Chapter 14: Basics of Functions

Find the domain and range.

1) {(5,1), (5,-4), (6,7), (3,4), (-9,-6)}

Find the indicated function value.

2) Find f(3) when $f(x) = \frac{x^2 + 4}{x^3 - 6x}$.

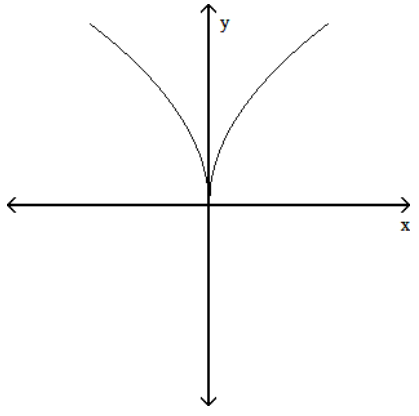
Decide whether the relation is a function.

3) Women's Shoe Sizes

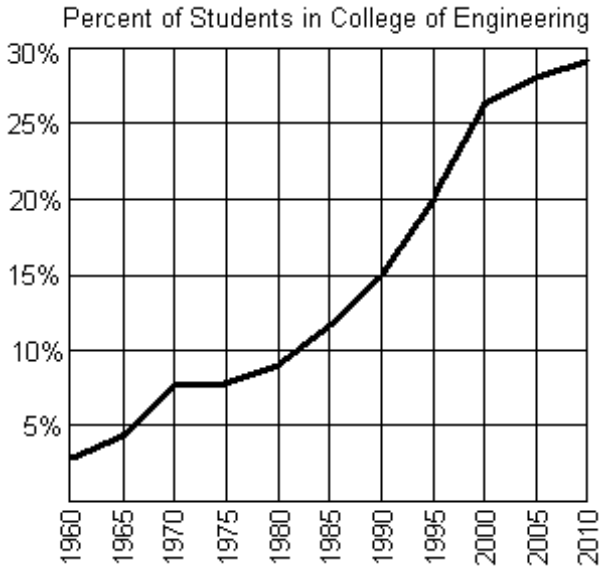
USA	3	4	5	6	7	8	9
Japan	20	21	22	23	24	25	26

Use the vertical line test to determine whether or not the graph is a graph of a function.

4)



The graph below shows the percentage of students enrolled in the College of Engineering at State University. Use the graph to answer the question.



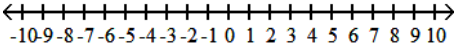
5) If f represents the function, find f(2010).

A) no

B) approximately 29%

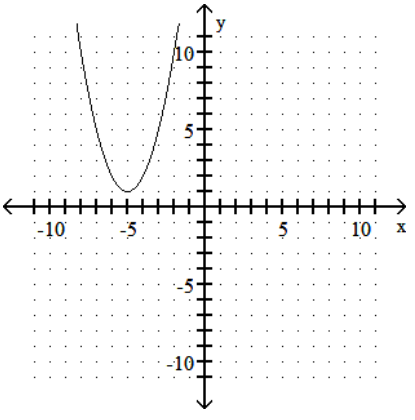
Express the interval in set builder notation and graph the interval on a number line.

6) (-9, 4)



Use the graph to identify domain and range.

7)



Find the domain of the function.

8) $f(x) = \frac{-2x}{x + 3}$

Find the indicated function value.

9) $f(x) = 5 - 8x$, $g(x) = -3x + 8$

Find $(f + g)(x)$.

Find the requested value.

10) $f(x) = -2x + 3,\ g(x) = -5x^2 - 5x + 3$

Find $\left(\frac{f}{g}\right)(-2)$.

Solve the problem.

11) A firm making toaster ovens finds that the total cost, C(x), of producing x units is given by
$C(x) = 35x + 510$.
The revenue, R(x), from selling x units is determined by the price per unit times the number of units sold, thus
$R(x) = 45x$.
Find and interpret $(R - C)(71)$.

Find the composition.

12) If $f(x) = 6x^2 + 4x$ and $g(x) = 3x$, find $(f \circ g)(x)$.

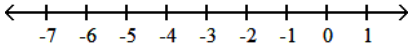
Find the inverse of the one-to-one function.

13) $f(x) = -5x + 4$

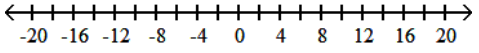
Chapter 15: Inequalities and Problem Solving

Solve the inequality. Other than ∅, graph the solution set on a number line.

14) $4x + 10 + 6x < 2 + 8x + 2$



15) $\frac{x}{3} \geq 2 + \frac{x}{9}$

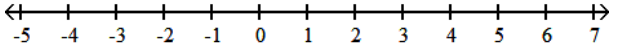


Solve the problem.

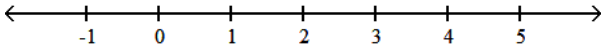
16) A certain store has a fax machine available for use by its customers. The store charges $2.15 to send the first page and $0.40 for each subsequent page. Use an inequality to find the number of pages that can be faxed for $4.95.

Solve the compound inequality and graph the solution set on a number line. Except for the empty set, express the solution set in interval notation.

17) $-4x < -4$ and $x + 4 > 3$



18) $-2x \leq -6$ or $2x > 6x - 4$

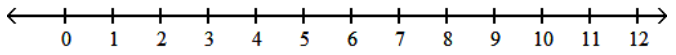


Find the intersection of the sets.

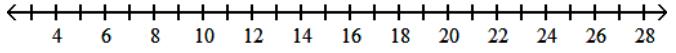
19) $\{-4, 0, 3, 6\} \cap \{3, 6, 8\}$

Solve and graph the solution set on a number line.

20) $|7x + 1| + 9 < 13$



21) $|x - 8| + 3 \geq 7$

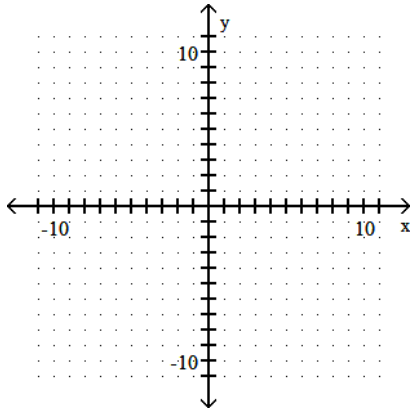


Solve.

22) A landscaping company sells 40-pound bags of top soil. The actual weight x of a bag, however, may differ from the advertised weight by as much as 0.75 pound. Write an inequality involving absolute value that expresses the relationship between the actual weight x of a bag and 40 pounds. Solve the inequality, and express the answer in interval form.

Graph the inequality.

23) $5x + y \leq -6$



Find the solution set for the equation.

24) $|5x - 9| + 7 = 3$

A) $\left\{1, -\frac{13}{5}\right\}$ B) $\left\{\frac{13}{5}, -1\right\}$ C) $\varnothing$ D) $\{1\}$

25) $|x - 8| = |9 - x|$

A) $\left\{\frac{1}{2}\right\}$ B) $\varnothing$ C) $\left\{\frac{17}{2}\right\}$ D) $\{17\}$

Chapter 16: Radicals, Radical Functions and Rational Expressions

Solve the problem.

26) The average height of a boy in the United States, from birth through 60 months, can be modeled by $y = 2.9\sqrt{x} + 20.1$ where y is the average height, in inches, of boys who are x months of age. What would be the expected difference in height between a child 49 months of age and a child 16 months of age?

Use rational exponents to simplify the radical. If rational exponents appear after simplifying, write the answer in radical notation.

27) $\sqrt[10]{x^6}$

A) $\sqrt{x}$ B) $\sqrt{x^3}$ C) $\sqrt[5]{x}$ D) $\sqrt[5]{x^3}$

Multiply and simplify. Assume that all variables in a radicand represent positive real numbers.

28) $\sqrt{12xy} \cdot \sqrt{2xy^2}$

Simplify by factoring. Assume that any variable in a radicand represents a positive real number.

29) $\sqrt{12x^3}$

Rationalize the denominator and simplify.

30) $\dfrac{10x}{\sqrt[3]{2x^2}}$

A) $5\sqrt[3]{4x}$ B) $10\sqrt[3]{x}$ C) $5\sqrt[3]{2x}$ D) $\sqrt[3]{5x}$

Add or subtract as indicated.

31) $6\sqrt{14} + 5\sqrt{3} - 5\sqrt{14} - 8\sqrt{3}$

Divide and, if possible, simplify.

32) $\dfrac{\sqrt{x^2 + 7x - 8}}{\sqrt{x + 8}}$

33) $\dfrac{\sqrt{30xy^3}}{\sqrt{6x}}$

Rationalize the denominator.

34) $\dfrac{4}{8 - \sqrt{3}}$

Solve the equation.

35) $\sqrt{x + 5} = 5$

A) {100} B) {25} C) {30} D) {20}

36) $\sqrt{2x + 5} - \sqrt{x - 2} = 3$

A) {2} B) {2, 38} C) {-2} D) {3, 8}

Solve the problem.

37) It has been found that the less income people have, the more likely they are to report that their health is fair or poor. The function $f(x) = -4.4\sqrt{x} + 38$ models the percentage of Americans reporting fair or poor health, f(x), in terms of annual income, x, in thousands of dollars. According to the model, what annual income corresponds to 15% reporting fair or poor health? Round to the nearest thousand dollars.

Perform the indicated operation. Write the result in the form a + bi.

38) (7 - 8i) + (4 + 2i)

Find each product. Write the result in the form a + bi.

39) (8 + 4i)(3 - 9i)

Chapter 17: Quadratic Equations and Functions

Solve the quadratic equation by completing the square.

40) $x^2 - 8x = 15$

Solve the equation by the square root property. If possible, simplify radicals or rationalize denominators. Express imaginary solutions in the form a + bi.

41) $4x^2 = 60$

Use the quadratic formula to solve the equation.

42) $x^2 + 12x + 17 = 0$

Solve the problem.

43) The length of a rectangular storage room is 7 feet longer than its width. If the area of the room is 78 square feet, find its dimensions.

Determine whether the given quadratic function has a minimum value or maximum value. Then find the minimum or maximum value and determine where it occurs.

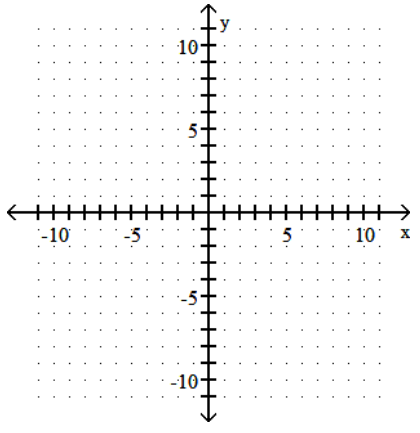
44) $f(x) = 2x^2 + 2x + 2$

Solve the problem.

45) The cost in millions of dollars for a company to manufacture x thousand automobiles is given by the function $C(x) = 4x^2 - 24x + 81$. Find the number of automobiles that must be produced to minimize the cost.

Sketch the graph of the quadratic function. Give the vertex and axis of symmetry.

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



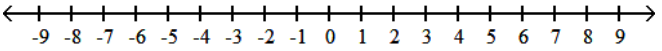
Solve the equation by making an appropriate substitution.

47) $x^4 - 40x^2 + 144 = 0$

48) $2x - 6\sqrt{x} - 56 = 0$

Solve the polynomial inequality and graph the solution set on a number line.

49) $x^2 + 3x - 4 > 0$

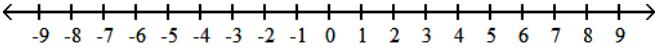


Solve.

50) An arrow is fired straight up from the ground with an initial velocity of 192 feet per second. Its height, s(t), in feet at any time t is given by the function $s(t) = -16t^2 + 192t$. Find the interval of time for which the height of the arrow is greater than 176 feet.

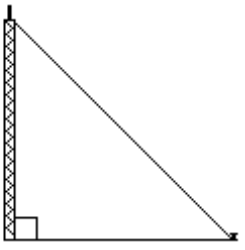
Solve the rational inequality and graph the solution set on a real number line.

51) $\frac{x - 5}{x + 4} > 0$



Solve.

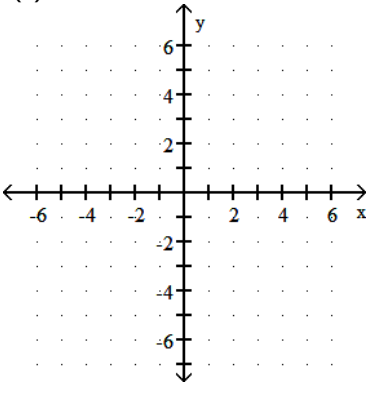
52) A guy wire is to be attached to the top of a 45-foot antenna. If the wire must be anchored 45 feet from the base of the antenna, what length of wire is required?



Chapter 18: Exponential and Logarithmic Functions

Graph the function by making a table of coordinates.

53) $f(x) = 4^x$



Solve the problem.

54) The function $D(h) = 5e^{-0.4h}$ can be used to determine the milligrams D of a certain drug in a patient's bloodstream h hours after the drug has been given. How many milligrams will be present after 12 hours? Round the answer to two decimal places.

Write the equation in its equivalent exponential form.

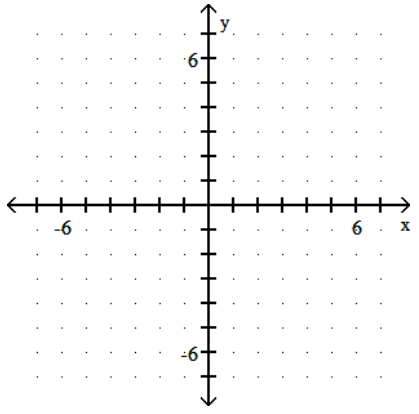
55) $3 = \log_2 x$

Write the equation in its equivalent logarithmic form.

56) $2^3 = x$

Graph the function.

57) First graph $f(x) = 2^x$, then use symmetry to graph $f(x) = \log_2 x$ on the same coordinate axes.



Evaluate the expression without using a calculator.

58) $\log_5 25$

Use properties of logarithms to expand the logarithmic expression as much as possible. Where possible, evaluate logarithmic expressions without using a calculator.

59) $\log_b(yz^8)$

Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1. Where possible, evaluate logarithmic expressions.

60) $\log_5 15 - \log_5 3$

Solve the exponential equation by taking the logarithm on both sides. Express the solution set in terms of logarithms.

61) $e^{5x} = 2$

Solve the logarithmic equation. Give an exact answer.

62) $\log_2 x = 5$

Solve the problem.

63) Find out how long it takes a $2800 investment to double if it is invested at 9% compounded semiannually. Round to the nearest tenth of a year. Use the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$.

Solve.

64) The first recorded population of a particular country was 26 million, and the population was recorded as 34 million 10 years later. The exponential growth function $A = 26e^{kt}$ describes the population of this country t years since the first recording. Use the fact that 10 years later the population increased by 8 million to find k to three decimal places.

65) The value of a particular investment follows a pattern of exponential growth. You invested money in a money market account. The value of your investment t years after your initial investment is given by the exponential growth model $A = 4300e^{0.049t}$. When will the account be worth $6683?

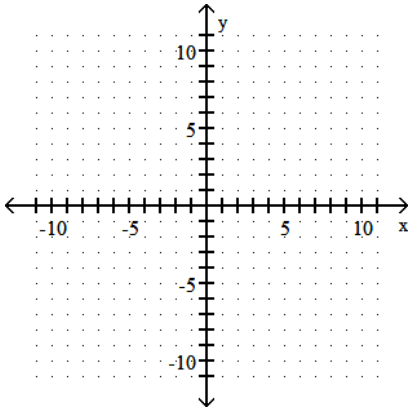
Chapter 19: Conic Sections

Write the standard form of the equation of the circle with the given center and radius.

66) Center (4, 9), r = 5

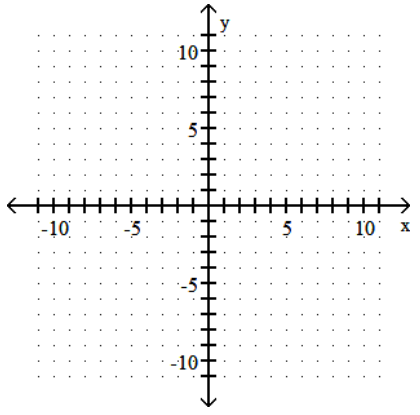
Give the center and radius of the circle described by the equation and graph the equation.

67) $(x - 3)^2 + (y - 1)^2 = 9$



Complete the square and write the equation in standard form. Then give the center and radius of the circle and graph the equation.

68) $x^2 + y^2 - 10x - 4y + 4 = 0$

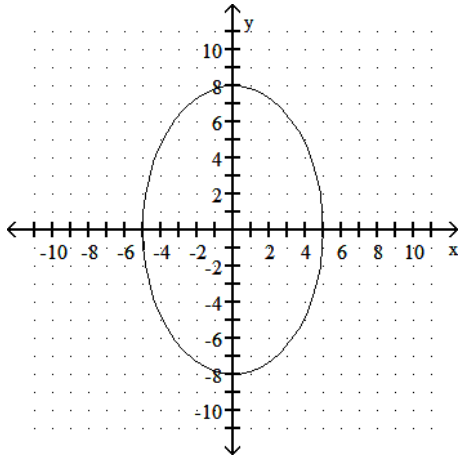


Solve the problem.

69) A local university is building a new arena to hold basketball games, indoor track meets, concerts, etc. The arena will be elliptical in shape with external dimensions of 470 feet by 380 feet. Assume that the center of the arena is the origin. Write an equation that models the shape of the new arena.

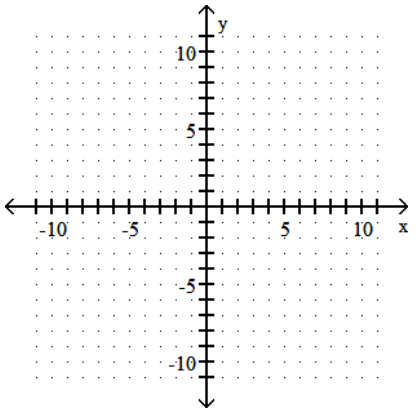
Find the standard form of the equation of the ellipse.

70)



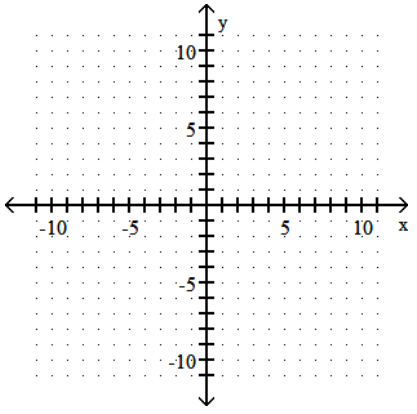
Use vertices and asymptotes to graph the hyperbola.

71) $\frac{x^2}{49} - \frac{y^2}{16} = 1$



Sketch the ellipse for the equation.

72) $\frac{(x - 2)^2}{16} + \frac{(y - 1)^2}{4} = 1$



Solve the system by the substitution method.

73) $\begin{cases} y = x + 4 \\ y^2 = 16x \end{cases}$

Solve the system by the addition method.

74) $\begin{cases} 7x^2 + y^2 = 49 \\ 7x^2 - y^2 = 49 \end{cases}$

Solve the problem.

75) Find the dimensions of a rectangle whose perimeter is 50 feet and whose area is 150 square feet.

Chapter 20: Sequences and Series

Write the first four terms of the sequence whose general term is given.

76) $a_n = 5n$

77) $a_n = \left(-\frac{2}{5} \right)^n$

78) $a_n = \frac{n^3}{(n - 1)!}$

Find the indicated sum.

79) $\sum_{i=1}^{5} (i - 7)$

80) $\sum_{i=1}^{4} 2^i$

Find the common difference for the arithmetic sequence.

81) 3, 5, 7, 9, . . .

Write the first five terms of the arithmetic sequence with the given first term, a_1, and common difference, d.

82) $a_1 = 18$; $d = -4$

Find the common ratio for the geometric sequence.

83) 4, -12, 36, -108, 324, . . .

Use the formula for the sum of the first n terms of a geometric sequence to solve.

84) Find the sum of the first 8 terms of the geometric sequence: 5, 10, 20, 40, 80, ...

1) domain = {6, -9, 3, 5}; range = {7, -6, 4, -4, 1}

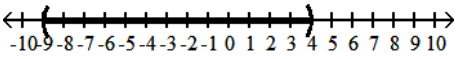
2) $\frac{13}{9}$

3) function

4) function

5) B

6) {x | -9 < x < 4 }



7) domain: $(-\infty, \infty)$
range: $[1, \infty)$

8) $(-\infty, -3)$ or $(-3, \infty)$

9) -11x + 13

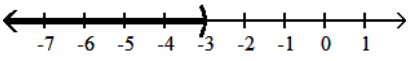
10) - 1

11) $200 profit, income exceeds cost

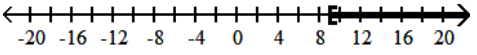
12) $54x^2 + 12x$

13) $f^{-1}(x) = \frac{x - 4}{-5}$

14) $(-\infty, -3)$

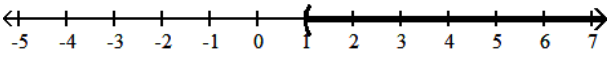


15) $[9, \infty)$

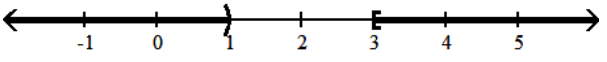


16) 8 pages or fewer

17) $(1, \infty)$

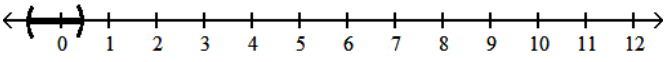


18) $(-\infty, 1) \cup [3, \infty)$

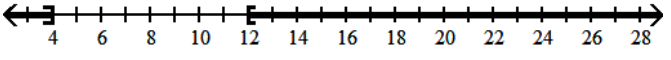


19) {3, 6}

20) $\left(-\frac{5}{7}, \frac{3}{7}\right)$

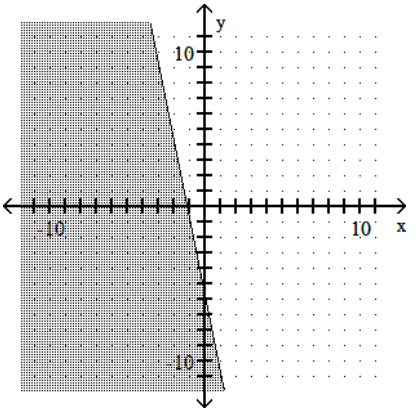


21) $(-\infty, 4] \cup [12, \infty)$



22) $|40 - x| \leq 0.75$; [39.25, 40.75]

23)



24) C

25) C

26) 8.7 in.

27) D

28) $2xy\sqrt{6y}$

29) $2x\sqrt{3x}$

30) A

31) $\sqrt{14} - 3\sqrt{3}$

32) $\sqrt{x - 1}$

33) $y\sqrt{5y}$

34) $\frac{32 + 4\sqrt{3}}{61}$

35) D

36) B

37) approximately $27 thousand

38) 11 - 6i

39) 60 - 60i

40) $\{4 \pm \sqrt{31}\}$

41) $\{\pm\sqrt{15}\}$

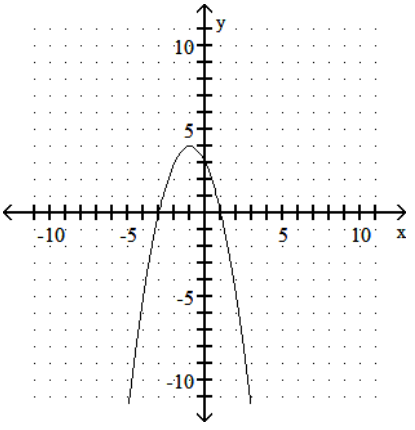
42) $\{-6 \pm \sqrt{19}\}$

43) 6 ft by 13 ft

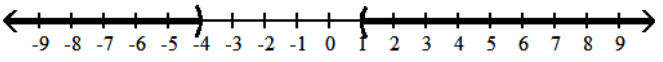
44) Minimum is $\frac{3}{2}$ at $x = -\frac{1}{2}$.

45) 3 thousand automobiles

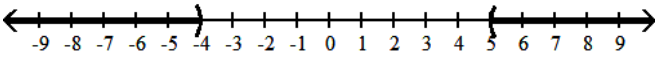
46) vertex: (- 1, 4)
axis of symmetry: x = - 1



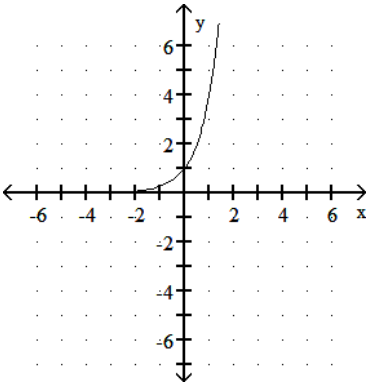
47) {-2, 2, -6, 6}
48) {49}
49) $(-\infty, -4) \cup (1, \infty)$



50) between 1 and 11 sec
51) $(-\infty, -4) \cup (5, \infty)$

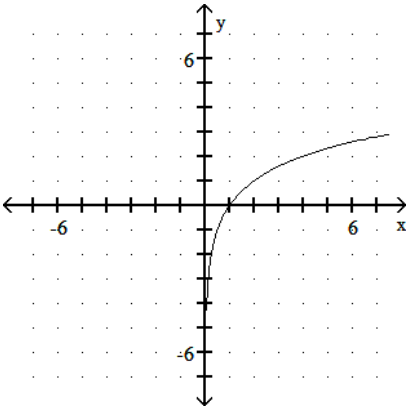


52) $45\sqrt{2}$ ft
53)

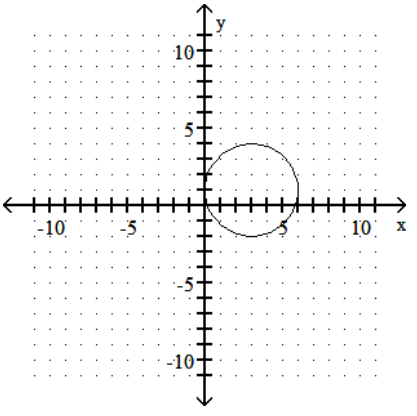


54) 0.04 mg
55) $2^3 = x$
56) $\log_2 x = 3$

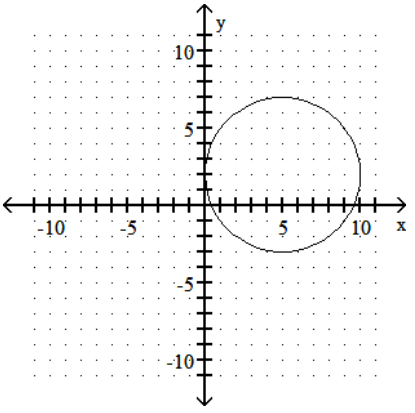
57)



58) 2
59) $\log_b y + 8 \log_b z$
60) 1
61) $\left\{\frac{\ln 2}{5}\right\}$
62) {32}
63) 7.9 yr
64) 0.027
65) 9 years after the initial investment
66) $(x - 4)^2 + (y - 9)^2 = 25$
67) center (3, 1), r = 3



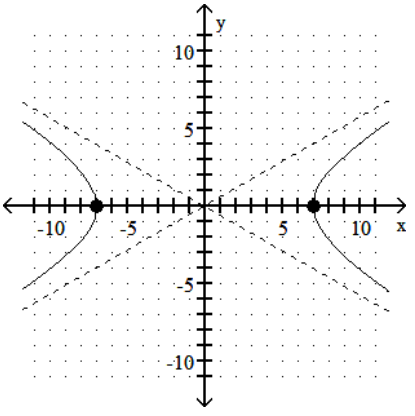
68) $(x - 5)^2 + (y - 2)^2 = 25$
center (5, 2), r = 5



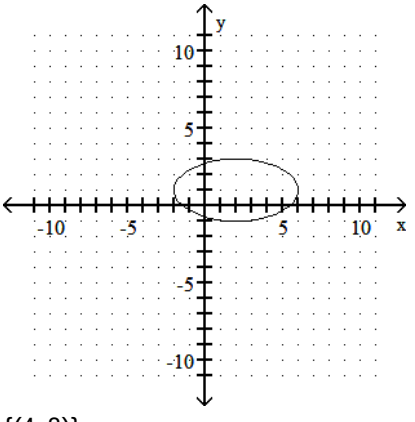
69) $\frac{x^2}{235^2} + \frac{y^2}{190^2} = 1$

70) $\frac{x^2}{25} + \frac{y^2}{64} = 1$

71)



72)



73) {(4, 8)}
74) $\{(\sqrt{7}, 0), (-\sqrt{7}, 0)\}$
75) 10 ft by 15 ft
76) 5, 10, 15, 20
77) $-\frac{2}{5}, \frac{4}{25}, -\frac{8}{125}, \frac{16}{625}$
78) $1, 8, \frac{27}{2}, \frac{32}{3}$
79) -20
80) 30
81) 2
82) 18, 14, 10, 6, 2
83) -3
84) 1275