# Math 109 - Test 2
October 17, 2019

Name key

Score

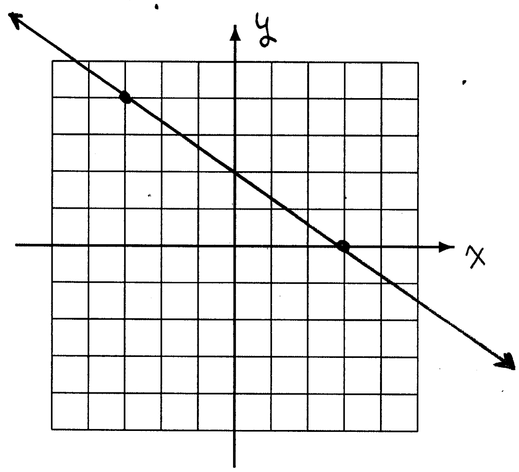
Show all work to receive full credit. Supply explanations where necessary. Label your axes when graphing.

1. (6 points [2]) A line with slope $-2/3$ passes through the point $(-3, 4)$. Sketch the graph of the line, and find an equation of the line.

$y - 4 = -\frac{2}{3}(x+3)$

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

$\boxed{y = -\frac{2}{3}x + 2}$




2. (8 points) Let $g(x) = x^2 - 2x$. Expand and simplify the difference quotient $\dfrac{g(x+h) - g(x)}{h}$.

$$\frac{g(x+h) - g(x)}{h} = \frac{[(x+h)^2 - 2(x+h)] - [x^2 - 2x]}{h}$$

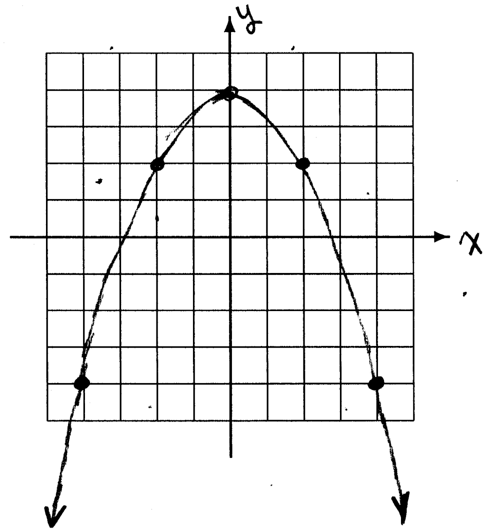
$$= \frac{x^2 + 2xh + h^2 - 2x - 2h - x^2 + 2x}{h}$$

$$= \frac{2xh + h^2 - 2h}{h} = \frac{\cancel{h}(2x + h - 2)}{\cancel{h}}$$

$$= \boxed{2x + h - 2}$$

3. (6 points [8]) Make a table that shows five points on the graph of $f(x) = -\frac{1}{2}x^2 + 4$. Then plot your points and sketch the graph of $y = f(x)$.

| x | y |
|---|---|
| 0 | 4 |
| ±2 | 2 |
| ±4 | -4 |




4. (4 points [2]) A line passes through the two points $(0, -5)$ and $(-4, 7)$. Find an equation for the line.

$$m = \frac{7-(-5)}{-4-0} = \frac{12}{-4} = -3$$

Y-INT : $(0, -5)$

$\boxed{y = -3x - 5}$

5. (6 points [2]) The line $L$ passes through the point $(5, 7)$ and is perpendicular to the line described by $3x - 6y = 11$. Determine an equation for $L$. Write your final answer in slope-intercept form.

$6y = 3x - 11$

$y = \frac{3}{6}x - \frac{11}{6}$

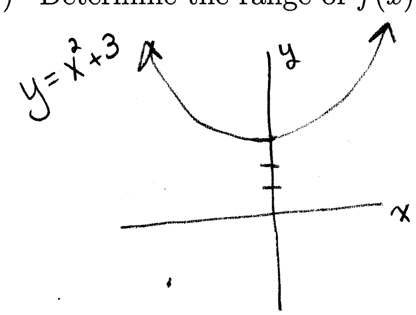
$m = \frac{1}{2}$

PERP SLOPE $= -2$

POIN $(5, 7)$

$y - 7 = -2(x - 5)$ OR $\boxed{y = -2x + 17}$

6. (3 points [1]) Determine the range of $f(x) = x^2 + 3$. Briefly explain your reasoning.




THE GRAPH OF $y = f(x)$ IS THE GRAPH OF $y = x^2$ SHIFTED UP 3. THAT SHIFTS THE RANGE UP 3:

$\boxed{\text{RANGE} = [3, \infty)}$

7. (4 points [1]) Determine the domain of $f(x) = \dfrac{2x-7}{\underbrace{x^2+3x-10}}$.

$(x+5)(x-2) = 0$

$\Rightarrow \quad x=-5,\ x=2$

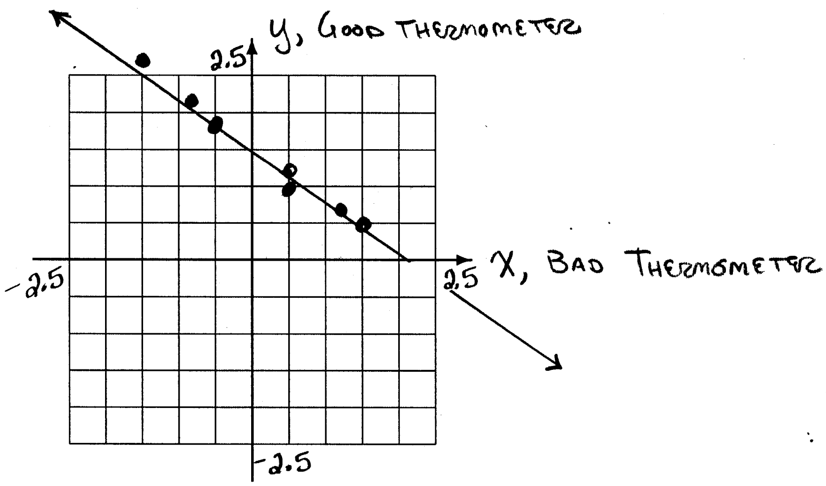
Domain = All real #s except $x = -5, 2$

8. (10 points [2,4]) In carrying out a science experiment, Liz was monitoring the temperature inside a cooler. Her thermometer did not seem to be working, so she double checked her temperatures with a thermometer that she knew was good. Each ordered pair below has a 1st coordinate obtained from the broken thermometer and a 2nd coordinate obtained from the good thermometer.

$(-1.5, 2.6)$, $(0.5, 1.1)$, $(-0.5, 1.9)$, $(-0.8, 2.1)$, $(1.2, 0.6)$, $(0.5, 1.0)$, $(1.5, 0.5)$

(a) Let each tick mark represent 0.5 units and sketch the scatterplot. Label your axes.

My line has y-int $(0, 1.5)$ and passes through $(-0.5, 1.9)$




(b) Sketch a line that approximates the best fit. Then find an equation for your line. Round all numbers to the nearest tenth.

$$m = \frac{1.9-1.5}{-0.5-0} = \frac{0.4}{-0.5} = -0.8$$

$y = -0.8x + 1.5$

(c) Use your equation to obtain a "good" temperature if the bad thermometer reads 0.2.

$$-0.8(0.2) + 1.5 = 1.34 \approx 1.3$$

9. (3 points [1]) Three relations are shown below. Circle all that are NOT functions. Then write a sentence explaining why you made your choice(s).

(a) $\{(x, y) : y \text{ is a whole number and } x = 1\}$ = $\{(1,0), (1,1), (1,2), \ldots\}$

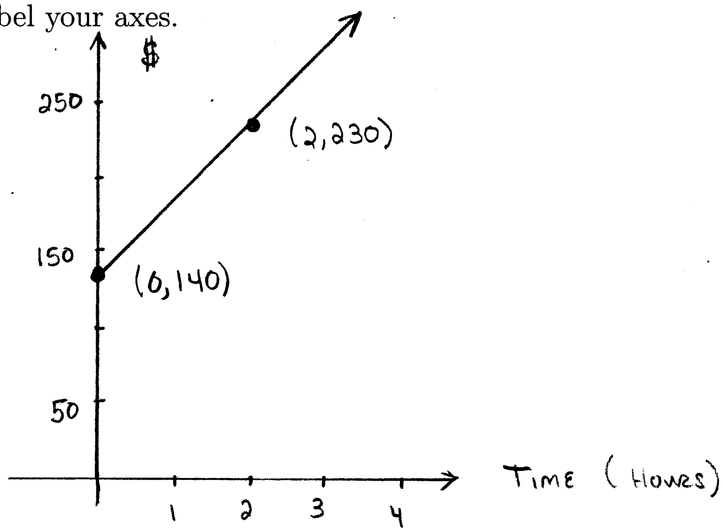
(b) $\{(3,4), (3,4), (3,4), (3,4), (3,4), (3,4)\}$

(c) $\{(0,0), (1,0), (0,1), (1,1)\}$

(a) & (c) EACH HAVE 2 OR MORE X-COORDS PAIRED WITH DIFFERENT y-COORDS.

10. (6 points [2,5]) Sal fixes vintage arcade games. He charges a flat fee of \$140 to make a house call, but then he charges a constant hourly rate on top of that. He recently made a house call to fix a Centipede game and ended up billing the client \$230 after 2 hours of work.

(a) Sketch the graph the shows how much Sal makes (in dollars) versus time (in hours). Label your axes.




(b) Which single word or phrase in the problem situation indicates that the graph should be a line?

CONSTANT HOURLY RATE

(c) Compute the slope of the graph. What does the slope of the graph represent?

$$m = \frac{230-140}{2-0} = \frac{90}{2} = 45$$

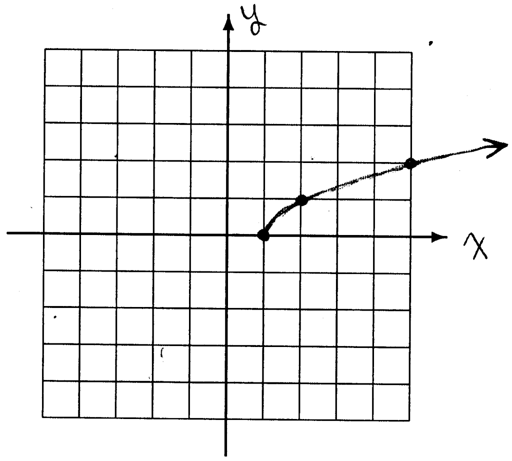
CHARGES \$45 PER HOUR

11. (4 points [6]) The graph of $y = \sqrt[3]{x}$ is shifted 3 units right and 6 units up. What is an equation for the new graph?

$$\boxed{y = \sqrt[3]{x-3} + 6}$$

12. (10 points [1,6]) Let $f(x) = \sqrt{x-1}$.

(a) Sketch the graph of the function $f$. Label your axes.




(b) What is the domain of $f$?

$[1, \infty)$

(c) What is the range of $f$?

$[0, \infty)$

(d) Evaluate $f(82)$.

$\sqrt{81} = \boxed{9}$

(e) Evaluate $f(0)$.

X = 0 IS NOT IN THE DOMAIN OF f.

f(0) IS NOT DEFINED.

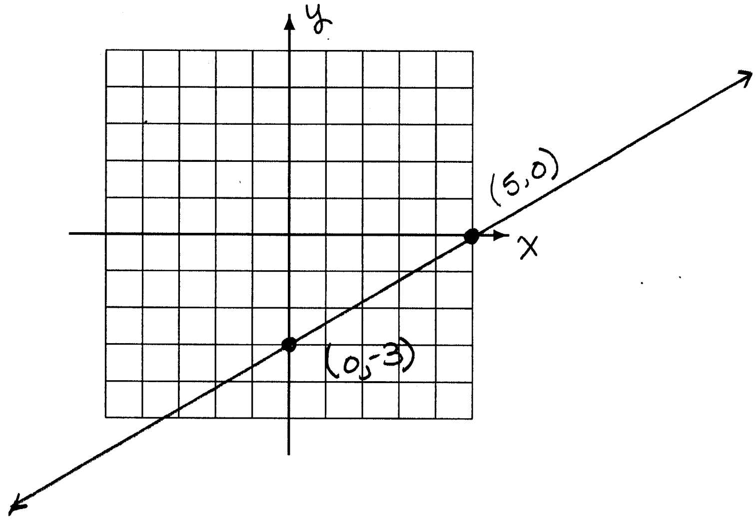
13. (4 points [6]) Describe the sequence of transformations that take the graph of $g(x) = x^2$ to that of $f(x) = -6 + (x+8)^2$.

SHIFT THE GRAPH OF $y = g(x)$

8 UNITS LEFT AND

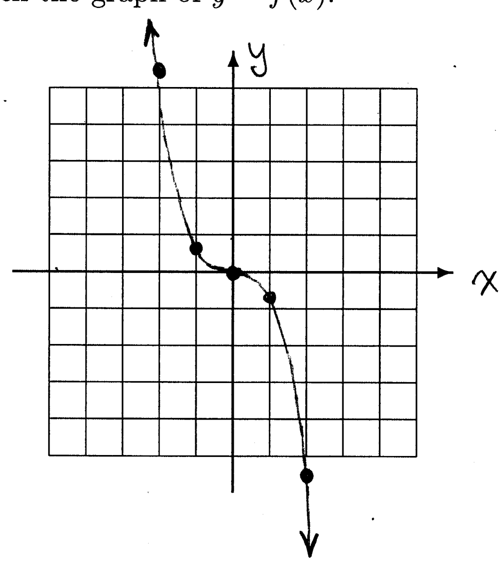
6 UNITS DOWN.

14. (6 points [2,3]) Sketch the graph of $f(x) = \frac{3}{5}x - 3$. Label your axes and two points on the graph.

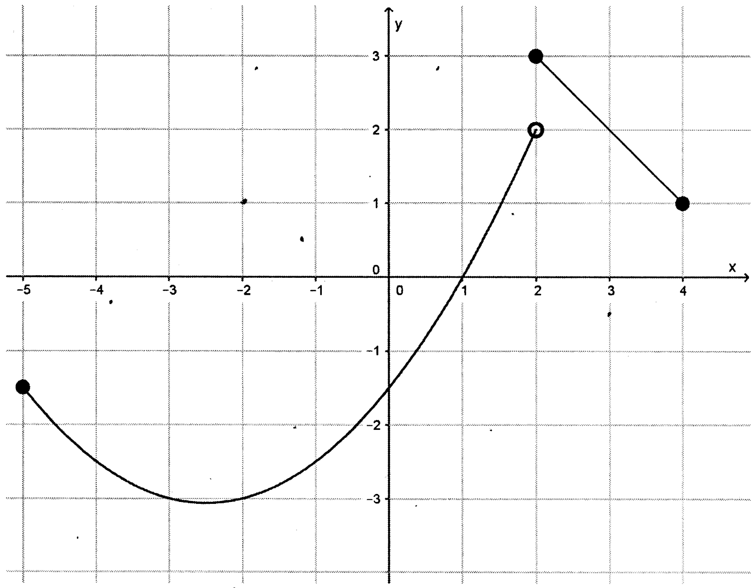



15. (6 points [6]) Make a table that shows five points on the graph of $f(x) = -\frac{2}{3}x^3$. Then plot your points and sketch the graph of $y = f(x)$.

| $x$ | $y = f(x)$ |
|---|---|
| 0 | 0 |
| 1 | $-\frac{2}{3}$ |
| -1 | $\frac{2}{3}$ |
| 2 | $-\frac{16}{3} = -5\frac{1}{3}$ |
| -2 | $\frac{16}{3} = 5\frac{1}{3}$ |



16. (14 points [1,5]) The graph of $y = f(x)$ is shown below. Use the graph to solve each part of this problem.




(a) Is this the graph of a function? How do you know?

YES, THE GRAPH PASSES THE VERTICAL LINE TEST

(b) What is the domain of $f$?

$[-5, 4]$

(c) What is the range of $f$?

ABOUT $[-3.1, 3]$

(d) Determine $f(2)$.

$f(2) = 3$

(e) Determine the interval(s) on which $f(x) < 0$.

$[-5, 1)$

(f) Determine open intervals on which $f$ is decreasing.

$(-5, -2.5) \cup (2, 4)$

(g) Determine the relative minimum value(s) of $f$.

$\boxed{y \approx -3.1}$ AT $x \approx -2.5$