Chapter 8 Quadratic Functions and Equations

8.1 Quadratic Functions and Their Graphs

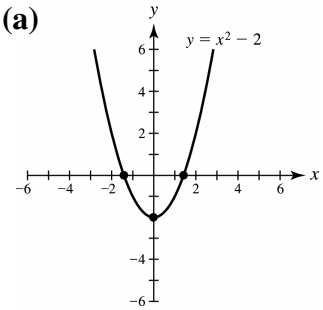
1. quadratic function

3. axis of symmetry

5. **a.** vertex; axis of symmetry
b. upward; downward
c. wider
d. narrower

Graphs of Quadratic Functions

1. **(a)**

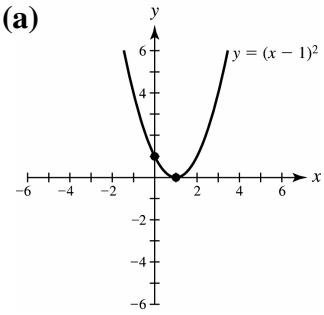


(b) $(0,-2)$

(c) $x=0$

(d) increasing: $x \geq 0$
decreasing: $x \leq 0$

3. **(a)**

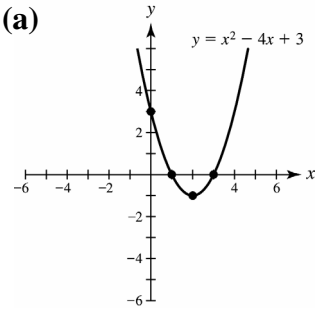


(b) $(1,0)$

(c) $x=1$

(d) increasing: $x \geq 1$
decreasing: $x \leq 1$

5. **(a)**



(b) $(2,-1)$

(c) $x=2$

(d) increasing: $x \geq 2$
decreasing: $x \leq 2$

7. $(1,2)$

9. $(2,5)$

11. $(0,-5)$

13. **(a)** 9
(b) increasing: $x \leq -2$
decreasing: $x \geq -2$

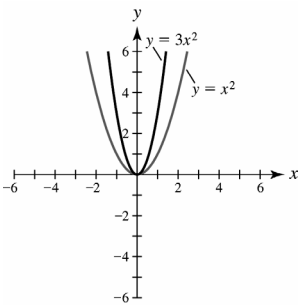
15. **(a)** $\frac{1}{4}$

(b) increasing: $x \leq -\frac{3}{2}$

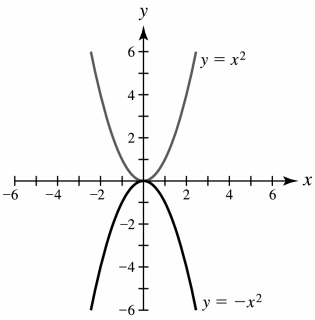
decreasing: $x \geq -\frac{3}{2}$

Basic Transformations of Graphs

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

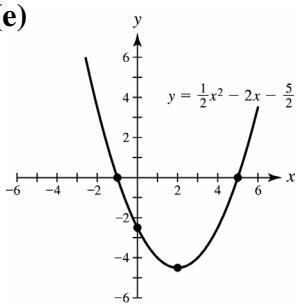


19. $f(x) = -x^2$

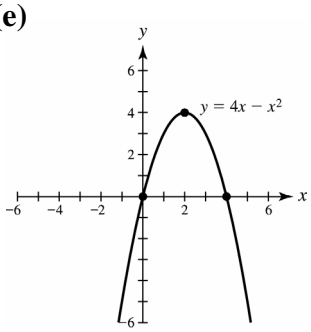


More About Graphing Quadratic Functions (Optional)

21. **(a)** opens upward
(b) wider
(c) $x = 2; \left(2, -\frac{9}{2}\right)$
(d) y-int: $-\frac{5}{2}$
x-int: $-1, 5$
(e)



23. **(a)** opens downward
(b) same
(c) $x = 2; (2, 4)$
(d) y-int: 0
x-int: 0, 4
(e)



Min-Max Applications

25. **(a)** 4 feet
(b) 148 feet

27. **(a)** $f(x) = x(30 - 0.50x)$
(b) 30 shirts

29. **(a)** $f(x) = x(40 - x)$
(b) 20 ft by 20 ft

8.2 Parabolas and Modeling

1. translations

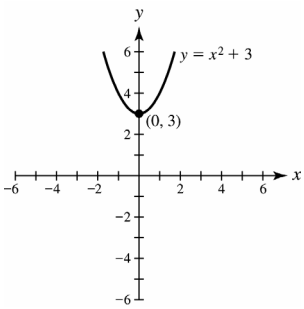
3. $y = x^2 - k$

5. $y = (x + h)^2$

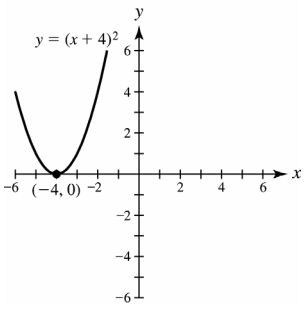
7. completing the square

Vertical and Horizontal Translations

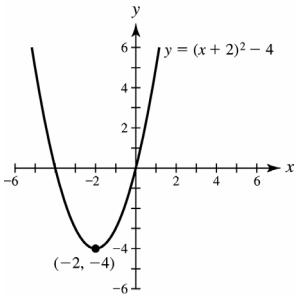
1.



3.

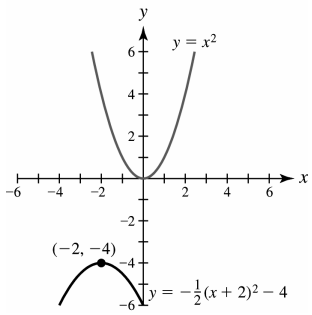


5.

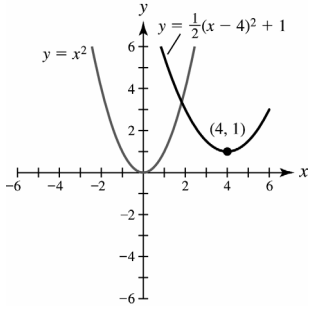


Vertex Form

7.



9.



11. **(a)** $y = -2(x-1)^2 + 1$

(b) $y = -2x^2 + 4x - 1$

13. **(a)** $y = -(x+3)^2 - 1$

(b) $y = -x^2 - 6x - 10$

15. **(a)** $y = -\frac{1}{2}(x+5)^2 - 3$

(b) $y = -\frac{1}{2}x^2 - 5x - \frac{31}{2}$

17. **(a)** $y = \left(x + \frac{5}{2}\right)^2 - \frac{33}{4}$

(b) $\left(-\frac{5}{2}, -\frac{33}{4}\right)$

19. **(a)** $y = -2\left(x - \frac{3}{2}\right)^2 + \frac{1}{2}$

(b) $\left(\frac{3}{2}, \frac{1}{2}\right)$

8.3 Quadratic Equations

1. quadratic equation

Basics of Quadratic Equations

1. No real solutions

3. 1

5. No real solutions

The Square Root Property

7. $\pm 2\sqrt{2}$

9. $-7, 1$

11. $\sqrt{5}$ sec ≈ 2.2 sec

Completing the Square

13. **(a)** $\frac{9}{4}$

(b) $\left(x+\frac{3}{2}\right)^2$

15. **(a)** $\frac{1}{4}$

(b) $\left(x-\frac{1}{2}\right)^2$

17. $-2\pm\sqrt{7}$

19. $\frac{5\pm\sqrt{17}}{2}$

21. $\frac{5\pm\sqrt{57}}{4}$

23. $\frac{1\pm\sqrt{3}}{3}$

Solving an Equation for a Variable

25. $a=\sqrt{c^2-b^2}$

27. $s=\pm\sqrt{r+4}$

Applications of Quadratic Equations

29. 20 mph

8.4 The Quadratic Formula

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

Solving Quadratic Equations

1. $\frac{-1\pm\sqrt{61}}{6}$

3. $-1\pm\sqrt{5}$

5. 4

7. No real solutions

9. No real solutions

11. about 3 seconds

The Discriminant

13. one real solution; $\frac{2}{3}$

15. two real solutions; $\frac{-5\pm\sqrt{13}}{6}$

17. **(a)** $a<0$
(b) -1, 5
(c) positive

Quadratic Equations Having Complex Solutions

19. $\pm i\sqrt{7}$

21. $\pm 5i$

23. $-\frac{1}{4}\pm i\frac{\sqrt{31}}{4}$

25. $\frac{3}{2}\pm i\frac{\sqrt{15}}{2}$

27. $1\pm i$

29. $3\pm 4i$

8.5 Quadratic Inequalities

1. quadratic inequality

Basic Concepts

1. yes

3. no

Graphical and Numerical Solutions

5.

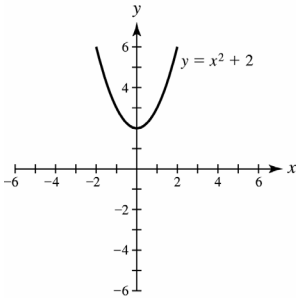
x	y
−4	6
−3	0
−2	−4
−1	−6
0	−6
1	−4
2	0
3	6

7. $(-\infty,-3)\cup(2,\infty)$

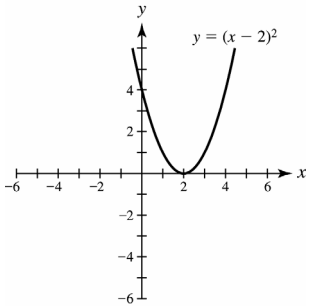
9. $[-1,1]$

11. $(-\infty,-4]\cup[4,\infty)$

13. No real solutions



15. $(-\infty,2)\cup(2,\infty)$



Symbolic Solutions

17. $[2,5]$

19. $[-6,1]$

8.6 Equations in Quadratic Form

Higher Degree Polynomial Equations

1. $\pm\sqrt{2}, \pm 2$

3. $0, \pm 2$

Equations Having Rational Exponents

5. $-1, \frac{1}{4}$

7. $-\frac{3}{4}, \frac{2}{3}$

9. $1, 16$

11. $-\frac{1}{8}, -8$

Equations Having Complex Solutions

13. $\pm 3, \pm 3i$

15. $0, \pm 2i$

17. $-\frac{1}{4} \pm i\frac{\sqrt{7}}{4}$

19. $\frac{1}{2} \pm i\frac{\sqrt{3}}{2}$