

You will have 2 hours to complete this exam. You may use a calculator (TI-84 or lower, no cell phones) but must show all algebraic work in the space provided to receive full credit. Read all directions carefully, simplify all answers fully, and clearly indicate your answer. Good Luck!

**Factor Completely.** If the polynomial is prime, say so. (2pts each)

1.  $8x^2 - 2x - 15$

2.  $3x^3 - 3x$

**Perform the indicated operation and simplify completely.** Leave complex answers in the form  $a + bi$ , rationalize all denominators. (3 pts each)

3.  $\frac{x^2-9}{5x-2} \cdot \frac{15x-6}{x^2-x-6}$

4.  $\frac{x^2}{x-5} + \frac{25}{5-x}$

Perform the indicated operation and simplify completely. Leave complex answers in the form  $a + bi$ , rationalize all denominators. (3 pts each)

5.  $\frac{x}{x^2+5x+6} - \frac{2}{x^2+3x+2}$

6.  $\sqrt[3]{-8x^7y^6}$

7.  $\sqrt{\frac{49}{5}}$

8.  $3\sqrt{45} - 8\sqrt{20}$

Perform the indicated operation and simplify completely. Leave complex answers in the form  $a + bi$ , rationalize all denominators. (3pts each)

9.  $(2 - \sqrt{3})(4 - \sqrt{3})$

10.  $(3 - 3\sqrt{2}) - (4 - 5\sqrt{2})$

11.  $(4 + 3i)(3 - 3i)$

12.  $\frac{3i}{4+2i}$

List any restrictions on the domain of each function below (1pt each)

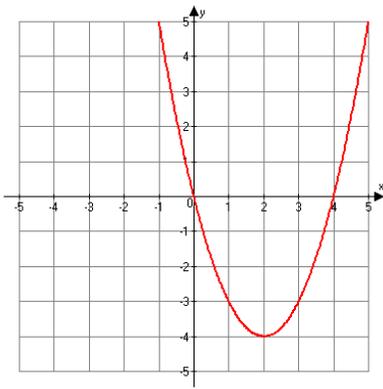
13.  $f(x) = x^2 - 6x - 16$

14.  $f(x) = \frac{x-3}{x^2-2x-15}$

15.  $f(x) = \sqrt{2x-8}$

16. (2pts) Given  $f(x) = x^2 - 6x + 1$ , find  $f(-3)$

17. Use the graph of the function below to determine the following: (2pts each)



What is the minimum value of the function? \_\_\_\_\_

What is the range of the function? \_\_\_\_\_

What are the zeros of the function? \_\_\_\_\_

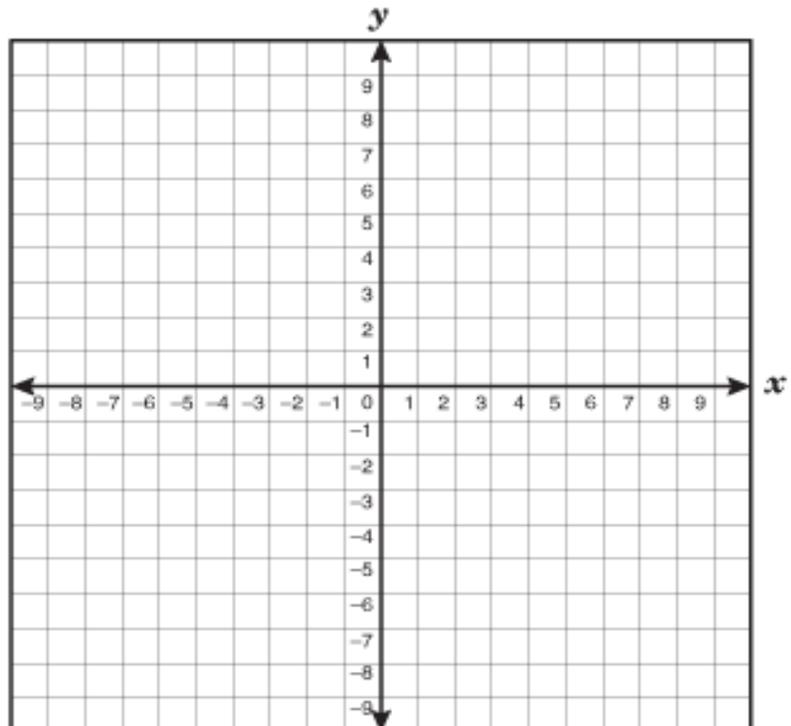
18. For the quadratic function  $f(x) = -x^2 + 2x + 3$ , find the following and graph (2pts each)

a. Vertex \_\_\_\_\_

b. x-intercept(s) \_\_\_\_\_

c. y-intercept \_\_\_\_\_

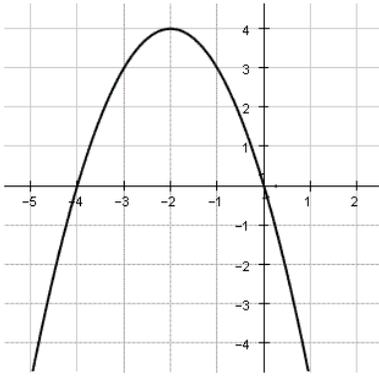
d. Graph to the right



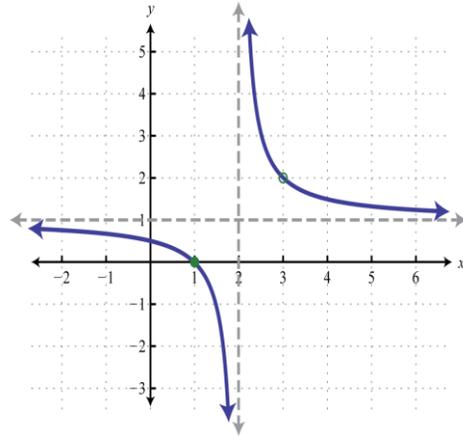
Match the graph to the type of function that best describes it. The same type may be used multiple times or not at all. (2pts each)

(a) : Linear                      (b) : Quadratic                      (c) : Exponential                      (d) : Radical                      (e): Rational

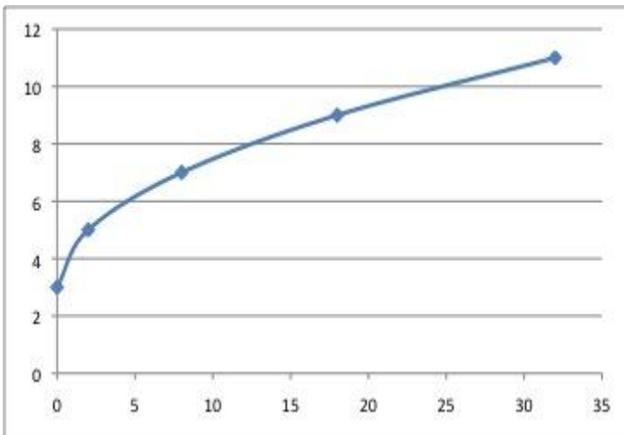
19. \_\_\_\_\_



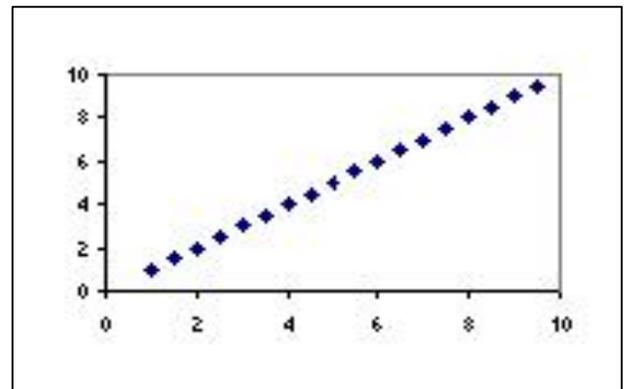
20. \_\_\_\_\_



21. \_\_\_\_\_



22. \_\_\_\_\_



Solve each equation below. Simplify completely, do not round. (3 pts each)

23.  $4x - 12x^2 = 0$

24.  $\frac{3}{x} + \frac{x}{x+2} = \frac{4}{x^2+2x}$

25.  $3 + \sqrt{5-x} = x$

Solve each equation below. Simplify completely, do not round. (3 pts each)

26.  $x^2 + 10 = 6x$

27.  $\sqrt[3]{x + 3} = -3$

**Application Problems.** For all problems where an equation is not given, you need to define your variable(s), set up an algebraic equation or equations, solve algebraically, and answer the question with the proper units. If an equation is given, be sure to answer the question completely and with proper units. (4 pts each)

28. The current in the Lazy River moves at a rate of 4 mph. Michelle's boat travels 6 miles upstream in the same time that it takes to travel 12 miles downstream. What is the speed of Michelle's boat in still water?

29. A sump pump from Home Depot can remove water from Sue's flooded basement in 70 minutes. The plumber's sump pump can do the same job in 30 minutes. How long would it take the two pumps working together to pump out Sue's flooded basement?

30. Rob's Metals has determined that when  $x$  hundred storage cabinets are built, the average cost per cabinet is given by

$$C(x) = 0.2x^2 - 1.3x + 3.4025$$

Where  $C(x)$  is in hundreds of dollars. What is the minimum cost per cabinet and how many cabinets should be built in order to achieve that minimum?

31. During a game's intermission, a team mascot launches t-shirts into the stands. The height  $h(t)$ , in feet, of an airborne t-shirt  $t$  seconds after being launched can be approximated by:

$$h(t) = -15t^2 + 75t + 10$$

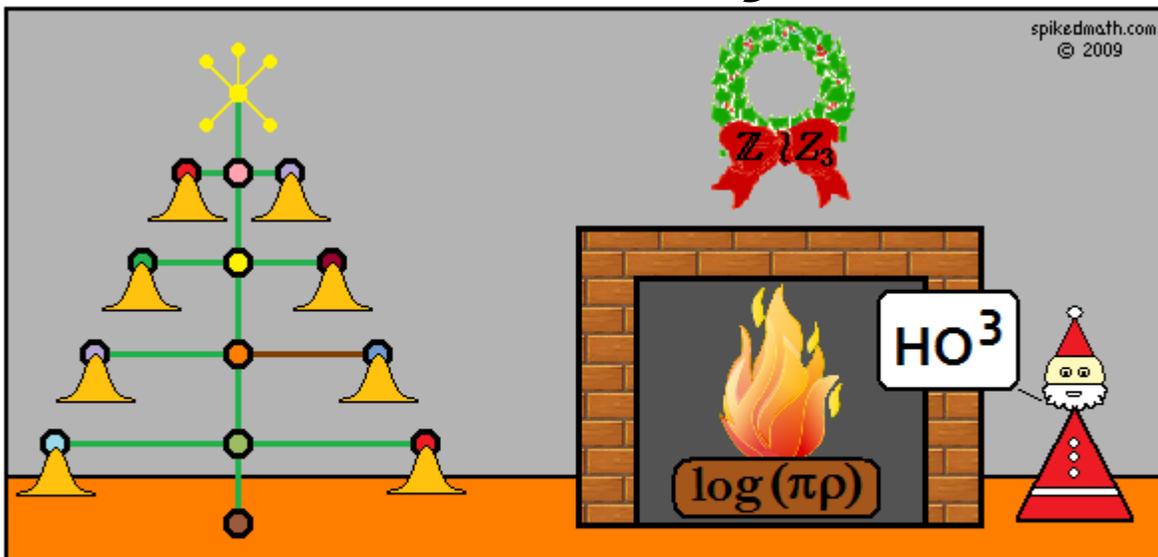
After peaking, a t-shirt is caught by a fan sitting at a height of 70 feet above ground level. For how long was the t-shirt in the air?

32. A slow-pitch softball diamond is actually a square 65 ft. on a side. How far is it from home plate to second base? (Round to nearest tenth of a foot)

33. Nick invests \$ 6250 in account that earns interest and is compounded annually. After 2 years his investment has grown to \$7290. What was the interest rate on the account?

Bonus (3pts): A quadratic function has  $(4,0)$  and  $(-2,0)$  as its x-intercepts and  $(1,3)$  as its vertex. Find the y-intercept.

*Have a wonderful break!*



**Merry Mathmas!**