Part I. Problems in this section are mostly short answer and multiple choice. Little partial credit will be given. 5 points each.

1.   State the slope and y-intercept for the line $4x + 3y = -9$

   $m =$ _____ $y - \text{int}:$ _____
                                                      (write as ordered pair)

2.   Factor **completely**. Do not solve.

   a) $4x^2 - 2x - 12$ b) $3x^3 + 6x^2 - 5x - 10$

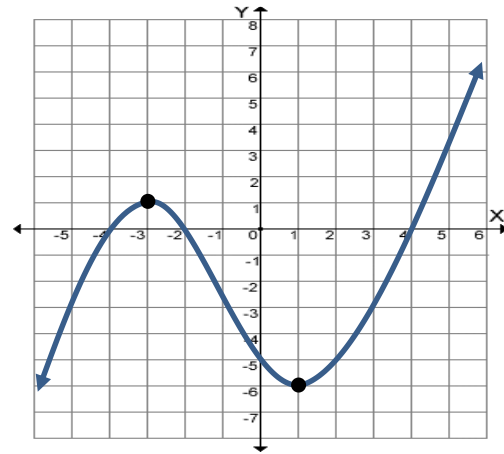3.   Find the domain of the function $f(x) = \sqrt{x - 4}$. Circle the correct answer.

   a) $[4, \infty)$
   b) $(-\infty, 4]$
   c) $(4, \infty)$
   d) $(-\infty, 4)$
   e) $(-\infty, \infty)$

4. Solve: $-4 < \dfrac{8 - 2x}{3} \leq 6$. Express your answer in interval notation.

5. Given the graph of $f(x)$, state all x such that:

    a) $f(x)$ is increasing (use interval notation)

    b) $f(x) \leq 0$ (use interval notation)

6. Solve ALGEBRICALLY. Show all work. $|4x + 2| + 6 = 20$

7. Solve for x. Show all work and circle your final answer.
    a) $2x - (5x + 3) = 12$ b) $\sqrt{4x + 9} = 7$

8. Let $f(x) = 2x - 5$ and $g(x) = x^2 + 3$.   Find and simplify.

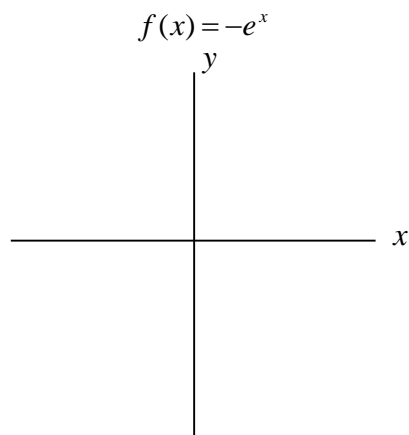   a) $(f - g)(x)$ b) $(f \circ g)(-1)$

9. Find the quotient and remainder.
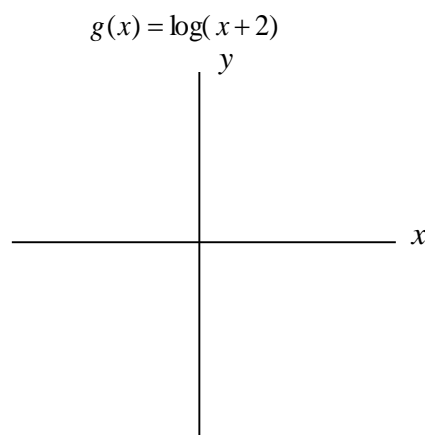
    $(x^3 + 2x - 3) \div (x + 1)$

    Quotient: _____

    Remainder: _____

10. Graph each function. Dash in asymptotes where needed. <u>Label all intercepts and asymptotes!</u>

    $f(x) = -e^x$ $g(x) = \log(x + 2)$

    Intercept in (x,y) form: _____   Intercept in (x,y) form: _____

    Equation of asymptote: _____   Equation of asymptote: _____

11. Find the <u>slope</u> of the linear function f such that $f(4) = -3$ and $f(2) = 5$.

$$m = \underline{\hspace{3cm}}$$

12. Find the product. Express in $a + bi$ form. $(2 + 7i)(3 - 2i)$

13. Write a polynomial of degree 3 that has zeros: 3 and $5i$. Write the final answer in polynomial form (multiplied out).

$f(x) = \underline{\hspace{3cm}}$

14. Given the point $(4, -5)$, find a point that is symmetric to the given point:

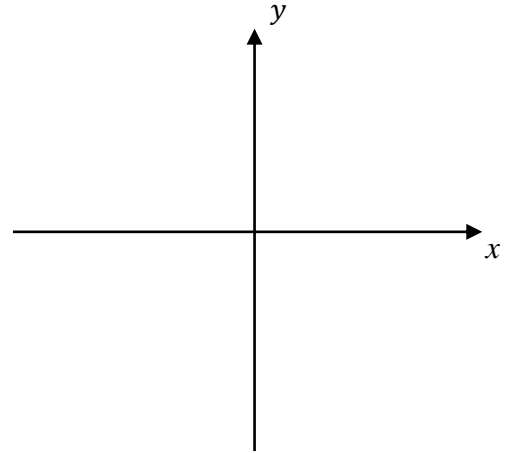   a)   with respect to the origin.   b)   with respect to the x-axis.

__Part II. There are 9 problems in this section. Show all work. 10 points each.__

15. Given the function $f(x) = 4x^2(x - 3)^3(x + 4)$,

   a) Find the y-intercept:

   b) Find the following information:

zero	multiplicity	tangent or cross thru

   c) Draw the ending behavior: d) Sketch the graph. Label all intercepts.

16. A stone is thrown directly upward. The height of the stone t seconds after it has been thrown is
    given by the function $s(t) = -16t^2 + 48t + 5$. The height of the stone is measured in feet. <u>Show
    your work algebraically and include **units** on your answers.</u>

   a) What is the initial height of the stone?

   b) How long does it take for the stone to reach its maximum height?

   c) What is the maximum height the stone reaches?

17. Given the rational function: $f(x) = \dfrac{4x-1}{x+2}$
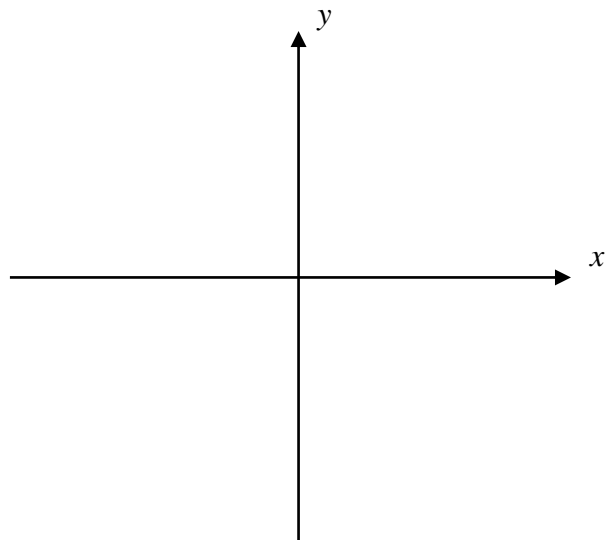
    Determine each of the following and graph the function. Be sure to <u>label</u> all intercepts, asymptotes, and additional points.

    y-intercept:

    zero(s):

    VA:

    HA:

    Additional Point(s):

18. Find a formula for the inverse function given that $f(x) = \dfrac{3x+2}{2x-1}$.

    $f^{-1}(x) = $ _____

19. Solve algebraically for x.

    a) $27^{3x+1} = 9^x$ b) $\log_2(3x + 4) = 4$

20. A bacteria culture starts with 200 bacteria. After 4 hours, there are 6000 bacteria. Assume that the number of bacteria is increasing according to the growth model $P = P_0 e^{kt}$. Find the value of k and leave your answer in exact form. (No calculators allowed.)

21. Solve the system of equations algebraically. Show your work.

$$\begin{cases} 2x - 3y = 5 \\ 3x + y = -9 \end{cases}$$

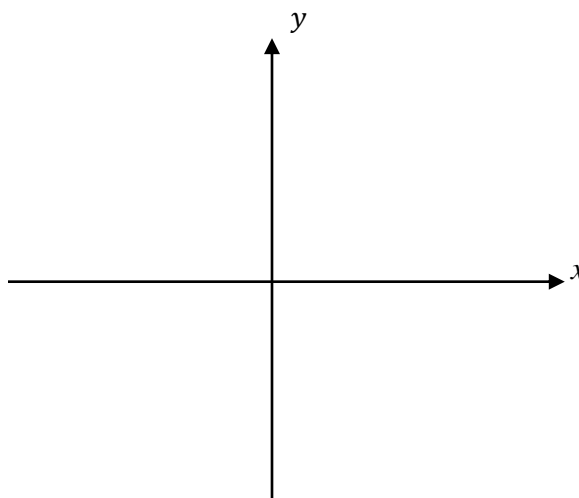22. Given the function $f(x) = x^2 + 8x + 7$

    a) State the y-intercept.

    b) State the zeros of the function.

    c) The vertex is   (_____ , _____).

    d) State the <u>range</u> of f .   e) <u>Graph</u> the function. <u>Label</u> intercepts and vertex.

23. Given the polynomial $g(x) = x^3 - x^2 + 2x - 8$, find **all** the zeros (both real and complex).

    a) List all possible rational zeros.

    b) Find one rational zero.

    c) Find all zeros of $g(x)$, both real and complex. Simplify your answer as much as possible.

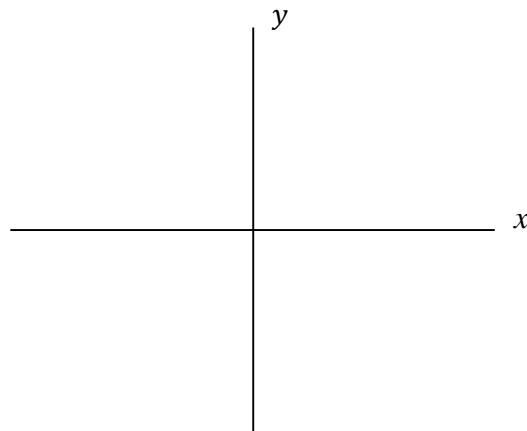   *State **all** of the zeros:* _____

Part III. There are 6 problems in this section. Choose any 4. Indicate in the boxes the problems you want graded. 10 points each. If you do not indicate which 4, the first 4 will be graded. No Extra Credit!

☐
Grade

24. Solve the equation algebraically for x. $\log_4 x + \log_4(x - 6) = 2$

☐
Grade

25. Write the equation of the line which passes through the points (-1, 2) and (1,-3). State the equation in standard form, $Ax + By = C$. Make sure your final answer meets all the requirements of standard form.

☐
Grade

26. Graph the following function. Label points.

$$f(x) = \begin{cases} 3x + 2, & x \geq 0 \\ -1, & x < 0 \end{cases}$$

y

x

27. Given $f(x) = x^2 + 5x$, find and simplify $\dfrac{f(x+h) - f(x)}{h}$.

Grade

28. The points (-1, 7) and (3, 1) are endpoints of the diameter of a circle.

Grade
    a)   Determine the center of the circle.   b)   Find the length of the radius of the circle.

    c)   State the equation of the circle in standard form.

29. Solve $\dfrac{x-5}{x+4} \le 0$. Express final answer in interval notation. To receive full credit you must show work that supports your answer.

Grade