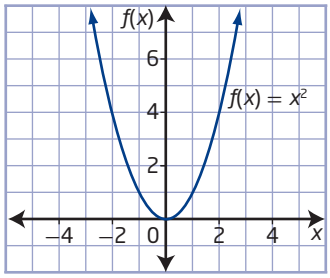
Check Your Understanding

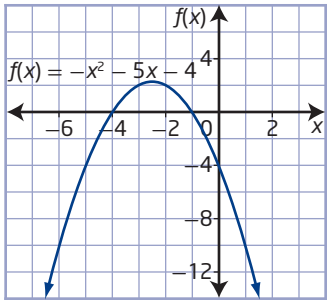
Practise

1. How many x-intercepts does each quadratic function graph have?

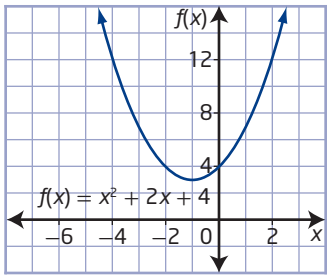
a)



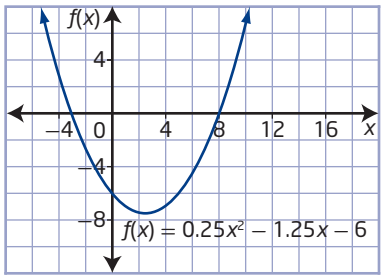
b)



c)



d)



2. What are the roots of the corresponding quadratic equations represented by the graphs of the functions shown in #1? Verify your answers.

3. Solve each equation by graphing the corresponding function.

a) $0 = x^2 - 5x - 24$

b) $0 = -2r^2 - 6r$

c) $h^2 + 2h + 5 = 0$

d) $5x^2 - 5x = 30$

e) $-z^2 + 4z = 4$

f) $0 = t^2 + 4t + 10$

4. What are the roots of each quadratic equation? Where integral roots cannot be found, estimate the roots to the nearest tenth.

a) $n^2 - 10 = 0$

b) $0 = 3x^2 + 9x - 12$

c) $0 = -w^2 + 4w - 3$

d) $0 = 2d^2 + 20d + 32$

e) $0 = v^2 + 6v + 6$

f) $m^2 - 10m = -21$

Apply

5. In a Canadian Football League game, the path of the football at one particular kick-off can be modelled using the function $h(d) = -0.02d^2 + 2.6d - 66.5$, where h is the height of the ball and d is the horizontal distance from the kicking team's goal line, both in yards. A value of $h(d) = 0$ represents the height of the ball at ground level. What horizontal distance does the ball travel before it hits the ground?

6. Two numbers have a sum of 9 and a product of 20.

a) What single-variable quadratic equation in the form $ax^2 + bx + c = 0$ can be used to represent the product of the two numbers?

b) Determine the two numbers by graphing the corresponding quadratic function.

12. Examples:

a) The vertex form of the function $C(v) = 0.004v^2 - 0.62v + 30$ is $C(v) = 0.004(v - 77.5)^2 + 5.975$. The most efficient speed would be 77.5 km/h and will produce a fuel consumption of 5.975 L/100 km.

b) By completing the square and determining the vertex of the function, you can determine the most efficient fuel consumption and at what speed it occurs.

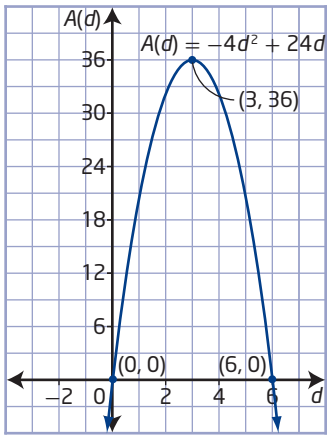
13. a) The maximum height of the flare is 191.406 25 m, 6.25 s after being shot.

b) Example: Complete the square to produce the vertex form and use the value of q to determine the maximum height and the value of p to determine when it occurs, or use the fact that the x-coordinate of the vertex of a quadratic function in standard form is $x = -\frac{b}{2a}$ and substitute this value into the function to find the corresponding y-coordinate, or graph the function to find the vertex.

14. a) $A(d) = -4d^2 + 24d$

b) Since the function is a polynomial of degree two, it satisfies the definition of a quadratic function.

c)



Example: By completing the square, determine the vertex, find the y-intercept and its corresponding point, plot the three points, and join them with a smooth curve.

d) (3, 36); the maximum area of 36 m² happens when the fence is extended to 3 m from the building.

e) domain: $\{d \mid 0 \le d \le 6, d \in \mathrm{R}\}$, range: $\{A \mid 0 \le A \le 36, A \in \mathrm{R}\}$; negative distance and area do not have meaning in this situation.

f) Yes; the maximum value is 36 when d is 3, and the minimum value is 0 when d is 0 or 6.

g) Example: Assume that any real-number distance can be used to build the fence.

15. a) $f(x) = -0.03x^2$

b) $f(x) = -0.03x^2 + 12$

c) $f(x) = -0.03(x + 20)^2 + 12$

d) $f(x) = -0.03(x - 28)^2 - 3$

16. a) $R = (2.25 - 0.05x)(120 + 8x)$

b) Expand and complete the square to get the vertex form of the function. A price of $1.50 gives the maximum revenue of $360.

c) Example: Assume that any whole number of price decreases can occur.

Chapter 4 Quadratic Equations

4.1 Graphical Solutions of Quadratic Equations, pages 215 to 217

1. a) 1 **b)** 2 **c)** 0 **d)** 2

2. a) 0 **b)** −1 and −4
c) none **d)** −3 and 8

3. a) $x = -3, x = 8$ **b)** $r = -3, r = 0$
c) no real solutions **d)** $x = 3, x = -2$
e) $z = 2$ **f)** no real solutions

4. a) $n \approx -3.2, n \approx 3.2$ **b)** $x = -4, x = 1$
c) $w = 1, w = 3$ **d)** $d = -8, d = -2$
e) $v \approx -4.7, v \approx -1.3$ **f)** $m = 3, m = 7$

5. 60 yd

6. a) $-x^2 + 9x - 20 = 0$ or $x^2 - 9x + 20 = 0$

b) 4 and 5

7. a) $x^2 + 2x - 168 = 0$

b) $x = 12$ and $x = 14$ or $x = -12$ and $x = -14$

8. a) Example: Solving the equation leads to the distance from the firefighter that the water hits the ground. The negative solution is not part of this situation.

b) 12.2 m

c) Example: Assume that aiming the hose higher would not reach farther. Assume that wind does not affect the path of the water.

9. a) Example: Solving the equation leads to the time that the fireworks hit the ground. The negative solution is not part of the situation.

b) 6.1 s

10. a) $-0.75d^2 + 0.9d + 1.5 = 0$ **b)** 2.1 m

11. a) $-2d^2 + 3d + 10 = 0$ **b)** 3.1 m

12. a) first arch: $x = 0$ and $x = 84$, second arch: $x = 84$ and $x = 168$, third arch: $x = 168$ and $x = 252$

b) The zeros represent where the arches reach down to the bridge deck.

c) 252 m