Counting Factors

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Student Activity

7 8 9 10 11 12

TI-Nspire | Coding | Student | 60 min

Finding Factors

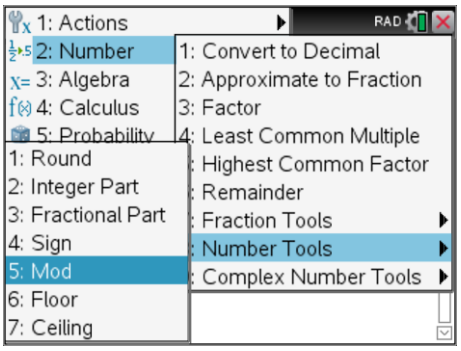
There are many ways to determine the quantity of factors for a specified number. The most common method is to test the divisibility for every number up to the specified number.

Example: Determine the quantity of factors for the number 18.

18 ÷ 1 = 18	Factor	18 ÷ 2 = 9	Factor	18 ÷ 3 = 6	Factor
18 ÷ 4 = 4 rem 2	Not a factor	18 ÷ 5 = 3 rem 3	Not a factor	18 ÷ 6 = 3	Factor
18 ÷ 7 = 2 rem 4	Not a factor	18 ÷ 8 = 2 rem 2	Not a factor	18 ÷ 9 = 2	Factor
18 ÷ 10 = 1 rem 8	Not a factor	18 ÷ 11 = 1 rem 7	Not a factor	18 ÷ 12 = 1 rem 6	Not a factor
18 ÷ 11 = 1 rem 7	Not a factor	18 ÷ 12 = 1 rem 6	Not a factor	18 ÷ 13 = 1 rem 5	Not a factor
18 ÷ 14 = 1 rem 4	Not a factor	18 ÷ 15 = 1 rem 3	Not a factor	18 ÷ 16 = 1 rem 2	Not a factor
18 ÷ 17 = 1 rem 1	Not a factor	18 ÷ 18 = 1	Factor		

The process above is exhaustive and you may already have ideas on how this can be sped up, however this concept will provide a basis for a simple program to count the quantity of factors of a given number.

Instructions:



Start a new document and insert a calculator application.

Locate the **mod** command using: **Number** > **Number Tools** > **Mod**

Determine the result of the following calculations:

Mod(18,6)

Mod(18,5)

Mod(18,12)

Question: 1.

Based on your experimentation, what value does the MOD command return?

Question: 2.

If MOD(*a*, *b*) = 0, what does this say about the relationship between *a* and *b*?

Question: 3.

If MOD(*a*, 2) = 0, what does this say about the value of *a*?

Question: 4.

Write a statement similar to those above that would be true for any odd number '*a*'.

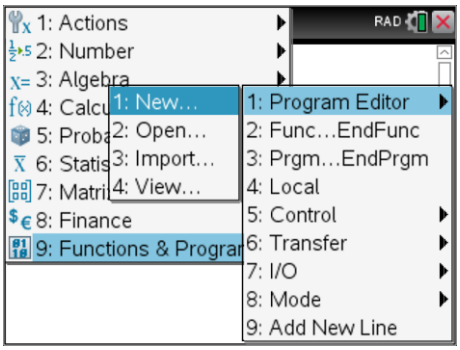
Author: P. Fox

Create a new program by selecting:

Functions & Programs > **Program Editor** > **New**

Call the program: FactorCount

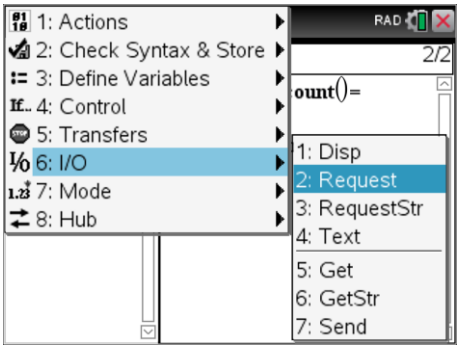
Note that 'FactorCount' is one word as program names cannot contain spaces.



The first task is to request a number from the program user.

Use the I/O (input / output) menu to access the **Request** command. The request command can include a text prompt followed by a variable to store the number.

Request "Enter a number",n



- Quotation marks: " " can be entered by pressing [**Ctrl**] + [**x**]
- The comma **,** can be found in the bottom left corner of the keyboard.

A counter will be used to 'count' the quantity of factors. The counter must be set to zero before the counting process begins.

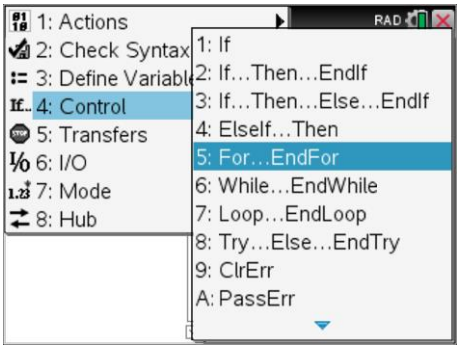
c : = 0

Then start a **For** loop by selecting:

Control > **For … EndFor**

The loop will start at 1 and finish at n and use ***i*** to count the number of times the loop has been executed.

For *i* , 1, n



An **IF** statement will be used to check if the user's number has a factor each time the program executes the loop.

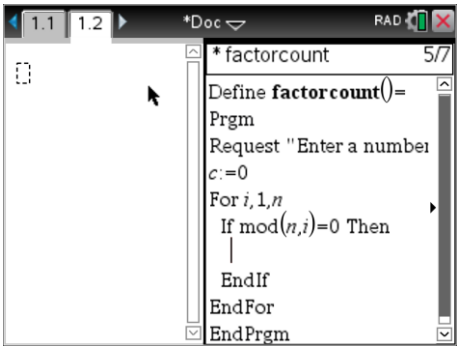
The IF command can be selected by:

Control > **IF** … **THEN** … **ENDIF**

Between the IF and THEN statement insert the command:

Mod(n, *i*) = 0

Note that 'mod' can be typed directly from the keyboard or accessed through the catalogue.



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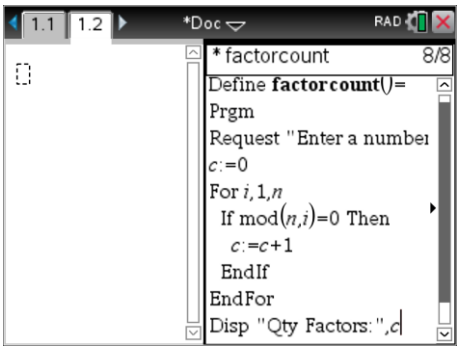
Move the cursor into the empty line between **THEN** and **EndIf**. This line of code is only executed if **MOD**(n, i) = 0 is true.



Insert the command:

c := c + 1

Create another line between **EndFor** and **EndPrgm**

From the I/O menu select **Disp** and type the command:

Disp "Qty Factors", c

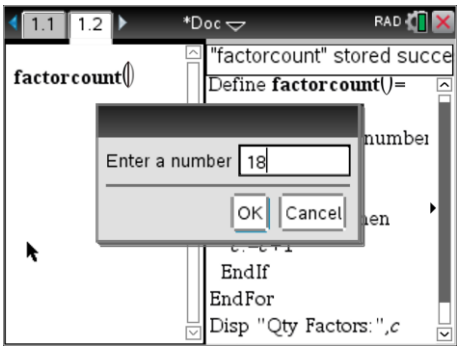
Save the program by pressing [**Ctrl**] + [**B**] and then transfer focus to the calculator application by pressing [**Ctrl**] + [**Tab**].

The program is ready to run!

Press the [**VAR**] key and select your program.

Do **NOT** enter the number to be factored into the brackets, press [**Enter**] and enter the number to be factored when prompted by the request command.

Start by testing the number 18 and check the output with the original table.



Question: 5.

Determine the quantity of factors for each of the following numbers:

a. 24

b. 36

c. 37

d. 144

Check each of your answers by writing down all the factors.

Question: 6.

Determine the quantity of factors for each of the following numbers. Identify a specific characteristic about the quantity of factors and use this to classify the numbers into two groups, explain your classification.

29, 84, 104, 87, 22, 37, 101, 97, 45, 43, 133, 153, 173, 107

Question: 7.

Determine the quantity of factors for each of the following numbers. Identify a specific characteristic about the quantity of factors and use this to classify the numbers into two groups, explain your classification.

28, 30, 90, 45, 50, 60, 120, 72, 25, 49, 81, 144, 441, 82, 24, 720

Question: 8.

The FactorCount program works, but it could be more efficient. Use a stop watch to time how long the program takes to count the number of factors for: 10,000; 20,000 and 30,000. Use these times to predict how long it will take to count the factors for 40,000. Test your answer!

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