Math 101 Practice Exam Chapter 3

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Write the expression in standard form. Do not use a calculator.

1) $5i - (2 + i)$

1) _____

2) $\dfrac{3 - 6i}{i}$

2) _____

Write the number in simplest form, without a negative radicand.

3) $\sqrt{-5}$

3) _____

4) $8 + \sqrt{-9}$

4) _____

Perform the indicated operations. Simplify the answer.

5) $\dfrac{\sqrt{-54}}{\sqrt{-6}}$

5) _____

6) $\dfrac{\sqrt{-6} \cdot \sqrt{-3}}{\sqrt{2}}$

6) _____

Perform the indicated operation. Write the result in standard form.

7) $(-2 - 9i) - (-5 - 2i) - (-6 + 3i)$

7) _____

8) $(5 - 3i) - (7 + 6i) + (1 - 3i)$

8) _____

9) $(3 - 6i)(3 + 2i)$

9) _____

10) $(3 + 4i)^3$

10) _____

Simplify the power of i to i, 1, -i or -1.

11) i^{63}

11) _____

Divide as indicated. Write the quotient in standard form.

12) $\dfrac{2 + 3i}{5 + 4i}$

12) _____

13) $\dfrac{5 - 3i}{5 + 2i}$

13) _____

Write the quadratic function in the form $y = a(x - h)^2 + k$.

14) $f(x) = x^2 + 3x + 1$

14) _____

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

15) _____

Identify the vertex of the parabola.

16) $f(x) = -4(x - 8)^2 - 1$

16) _____

17) $P(x) = 4x^2 - 8x + 7$

17) _____

Find the equation of the axis of symmetry of the parabola.

18) $y = 3x^2 + 6x + 7$

18) _____

19) $y = 4x^2 - 32x + 58$

19) _____

Find the domain and range of the function.

20) $f(x) = x^2 - 6x + 15$

20) _____

21) $f(x) = -x^2 - 2x - 6$

21) _____

Give the largest interval where the function increases or decreases, as requested.

22) $f(x) = 2x^2 - 1;$ increases

22) _____

23) $f(x) = -4x^2 - 2;$ decreases

23) _____

State whether the vertex of the function is a maximum or minimum and give the corresponding maximum or minimum value of the function.
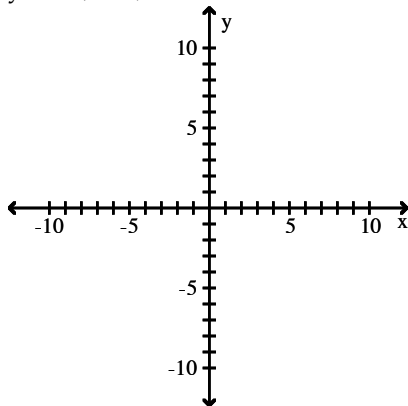
24) $f(x) = -x^2 - 4x - 11$

24) _____

Graph.
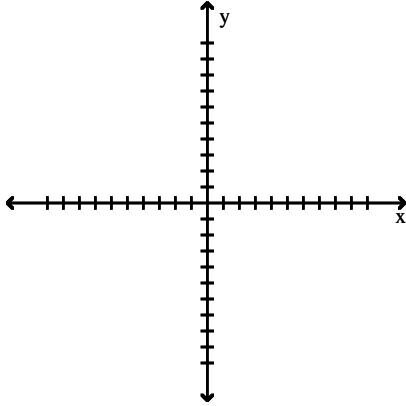
25) $y = -2(x + 6)^2 - 2$

25) _____

26) $y = -3x^2 - 2x - 1$ 26) _____

Solve the problem.

27) Bob owns a watch repair shop. He has found that the cost of operating his shop is given   27) _____
by $c(x) = 3x^2 - 216x + 74$, where c is cost and x is the number of watches repaired. How
many watches must he repair to have the lowest cost?

28) If an object is propelled upward from a height of 16 feet at an initial velocity of 80 feet   28) _____
per second, then its height after t seconds is given by the equation $h = -16t^2 + 80t + 16$,
where h is in feet. After how many seconds will the object reach a height of 116 feet?

29) A rock is propelled upward from the top of a building 180 feet tall at an initial velocity of   29) _____
96 feet per second. The function that describes the height of the rocket in terms of time t
is $f(t) = -16t^2 + 96t + 180$. Determine the time at which the rock reaches its maximum
height.

Answer the question.

30) Fill in the blanks to complete the statement. The graph of $P(x) = -0.3(x - 10)^2$ is a   30) _____
parabola with ____ x–intercept(s). Its vertex is the ____ point of the graph and has
coordinates _____.

Find the real or imaginary solutions by using the quadratic formula.

31) $9p^2 + 5p - 5 = 0$ 31) _____

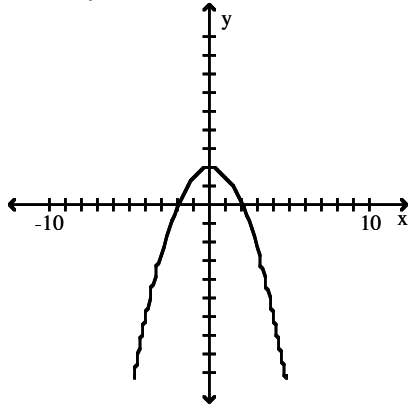32) $x^2 = 15 + 9x$ 32) _____

Write a quadratic equation in the form $ax^2 + bx + c = 0$ that has the given numbers as solutions.

33) –6, –1   33) _____

34) 1, –3   34) _____

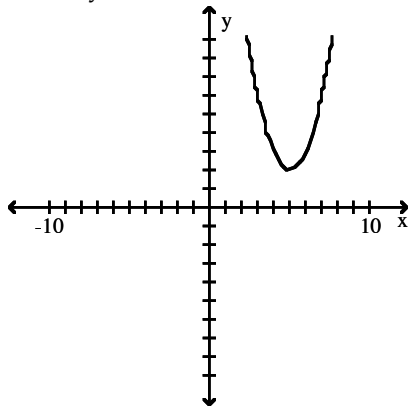**Find the real number solution set of the equation or inequality shown below the graph.**

35)   y = f(x)   35) _____

f(x) > 0

36)   y = f(x)   36) _____

f(x) = 0

Solve the inequality analytically. Support the answer graphically. Give exact values for endpoints.
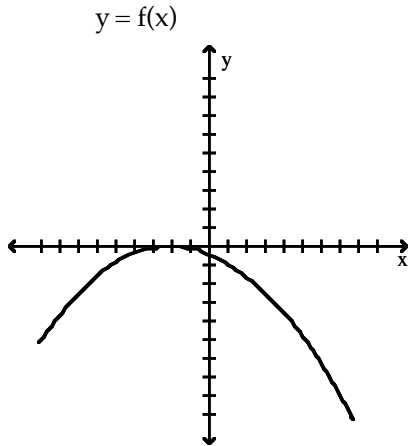
37) $x^2 - 2x - 15 \leq 0$ 37) _____

38) $x^2 + x - 4 \geq 0$ 38) _____

4

Provide an appropriate response.

39) Fill in the blanks to complete the statement.

$y = f(x)$

The graph of $y = f(x)$ has _____ x–intercept(s) and _____ y–intercept(s).

39) _____

40) Sketch the graph of a quadratic function for which the graph has one x–intercept and the function is increasing on the interval $(-\infty, -1)$.

40) _____

41) Sketch the graph of a quadratic function for which the value of the discriminant is negative and the graph opens downward.

41) _____

Find the indicated function.

42) A parking lot measures 110 by 160 feet including a sidewalk of uniform width around its perimeter. Let x represent the width of the sidewalk. What is a function to represent the area of the sidewalk?

42) _____

43) A group of men want to share equally in the $200 cost of painting a building. At the last minute, two men drop out. This raises the share of each remaining man by $50. If x represents the original number of men in the group, what is a function to represent the amount of increase in cost for each man still remaining?

43) _____

Solve the problem.

44) If an object is thrown upward with an initial velocity of 16 ft/s, its height after t seconds is given by $h = 16t - 16t^2$. Find the maximum height attained by the object.

44) _____

45) A can has a surface area of 612 square inches. Its height is 6.81 inches. What is the radius of the circular top? Round to the nearest hundredth.

45) _____

46) Two cars leave an intersection. One car travels north; the other east. When the car traveling north had gone 6 mi, the distance between the cars was 2 mi more than the distance traveled by the car heading east. How far had the eastbound car traveled?

46) _____

47) A square has an area of 49 square inches. If the same amount is added to the length and removed from the width, the resulting rectangle has an area of 45 square inches. Find the dimensions of the rectangle.

47) _____

5

Use an end behavior diagram (⌣ , ⌢ , ↘ , or ↗) to describe the end behavior of the graph of the function.
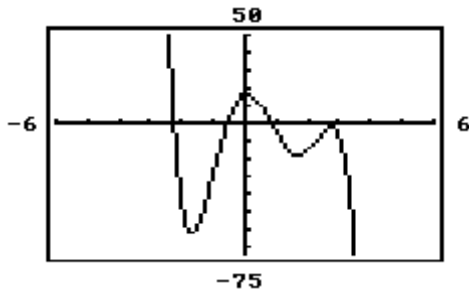
48) $P(x) = \pi x^7 + 7x^2 - 4$

48) _____

49) $P(x) = \sqrt{5}x^6 - x^5 + 9x^2 - 7$

49) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

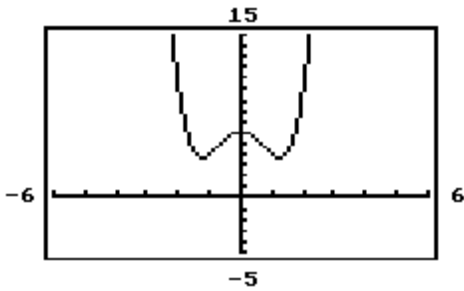**Find the equation that the given graph represents.**

50)

50) _____

A) $P(x) = -x^6 + 7x^5 - x^2 - 2x + 16$

B) $P(x) = -2x^5 + 7x^4 + 9x^3 - 40x^2 + 4x + 16$

C) $P(x) = 2x^6 + 9x^3 - 7x^2 + 4x - 16$

D) $P(x) = x^5 + 7x^4 - x^3 - 40x^2 + 2x + 16$

51)

51) _____

A) $P(x) = -x^5 - 3x^2 + 6$
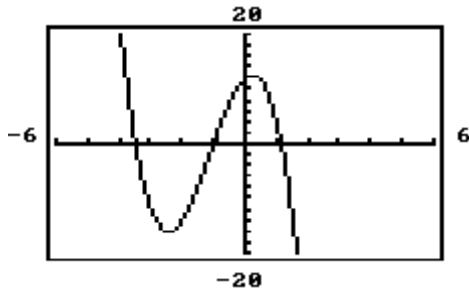
B) $P(x) = x^4 - 3x^2 + 6$

C) $P(x) = x^6 - 2x^2 - 6$

D) $P(x) = x^5 + 2x^3 + 6$

Find the equation that the given graph represents and give the domain, range, and interval(s) over which the function is increasing and decreasing.
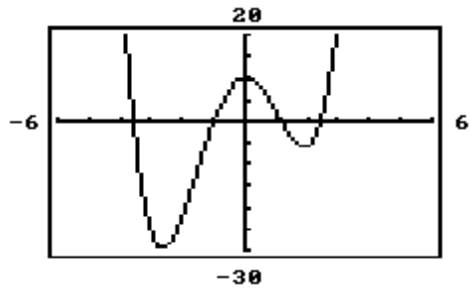
52)

52) _____

A) $P(x) = -3x^3 - 10x^2 + 5x + 12$;
   domain: $(-\infty, \infty)$; range: $(-\infty, \infty)$;
   Increasing over $[-2.47, .19]$;
   Decreasing over $(-\infty, -2.47]$ and $[.19, \infty)$

B) $P(x) = x^4 - 2x^2 - 3x + 12$;
   domain: $(-\infty, \infty)$; range: $(-\infty, \infty)$;
   Increasing over $(-\infty, -1.21]$ and $[.97, \infty)$;
   Decreasing over $[-1.21, .97]$

C) $P(x) = 2x^3 - 12x^2 - 5x - 12$;
   domain: $(-\infty, \infty)$; range: $(-\infty, \infty)$;
   Increasing over$[-.98, 3.09]$;
   Decreasing over $(-\infty, -.98]$ and $[3.09, \infty)$

D) $P(x) = -3x^5 + 2x^4 - x^2 + 2x - 12$;
   domain: $(-\infty, \infty)$; range: $(-\infty, \infty)$;
   Increasing over $(-\infty, -1.33]$ and $[.67, \infty)$;
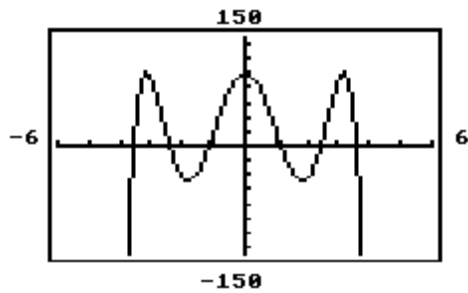   Decreasing over $[-1.33, .67]$

53)

53) _____

A) $P(x) = -x^5 - 10x^2 - 10$;
   domain: $(-\infty, \infty)$; range: $[-29.51, \infty)$;
   Increasing over $(-\infty, 0]$ and $[4.77, \infty)$;
   Decreasing over $(-\infty, 0]$ and $[0, 4.77]$

B) $P(x) = x^4 + x^3 - 10x^2 + 10$;
   domain: $(-\infty, \infty)$; range: $[-29.51, \infty)$;
   Increasing over $[-2.67, 0]$ and $[1.90, \infty)$;
   Decreasing over $(-\infty, -2.67]$ and $[0, 1.90]$

C) $P(x) = -x^4 + x^3 - 12x^2 + 10$;
   domain: $(-\infty, \infty)$; range: $[-29.51, \infty)$;
   Increasing over $[-3.56, 0]$ and $[.83, \infty)$;
   Decreasing over $(-\infty, -3.56]$ and $[0, .83]$

D) $P(x) = x^5 - 4x^3 + 12x^2 + 10$;
   domain: $(-\infty, \infty)$; range: $[-29.51, \infty)$;
   Increasing over $[-.61, \infty)$;
   Decreasing over $(-\infty, -.61]$ and $[0, 7.85]$

54)

A) $P(x) = -x^6 + 20x^4 - 100x^2 + 100$;
   domain: $(-\infty, \infty)$; range: $(-\infty, 99.85]$;
   Increasing over $(-\infty, -3.14]$ and $[-1.81, 0]$ and $[1.81, 3.14]$;
   Decreasing over $[-3.14, -1.81]$ and $[0, 1.81]$ and $[3.14, \infty)$

B) $P(x) = -x^6 + 10x^4 - 100x^2 - 100$;
   domain: $(-\infty, \infty)$; range: $(-\infty, 100]$;
   Increasing over $(-\infty, -4.41]$ and $[-.61, 0]$ and $[1.70, 3.14]$;
   Decreasing over $[-4.41, -.61]$ and $[0, .61]$ and $[1.70, \infty)$

C) $P(x) = -x^5 - 20x^4 - 100x^2 + 100x$;
   domain: $(-\infty, \infty)$; range: $(-\infty, -100]$;
   Increasing over $(-\infty, -3.98]$ and $[-1.11, 0]$ and $[1.11, 3.98]$;
   Decreasing over $[-3.98, -.32]$ and $[0, .32]$

D) $P(x) = x^5 - 10x^4 - 100x^2 + 100$;
   domain: $(-\infty, \infty)$; range: $(-\infty, -99.85]$;
   Increasing over $(-\infty, -5.16]$ and $[-1.81, 0]$ and $[1.81, 5.16]$;
   Decreasing over $[-5.16, -1.81]$ and $[0, 1.81]$

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide the appropriate response.

55) Fill in the blank to complete the statement.
   The maximum number of local extrema of the graph of a polynomial function of degree 7 is ___ .

55) _____

Find the complete quotient when P(x) is divided by the binomial following it.

56) $P(x) = 2x^3 + 3x^2 + 4x - 10; x + 1$

56) _____

57) $P(x) = 2x^5 - x^4 + 3x^2 - x + 5; x - 1$

57) _____

Use the remainder theorem and synthetic division to find P(k).

58) $k = 3; P(x) = -x^3 - 2x^2 - 5$

58) _____

One zero is given. Find all others.

59) $P(x) = 3x^3 - 7x^2 - 15x - 5; -1$

59) _____

60) $P(x) = x^3 - 4x^2 - 36x + 144; -6$

60) _____

Factor P(x) into linear factors given that k is a zero of P.

61) $P(x) = 2x^3 - 17x^2 + 38x - 15; k = 3$

61) _____

62) $P(x) = 4x^3 + 25x^2 + 38x + 8; k = -2$

62) _____

Divide.

63) $\dfrac{16y^4 + 20y^3 + 5y - 1}{4y^2 + 1}$
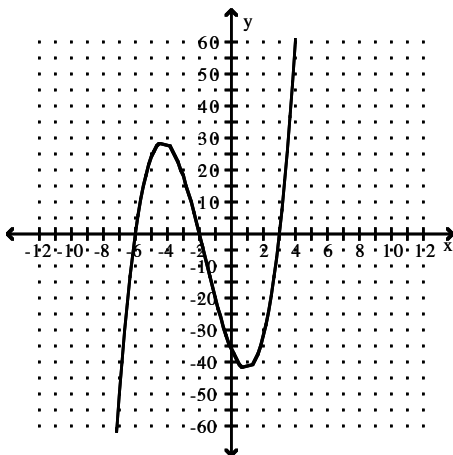
63) _____

64) $\dfrac{x^4 + 3x^2 + 8}{x^2 + 1}$

64) _____

Provide an appropriate response.

65) Consider the graph of the polynomial function $P(x) = x^3 + 5x^2 - 12x - 36$.
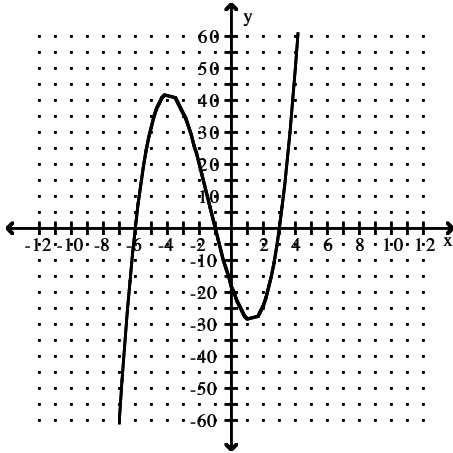
65) _____

If P(x) is divided by x − 2, what is the remainder? What is P(2)?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

66) Consider the graph of the polynomial function $P(x) = x^3 + 4x^2 - 15x - 18$.

66) _____

Give the solution set of $P(x) < 0$ using interval notation.

A) $(-6, -1) \cup (3, \infty)$

B) $(-\infty, -1) \cup (3, 6)$

C) $(-\infty, -6) \cup (-1, 3)$

D) $(-\infty, 6) \cup (1, 3)$

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Find a function P(x) defined by a polynomial of degree 3 with real coefficients that satisfies the given conditions.

67) Zeros of 3, i, –i and $P(2) = 20$

67) _____

68) Zeros of –3, 2, 7 and $P(1) = 24$

68) _____

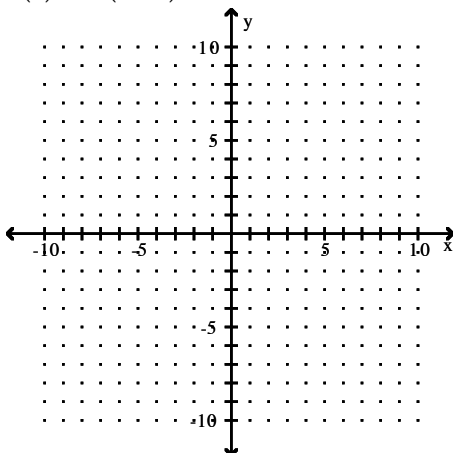**One or more zeros of the polynomial are given. Find all remaining zeros.**

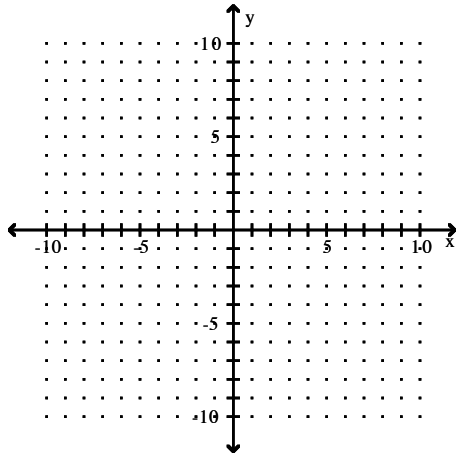69) $P(x) = x^3 - 2x^2 - 3x - 20;\ 4$ is a zero

69) _____

Graph the function.

70) $P(x) = 2x(x + 1)^2$

70) _____

10

71) $P(x) = (2x + 1)(x - 2)^2$

71) _____

1) $-2 + 4i$
   Points: 1

2) $-6 - 3i$
   Points: 1

3) $i\sqrt{5}$
   Points: 1

4) $8 + 3i$
   Points: 1

5) 3
   Points: 1

6) -3
   Points: 1

7) $9 - 10i$
   Points: 1

8) $-1 - 12i$
   Points: 1

9) $21 - 12i$
   Points: 1

10) $-117 + 44i$
    Points: 1

11) $-i$
    Points: 1

12) $\dfrac{22}{41} + \dfrac{7}{41}i$

    Points: 1

13) $\dfrac{19}{29} - \dfrac{25}{29}i$

    Points: 1

14) $f(x) = \left(x + \dfrac{3}{2}\right)^2 - \dfrac{5}{4}$

    Points: 1

15) $f(x) = 3\left(x - \dfrac{2}{3}\right)^2 - \dfrac{4}{3}$

    Points: 1

16) $(8, -1)$
    Points: 1

17) $(1, 3)$
    Points: 1

18) $x = -1$
    Points: 1

19) $x = 4$
    Points: 1

20) Domain: $(-\infty, \infty)$; Range: $[6, \infty)$
    Points: 1

21) Domain: $(-\infty, \infty)$; Range: $(-\infty, -5]$
   Points: 1

22) $(0, \infty)$
   Points: 1
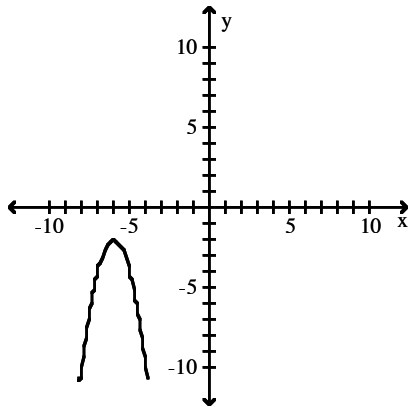
23) $(0, \infty)$
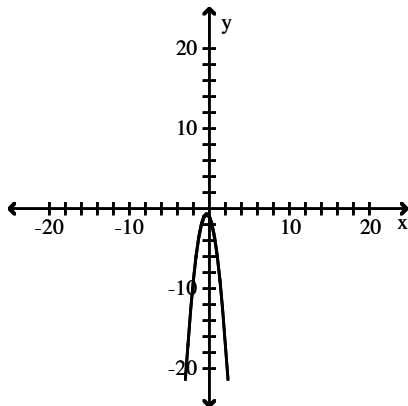   Points: 1

24) maximum: -7
   Points: 1

25)

   Points: 1

26)

   Points: 1

27) 36 watches
   Points: 1

28) 2.5 sec
   Points: 1

29) 3 sec
   Points: 1

30) one; maximum (or highest); (10, 0)
   Points: 1

31) $\left\{\dfrac{-5 \pm \sqrt{205}}{18}\right\}$
   Points: 1

32) $\left\{ \dfrac{9 \pm \sqrt{141}}{2} \right\}$

Points: 1

33) $x^2 + 7x + 6 = 0$

Points: 1

34) $x^2 + 2x - 3 = 0$

Points: 1

35) $(-2, 2)$

Points: 1

36) $\varnothing$

Points: 1

37) $[-3, 5]$

Points: 1

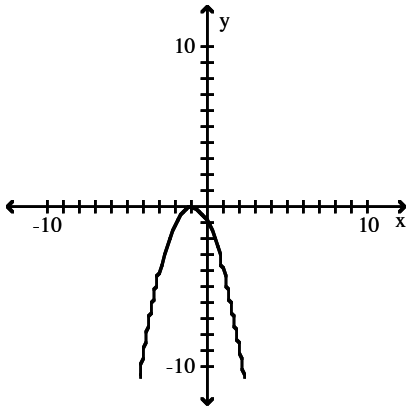38) $(-\infty, \dfrac{-1 - \sqrt{17}}{2}] \cup [\dfrac{-1 + \sqrt{17}}{2}, \infty)$
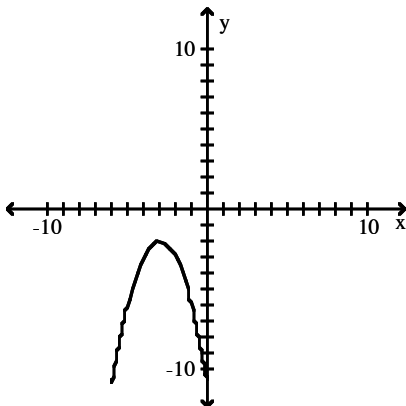
Points: 1

39) 1; 1

Points: 1

40)

Points: 1

41)

Points: 1

42) $A(x) = x(320 + 2(110 - 2x))$
Points: 1

43) $C(x) = \dfrac{200}{x-2} - \dfrac{200}{x}$
Points: 1

44) 4 ft
Points: 1

45) 7.04 inches
Points: 1

46) 8 mi
Points: 1

47) 5 in. by 9 in.
Points: 1

48)
Points: 1

49)
Points: 1

50) B
Points: 1

51) B
Points: 1

52) A
Points: 1

53) B
Points: 1

54) A
Points: 1

55) 6
Points: 1

56) $Q(x) = 2x^2 + x + 3 + \dfrac{-13}{x+1}$
Points: 1

57) $Q(x) = 2x^4 + x^3 + x^2 + 4x + 3 + \dfrac{8}{x-1}$
Points: 1

58) −50
Points: 1

59) $\dfrac{5 + 2\sqrt{10}}{3}, \dfrac{5 - 2\sqrt{10}}{3}$
Points: 1

60) 4, 6
   Points: 1

61) $P(x) = (x - 3)(x - 5)(2x - 1)$
   Points: 1

62) $P(x) = (x + 2)(x + 4)(4x + 1)$
   Points: 1

63) $4y^2 + 5y - 1$
   Points: 1

64) $x^2 + 2 + \dfrac{6}{x^2 + 1}$

   Points: 1

65) −32, −32
   Points: 1

66) C
   Points: 1

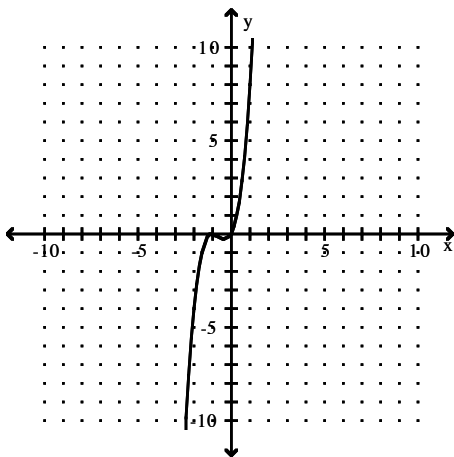67) $P(x) = -4x^3 + 12x^2 - 4x + 12$
   Points: 1

68) $P(x) = x^3 - 6x^2 - 13x + 42$
   Points: 1
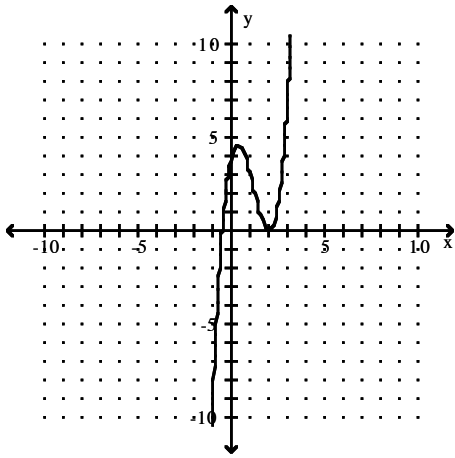
69) $-1 + 2i, -1 - 2i$
   Points: 1

70)

   Points: 1

71)

Points: 1