Math 140
Test One

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name (12 points)

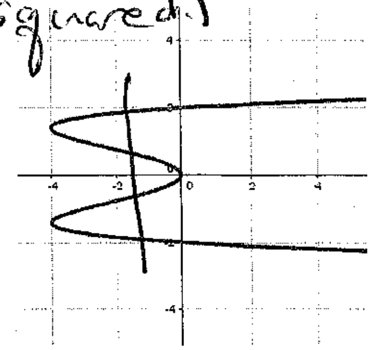
This exciting test covers chapters 3 and sections 4.1-2 of Algebra and Trigonometry (2nd UTM edition) by Sullivan and Sullivan. Clearly indicate your answers—no credit will be given for answers that I cannot find or cannot read. Unless otherwise indicated, all parts of problems are four points each.

1. Determine if each of the following represent a function.

   a. Does the equation $2x^2 + 3y^2 = 1$ define y as a function of x? Why or why not?

   No - there are two y values $(\pm\frac{1}{3}\sqrt{1-2x^2})$ for each x. (or mention y is squared.)

   b. Is the graph on the right the graph of a function? Why or why not?

   No - fails vertical line test.

2. Determine the domain of the following functions

   a. $f(x) = \frac{3x+2}{x^2-9}$

   Need $x^2 - 9 \neq 0$
   $x^2 \neq 9$
   $x \neq \pm 3$

   $\boxed{\text{domain } x \neq \pm 3}$

   $-\frac{1}{2}$ for $x \neq 3$

   b. $g(x) = \sqrt{3x+7}$

   Need $3x + 7 \geq 0$, so
   $3x \geq -7$ or $x \geq -\frac{7}{3}$

   $\boxed{\text{domain } x \geq -\frac{7}{3}}$
   or $[-\frac{7}{3}, \infty)$

   -2 for $x \geq -2$

3. Let $f(x) = 2x + 1$, and $g(x) = -x^2$, find $\left(\frac{g}{f}\right)(2)$.

   $g(2) = -2^2 = -4$
   $f(2) = 2(2) + 1 = 5$ so

   $\boxed{\frac{g(2)}{f(2)} = -\frac{4}{5}}$

   -2 for $\frac{f}{g}(x)$

4. Determine if the function $g(x) = 4x^3 - 2x^7$ is even, odd or neither.

   $\boxed{\text{Odd}}$

5. Find the equation of the function that is graphed after $y = x^2$ is shifted down 4 units and then shifted right 2 units.

$$\boxed{y = (x-2)^2 - 4}$$

6. If (2,4) is a point on the graph of $y = f(x)$, what point must be on the graph of $y = f(4x)$?

$\boxed{\left(\frac{1}{2}, 4\right)}$

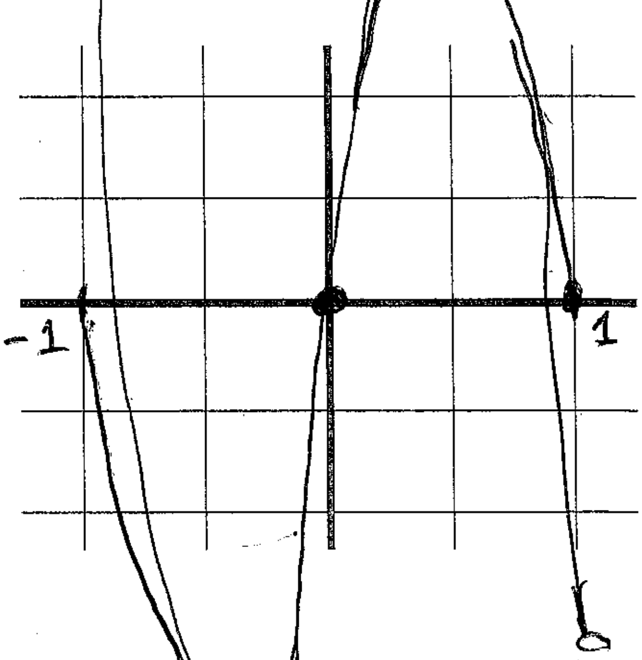
Because X is multiplied by 4, so the x-value is $\frac{1}{4}$ of the size.

$$f\left(4\left(\tfrac{1}{2}\right)\right) = f(2) = 4$$

$(.471, 1.89)$

$(-1, 3)$

7. Use a graphing utility to graph the function $f(x) = 6x - 9x^3$ on the interval $[-1, 1]$. Clearly label the points where $f(x)$ has its minimum and maximums. (6 points)

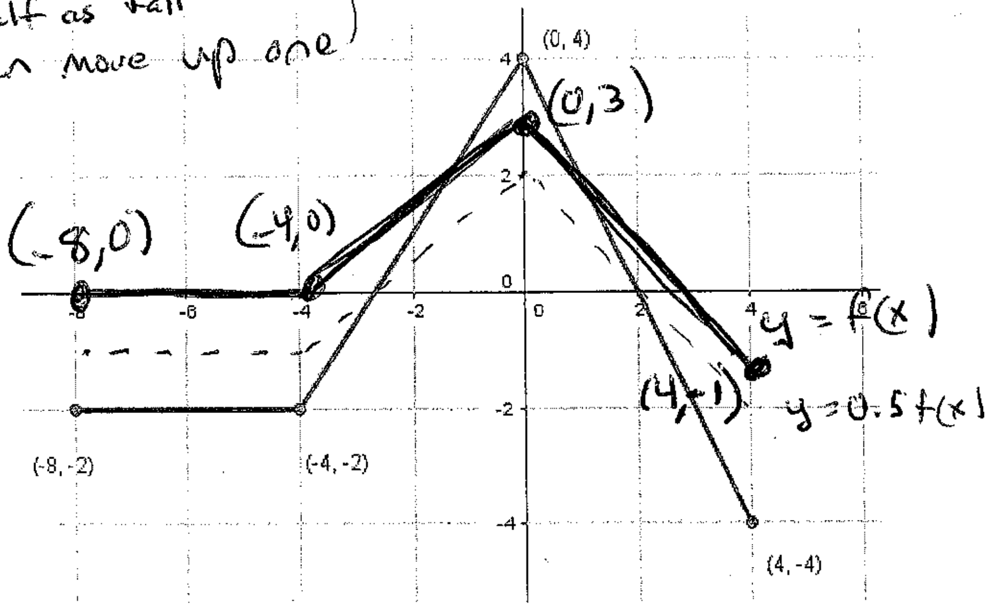


$(-.471, -1.89)$

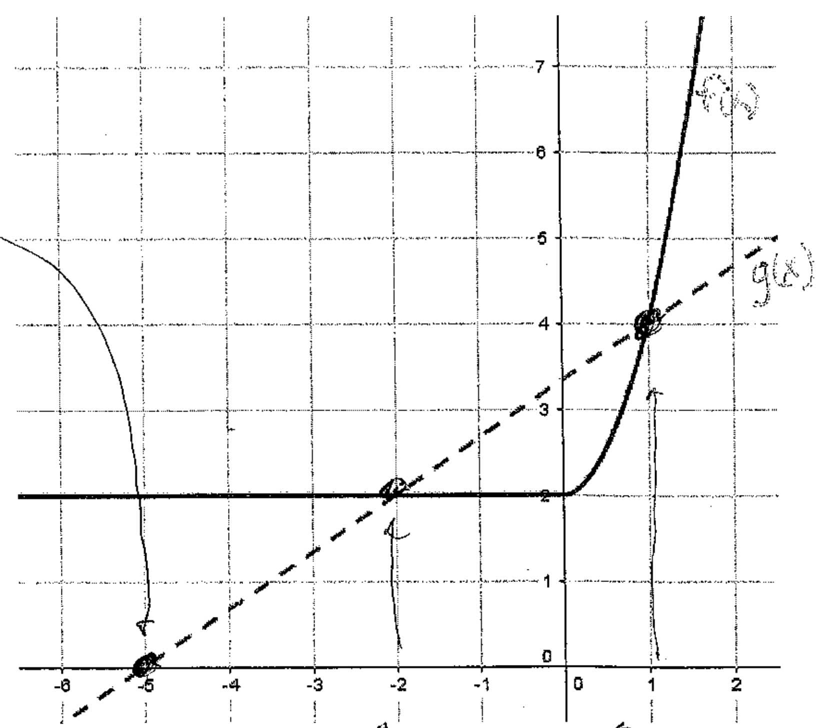
$(1, -3)$

8. Draw the graph of $y = 0.5\,f(x) + 1$ where $y = f(x)$ is as shown below (you may use the same axes for your answer).

One half as tall then move up one



9. Find the following for the functions graphed on the left. (3 points each)



a. Find the zero(s) of the function g(x).

$\boxed{x = -5}$

$-\frac{1}{2}$ for $(-5, 0)$

b. For which values of x is $f(x) \geq g(x)$?

$\boxed{x \leq -2 \text{ and } x \geq 1}$

or $(-\infty, -2]$ and $[1, \infty)$

$-\frac{1}{2}$ for $(-2, 2)$, $(1, 4)$

c. Find where the function f(x) is constant.

$x \leq 0$

or $(-\infty, 0]$

d. Solve $f(x) = g(x)$.

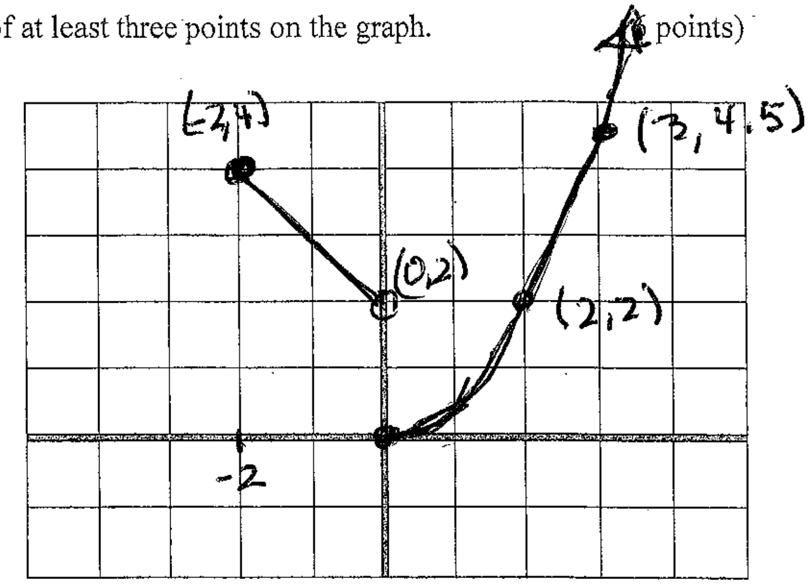
$\boxed{x = -2 \text{ and } x = 1}$

$-\frac{1}{2}$ for $(-2, 2)$, $(1, 4)$

10. Graph the given function. Identify the location of at least three points on the graph. 4 points)

$$f(x) = \begin{cases} -x+2 & -2 \le x < 0 \\ 0.5\,x^2 & x \ge 0 \end{cases}$$

$-2\frac{d}{2}$ if both drawn correctly



11. Baking: Suppose that for the first 300 loaves of bread the charge is \$3 per loaf. If you order over 300 loaves, the cost is \$600 plus \$2.50 for each additional loaf over 300. (3 points each)

a. How much would 600 loaves cost?

$$L(600) = 600 + 2.5(600 - 300)$$
$$= 600 + 750 = \boxed{\$1350}$$

b. Develop a piece-wise define function L(x) where L(x) is the cost for x loaves of bread.

$$\boxed{L(x) = \begin{cases} 3x & \text{if } x \le 300 \\ 600 + 2.50(x-300) & \text{if } x > 300 \end{cases}}$$

additional loaves over 300.

12. **Fleas on feral cats**: Feral cats have fleas.

a. Use the give data to calculate a *linear* regression equation to determine the number of fleas f(x) on x cats. Write the equation in the space below. Round to three significant digits. (6 points)

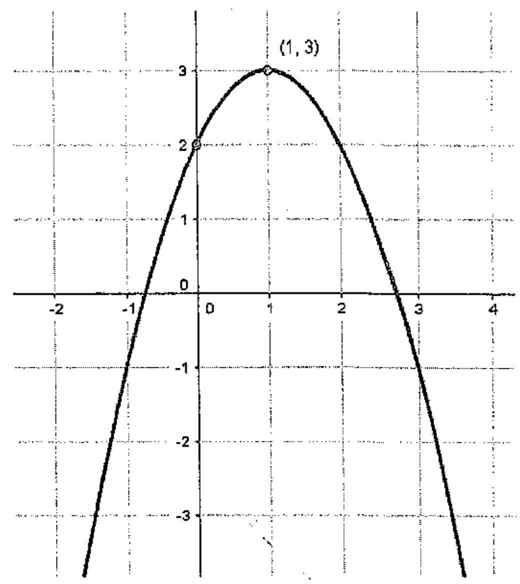
Cats x	Total fleas $f(x)$
2	54
3	84
8	250
11	320

$\boxed{f(x) = 30.2x - 4.33}$

b. According to the regression equation model you found, what is the total number of fleas on 9 cats?

$30.2(9) - 4.33 = 267.47$ $\boxed{267 \text{ fleas}}$

13. Find the equation of the parabola on the left.



Vertex (1,3):

$y = a(x-h)^2 + k = a(x-1)^2 + 3.$

Intercept (0,2):

$2 = a(0-1)^2 + 3 = a + 3$

so $a = -1.$

$\boxed{y = -(x-1)^2 + 3} = -x^2 + 2x + 2$

14. The daily revenue achieved by selling x boxes of candy is $R(x) = -0.2x^2 + 75x$.

a) What price should be charged to achieve the maximum revenue?

$x = -\frac{b}{2a} = -\frac{75}{2(-0.2)} = \boxed{\$187.5}$

b) What is that maximum revenue?

$R(187.5) = \boxed{\$7031.25}$