3.2 Graphing Functions

We can graph functions to get a visual representation of the relationship between two quantities. We graph these on the coordinate plane, but we may not always use the variables x and y.

Input/Output Charts

To graph a function, we first need an input/output chart. This chart will give us the points we need to graph on the coordinate plane. Let's start by graphing the following function:

$$c = 2t + 3$$

For this function, notice that t is the input, or independent variable, and c is the output, or dependent variable. We'll now make a simple chart with five spaces to fill out as follows:

Input t					
Output c					

Sometimes input values will be given to us to plug in, other times we will need to make up our own. In this case, we are not given values for the input. Therefore, it is suggested to use the values from -2 to 2 to make sure we get a good picture of the function. It is not always necessary to find five points, but the more points we have, the better graph we will get.

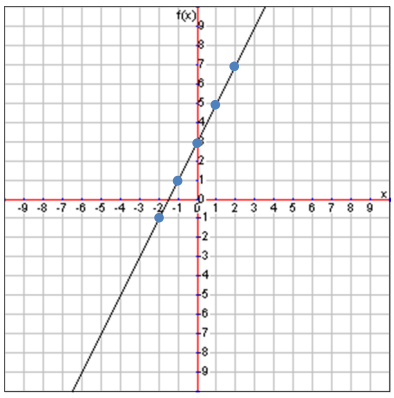
Input t	-2	-1	0	1	2
Output c					

Now we evaluate the function for each input. Let's look at the work for $t = -2$.

$$c = 2(-2) + 3 = -4 + 3 = -1$$

Input t	-2	-1	0	1	2
Output c	-1	1	3	5	7

Following this same process for each input value, we get the table at the right.



Now we plot each associated input and output as a point like this: $(input, output)$ or (t, c). Since t is the dependent variable, that takes the place of x and c will take the place of y. Graph each point and connect the points as we can see at the left.

In most cases the input/output chart only uses the variables as labels instead of "input" and "output". That would look like this:

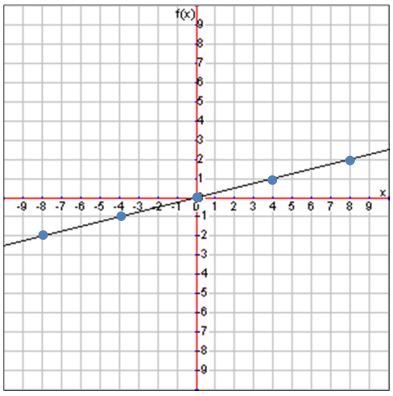
t	-2	-1	0	1	2
c	-1	1	3	5	7

Notice we plotted five points: $(-2, -1), (-1,1), (0,3), (1,5)$, and $(2,7)$.

Deciding on Appropriate Inputs

Since we are graphing by hand, it is easiest if we work with integer inputs and outputs. Some functions have fractions, decimals, or even square roots that make our choice of inputs critical. For example, consider the function $a = \frac{1}{4}b$.

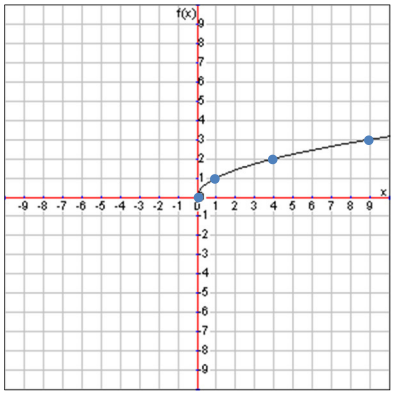
b	-8	-4	0	4	8
a	-2	-1	0	1	2



If we choose $b = 1$ as an input, we'll have to graph the point $\left(1, \frac{1}{4}\right)$ which is not convenient by hand. Therefore, we should choose values for b that we can multiply by $\frac{1}{4}$ and get integer outputs for a. Perhaps the input/output chart given to the left would work best yielding the graph below the chart.

Notice that choosing multiples of 4 for our inputs allowed integer outputs.

x	0	1	4	9
y	0	1	2	3



Let's look at the square root function $y = \sqrt{x}$. Since we can't take the square root of negative numbers, we won't use any negative inputs. Also, since the number 2 does not have an integer square root, we'll skip ahead to the inputs that do have integer square roots. Therefore we might use an input/output chart like the one to the left yielding the graph below the chart.

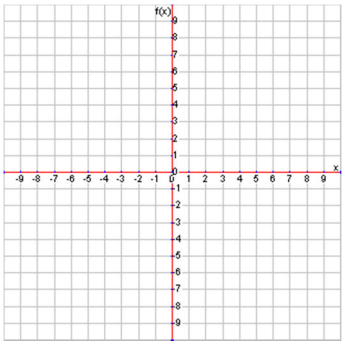
Notice that we only used four inputs instead of five since the next input yielding an integer output would be $x = 16$ and that x value would be off the coordinate plane we have which only goes up to $x = 10$.

Lesson 3.2

Graph the following functions by filling out the x/y chart using the given inputs (x values).

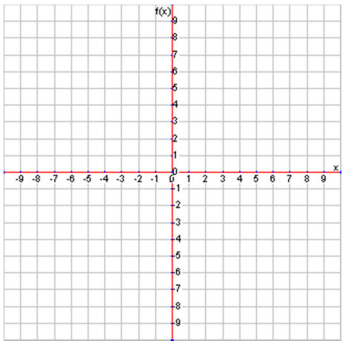
1. $y = x^2 - 7$

x	-2	-1	0	1	2
y					



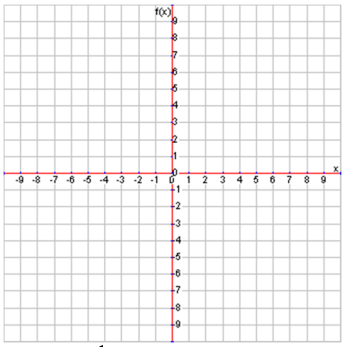
2. $y = \frac{1}{3}x + 2$

x	-6	-3	0	3	6
y					



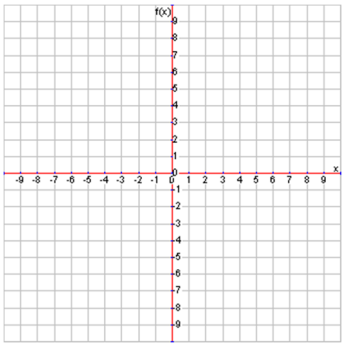
3. $y = \sqrt{x + 9}$

x	-9	-8	-5	0	7
y					



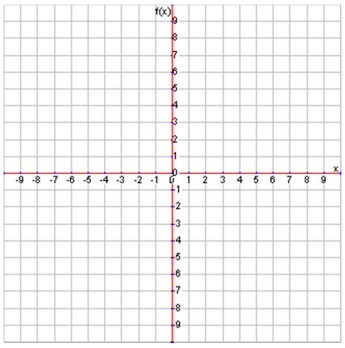
4. $y = 2x^2 - 1$

x	-2	-1	0	1	2
y					



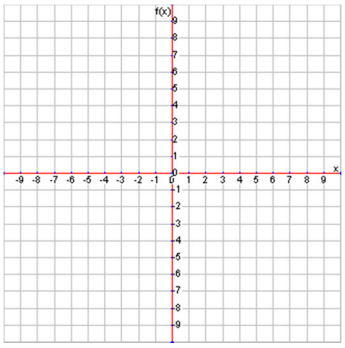
5. $y = \frac{1}{5}x + 2$

x	-10	-5	0	5	10
y					



6. $y = \sqrt{x + 7}$

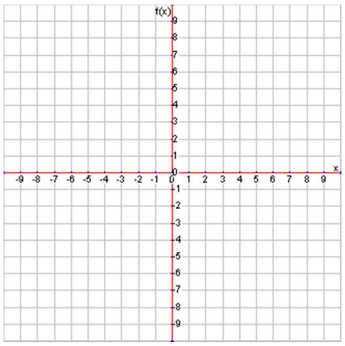
x	-7	-6	-3	2	9
y					



Graph the following functions by filling out the x/y chart using the inputs (x values) that you think are appropriate.

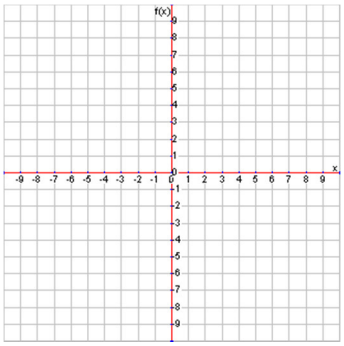
7. $y = 2x^2 - 8$

x					
y					



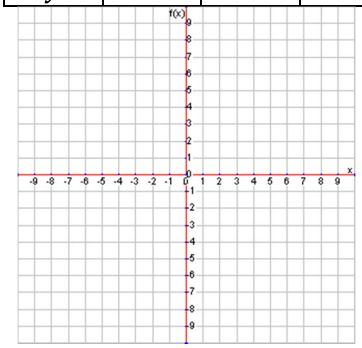
8. $y = \frac{2}{3}x - 4$

x					
y					



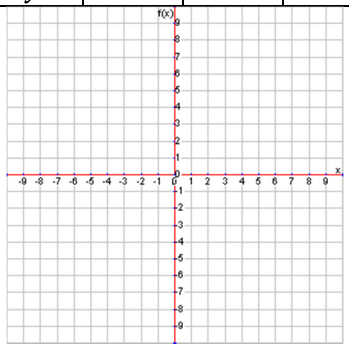
9. $y = \frac{1}{2}x - 4$

x					
y					



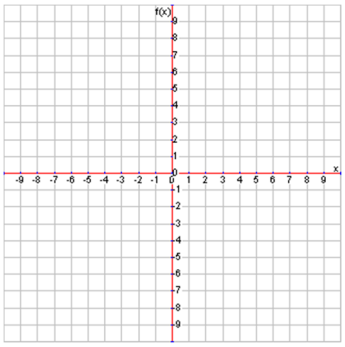
10. $y = \sqrt{x + 8}$

x					
y					



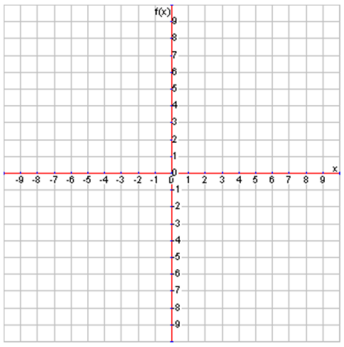
11. $y = -\sqrt{x + 7}$

x					
y					



12. $y = -x^2 + 4$

x					
y					



13. Explain why it would be beneficial to choose the inputs -2, -1, 0, 1, and 2 for the function $y = x^2 + 1$.

14. Explain why it would be beneficial to choose the inputs -8, -4, 0, 4, and 8 for the function $y = \frac{3}{4}x - 2$.

15. Explain why it would be beneficial to choose the inputs -9, -8, -5, 0, and 7 for the function $y = \sqrt{x + 9}$.

16. Explain how you would choose 5 different inputs for the function $y = \sqrt{x + 6}$. Explain why you feel these are the best input values for this function.

17. For problems 2, 5, 8, 9, describe a pattern in the change in the y values for each function.

18. For problems 2, 5, 8, 9, explain similarities and differences in the structure of the equations.

19. For problems 2, 5, 8, 9, explain similarities and differences in the graph of each function.