Chapter 5: Quadratic Functions

Section 5.1: Square Root Property

#1 - 20: Solve the equations using the square root property.

1) $x^2 = 16$ 2) $y^2 = 25$ 3) $b^2 = -49$ 4) $a^2 = -16$

5) $m^2 = 98$ 6) $d^2 = 24$ 7) $x^2 = -75$ 8) $x^2 = -54$

9) $(x-3)^2 = 25$ 10) $(x+2)^2 = 81$ 11) $(2x-5)^2 = 49$ 12) $(3x+7)^2 = 121$

13) $(x-4)^2 = 150$ 14) $(x-8)^2 = 48$ 15) $(2x-6)^2 = -75$ 16) $(5x+9)^2 = 84$

17) $\left(x+\frac{1}{3}\right)^2 = 49$ 18) $\left(x-\frac{1}{2}\right)^2 = 16$ 19) $\left(x+\frac{2}{3}\right)^2 = 21$ 20) $\left(y-\frac{1}{5}\right)^2 = 19$

#21 - 38: Find a value of C so that the expression becomes a perfect square. Factor your result. We refer to this method as completing the square.

21) $x^2 + 6x + C$ 22) $b^2 + 8b + C$ 23) $y^2 + 10y + C$ 24) $x^2 + 16x + C$

25) $b^2 – 4b +C$ 26) $d^2 – 12d +C$ 27) $x^2 – 14x + C$ 28) $y^2 – 20y + C$

29) $x^2 + 6x + C$ 30) $b^2 + 14b + C$ 31) $x^2 +3x+ C$ 32) $v^2 + 9v + C$

33) $x^2 – 7x + C$ 34) $y^2 – 5y + C$ 35) $a^2 – 11a + C$ 36) $b^2 – b + C$

37) $b^2 + \frac{1}{2}b + C$ 38) $a^2 - \frac{1}{3}a + C$

#39 - 62: Solve by completing the square. Specifically, rewrite the equation so it can be solved using the square root property. That is, first solve for C, like in problems 21-38, and then solve using square roots like problems 1-24.

39) $x^2 + 6x = 7$ 40) $b^2 + 8b = 9$ 41) $a^2 + 10a – 24=0$ 42) $y^2 + 6y – 16=0$

43) $a^2 – 10a = 75$ 44) $y^2 – 6y = 7$ 45) $x^2 – 8x+7 = 0$ 46) $y^2 – 4y+3=0$

47) $x^2 + 2x= 6$ 48) $b^2 + 8b = 4$ 49) $a^2 – 12a –18=0$ 50) $x^2 – 6x+24=0$

51) $x^2 + 6x = 5$ 52) $y^2 + 10y = 12$ 53) $b^2 + 6b = 11$ 54) $x^2 – 6x= -4$

55) $x^2 + 8x = -20$ 56) $y^2 -6y = -16$ 57) $x^2 + 3x + 5 = 0$ 58) $b^2 + b – 4 = 0$

59) $2x^2 + 6x – 5 = 0$ 60) $3x^2 + x – 4 =0$ 61) $4x^2 + x – 3 = 0$ 62) $2x^2 + 23x +11=0$

Chapter 5: Quadratic Functions

Section 5.2: Quadratic Formula

$$\boldsymbol{x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}}$$

1) Solve: $x^2 - 4x - 12 = 0$ by
a) Factoring
b) Completing the square
c) The quadratic formula

2) Solve: $x^2 - 6x - 7 = 0$ by
a) Factoring
b) Completing the square
c) The quadratic formula

3) Solve: $y^2 + 10y = 5$ by
a) Completing the square
b) The quadratic formula
(This can't be solved by factoring)

4) Solve: $b^2 + 6b = 3$
a) Completing the square
b) The quadratic formula
(This can't be solved by factoring)

#5 - 16: Solve using the quadratic formula.

5) $y^2 + 6y - 16 = 0$ 6) $z^2 + 10z - 9 = 0$ 7) $x^2 + 6x + 9 = 0$ 8) $d^2 + 2d + 1 = 0$

9) $y^2 - 2y + 6 = 0$ 10) $x^2 - 3x + 5 = 0$ 11) $2w^2 + 3w - 5 = 0$ 12) $3t^2 - 7t + 4 = 0$

13) $3z^2 - 4z + 3 = 0$ 14) $2t^2 - 6t + 5 = 0$ 15) $9y^2 - 12y + 2 = 0$ 16) $9x^2 - 12x + 4 = 0$

#17 - 32: Rewrite in the form $ax^2 + bx + c = 0$ with $a > 0$, then solve using the quadratic formula.

17) $y^2 + 5y = 6$ 18) $x^2 + 9x = 10$ 19) $2t^2 + 5t = 8$ 20) $3x^2 - 6x = -2$

21) $x^2 = 3 - 5x$ 22) $y^2 = 4 - 5y$ 23) $3y + 4y^2 = 2$ 24) $-5y - 6y^2 = 4$

25) $(x+1)(x-3) = 12$ 26) $(x-3)(x-4) = 2$ 27) $2x(x-1) = 40$ 28) $3x(x-1) = 6$

29) $3x(x+1) - 5x = 4$ 30) $2x(x-3) + 5(x-4) = 9$

31) $y(y-3) + 2y = 4$ 32) $s^2 + s(s-4) = 5s + 6$

Chapter 5: Quadratic Functions

Section 5.3: Graphs of Quadratic Functions

#1 - 12: Make a table of values and sketch the function. Identify the vertex.

1) $f(x) = x^2$
2) $g(x) = x^2 + 2$
3) $k(x) = x^2 + 4$
4) $h(x) = x^2 - 3$
5) $n(x) = x^2 - 6$
6) $f(x) = x^2 - 2$
7) $f(x) = 3x^2 - 4$
8) $g(x) = 2x^2 - 6$
9) $b(x) = -5x^2 + 12$
10) $g(x) = -4x^2 + 9$
11) $m(x) = -2x^2 + 1$
12) $k(x) = -6x^2 + 15$

#13 - 24: Make a table of values and sketch the function. Identify the vertex and axis of symmetry.

13) $f(x) = (x - 2)^2$
14) $g(x) = (x - 3)^2$
15) $m(x) = (x - 1)^2$
16) $k(x) = (x - 7)^2$
17) $n(x) = (x+3)^2$
18) $h(x) = (x+5)^2$
19) $f(x) = 3(x - 2)^2$
20) $g(x) = 4(x - 1)^2$
21) $b(x) = \frac{-1}{2}(x - 5)^2$
22) $f(x) = \frac{-1}{3}(x - 1)^2$
23) $r(x) = \frac{2}{5}(x + 1)^2$
24) $f(x) = \frac{1}{4}(x+2)^2$

#25 - 36: Make a table of values and sketch the function. Identify the vertex and axis of symmetry. Identify whether the vertex is a maximum or minimum point, then state the maximum or minimum value.

25) $f(x) = (x - 3)^2 + 4$
26) $g(x) = (x - 2)^2 + 6$
27) $h(x) = 2(x+3)^2 - 4$
28) $m(x) = 3(x+1)^2 + 2$
29) $g(x) = \frac{1}{2}(x + 4)^2 - 6$
30) $f(x) = \frac{1}{3}(x + 3)^2 - 1$
31) $m(x) = -2x^2 + 3$
32) $t(x) = 3x^2 + 6$
33) $f(x) = -\frac{1}{4}(x + 5)^2 - 2$
34) $n(x) = -3(x - 3)^2 - 3$
35) $b(x) = 2(x+3)^2 + 4$
36) $f(x) = -2(x+1)^2 + 5$

#37 – 48: Find the vertex using the vertex formula. Make a table of values and sketch the function. Identify the vertex and axis of symmetry. Identify whether the vertex is a maximum or minimum point, then state the maximum or minimum value.

37) $f(x) = x^2 + 6x + 5$
38) $g(x) = x^2 + 10x - 11$
39) $k(x) = x^2 - 4x + 2$
40) $m(x) = x^2 - 2x + 6$
41) $f(x) = 2x^2 + 8x - 3$
42) $h(x) = -2x^2 + 24x - 6$
43) $f(x) = -x^2 + 6x + 4$
44) $g(x) = x^2 - 4x - 2$
45) $k(x) = -3x^2 + 6x - 7$
46) $g(x) = 2x^2 + 12x + 3$
47) $f(x) = 3x^2 - 2x + 1$
48) $n(x) = -2x^2 + 6x + 3$

Chapter 5: Quadratic Functions

Section 5.4: Applications of Quadratic Functions

1) When a ball is thrown straight upward into the air, the equation $h= -8t^2 + 80t$ gives the height (h) in feet that the ball is above the ground t seconds after it is thrown.

a) When does the ball reach its maximum height?
b) What is the maximum height of the ball?

2) When an object is thrown straight upward into the air, the equation $h= -10t^2 + 80t + 12$ gives the height (h) in feet that the ball is above the ground t seconds after it is thrown.

a) When does the object reach its maximum height?
b) What is the maximum height of the object?

3) An object is launched from a platform. The equation for the object's height in meters at time t seconds after launch is $h(t) = –4.9t^2 + 19.6t + 58.8$, where s is in meters.

a) When does the object reach its maximum height?
b) What is the maximum height of the object?

4) A golf ball is hit and its height is given by $h(t) = -4.9t^2 + 29.4t$, where h is its height in meters and t is the time in seconds.

a) At what time does the golf ball reach its maximum height?
b) What is the ball's maximum height?

5) If a soccer ball is kicked straight up from the ground, its height above the earth in feet is given by $h(t) = -16t^2 + 32t$ where t is time in seconds.

a) When does the ball reach its maximum height?
b) What is the maximum height of the ball?

6) The height h (in feet) above the ground of a baseball depends on the time t (in seconds) it has been in flight. Cameron hits a bloop single whose height is described approximately by the equation:
$h = 64t – 16t^2$.

a) When does the ball reach its maximum height?
b) What is the maximum height of the ball?

Chapter 5: Quadratic Functions

Section 5.4: Applications of Quadratic Functions

7) The height (in feet) of the water level in a reservoir over a 1-year period is modeled by the function $H(t) = 3.3(t - 9)^2 + 14$, where t = 1 represents January, t = 2 represents February, and so on.

a) How low did the water level get that year?
b) When did it reach its low mark?

8) The height (in feet) of the water level in a reservoir over a 1-year period is modeled by the function $H(t) = 5(t - 7)^2 + 3$, where t = 1 represents January, t = 2 represents February, and so on.

a) How low did the water level get that year?
b) When did it reach its low mark?

9) The depth (in feet) of the snow at the base of a mountain over a 1-year period is modeled by the function: $H(t) = 4(t-10)^2 + 15$, where t = 1 represents January, t = 2 represents February, and so on.

a) How low did the snow level get that year?
b) When did it reach its low mark?

10) The following function can be used to compute the average score on a math placement exam taken between 2000 – 2011: $S(t) = t^2 - 10t + 87$. (t = 0 represents 2000, t = 1 represents 2001 and so on.)

a) In which year was the average math placement score lowest,
b) What is the lowest average score?

11) The following function can be used to compute the average daily high temperature for any month of the year in a small town in southwestern USA: $T(m) = -m^2 + 14m + 52$. (m = 1 represents January, m = 2 represents February and so on.)

a) Which month has the highest average daily high temperature?
b) What is the temperature?

12) The following function can be used to compute the average daily high temperature for any month of the year in a small town in Iceland: $T(m) = -m^2 + 16m + 2$. (m = 1 represents January, m = 2 represents February and so on.)

a) Which month has the highest average daily high temperature?
b) What is the temperature?

Chapter 5: Quadratic Functions

Section 5.5: Equations in Quadratic Form

#1 - 6: Solve by isolating the term with the square root, and squaring both sides of the equation to eliminate the square root. Make sure to check your answers.

1) $\sqrt{x} = x - 2$ 2) $\sqrt{y} = y - 12$ 3) $y + 2\sqrt{y} - 15 = 0$

4) $2y + 5\sqrt{y} - 3 = 0$ 5) $x + 2\sqrt{x} - 8 = 0$ 6) $b - 3\sqrt{b} + 2 = 0$

I deleted problems 7 – 10 as I didn't like them too much.

#11 - 19: Solve by substitution. That is create and solve a problem with a "u", then use the solutions to the "u" problem to solve the given problem.

11) $(x+3)^2 + 5(x+3)-6= 0$ 12) $(x-5)^2 +6(x-5) - 7 = 0$ 13) $(2y+5)^2 + 6(2y+5) + 5 = 0$

14) $(2x-7)^2 + 4(2x-7) + 3 = 0$ 15) $5(x-6)^2 + 3(x-6) -8 = 0$ 16) $3(x - 1)^2 + 5(x - 1) + 2 = 0$

17) $5(3x - 1)^2 + 7(3x - 1) + 2 = 0$ 18) $7(3x + 7)^2 + 8(3x + 7) + 1 = 0$

19) $5(4x + 3)^2 + 2(4x + 3) - 3 = 0$

#20 - 29: Solve by factoring or substitution.

20) $x^4 + 3x^2 - 4 = 0$ 21) $y^4 + 8y^2 - 9 = 0$ 22) $n^4 + 5n^2 - 24 = 0$

23) $a^4 + 5a^2 - 6 = 0$ 24) $x^{-2} +7x^{-1} - 8 = 0$ 25) $y^{-2} + 26y^{-1} - 27 = 0$

26) $m^{2/3} + 3m^{1/3} - 4 = 0$ 27) $x^{2/3} + 5x^{1/3} - 6 = 0$ 28) $b^{2/5} - 3b^{1/5} + 2 = 0$

29) $x^{2/5} - 4x^{1/5} + 3 = 0$

Chapter 5: Quadratic Functions

Section 5.6: Quadratic Inequalities

#1 – 12: Use the graph of f(x) to solve

a) f(x) = 0

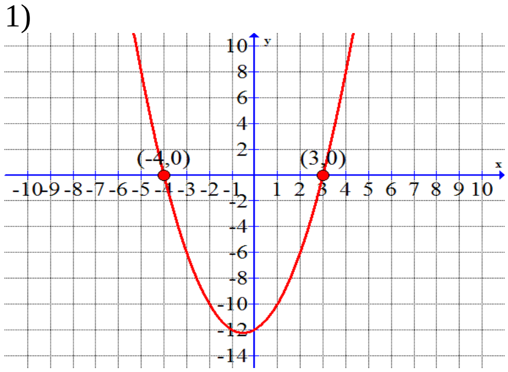
b) f(x) > 0

c) f(x) < 0

d) f(x) ≥ 0

e) f(x) ≤ 0

1)



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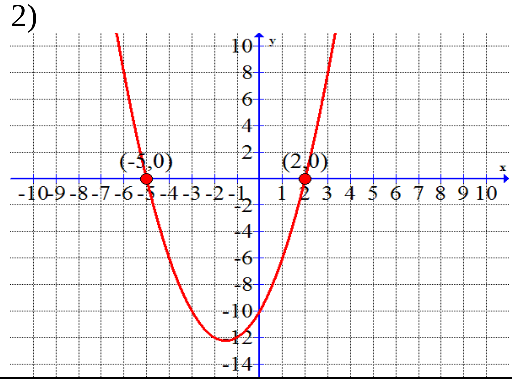

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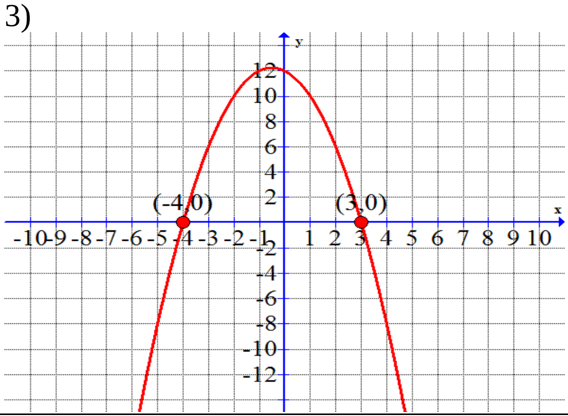

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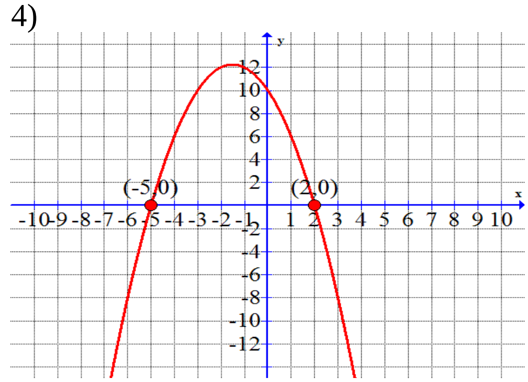

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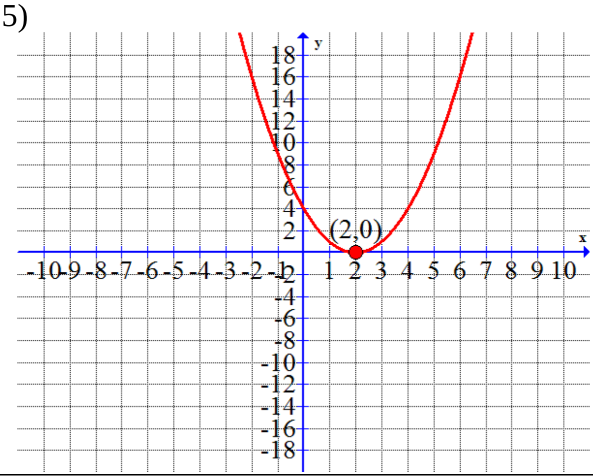

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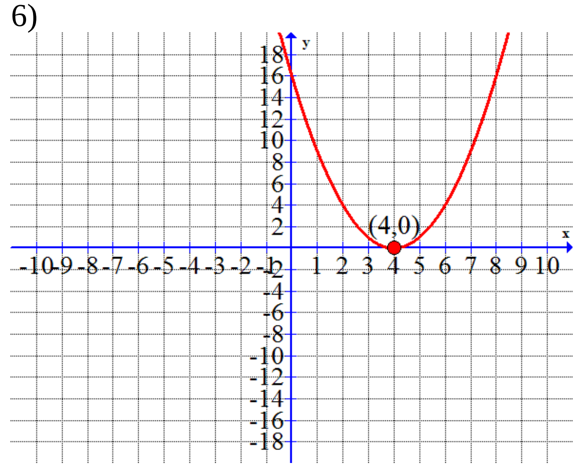
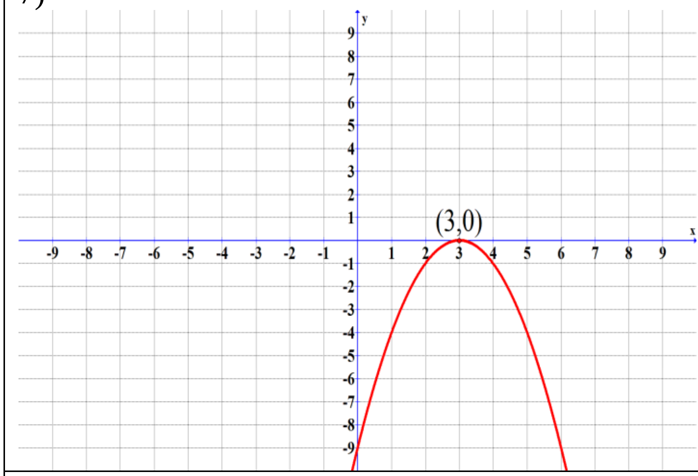


Chapter 5: Quadratic Functions

Section 5.6: Quadratic Inequalities

7)



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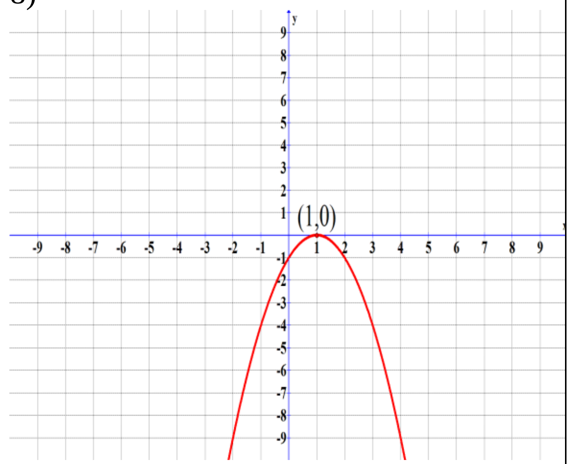

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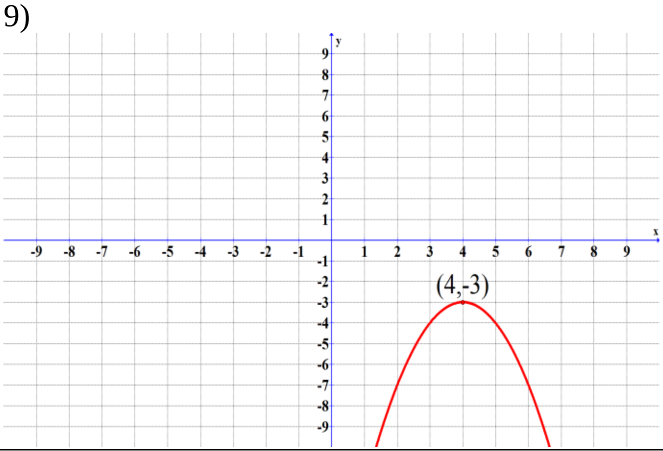

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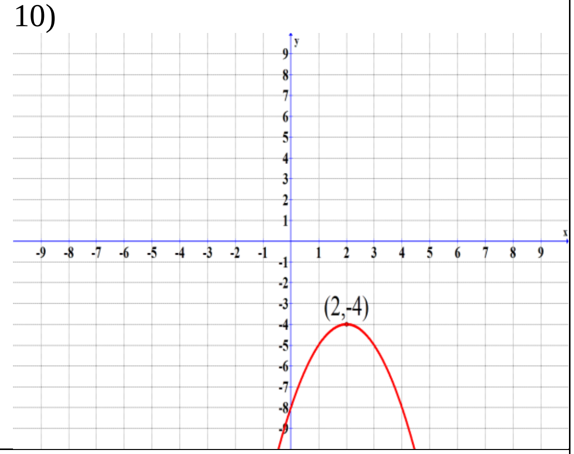

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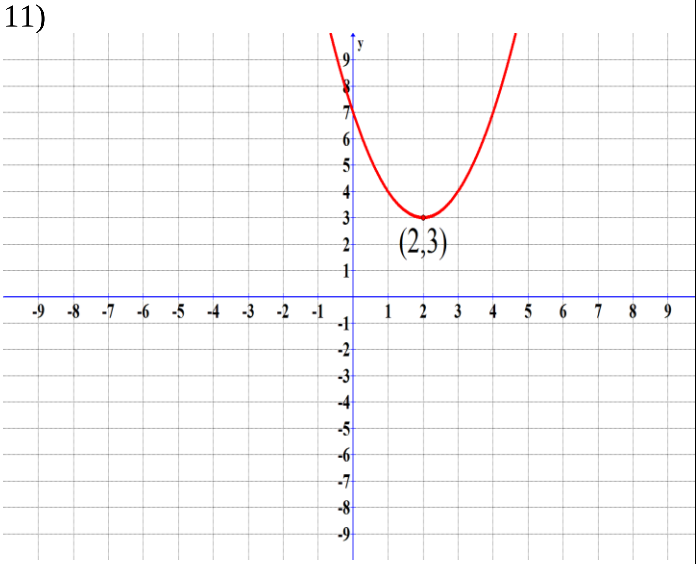

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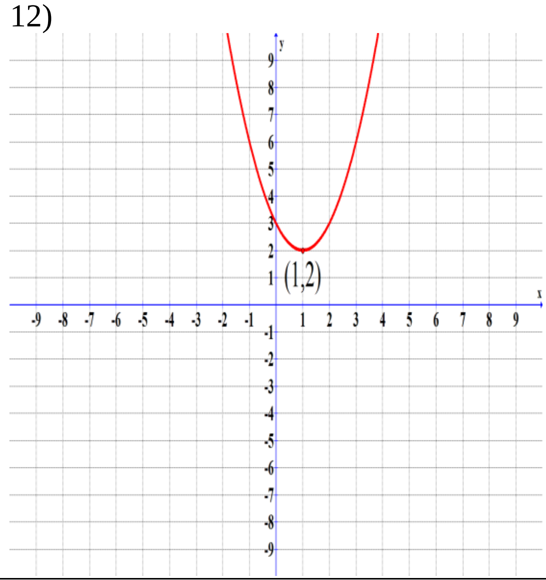


Chapter 5: Quadratic Functions

#13 – 27: Find the following:
a) $f(x) = 0$
b) $f(x) > 0$
c) $f(x) < 0$
d) $f(x) \geq 0$
e) $f(x) \leq 0$

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

14) $f(x) = x^2 + 8x - 20$

15) $f(x) = x^2 - 6x + 5$

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

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

18) $f(x) = (x - 2)^2 - 25$

19) $f(x) = (x + 4)^2 - 49$

20) $f(x) = (x + 3)^2 - 64$

21) $f(x) = -2(x - 5)^2 + 50$

22) $f(x) = -4(x - 4)^2 + 64$

23) $f(x) = -2(x + 6)^2$

24) $f(x) = -3(x + 5)^2$

25) $f(x) = (x - 3)^2 + 9$

26) $f(x) = (x - 2)^2 + 25$

27) $f(x) = x^2 + 2x + 4$

28) $f(x) = x^2 + 4x + 6$

Chapter 5: Quadratic Functions

MAT 120 Chapter 5 practice test

1. Make a table of values. Find the vertex and axis of symmetry and sketch a graph.

a) $y = (x-4)^2 – 3$

b) $y = -2(x+5)^2 + 4$

2. Find the vertex by using the vertex formula then make a table of values and sketch a graph.

a) $T(x) = 3x^2 – 18x + 22$

b) $s(x) = -x^2 + 10x - 20$

3. Solve the equation using the quadratic formula.

a) $6x^2 + 5x = 3$

b) $3x^2 + 5x – 2 = 0$

c) $x^2 - 4x + 8 = 0$

4. Solve by the square root property.

a) $(q+2)^2 = 25$

b) $(t - 6)^2 = 20$

Chapter 5: Quadratic Functions

5. Solve the quadratic equation by completing the square and applying the square root property.
(0 points for a correct answer gotten by another method)

$p^2 + 4p = 2$

6. Solve

a) $p - 8 = 2\sqrt{p}$

b) $x^4 - 7x^2 - 18 = 0$

c) $(x+3)^2 + 5(x+3) - 14 = 0$

7) Use the graph of f(x) to solve

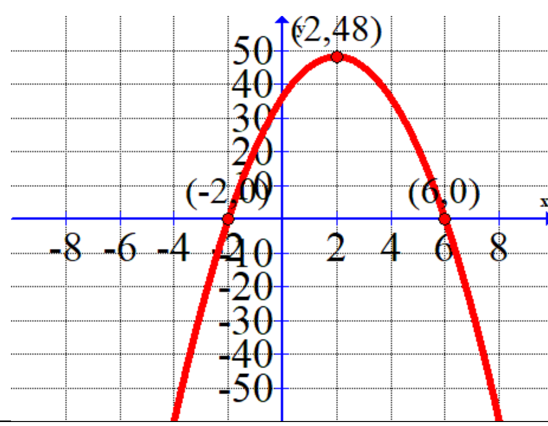
a) $f(x) = 0$

b) $f(x) > 0$

c) $f(x) < 0$

d) $f(x) \geq 0$

e) $f(x) \leq 0$



8) $f(x) = x^2 + 6x - 16$ (find the following)

a) $f(x) = 0$

b) $f(x) > 0$

c) $f(x) < 0$

d) $f(x) \geq 0$

e) $f(x) \leq 0$