Math Connections Worksheets

MAT1033C Intermediate Algebra

Chapter 8

Quadratic Equations and Functions

Name: **Date:**
Instructor: **Section:**

Chapter 8 Quadratic Equations and Functions
Section 8.1 Solving Quadratic Equations by Completing the Square

Learning Objective
1. Use the square root property to solve quadratic equations.
2. Solve quadratic equations by completing the square.
3. Use quadratic equations to solve problems.

Vocabulary
Use the choices to complete each statement.

Completing the square	**Quadratic Equation**	$\sqrt{b}$
$-\sqrt{b}$	$\pm\sqrt{b}$	b^2
$\frac{b}{2}$	$\left(\frac{b}{2}\right)^2$	

1. A _____ is an equation that can be written in the form $ax^2+bx+c=0,\ a\neq 0$.
2. According to the square root property, if $a^2=b$ then $a=$_____, if b is a real number.
3. One method to solve a quadratic equation is _____, this method is the process of rewriting one side to be a perfect square trinomial.
4. To solve a quadratic equation by completing the square, one will add _____ to both sides.

Objective 1

Use the square root property to solve each equation.

5. $x^2=36$ 5. _____

6. $(x+7)^2=16$ 6. _____

7. $x^2+4=9$ 7. _____

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8. $(x+2)^2 = 10$ 8. _____

9. $(x-3)^2 = -9$ 9. _____

10. $(x-4)^2 = -12$ 10. _____

Objective 2

Solve each equation by completing the square.

11. $x^2 + 6x + 2 = 0$ 11. _____

12. $x^2 + 8x - 6 = 0$ 12. _____

13. $x^2 + 3x + 5 = 0$ 13. _____

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14. $3y^2 + 6y - 4 = 0$ 14. _____

15. $x^2 + 6x + 12 = 0$ 15. _____

16. $x^2 + 4x + 8 = 0$ 16. _____

17. $2x^2 + 6x + 11 = 0$ 17. _____

Objective 3

Use the formula $A = P(1 + r)^t$ to solve.

18. Find the rate r at which \$3000 compounded annually grows to \$4320 in 2 years.

18. _____

19. Find the rate r at which \$4200 compounded annually grows to \$8232 in 2 years.

19. _____

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Concept Extension

20. An right triangle has legs of equal length. If the hypotenuse is 48 centimeters long, find the length of each leg.

20. _____

21. The area of a square is 36 square centimeters. Find the length of the diagonal of the square.

21. _____

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Section 8.2 Solving Quadratic Equations by the Quadratic Formula

Learning Objectives
1. Solve quadratic equations by using the quadratic formula.
2. Determine the number and type of solutions of a quadratic equation by using the discriminant.
3. Solve geometric problems modeled by quadratic equations.

Objective 1

Use the quadratic formula to solve each equation.

1. $x^2 + 16x + 15 = 0$ 1. _____

2. $x^2 + 14x + 45 = 0$ 2. _____

3. $2x^2 + 3x - 6 = 0$ 3. _____

4. $3x^2 + 12x - 20 = 0$ 4. _____

5. $-2x^2 + x - 5 = 0$ 5. _____

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6. $\frac{2}{5}y^2+\frac{1}{5}y+\frac{3}{5}=0$ 6. _____

Use the discriminant to determine the number and types of solutions of each equation.

7. $2x^2+4x-5=0$ 7. _____

8. $x^2+3x+7=0$ 8. _____

9. $6=4x-5x^2$ 9. _____

10. $15x^2+13x-27=0$ 10. _____

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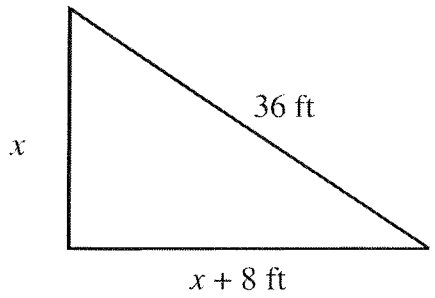
Objective 3

Solve.

11. Nancy, Thelma, and John Varner live on a corner lot. Often, neighborhood children across their lot to save walking distance. Give the diagram below, approximate to the nearest foot how many feet of walking distance is saved from cutting across their property instead of walking around the lot.



11. _____

12. A rectangle is 6 more meters long as it is high. If the area of the rectangle is 22 square meters. Find dimensions of the rectangle.

12. _____

Concept Extension

Use the quadratic equation to solve each quadratic equation.

13. $x^2 + \sqrt{5}x - 3 = 0$ 13. _____

14. $3x^2 - \sqrt{6}x + 2 = 0$ 14. _____

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Section 8.5 Quadratic Functions and Their Graphs

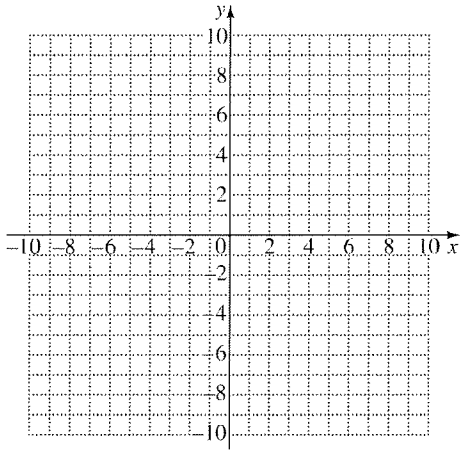
Learning Objectives

1. Graph quadratic functions of the form $f(x) = x^2 + k$.
2. Graph quadratic functions of the form $f(x) = (x-h)^2$.
3. Graph quadratic functions of the form $f(x) = (x-h)^2 + k$.
4. Graph quadratic functions of the form $f(x) = ax^2$.
5. Graph quadratic functions of the form $f(x) = a(x-h)^2 + k$

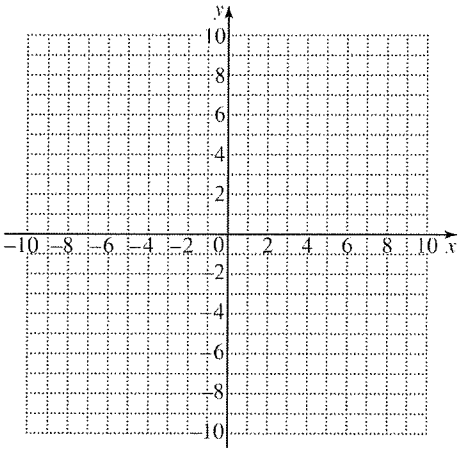
Objective 1

Sketch the graph of each quadratic function. Label the vertex, and sketch and label the axis of symmetry.

1. $f(x) = x^2 + 2$



2. $f(x) = x^2 - 4$



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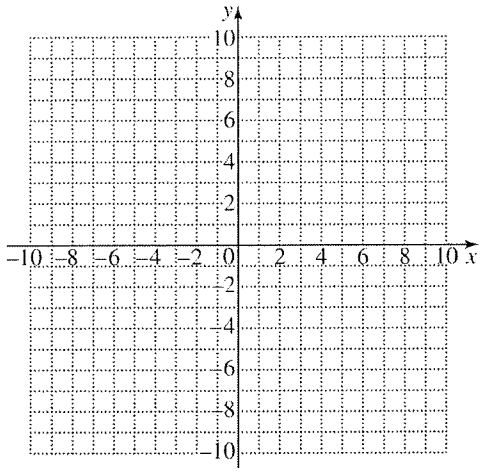
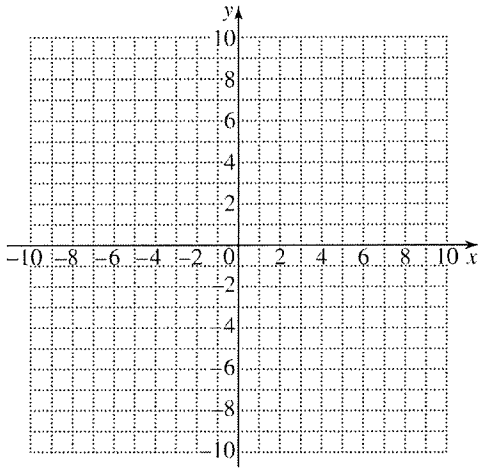
3. $f(x) = x^2 + 6$



Objective 2

Sketch the graph of each quadratic equation. Label the vertex, and sketch and label the axis of symmetry.

4. $h(x) = (x+2)^2$



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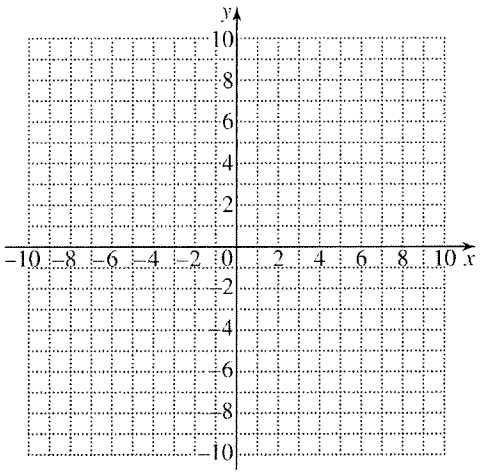
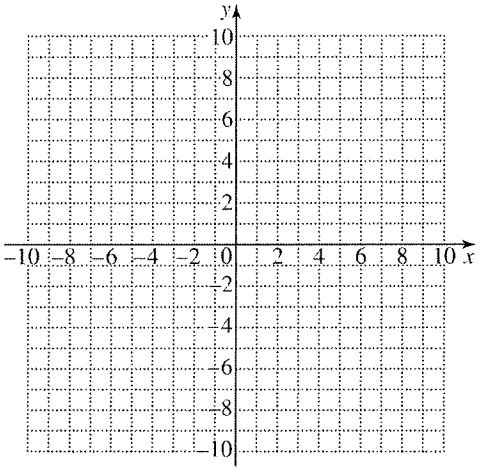
5. $f(x)=(x-4)^2$



6. $f(x)=(x+3)^2$



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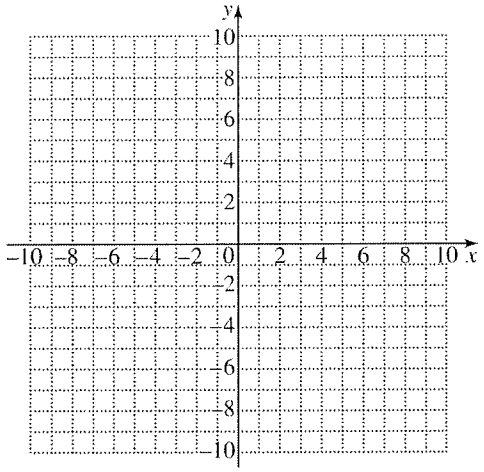
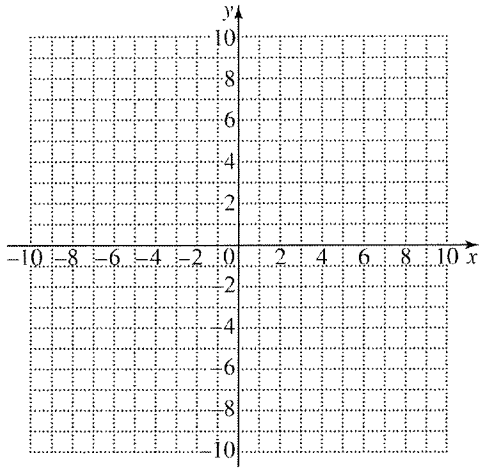
Objective 3

Sketch the graph of each quadratic equation. Label the vertex, and sketch and label the axis of symmetry.

7. $f(x)=(x-2)^2+5$



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



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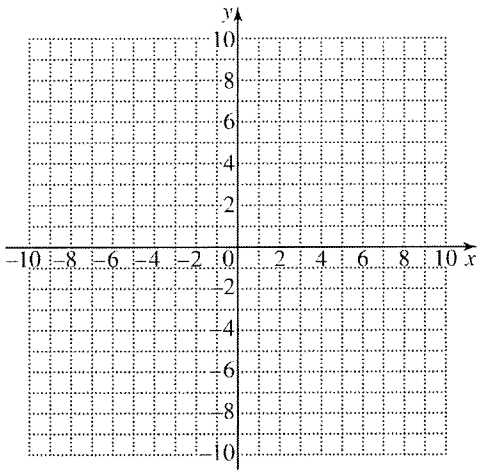
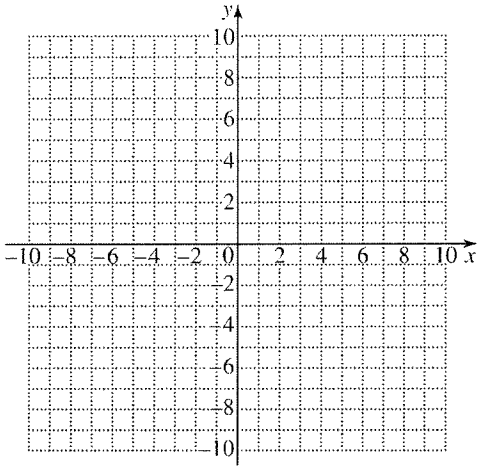
9. $f(x)=(x-3)^2-2$



Objective 4

Sketch the graph of each quadratic equation. Label the vertex, and sketch and label the axis of symmetry.

10. $f(x)=3x^2$



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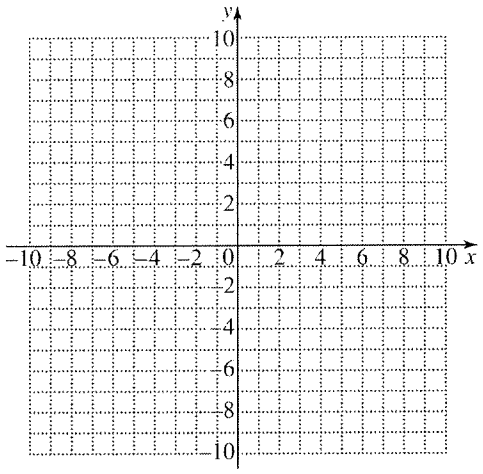
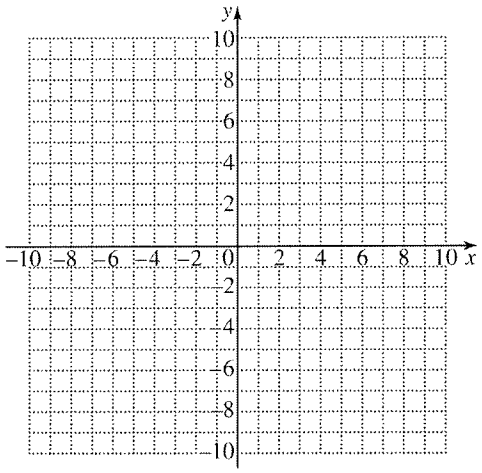
11. $f(x) = -4x^2$



12. $f(x) = -\frac{1}{2}x^2$



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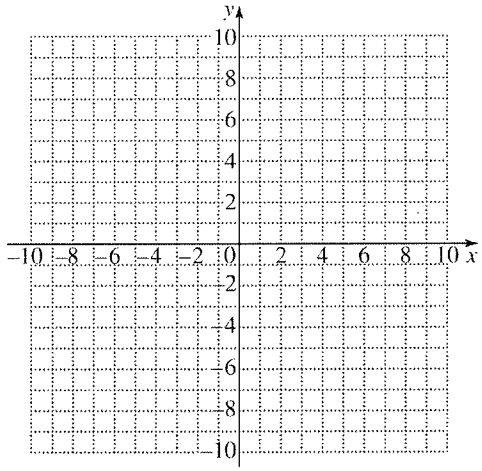
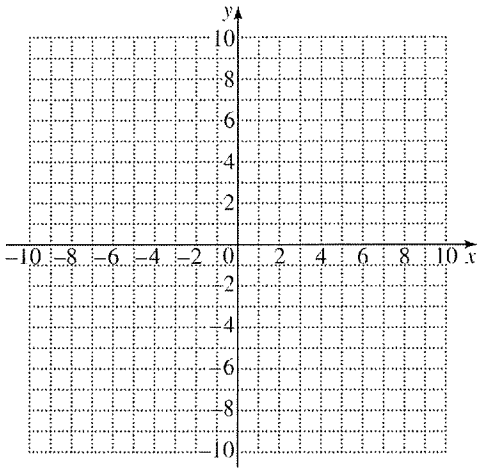
13. $f(x)=\frac{1}{4}x^2$



Objective 5

Sketch the graph of each quadratic equation. Label the vertex, and sketch and label the axis of symmetry.

14. $h(x)=-3(x+3)^2+1$



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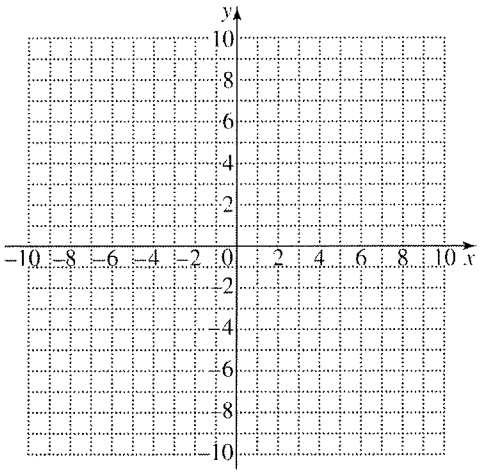
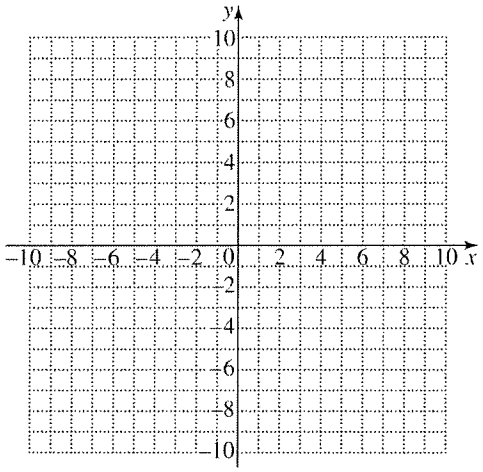
15. $f(x)=2(x-1)^2+2$



16. $f(x)=\frac{1}{2}(x+2)^2+3$



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Concept Extension

17. Write the equation of the parabola that has the same shape of $f(x) = -2x^2$ but with the vertex of $(4,-6)$.

17. _____

18. What about $(-7,9)$?

18. _____

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Section 8.6 Further Graphing of Quadratic Functions

Learning Objectives

1. Write quadratic functions in the form $y = a(x-h)^2 + k$.
2. Derive the formula for finding the vertex of a parabola.
3. Find the minimum or maximum value of a quadratic function.

Objective 1

Rewrite the following functions in the form $y = a(x-h)^2 + k$. State the vertex of each function.

1. $f(x) = x^2 - 2x - 15$ 1. _____

2. $f(x) = x^2 + 6x + 17$ 2. _____

3. $f(x) = x^2 + 5x + 18$ 3. _____

4. $f(x) = 2x^2 + 6x - 11$ 4. _____

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5. $f(x) = -3x^2 + 12x + 8$ 5. _____

6. $f(x) = -x^2 + 8x - 9$ 6. _____

Objective 2

7. Take the equation $y = ax^2 + bx + c$ and using the variables a, b, and c to rewrite the equation to be in the form $y = a(x-h)^2 + k$. What value did you get in place of the h?

7. _____

8. The value you created from # 7 is the x-value of your vertex, how would you get the y-value of the vertex?

8. _____

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Using the formula you found in # 7 and # 8, find the vertex of the following functions.

9. $y = x^2 + 4x + 7$ 9. _____

10. $f(x) = 2x^2 + 6x + 9$ 10. _____

11. $f(x) = 3x^2 - 6x - 13$ 11. _____

12. $f(x) = -x^2 + 4x - 5$ 12. _____

Objective 3

Solve.

13. If a projectile is fired straight upward from the ground with an initial speed of 96 feet per second, then its height h in feet after t seconds is given by the equation $h(t) = -16t^2 + 96t$. Find the maximum height of the projectile.

13. _____

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14. The local high school bowling team is selling candles to raise money for their scholarship fund. The profit in dollars is $P(x) = 420x - x^2$.

a. How many candles must be sold to maximize profit.

14a. _____

b. Find the maximum profit.

14b. _____

Concept Extension

Find the maximum or minimum value of each function. Approximate to two decimal points. State whether it is a maximum or minimum value.

15. $f(x) = 1.2x^2 + 3.6x + 4.5$ 15. _____

16. $f(x) = -0.3x^2 + 1.6x - 1.2$ 16. _____

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Chapter 8 Vocabulary

Vocabulary Word	Definition	Example
Square root property	If $a^2 = b$ then $a = \pm\sqrt{b}$	$\sqrt{36} = \pm 6$
Quadratic Formula	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	
Quadratic function	$y = a(x-h)^2 + k$ Vertex: (h,k) if a is positive parabola opens upward if a is negative parabola opens downward.	$y = 4(x-3)^2 + 5$ Vertex: $(3,5)$, parabola opens upward since $a = 4$
Quadratic equation	$y = ax^2 + bx + c$ Vertex $\left(-\dfrac{b}{2a}, f\left(-\dfrac{b}{2a}\right)\right)$	$y = 2x^2 - 8x + 9$ Vertex at $(2,1)$

Answers

Chapter 8
Section 8.1

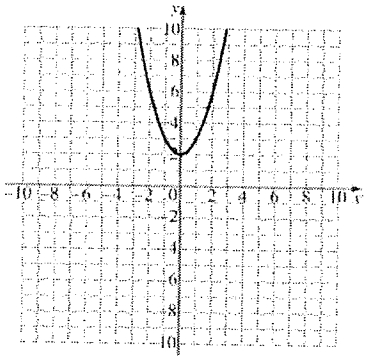
1. Quadratic Equation
2. $\pm\sqrt{b}$
3. Completing the Square
4. $\left(\frac{b}{2}\right)^2$
5. 6 and – 6
6. – 3 and – 11
7. $\pm\sqrt{5}$
8. $-2\pm\sqrt{10}$
9. $3\pm 3i$
10. $4\pm 2\sqrt{3}i$
11. $-3\pm\sqrt{7}$
12. $-4\pm\sqrt{22}$
13. $\frac{-3\pm i\sqrt{11}}{2}$
14. $\frac{-3\pm\sqrt{21}}{3}$
15. $-3\pm\sqrt{3}i$
16. $-2\pm 2i$
17. $-\frac{3}{2}\pm\frac{\sqrt{13}i}{2}$
18. 20%
19. 40%
20. $24\sqrt{2}$
21. $6\sqrt{2}$

Section 8.2

1. – 15 and – 1
2. – 9 and – 5
3. $\frac{-3\pm\sqrt{57}}{4}$
4. $\frac{-6\pm 4\sqrt{6}}{3}$
5. $-\frac{1}{4}\pm\frac{\sqrt{39}}{4}i$
6. $\frac{-1\pm\sqrt{23}i}{4}$
7. Two real solutions
8. Two complex solutions
9. Two complex solutions
10. Two real solutions
11. 14 ft
12. $\sqrt{31}-3$ and $\sqrt{31}+3$
13. $\frac{-\sqrt{5}\pm\sqrt{17}}{2}$
14. $\frac{\sqrt{6}\pm 3\sqrt{2}i}{6}$

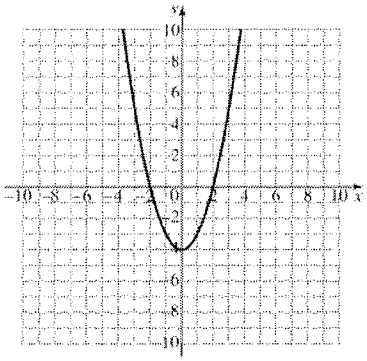
Section 8.5

1. axis of symmetry at x = 0 Vertex $(0,2)$

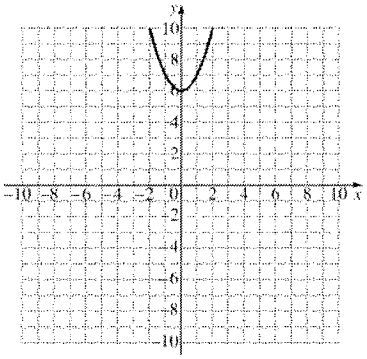


Answers

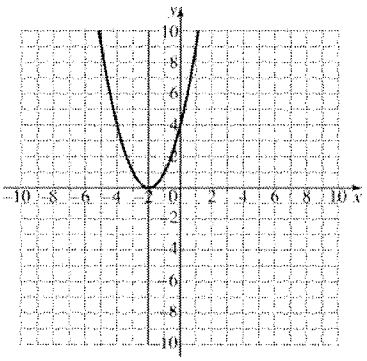
2. axis of symmetry at x = 0 Vertex $(0,-4)$



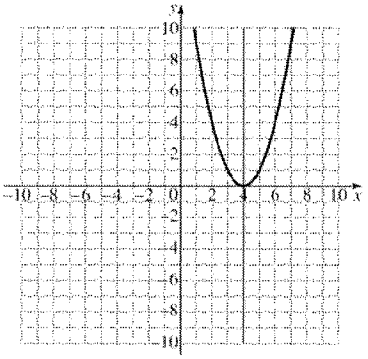
3. axis of symmetry at x = 0 Vertex $(0,6)$



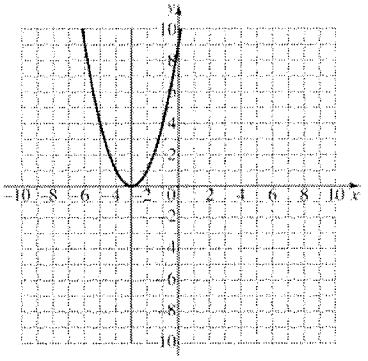
4. axis of symmetry at $x=-2$ Vertex $(-2,0)$



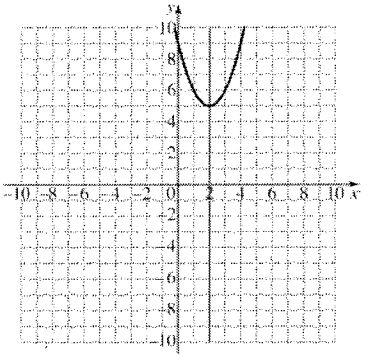
5. axis of symmetry at $x=4$ Vertex $(4,0)$



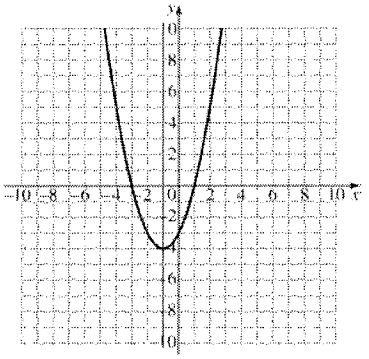
6. axis of symmetry at $x=-3$ Vertex $(-3,0)$



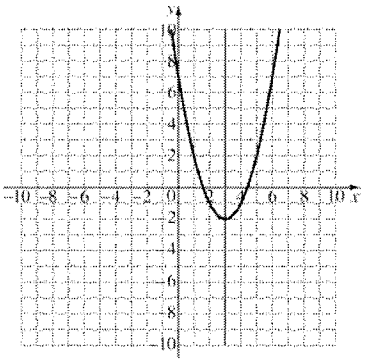
7. axis of symmetry at $x=2$ Vertex $(2,5)$



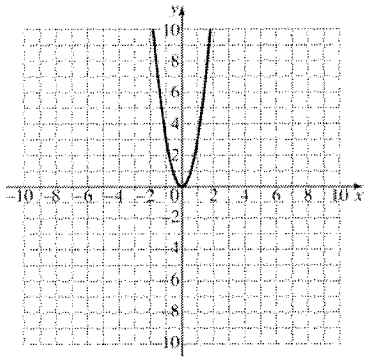
8. axis of symmetry at $x=-1$ Vertex $(-1,-4)$



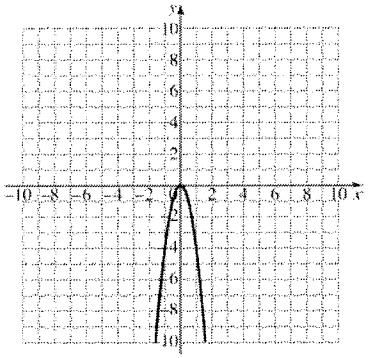
9. axis of symmetry at $x=3$ Vertex $(3,-2)$



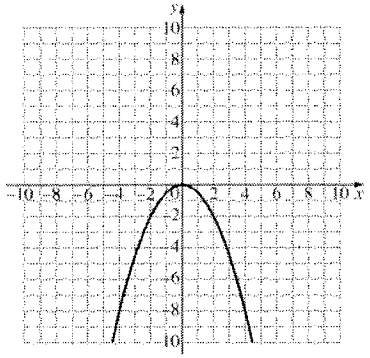
10. axis of symmetry at $x=0$ Vertex $(0,0)$



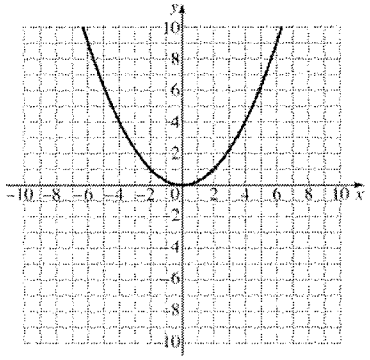
11. axis of symmetry at $x=0$ Vertex $(0,0)$



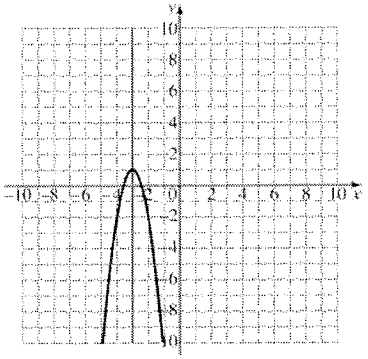
12. axis of symmetry at $x=0$ Vertex $(0,0)$



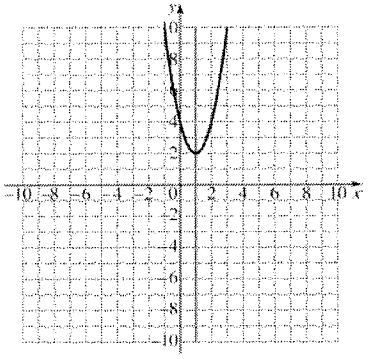
13. axis of symmetry at $x=0$ Vertex $(0,0)$



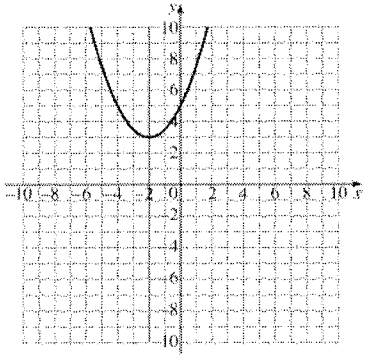
14. axis of symmetry at $x=-3$ Vertex $(-3,1)$



15. axis of symmetry at $x=1$ Vertex $(1,2)$



16. axis of symmetry at $x=-2$ Vertex $(-2,3)$



17. $f(x)=-2(x-4)^2-6$

18. $f(x)=-2(x+7)^2+9$

Section 8.6

1. $f(x)=(x-1)^2-16$; $(1,-16)$
2. $f(x)=(x+3)^2+8$; $(-3,8)$
3. $f(x)=\left(x+\frac{5}{2}\right)^2+\frac{47}{4}$; $\left(-\frac{5}{2},\frac{47}{4}\right)$
4. $f(x)=2\left(x+\frac{3}{2}\right)^2-\frac{31}{2}$; $\left(-\frac{3}{2},-\frac{31}{2}\right)$

Answers

5. $f(x)=-3(x-2)^2+20$; $(2,20)$
6. $f(x)=-(x-4)^2+7$; $(4,7)$
7. $-\frac{b}{2a}$
8. Plug $-\frac{b}{2a}$ in for x into the function and solve for y.
9. $(-2,3)$
10. $\left(-\frac{3}{2},\frac{9}{2}\right)$
11. $(1,-16)$
12. $(2,-1)$
13. 144 ft

14a. 210 candles
14b. $44,100
15. 1.8; minimum
16. 0.93; maximum