Advanced Algebra and Trig - Spring Midterm Review   Name _____

1. Graph each of the following:

    a. $y = -3x - 2$ b. $y = \dfrac{1}{3}x - 3$ c. $y = -\dfrac{1}{3}x - 1$ d. $y = 3x + 1$

2. Graph the following piecewise function: $f(x) = \begin{cases} -3 & \text{if } x < -2 \\ 2x - 3 & \text{if } -2 \le x < 0 \\ \dfrac{1}{2}x^2 + 1 & \text{if } x \ge 0 \end{cases}$ $f(x) = \begin{cases} x + 3 & \text{if } x \le 0 \\ 3 - x & \text{if } 1 < x \le 3 \\ 3x & \text{if } x > 3 \end{cases}$

3. Given $f(x) = 3x^2 - 1$ and $g(x) = x - 5$ find each of the following:

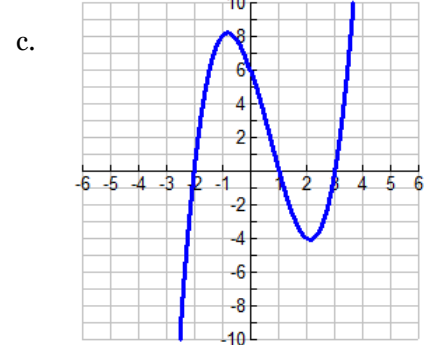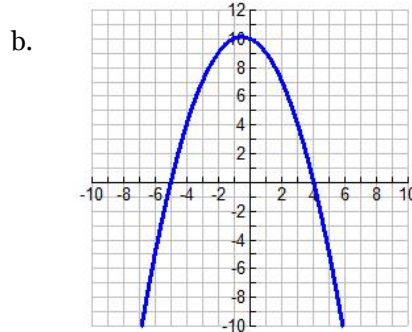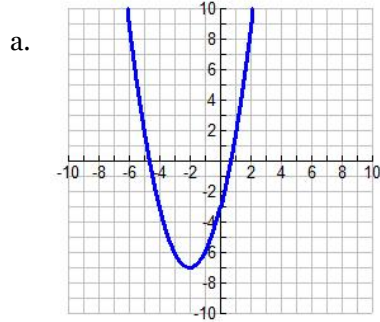   a. $(f + g)(x)$ b. $(f - g)(x)$ c. $(f \circ g)(x)$ d. $(g \circ f)(x)$

4. Find the domain of the function:

    a. $f(x) = \dfrac{5}{x + 3}$ b. $f(x) = \dfrac{x - 3}{x^2 + 2x - 15}$ c. $f(x) = \sqrt{x + 4}$

5. What is the interval of increase, interval of decrease, maximum, minimum, domain, and range of each graph below.

    a.   b.   c.

6.. Find the inverse of   a. $f(x) = 4x^2 + 1$ b. $f(x) = \dfrac{x + 1}{3}$

7. Solve each rational inequality. Write your answer in interval notation.

    a. $y \le \dfrac{1}{x + 3} - 5$ b. $y > \dfrac{2x - 1}{(x - 1)(x + 3)}$

8. Simplify the following functions.

a. $\dfrac{x^2+5x-6}{2x-2}$

b. $\dfrac{2x}{5}+\dfrac{x+1}{2x-3}$

c. $\dfrac{7}{2x+1}-\dfrac{8x}{x-5}$

d. $\dfrac{5x}{x+2}+\dfrac{3}{x}$

9. Describe the transformations of the function from the parent graph of $f(x)=\dfrac{1}{x}$

a. $f(x)=\dfrac{1}{x-7}+4$

b. $f(x)=\dfrac{4}{x}$

c. $f(x)=-\dfrac{1}{x+3}$

d. $f(x)=-\dfrac{3}{x+2}-7$

10. Describe the end behavior of the following functions

a. $f(x) = 4(x + 3)(x - 5)$

b. $f(x) = x^2 + 7x + 12$

c. $f(x) = 3(x - 5)^2 + 7$

11. Graph the following function and state the domain and range.

a. $y = 3\log_2(x + 1) + 4$

b. $y = \log_5(x - 1) + 7$

12. Find the exact roots of the polynomial.

a. $x^3 - 7x^2 + 10x = 0$

b. $x^2 + 100 = 0$

c. $x^4 - 10x^2 + 9 = 0$

d. $x^2 - 121 = 0$

e. $x^3 + 9x = 0$

f. $x^2 + 18 = 0$

g. $x^4 + x^2 - 2 = 0$

13. Write the polynomial equation of least degree for the roots given.

a. 1,0,-5

b. -2, $\pm 4i$

c. double root at 8, $\pm 3i$, 0

14. Divide.

a. $(x^3 - 4x^2 + 5x - 11) \div (x - 1)$

b. $(2x^4 - 3x + 1) \div (x + 3)$

15. Find the remainder for each division. Is the divisor a factor of the polynomial?

a. $(x^3 - 4x^2 + 100) \div (x - 5)$

b. $(x^3 - 7x^2 - 16x + 112) \div (x - 4)$

R _____   Factor? _____

R _____   Factor? _____

16. Find <u>all possible</u> rational zeros of the function. Then determine all the zeros.

a. $f(x) = 8x^3 - 6x^2 - 23x + 6$ b. $f(x) = 2x^4 + 3x^3 - 8x^2 - 9x + 6$

Possible zeros: _____   Possible zeros: _____

Zeros: _____   Zeros: _____

17. Graph the following functions and find the domain, range, and find the maximum or minimum.
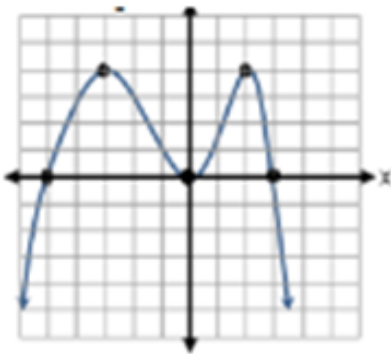
a. $y = (x+4)^2 - 3$ b. $y = -3x^2 + 12x - 5$ c. $y = 2x^2 - 12x + 7$

18. Write the **first derivative** of

a. $f(x) = 5x^4 + x^3 - 6x^2 - 7x + 13$ b. $f(x) = 3x^7 + 2x^5 - x^4 - 7x + 13$

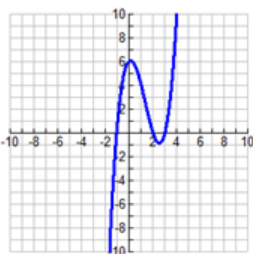**19.** Write an equation to the following graph. (Hint: use the x-intercepts to write the equation)

What are the x-intercepts? _____

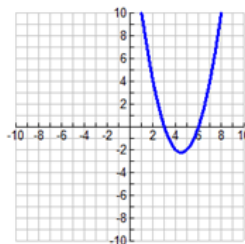Write your factors of the polynomial by using the x-intercepts. _____

"FOIL" or Distribute your factors above _____

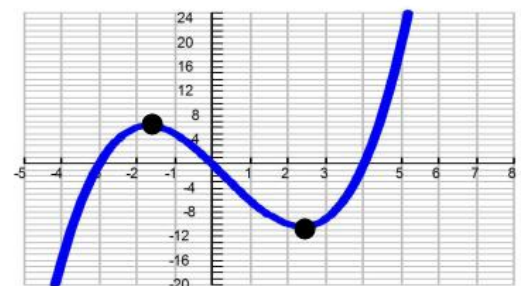**20.** Write the interval of increase, decrease, end behavior, maximum(s), and minimum(s) for each graph below.

a.   b.   c.

21. Find the zeros

    a. $y = 2x^2 - 12x + 7$ b. $y = x(x-2)(x+7)$ c. $y = 3x^3 + 21x^2 + 36x$

22. Graph the following functions and find the vertical asymptote(s), horizontal asymptote(s), and holes.

    a. $y = \dfrac{x+3}{x^2 + 21x + 54}$ b. $y = \dfrac{x^2 - 6x + 3}{x^2 + 5x - 24}$

23. Write the equation of the following lines:
    a. Write the linear equation of a line with a slope of 3 and passing through the point (3, -5).

    b. Write the linear equation that contains the points (-5, 4) and (-6, 0).

    c. Write the linear equation that is perpendicular to $y = 4x - 9$ and through the point (5, 3).

1) Find the equation of the regression line for the given data.

x	-5	-3	4	1	-1	-2	0	2	3	-4
y	-10	-8	9	1	-2	-6	-1	3	6	-8

A) $\hat{y} = -0.552x + 2.097$ B) $\hat{y} = 2.097x + 0.552$

C) $\hat{y} = 2.097x - 0.552$ D) $\hat{y} = 0.522x - 2.097$

2) Use the regression equation to predict the value of y for x = ___1.1.
Assume that the variables x and y have a significant correlation.

x	-5	-3	4	1	-1	-2	0	2	3	-4
y	11	6	-6	-1	3	4	1	-4	-5	8

A) 2.832   B) -1.315   C) 2.719   D) -1.051