our-Function Calculators only. NO CELL PHONES ALLOWED.

- **You must show ALL work on this paper to receive credit.**
  If you use scratch paper, you MUST transfer your work to this test and submit scratch paper with your final.
- **All cell phones must be stored in a bag.**
  If you are caught with a cell phone, you will receive a 0 for the test.

Part I. Answer all problems in this section. Little or no partial credit will be given.

[4 points each]

1. Factor completely.
   a. $6x^2 - 3x - 18$

   b. $4x^3 - 3x^2 - 4x + 3$

2. Simplify. Express answers using only positive exponents.

   a) $\dfrac{x^{-2}}{x^{-4}}$

   b) $\dfrac{(-3x^9\,y^{-3})^2}{x^6}$

3. Find the domain of the function $f(x) = \sqrt{4 - x}$
   a. $[4, \infty)$
   b. $(-\infty, 4]$
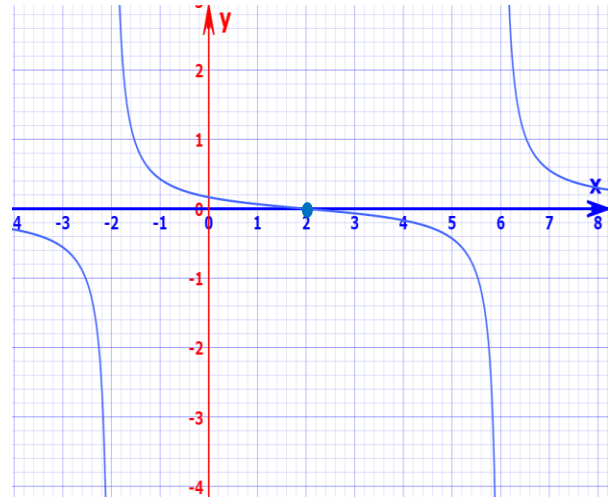   c. $(4, \infty)$
   d. $(-\infty, 4)$
   e. $(-\infty, \infty)$

4. Solve: $-2 \leq \dfrac{-2x+20}{3} < 10.$ Express your answer in interval notation.

5. Given the graph of a function, answer the following questions (**in interval notation**):

   a. What is the domain of the function?

   b. State all x such that $f(x) \leq 0$

6. Simplify the following.

   a) $\sqrt{-28} =$ _____

   b) $(-2i)^5 =$ _____

7. Given the point $(-3, 8)$, on the graph $f(x)$, find the corresponding point:

   a. Symmetric to the x-axis

   b. On the graph of $y = f(x - 3)$

Part II. Answer all problems in this section.

Some partial credit will be given for correct work shown.

8. [8 pts] Complete the following function operations. Simplify your answer, but do not try to factor your answer.

$f(x) = x^2 - 3$ and $g(x) = 3x - 5$

a) $(g - f)(x)$

b) $(f \circ g)(-1) =$

9. [8 pts] Find a formula for the inverse function given $f(x) = \frac{2x+3}{1-x}$. Show all work.

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

10. [8 pts] Write a polynomial of degree 3 that has zeros: 2 and 9i. Write the final answer in polynomial form (multiplied out).

$f(x) =$ _____

11. [10 pts] Abebe is selling concert tickets. Premium tickets sell for \$65 each. Regular ticket sell for \$48 each. Abebe sold 42 tickets and made \$2305. How many tickets did she sell of each type? You must set up a system of equations and solve algebraically.
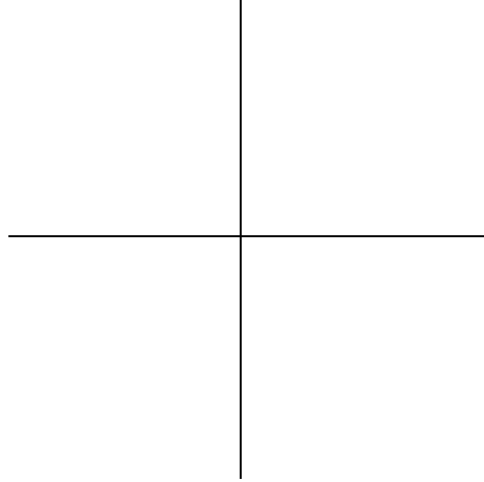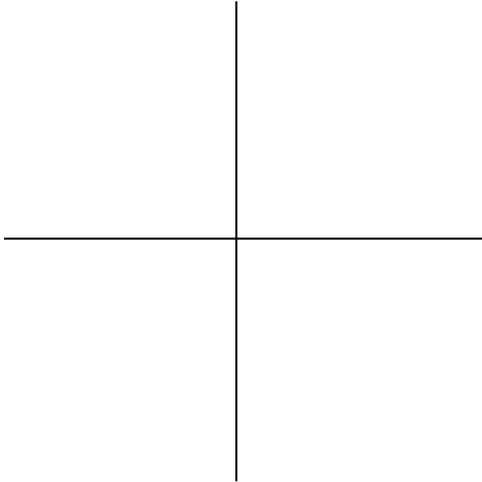
12. [8 pts] Find the equation (in slope intercept form) that contains the points (3, -5) and (2, 3)

$y =$ _____

13. [10 pts] Graph the following functions, and state the asymptote and intercept of each.

a) $f(x) = e^{-x}$

b) $g(x) = \ln(x + 3)$

HA: _____ $y - int:$_____

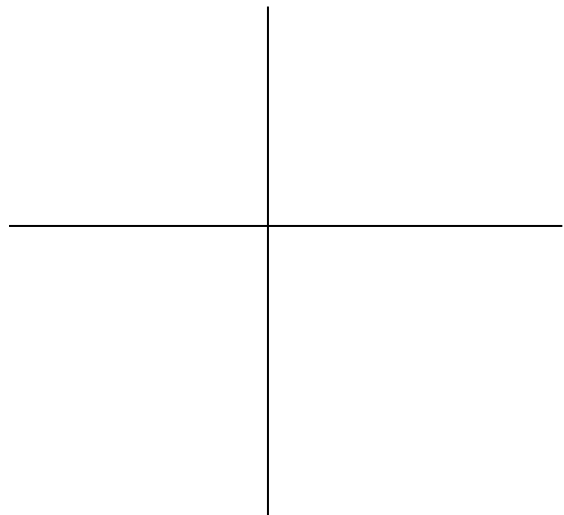VA: _____ $x - int:$_____

14. [12 pts] Given the rational function: $f(x) = \frac{2x-1}{3-x}$. State the following and graph the function. Be sure to label all intercepts and asymptotes.

Domain:

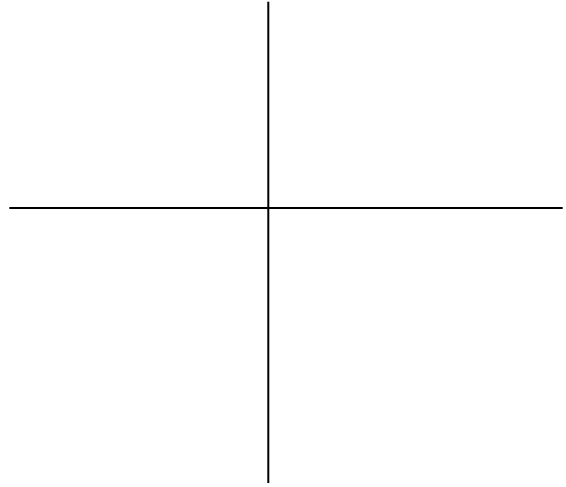Zeros: y-int:

HA: VA:

Additional Points:

15. [12 pts] Given $f(x) = -x^3(x-2)(x+1)^2$ find the following. Then, sketch the graph.
Be sure to label all intercepts.

- y-intercept:

Zero	Multiplicity	Tangent or Crosses Thru

- End Behavior:

16. [10 pts] If a baseball is projected upward from 80 feet with an initial velocity of 64 feet per second, then its height is a function of time, given by: $s(t) = -16t^2 + 64t + 80$.

a. What is the time at which the maximum height is reached?

b. What is the maximum height?

c. Find the time at which the ball hits the ground? You must set up an equation and solve it for credit.

17. [24 pts] Solve for x. You must **show all work algebraically** to receive credit.

a. $8^{3x+1} = \left(\frac{1}{4}\right)^{5x}$

b. $\sqrt{3x - 5} = x - 1$

c. $\log x + \log(x - 15) = 2$

18. [6 pts] Solve **algebraically. Show all work.** $|2x - 5| - 20 = -5$
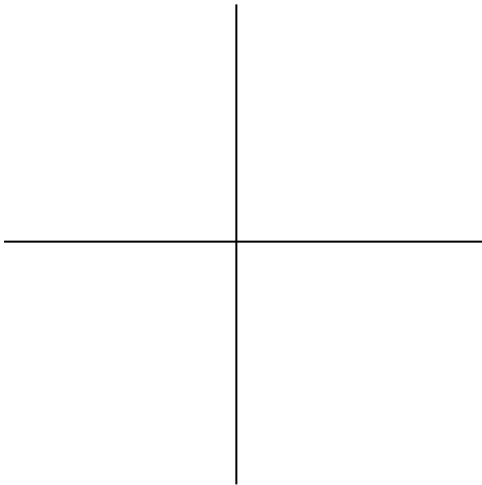
19. [10 pts] Solve for x. Find all solutions, both real and complex. Simplify your answer.

    a) $x^2 + 2x + 3 = 0$

    b) $x^4 + 3x^2 - 28 = 0$

20. [10 pts] Graph the following functions and state the coordinates of the indicated points.
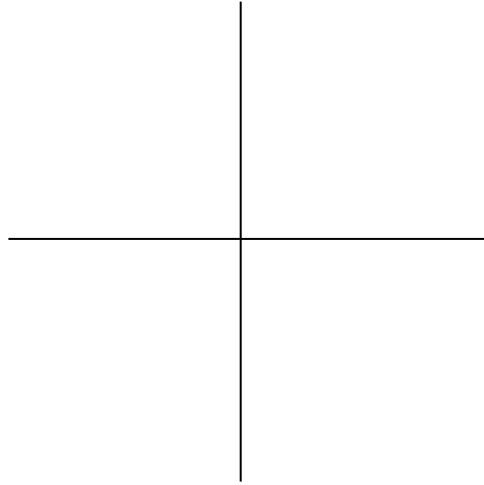
    a) $f(x) = -3x^2 + 6x$

    b) $g(x) = -4x + 5$

Vertex: _____

$x - ints$: _____

$x - int$: _____ $y - int$:_____

Part III. There are 5 problems in this section. <u>Choose any 3</u>.

Indicate in the boxes the problems you want graded or the 1st three will be graded.

[12 points each]

21. Let $f(x) = 2x^2 - 3$.   Find the difference quotient: $\dfrac{f(x+h)-f(x)}{h}$

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Grade

22. The points (-2, 9) and (2, 1) are the endpoints of the diameter of a circle.

a. Determine the center of the circle.

b. Find the length of the radius of the circle.

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Grade

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

23. Suppose that $15,000 is invested in a savings account in which interest, k, is compounded continuously at 0.9% per year. The balance $P(t)$ after time t, in years, is $P(t) = Pe^{kt}$.

a. What is the exponential growth function in terms of t?

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Grade

b. How long will it take for the investment to reach $20,000? Leave your answer in exact form.

24. [8 pts.] Find all the zeros (both real and complex) of the function:

$$f(x) = x^3 + x^2 + 2x - 4$$

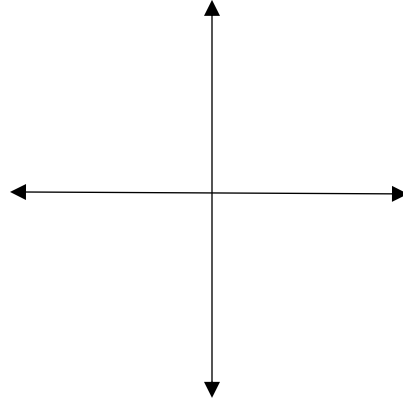a. List all possible rational zeros.

b. Find 1 rational zero

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c. Find the other zeros of $f(x)$. Simplify your answer.

25. Graph the following function. Label points.

$$f(x) = \begin{cases} -5x + 2, x \le 1 \\ 3, x > 1 \end{cases}$$

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Grade

Mark sure you checked the boxes beside the problems you want to be graded!