INSTRUCTOR GUIDANCE EXAMPLE: Week Five Discussion

Relations and Functions

pg 709 #31

The **relation** is $\boldsymbol{f}(\boldsymbol{x}) = \sqrt{(\boldsymbol{x} - 1)}$ where the -1 is included with x under the radical.

$\boldsymbol{f}(1) = \sqrt{(1 - 1)} = \sqrt{0} = 0$

$\boldsymbol{f}(5/4) = \sqrt{(5/4 - 1)} = \sqrt{(1/4)} = 1/2$

$\boldsymbol{f}(2) = \sqrt{(2 - 1)} = \sqrt{1} = 1$

$\boldsymbol{f}(5) = \sqrt{(5 - 1)} = \sqrt{4} = 2$

$\boldsymbol{f}(10) = \sqrt{(10 - 1)} = \sqrt{9} = 3$

$\boldsymbol{x}$	$\boldsymbol{f}(\boldsymbol{x}) = \sqrt{(\boldsymbol{x} - 1)}$
1	0
5/4	½
2	1
5	2
10	3

This being the graph of a square root **function**, it is shaped like half of a parabola laid over on its side. It has a starting point at (1, 0) and extends infinitely in the positive infinity direction (to the right). This graph falls entirely in the first quadrant and doesn't exist in any of the other three quadrants.

This **function** has no y intercepts and the only x intercept is the same as its starting point at (1, 0). I chose my x values carefully so that the y values were rational numbers coming out of the radical. The domain is all real numbers greater than or equal to 1, while the range is all non-negative real numbers. In interval notation it is written as follows:
$D = [1, \infty)$ and $R = [0, \infty)$

This **relation** is a **function** because every element of the **domain** has one and only one value associated with it in the **range**, and it passes the vertical line test.

pg711 #57

The relation is $\boldsymbol{f}(\boldsymbol{x}) = 1 - |\boldsymbol{x}|$ where the 1 and the subtraction are outside of the absolute value bars.

$\boldsymbol{f}(-4) = 1 - |-4| = 1 - 4 = -3$

$\boldsymbol{f}(-1) = 1 - |-1| = 1 - 1 = 0$

$\boldsymbol{f}(0) = 1 - |0| = 1 - 0 = 1$

$\boldsymbol{f}(1) = 1 - |1| = 1 - 1 = 0$

$\boldsymbol{f}(4) = 1 - |4| = 1 - 4 = -3$

$\boldsymbol{x}$	$\boldsymbol{f}(\boldsymbol{x}) = 1 - \|\boldsymbol{x}\|$
-4	-3
-1	0
0	1
1	0
4	-3

This is the graph of an absolute value **function** so it is shaped like a straight sided V with a sharp turn at the vertex. The ***a*** value is negative and so the V opens downward. The majority of the graph occurs in the third and fourth quadrants with only a tiny bit crossing into the first and second quadrants.

The highest point on the graph occurs at the vertex, (0, 1) and the graph is symmetrical across the y-axis. The y-intercept is at the vertex (0, 1) as well, and the x intercepts are at (-1, 0) and (1, 0). The **domain** is all real numbers while the **range** is restricted to real numbers less than or equal to 1.

This relation is also a **function** because it passes the vertical line test, and each **domain** value has one and only one **range** value associated with it.

Let us take this same **function** and shift it three units upwards and 4 units to the left. How will this affect the equation?

- Three units upwards means we add a positive 3 outside of the absolute value bars.
- Four units to the left means we add a positive 4 inside of the absolute value bars.
- The function will now look like this:

  $f(x) = 1 + 3 - |x + 4|$ so $f(x) = 4 - |x + 4|$ and this reflects a **transformation** of the function three units up and four units to the left.

Just for the sake of a thorough example I am also going to show the other function ***transformed*** in the same manner.

- Three units upwards means we add a positive 3 outside of the radical.
- Four units to the left means we add a positive 4 inside of the radical.
- The function will now look like this:

  $f(x) = 3 + \sqrt{(x - 1 + 4)}$ so $f(x) = 3 + \sqrt{(x + 3)}$

  This does incorporate the two shifts into the **transformed** function.