Algebra/Spreadsheet Activity:
Finding Pythagorean Triples, part 2

CALCULATORS: Casio: *fx-9860G*

INTRODUCTION:

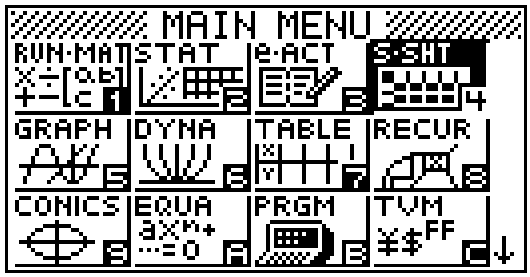
A Pythagorean Triple is a sequence of three positive integers (*a, b, c*) which satisfy the Pythagorean Theorem ($a^2 + b^2 = c^2$).

In part 1 of this Activity, it was found that for odd values of *a* (3, 5, 7, 9, ...) ,

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

The Spreadsheet mode on the Casio *fx-9860G* can be used to quickly generate lists of Pythagorean triples using formulas like the one listed above.

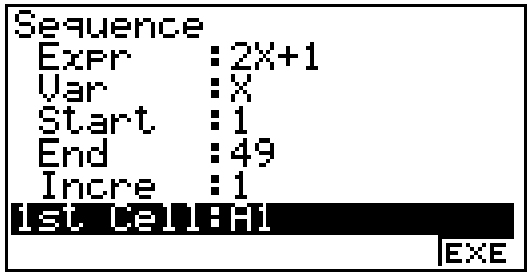
PROCEDURE:



From the Main Menu, select the Spreadsheet mode (mode #4).

Press **[F1]** (FILE), then **[F1]** (NEW) to create a new named spreadsheet. Enter "PYTHTRIP" as the name of this spreadsheet, then press **[EXE]**.

Press **[F2]** (EDIT), then **[F5]** (SEQ). Enter the values shown in the diagram to the right.



[2] [X,*q*,T] [+] [1] [EXE]
[X,*q*,T] [EXE] [1] [EXE]
[4][9] [EXE] [1] [EXE]

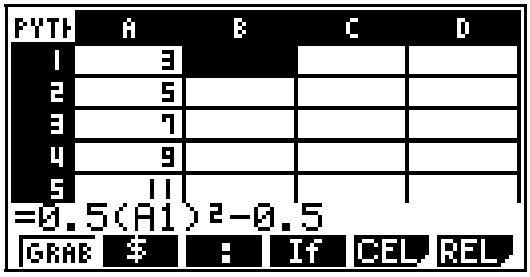
Then press **[F6]** (EXE).
This generates the odd numbers from 3 to 99 in column A of the spreadsheet.

Press **[ ]** to move to cell B1.

Press **[SHIFT]-[.]** to create an equals sign (=) in cell B1. This is the syntax used to begin entering a formula in the spreadsheet. Notice that

the menu at the bottom of the screen changes to show commands that are helpful during formula entry.

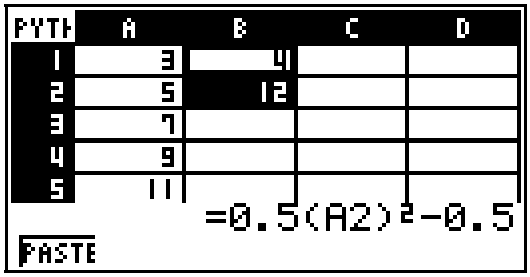
Enter the formula "$0.5\left(\text{A1}\right)^2$ - 0.5" after the equals sign. Note that this is simply the formula $b = 0.5a^2 - 0.5$, applied to cell A1.



[0][.][5] [( ] [ALPHA]-[X,q,T] [1] [ )]
[x^2] [–] [0][.][5] [EXE]

After pressing **[EXE]** above, the value in cell B1 should now show "4". If cell B1 shows a different value, or if the contents of any cell need to be edited for any reason, simply use the arrows on the **REPLAY** pad to navigate to the cell, then press **[F3]** (CELL).

To copy the formula from cell B1 to the other cells in column B, press **[ ]** to return to cell B1, followed by **[F2]** (COPY). Then press **[ ]** to move to cell B2, and press **[F1]** (PASTE). The screen should now look like the diagram shown to the right.

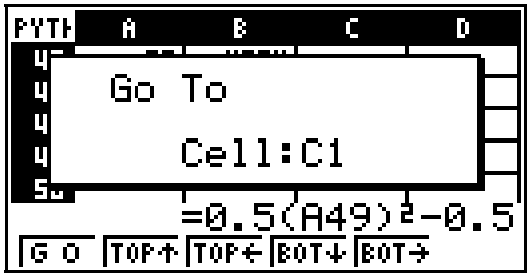


Fill in the rest of column B, using the same relative formula, by repeatedly pressing **[ ]** followed by **[F1]** (PASTE).

Press **[EXIT]**, then **[F4]** (JUMP), followed by **[F1]** (GO). Type "C1" in the entry area.

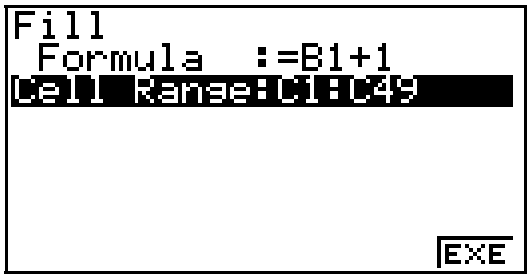
[ALPHA]-[ln] [1] [EXE]

Press **[ ]** twice, then **[ ]** twice. This will allow columns A and B to be seen.



There is an easier way to fill a series of cells with a relative formula:

With cell C1 selected, press **[F6]** (▷) to see more of the menu, and then **[F1]** (FILL). Input the formula "=B1+1".



[SHIFT]-[.] [ALPHA]-[log] [1][+][1] [EXE]

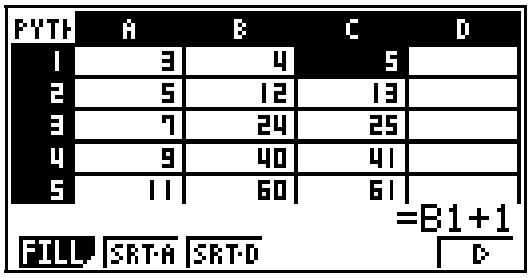
Type in the cell range "C1:C49".

[ALPHA]-[ln] [1] [F1] (:) **[ALPHA]-[ln] [4][9] [EXE]**

Finally, press **[F6]** (EXE).

(This technique edits the cell range from scratch. The same effect can be achieved by pressing **[ ]** when "Cell Range" is highlighted, then using the **REPLAY** pad and **[DEL]** key to navigate and edit as necessary.

Notice that each row of the spreadsheet now displays a different Pythagorean triple, using ascending odd numbers as the seed values for *a*.



All that remains is to show that each triple satisfies the Pythagorean Theorem. This is left as an exercise:

*<u>Exercise 1.</u> Fill cells D1 through D49 in the spreadsheet with a formula that computes "**c**" using the values of "**a**" and "**b**" given in columns A and B.*

(Hint: use the basic idea that $c = \sqrt{a^2 + b^2}$.)

<u>Exercise 2.</u> Use the spreadsheet to complete the missing values in each of these Pythagorean triples:

(49, _____ , _____) *(_____, 544, 545)*

(91, _____ , 4141) *(_____, 2520, _____)*

SOLUTIONS TO EXERCISES.

<u>Exercise 1.</u>

Navigate to cell D1. From the main spreadsheet menu, press ***[F2]*** *(EDIT),* ***[F6]*** *(▷), and*
[F1] *(FILL) in succession. Input the formula "=*$\sqrt{\left(A1^2+B1^2\right)}$*" using these keystrokes:*

[SHIFT]-[.] [SHIFT]-[x^2 ***] [( ] [ALPHA]-[X,*** q ***,T] [1] [*** x^2 ***] [+]***
[ALPHA]-[log] [1] [x^2 ***] [ )] [EXE]***

Then change the cell range to "D1:D49" using the following keystrokes:

[ ] [ ][ ][ ][ ][ ] [DEL] [4][9] [EXE]

Finally, press ***[F6]*** *(EXE). The contents of column D should exactly match those of column C, showing that the triples formed by columns A, B, and C indeed satisfy the Pythagorean Theorem*

Exercise 2.

*(49, __**1200**__, __**1201**__)* *(__**33**__, 544, 545)*

*(91, __**4140**__, 4141)* *(__**71**__, 2520, __**2521**__)*