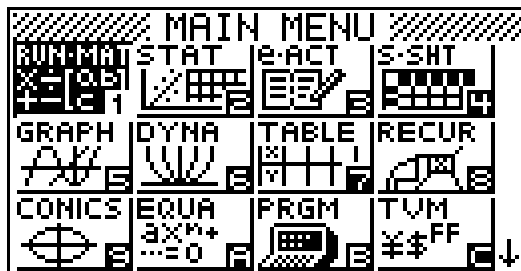


For example, (3, 4, 5) is a Pythagorean triple, since  $3^2 + 4^2 = 5^2$ .

The Casio fx-9860G can be used to help identify other Pythagorean triples, along with a pattern that some of the triples fall into.

## PROCEDURE:

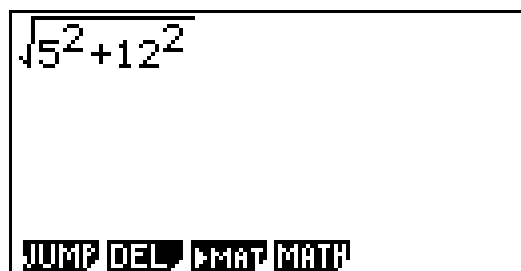
From the Main Menu, select the Run-Matrix mode (mode #1).



Press **[SHIFT]-[MENU]** to enter the **SET UP** menu, and press **[F1]** to make sure you are in **Math** input mode. Press **[EXIT]** to return to the data entry area.

Enter the following expression:

$\sqrt{5^2 + 12^2}$   
**[SHIFT]-[x<sup>2</sup>] [5] [x<sup>2</sup>] [+]** **[1][2]**  
**[x<sup>2</sup>]**



Then press **[EXE]**.

You have just found a new Pythagorean triple:  
 (5, 12, \_\_\_\_\_) *[fill in the blank.]*

This type of expression can be used to find if there is an integral  $c$  to match a particular choice of  $a$  and  $b$ .

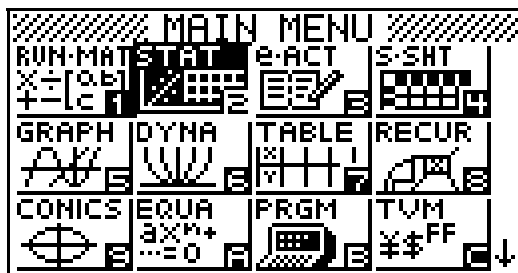
Exercise 1. Find the missing value in each of the following Pythagorean triples:

(3, 4, \_\_\_\_\_)      (5, 12, \_\_\_\_\_)      (7, 24, \_\_\_\_\_)      (9, 40, \_\_\_\_\_)

Exercise 2. Write an equation for “*c*” in terms of “*b*”, using the data from the triples above.

Notice that in the four triples above, the values of *a* form a sequence of ascending odd numbers. The *fx-9860G* can be used to determine the values of *b* that correspond to those values of *a*:

Press **[MENU]**, then select Statistics mode (mode #2).



Scroll down to line 1 of List 1, then enter the values 3, 5, 7, 9. (List 1 will be used to store the values of *a* from the triples.)

**[3] [EXE] [5] [EXE] [7] [EXE] [9] [EXE]**

Press **[ ]** to move over to line 1 of List 2, then enter the values 4, 12, 24, 40. (List 2 will be used to store the values of *b*.)

	List 1	List 2	List 3	List 4
SUB				
1	3	4		
2	5	12		
3	7	24		
4	9	40		
				40

**[4] [EXE] [1][2] [EXE] [2][4] [EXE]**

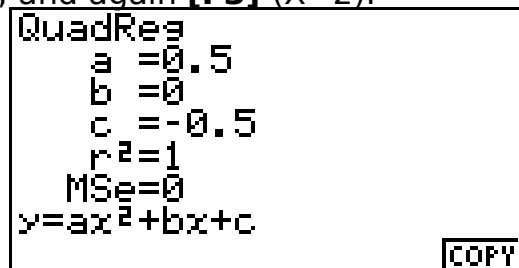
**[4][0] [EXE]**

Since the differences between consecutive values of *b* are not constant, there cannot be a linear relationship between *a* and *b*. However, the differences do have a constant *rate of change*, meaning there is a quadratic relationship between *a* and *b*.

Press **[F2]** (CALC), followed by **[F3]** (REG), and again **[F3]** ( $X^2$ ).

The equation at the bottom of the screen shows the quadratic relationship between the values in List 2 (*y*) and the values in List 1 (*x*).

In other words, for odd values of *a*,



$$b = 0.5a^2 - 0.5$$

**SOLUTIONS TO EXERCISES:**

Exercise 1. Find the missing value in each of the following Pythagorean triples:

$$(3, 4, \underline{\mathbf{5}})$$

$$(5, 12, \underline{\mathbf{13}})$$

$$(7, 24, \underline{\mathbf{25}})$$

$$(9, 40, \underline{\mathbf{41}})$$

Exercise 2. Write an equation for "**c**" in terms of "**b**", using the data from the triples above.

$$c = b + 1$$