Math 111 – Lab #1 Name: _____

Please work together, however students must hand in their own lab. **Remember to show any work, NEATLY, and in PENCIL, please ☺, so to that end you may want to do your scratch work on a separate paper, transfer neat work to this, and staple your scratch to this. Make sure you number your scratch problems. Points are deducted for illegible work. (100 pts)**

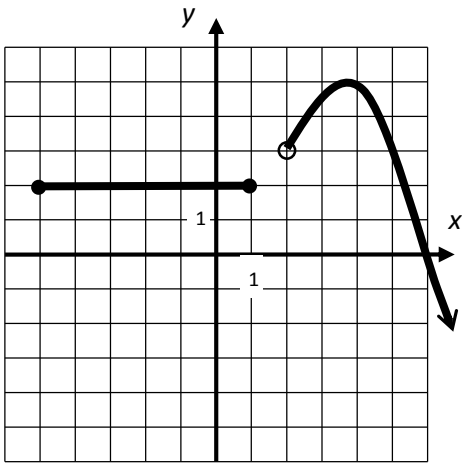
1. (12 pts) Because of the curvature of the earth, the maximum distance D that you can see from the top of a tall building or from an airplane at height h is given by the function $D(h) = \sqrt{2rh + h^2}$ where r is the radius of the earth (which is 3960 miles). The variables D and h are also measured in miles. Round the answer to 2 decimal places as needed.

   a. Find $D(0.1)$ and $D(0.2)$. (4 pts)

   b. Describe using a sentence what $D(1) = 89$ means. (4 pt)

   c. How far can you see from the observation deck of Toronto's CN Tower, 1135 ft. above the ground? Show your mathematical reasoning using function notation.
   (Hint: 1 mile = 5,280 feet) (4 pt)

2. This is the graph of $f(x)$.

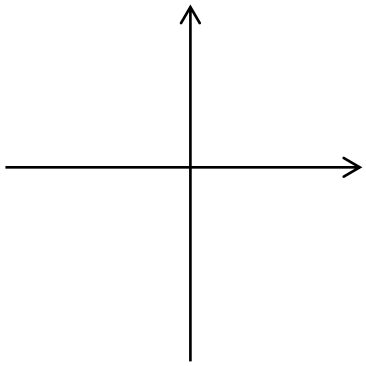


Find $f(-3), f(0), f(2)\ and\ f(6)$. Write your answers in the form $f(x) = y$. (7 pts)

Find the domain and range of f. Write using interval notation. (9 pts)

3. On the axes, sketch a graph of a relation that is NOT a function. (5 pts)

   Why isn't your graph a function?



4. (21 pts)In a certain country, income tax is assessed by the following: if a person makes at most $10,000 they pay no taxes; if they make more than $10,000 but no more than $20,000 they pay 8% of their earnings; if they make more than $20,000 they pay $1600 in addition to 15% of their earnings. Let x be their earnings and $T(x)$ is the amount they pay in taxes.

a. Create a piecewise defined function for the 3 intervals where the function is valid. (9 pts)

$$T(x) = \begin{cases} \\ \\ \end{cases}$$

b. Find $T(5{,}000), T(12{,}000), \& \; T(25{,}000)$. (6 pt) Write your answers in the form $T(x) = y$.

c. What do your answers in part (b) mean, use units and complete sentences please. (6 pts)

5. Find the domain for each of the following. Show any necessary work. Write the domain using **set builder** or **interval notation**. (20 pts)

a. $f(x) = 14x^2 - 13x + 42$

b. $g(x) = \sqrt{x+5} - 2$

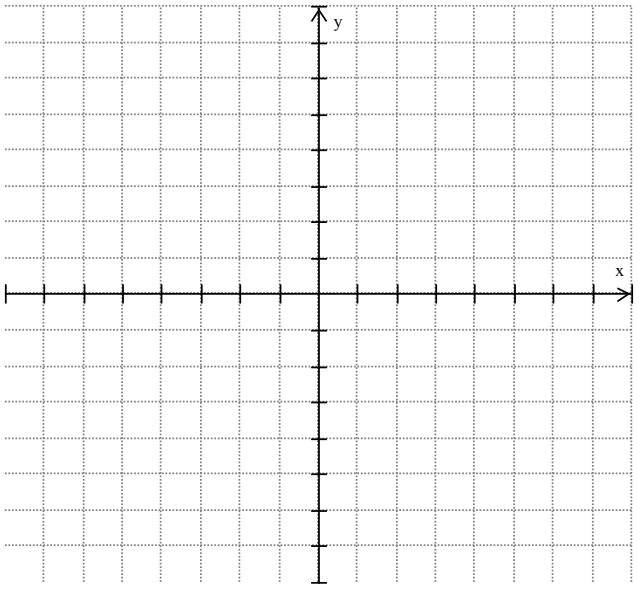
c. $h(x) = \frac{x+1}{x+3}$

d. $p(x) = \sqrt{16 - x^2}$ (be sure to show your work for this one! You can use your calculator to graph the function.)

6. Graph the following piecewise function on the given axes. Be sure to label your axes with a numerical scale. Use solid dots and open dots appropriately. (10 pts)

$$f(x) = \begin{cases} \frac{x-3}{2} & , \quad -3 \le x \le 3 \\ 6 & , \quad 3 < x \le 6 \end{cases}$$

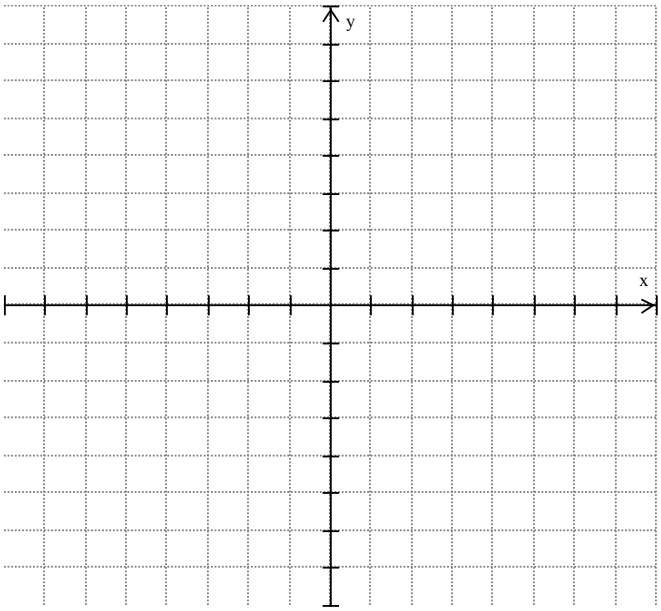
(Does your graph pass the vertical line test??)



Note, for the problems that ask you to label your axes with a numerical scale, each tick mark does not have to be 1 unit apart but you have to be consistent within each axis. For example, you can have units of 10 on the *x*-axis and units of 50 on the *y*-axis, so you'd have 10,20,30,40 etc. on the *x*-axis and 50,100,150,200 etc. on the *y*-axis. Just label a couple on each so it doesn't get cluttered. And you can skip tic marks!

7. Complete the T-table for the function $f(x) = |4x - 2|$ and use it to sketch a graph on the axes. Be sure to label your axes with a numerical scale. (8 pts)

x	y
-3	
-2	
-1	
0	
1	
2	
3	



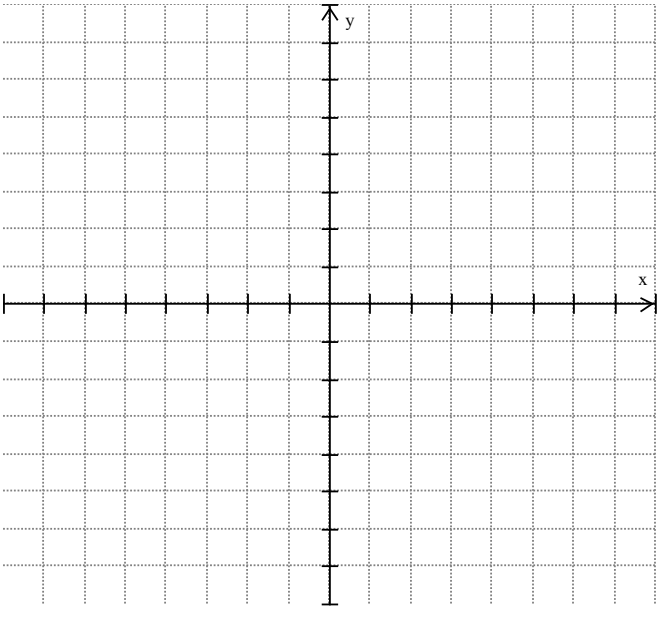
Where does $f(x) = 0$? In other words, what value of x makes the graph touch or cross the *x*-axis?

8. The power produced by a wind turbine depends on the speed of the wind. If a windmill has blades 3 meters long, then the power P produced by the turbine is modeled by

$$P(v) = 14.1v^3$$

Where P is measured in watts (W) and v is measured in meters per second (m/s).

a. Use your graphing calculator to graph the function P for wind speeds between 0 m/s and 7 m/s. Then accurately sketch the graph below. Be sure to label your axes with a numerical scale. (8 pts)



b. What is the power produced if the wind is blowing at 6 m/s? Use appropriate units in your answer.

(5 pts bonus!) to the nearest 100th what is the speed of the wind in miles per hour in part b.? Show work.