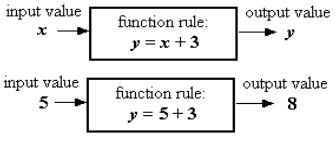
Study Guide

Function Rules
03/01/2012

Function Rules

A function rule is an equation relating two variables. Variables are letters that represent unknown numbers, such as *x* and *y*.

In a function, the value of the output variable, *y*, depends on the value of the input variable, *x*. The function rule takes a given value of *x*, and performs an operation (addition, subtraction, multiplication, or division) on it to make it equal to *y*.



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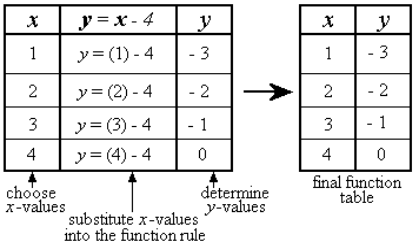
A table of related values for input-output variables that can be generated from a function rule is called a function table. It is important for students to understand what a function table represents. To create the function table below, *x*-values were chosen and placed in the table. Next, the *x*-values were substituted into the function rule and a *y*-value was generated for each *x*-value. The final function table appears on the right without the function rule.



It is possible to determine the function rule from a table of values for related input-output variables. The first two examples deal with simple function rules that use addition and subtraction only.

Example 1: What function rule relates the values of the input variable, *x*, to the values of the output variable, *y*, in the table below?

x	*y*
- 3	3
- 2	4
- 1	5
0	6

Step 1: Determine what needs to be added to or subtracted from - 3 to make it equal to 3. The solution is, "add 6," because - 3 + 6 = 3.
Step 2: Add 6 to each of the remaining *x*-values, and verify that they match the values listed for *y*.
Step 3: Write the function rule: $y = x + 6$.

Example 2: What function rule relates the values of the input variable, *x*, to the values of the output variable, *y*, in the table below?

x	*y*
1	- 4
2	- 3
3	- 2
4	- 1

Step 1: Determine what needs to be added to or subtracted from 1 to make it equal to - 4. The solution is, "subtract 5," because 1 - 5 = - 4.
Step 2: Subtract 5 from each of the remaining *x*-values, and verify that they match the values listed for *y*.
Step 3: Write the function rule: $y = x - 5$.

Function rules can also be of the form $y = ax + b$, or $y = ax$. Rules of this form require the student to use multiplication, as well as addition and subtraction.

Example 3: What function rule relates the values of the input variable, *x*, to the values of the output variable, *y*, in the table below?

x	*y*
- 4	-12
- 2	-6
0	0
2	6
4	12

Step 1: First, the student should test the *y* values to see if they are multiples of the *x* values. If the function is of the form $y = ax$, then the student should be able to multiply all of the values in the *x* column by the same number, and arrive at the values in the *y* column. Multiplying - 4 by 3 yields - 12.
Step 2: Multiply the remaining *x* values by 3, and verify that they match the values listed for *y*.
Step 3: Write the function rule: $y = 3x$.

Example 4: What function rule relates the values of the input variable, *x*, to the values of the output variable, *y*, in the table below?

x	*y*
- 4	-19
- 2	-11
0	-3
2	5
4	13

Step 1: First, the student should test the *y* values to see if they are multiples of the *x* values. If the function is of the form $y = ax$, then the student should be able to multiply all of the values in the *x* column by the same number, and arrive at the values in the *y* column. If the student is unable to determine a single factor that yields the output values, he or she should continue to step 2. Since there isn't a factor that yields - 19 when multiplied by - 4, the student should continue to step 2.
Step 2: If there is an input value equal to 0, the student should always begin with this value. This line in the table will help the student to determine the value that is being added or subtracted since any factor multiplied by 0 equals zero. In this case, 3 is being subtracted from *x* because 0 - 3 = - 3. Therefore, the function must be of the form $y = ax - 3$.
Step 3: The student must now determine what value of *a* satisfies the function. Determining this value is made easier by performing the inverse of the operation found in step 2 on a chosen *y* value. Adding 3 to -19 yields - 16. Since - 4, (the corresponding *x* value) must be multiply by 4 in order to yield -16, the

factor 4 is the correct value for *a*.
Step 4: Multiply each input value by 4 and subtract 3 in order to verify that they match the values listed for *y*.
Step 5: Write the function rule: $y = 4x - 3$.