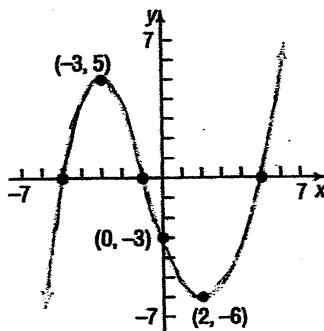


Part I: Short answer questions. No work is required. Each answer is worth 1 point.

- The slope of a vertical line is \_\_\_\_\_; the slope of a horizontal line is \_\_\_\_\_.
- The product of  $2+3i$  and its conjugate is \_\_\_\_\_.
- Are  $-x+2y=4$  and  $2x+y=0$  parallel, perpendicular or neither? \_\_\_\_\_
- Write  $\{x \mid x > -3 \text{ and } x \leq 10\}$  in interval notation. \_\_\_\_\_
- Find the solution set of  $|3x-1|=2$ . \_\_\_\_\_

In answering questions 6 - 9 use the figure below.



- The zeros of the function are \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.
- The open intervals on which  $f$  is increasing or decreasing.  
Increasing: \_\_\_\_\_ Decreasing: \_\_\_\_\_
- The local minimum value of the function is \_\_\_\_\_.
- Is the function even, odd or neither? \_\_\_\_\_
- Write the function whose graph is the graph of  $y=x^3$ , but is reflected about the x-axis and is vertically shifted up 4 units.  $f(x) =$  \_\_\_\_\_
- Given the function:  $f(x) = -3x^4(x-9)^2(x+4)^5$ 
  - Since  $-4$  is a zero of the function what is the multiplicity? \_\_\_\_\_
  - What is the degree of the polynomial? \_\_\_\_\_
  - Does the graph of  $f(x)$  touch or cross the x-axis when  $x = 0$ ? \_\_\_\_\_

Answer questions 12, and 13 with True or False

12. The domain of every polynomial function is the set of all real numbers. \_\_\_\_\_

13. The graph of a rational function never intersects a horizontal asymptote. \_\_\_\_\_

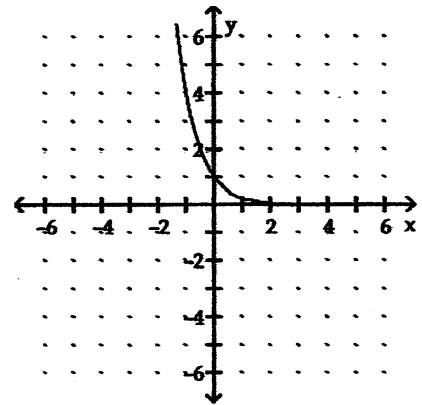
14. Write the exponential equation  $10^{-2} = 0.01$  in logarithmic form. \_\_\_\_\_

15. Find the exact value of the following logarithmic expressions.

a)  $\ln e^4$  \_\_\_\_\_      b)  $\log_2\left(\frac{1}{4}\right)$  \_\_\_\_\_      c)  $\log 400 - \log 4 + \log 1$  \_\_\_\_\_

16. The logistic growth model  $P(t) = \frac{1500}{1 + 29e^{-0.439t}}$  represents the population (in grams) of a bacterium after  $t$  hours. Determine the initial population size. \_\_\_\_\_

17. True or False: The graph of the function  $f(x) = 4^{-x}$  is shown at the right.



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18. The solution to the system of equations  $\begin{cases} x + 2y = 10 \\ x - 2y = -2 \end{cases}$  is (\_\_\_\_\_, \_\_\_\_\_).

19. Write the augmented matrix of the given system of equations.

$$\begin{cases} x + 2y - z = 5 \\ 2y + z = -1 \\ 3x + y - 5z = 4 \end{cases}$$

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20. True or False: Any pair of matrices can be multiplied. \_\_\_\_\_

21. Evaluate:  $2 \begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix} - \begin{bmatrix} 5 & 2 \\ -3 & 6 \end{bmatrix} = \begin{bmatrix} & \\ & \end{bmatrix}$

22. The reduced row echelon form of a system of equations is given as:

$$\begin{bmatrix} 1 & 0 & 0 & -3 \\ 0 & 1 & 0 & 4 \\ 0 & 0 & 0 & 2 \end{bmatrix}$$

Is the system consistent or inconsistent? \_\_\_\_\_

**Part II: Show all your work on the following problems. Use exact answers only.**

**23.(3 pts.) Solve the equation  $\sqrt{7-2x} = x-2$ . Be sure to check for extraneous solutions.**

**24.(3 pts.) Find an equation of a line that is parallel to the line  $2x + 3y = -4$  that goes through the point  $(-5, 1)$ . Write your answer in slope-intercept form.**

**25.(3 pts.) Find the center and radius of the following equation of a circle.**

$$x^2 + y^2 - 4x + 8y + 11 = 0$$

26.(6 pts.)  $f(x) = 3x^2 - 5$

a)  $f(-1) =$  \_\_\_\_\_ b)  $f(x+h) =$  \_\_\_\_\_

c) Is  $f(x)$  even, odd or neither? \_\_\_\_\_

d) If  $f(x) = 7$  then what is  $x$ ? \_\_\_\_\_ e) Find the average rate of change from 2 to 5.

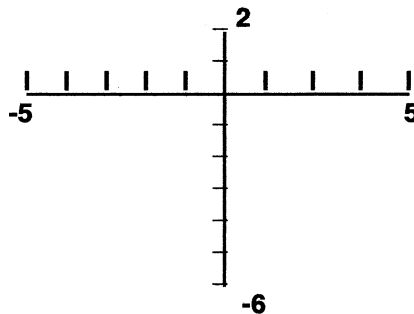
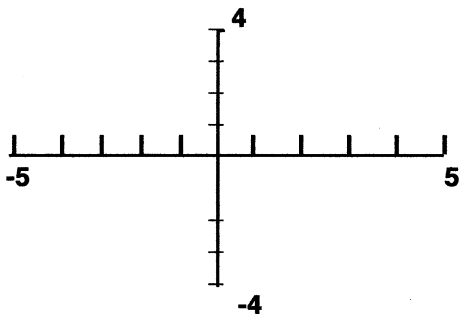
27.(8pts.) For each of the following state the transformations and sketch the graph.

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

b)  $f(x) = -\frac{1}{2}|x+1| - 3$  \_\_\_\_\_

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28.(7 pts.) Find the following information about the given function.

$f(x) = 2x^2 - 4x + 1$

Write  $f(x)$  in the form  $f(x) = a(x-h)^2 + k$ : \_\_\_\_\_

Vertex: \_\_\_\_\_

Line of Symmetry: \_\_\_\_\_

y-intercept: \_\_\_\_\_

x-intercepts: Reduced radical form

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Opens up or down: \_\_\_\_\_

29.(6 pts.) Given  $R(x) = \frac{4x^2 - 1}{2x^2 + 6x}$  If there is no answer write none.

a) Write  $R(x)$  in factored form and reduce if possible.  $R(x) =$  \_\_\_\_\_

b) Domain: \_\_\_\_\_

c) Write the intercepts as ordered pairs.

d) Write equations of the asymptotes.

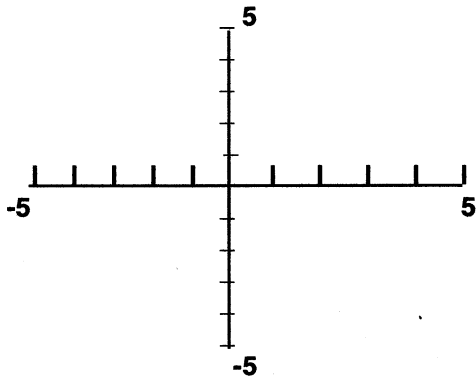
x-intercepts: \_\_\_\_\_

y-intercepts: \_\_\_\_\_

Vertical asymptotes: \_\_\_\_\_

Horizontal asymptotes: \_\_\_\_\_

30. (3 pts) Graph the following piecewise defined function.  $f(x) = \begin{cases} 2x-1 & \text{if } x \leq -1 \\ x^2 & \text{if } -1 < x < 2 \\ 4 & \text{if } x \geq 2 \end{cases}$



31.(5 pts.) The graph of the function  $p(x) = x^5 - x^4 - 4x^3 + 8x^2 - 32x + 48$  touches the x-axis at 2 and crosses the x-axis at -3. Find all the zeros of  $p(x)$  and write  $p(x)$  in factored form.

Zeros \_\_\_\_\_

Factored form for  $p(x) =$  \_\_\_\_\_

32.(4 pts.) Given  $f(x) = \sqrt{x+9}$  and  $g(x) = 8x - 13$

a) Find  $f \circ g(x)$

b) What is the domain of  $f \circ g(x)$ ?

$f \circ g(x) =$  \_\_\_\_\_

Domain: \_\_\_\_\_

33.(2 pts.) If  $f(x) = \frac{2x}{x-1}$ , find  $f^{-1}(x)$ .  $f^{-1}(x) =$  \_\_\_\_\_

34.(2 pts.) Solve the equation.  $2^{(5-3x)} = \frac{1}{16}$

35.(2 pts) Solve the following log equation.

$$\log(x+10) - \log(4x-3) = 1$$

36.(4 pts.) A midwestern town finds its residents moving to the city. Its population is declining according to the function defined by  $P(t) = 1000e^{-0.04t}$ , where  $t$  is measured in years.

a) Find the population at  $t = 2$ .  
Leave your answer in terms of  $e$ .

b) Find the number of years it will take for the population to decline to 800. Leave your answer in terms of logarithms.

37.(3 pts.) Suppose that the amount of carbon dioxide in the atmosphere grows exponentially according to  $y = y_0 e^{kt}$ , where  $y$  is the amount of carbon dioxide in ppm (parts per million) and  $t$  is the number of years since 1990. In 1990, the amount of carbon dioxide was 352 ppm and it is projected that the amount will double in 2090. Determine the value of  $k$  and leave your answer in terms of logarithms.

38.(3 pts.) Multiply the following matrices.  $\begin{bmatrix} -4 & 1 \\ 6 & -2 \end{bmatrix} \cdot \begin{bmatrix} 0 & 3 & -5 \\ 1 & 2 & 6 \end{bmatrix}$

39.(3 pts.) The perimeter of a rectangular floor is 42 meters. Find the dimensions of the floor if the length is twice the width. Do this problem algebraically by setting up a system of equations.

40.(3 pts.) Solve the following system of equations using matrices.  $\begin{cases} x + 2y = 5 \\ x + y = 3 \end{cases}$