

Key CONCEPTS

To solve a quadratic equation by factoring,

- write the equation in the form $ax^2 + bx + c = 0$
- factor $ax^2 + bx + c$
- use the zero product property
- solve the two resulting equations to find the roots
- check your solutions

Communicate Your Understanding

- If the product of two factors is zero, what must be true of the factors?
- Can $x(x - 3) = 0$ be solved by dividing both sides of the equation by x ? Explain.
- Describe how you would solve each equation by factoring.
 - $x^2 - 2x - 15 = 0$
 - $2x^2 - x = 1$
 - $2x^2 + 3x = 0$
 - $x^2 = 49$
 - $\frac{x^2}{4} + \frac{x}{2} = 2$

Practice

A

1. Solve.

- | | |
|--------------------------|---------------------------|
| a) $(x + 1)(x + 2) = 0$ | b) $(x + 3)(x - 1) = 0$ |
| c) $(x - 5)(x - 5) = 0$ | d) $(x - 2)(x + 3) = 0$ |
| e) $(2x + 1)(x - 3) = 0$ | f) $(3x + 4)(2x - 1) = 0$ |
| g) $x(x + 9) = 0$ | h) $x(4 - x) = 0$ |

2. Write each equation in the form $ax^2 + bx + c = 0$.

- | | | |
|--------------------|---------------------|-----------------------|
| a) $x^2 - 6 = 2x$ | b) $2y^2 - 3y = -2$ | c) $3(z^2 + 1) = -4z$ |
| d) $(x + 1)^2 = 4$ | e) $4m^2 = 3m$ | f) $2(x^2 - 1) = x$ |

3. Write each equation in the form $ax^2 + bx + c = 0$.

- | | | |
|--|--------------------------------------|--|
| a) $\frac{x^2}{2} - \frac{3x}{2} = -1$ | b) $\frac{x^2}{2} + \frac{x}{3} = 1$ | c) $\frac{x^2}{8} + \frac{5x}{4} = -2$ |
|--|--------------------------------------|--|

4. Solve and check.

- | | | |
|------------------------|------------------------|----------------------|
| a) $n^2 + 7n + 12 = 0$ | b) $y^2 - 3y + 2 = 0$ | c) $x^2 - x - 6 = 0$ |
| d) $a^2 - 8a + 16 = 0$ | e) $0 = p^2 + 2p - 35$ | f) $m^2 - 7m = 18$ |

5. Solve and check.

- | | | |
|------------------------|------------------------|-------------------------|
| a) $2a^2 + 3a - 2 = 0$ | b) $3s^2 - 4s + 1 = 0$ | c) $2t^2 + 11t + 5 = 0$ |
| d) $3x^2 + 7x - 6 = 0$ | e) $0 = 4m^2 - 4m - 3$ | f) $10y^2 - 16y = -6$ |

6. Solve and check.

- | | | |
|--------------------|---------------------|--------------------|
| a) $x^2 + 2x = 0$ | b) $y^2 - 3y = 0$ | c) $3m^2 + 2m = 0$ |
| d) $5n^2 - 8n = 0$ | e) $5t^2 - 20t = 0$ | f) $0 = 4x + 3x^2$ |

7. Solve.

a) $x^2 - 25 = 0$

c) $n^2 + 4 = 20$

e) $1.3 = x^2 + 0.3$

g) $2x^2 - 32 = 0$

i) $4x^2 + 5 = 21$

b) $y^2 + 12 = 48$

d) $m^2 - 7.5 = 92.5$

f) $1.25 + z^2 = 1.5$

h) $3x^2 + 2 = 29$

j) $125 = 3y^2 - 22$

8. Solve.

a) $x^2 - 2x - 11 = 4$

c) $3p^2 + 8p - 9 = 2p$

e) $5r^2 = 2r$

g) $(a + 4)^2 = 4$

b) $w^2 + 30 = 9 + 10w$

d) $4t^2 = 12t - 9$

f) $(x - 6)^2 - 8x = 0$

h) $(b - 3)^2 = 9$

9. Solve.

a) $x^2 + \frac{9x}{2} - \frac{5}{2} = 0$

c) $\frac{x^2}{6} + 2x + \frac{10}{3} = 0$

e) $\frac{x^2}{2} + \frac{7x}{4} = 0$

b) $\frac{x^2}{4} - x - 3 = 0$

d) $\frac{x^2}{9} - \frac{x}{3} = 2$

f) $\frac{x^2}{4} - \frac{x}{3} = \frac{1}{3}$

10. Solve.

a) $\frac{z^2 - 1}{5} = 7$

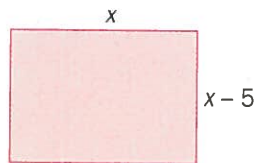
c) $\frac{3y^2 + 7}{2} = 5$

b) $2 = \frac{4 + x^2}{10}$

d) $\frac{1 - 5n^2}{4} = -31$

Applications and Problem Solving

11. **Measurement** The area of the rectangle shown in the diagram is 36 cm^2 . What are its dimensions?



12. **Framing a photograph** A photograph measuring 12 cm by 8 cm is to be surrounded by a mat before framing. The width of the mat is to be the same on all sides of the photograph. The area of the mat is to equal the area of the photograph. Find the width of the mat.

B

13. **Numbers** Two numbers differ by 6. If the numbers are squared and then added, the result is 146. What are the numbers?

14. **Integers** Two consecutive integers are added. The square of their sum is 361. What are the integers?

Chapter 5

Getting Started p. 268

1. $s^2 = 16$ 2. $s = \pm 4$ 3. $s = -4$ because wave cannot have negative speed. 4. $s = 4$ m/s 5. a) $s = 2$ m/s
b) $s = 6$ m/s c) $s = 1.2$ m/s

Review of Prerequisite Skills p. 269

1. a) 15 b) 30 c) 30 d) 3 e) 0 f) 31 g) 93 h) 36
2. a) -7 b) -22 c) 48 d) 11 e) 17 f) 6 g) 36 h) -39
3. a) $x = -16$ b) $y = -22$ c) $x = -3$ d) $w = 2$ e) $x = 1$
f) $t = 4$ g) $x = 2$ h) $x = \frac{1}{2}$ i) $x = -6$ j) $x = 6$
4. a) $4x(x+2)$ b) $3x(x-1)$ c) $2(3x^2+2x-4)$
d) $5(x^2-4x+2)$ 5. a) $(x+3)(x+4)$ b) $(x-5)(x-2)$
c) $(y-4)(y+2)$ d) not possible e) $(r+4)(r-4)$
f) $(w+5)(w-5)$ g) $(z+5)^2$ h) $(x-7)^2$ i) $(t-4)(t+3)$
j) $(w+6)(w-4)$ k) not possible l) $(w+11)(w-8)$
m) $(x-9)(x+5)$ n) $(y-1)^2$ o) $(z+10)(z-3)$
p) $(t+7)(t+4)$ q) $(w-10)(w-4)$ r) $(x+9)(x-3)$
s) $(y-5)(y+4)$ 6. a) $(2x+1)(x+3)$
b) $(3t+1)(2t-3)$ c) $(2y-5)(y-1)$ d) $(5x+2)(2x-1)$
e) not possible f) $(2x+3)(2x-3)$ g) $(2x-3)^2$
h) $(2w+5)(w+2)$ i) $(3t-5)(t-2)$ j) $(3x+4)(x-5)$
k) $(3y+1)^2$ l) not possible m) $(3w-1)(2w+1)$
n) $(2x+5)^2$ o) $(5n+1)(5n-1)$ 7. a) ± 7 b) not possible
c) ± 11 d) ± 9 e) ± 4 f) ± 6 g) ± 8 h) ± 8 i) ± 9
j) ± 5 k) ± 10 l) ± 5

Section 5.1 pp. 275-277

- Practice 1. a) $x = -3$ or $x = 2$ b) $x = 1$ or $x = 4$
c) $x = 2$ or $x = -2$ d) no real roots e) $x = 2$ or $x = -1$
f) $x = -4$ or $x = 1$ g) $x = -3$ h) $x = 0$ or $x = 5$
2. a) $x = 0$ or $x = -3$ b) $x = -4$ or $x = 1$ c) $x = 0$ or
 $x = 3$ d) $x = 3$ or $x = -3$ e) no real roots f) $x = -5$ or
 $x = 1$ g) $x = 2$ or $x = -1$ h) $x = 1$ or $x = 2$ i) no real
roots j) $x = 2$ 3. a) $x = -1$ or $x = 1.5$ b) $x = -0.5$ or
 $x = 3$ c) no real roots d) $x = -0.5$ e) $x = 0$ or $x = 2.5$
f) $x = -2.9$ or $x = 0.6$ g) $x = -0.5$ or $x = 1.3$ h) $a = 2.7$
i) $x = -0.6$ or $x = 0.4$ j) $x = -0.8$ or $x = 0.5$ k) $x = -1.6$
or $x = 3.6$ l) no real roots m) $x = 0$ or $x = -3.3$
n) $n = -1.7$

- Applications and Problem Solving 4. $w = 8$ m, $l = 9$ m
5. 45 m 6. $w = 3$ cm, $l = 11$ cm 7. 6 m, 8 m 8. 5 cm,
12 cm 9. 5 m 10. 35 m \times 65 m 11. $w = 14$ m,
 $l = 26$ m 12. $w = 4.8$ cm, $l = 6.4$ cm 13. 14, 16 or
-16, -14 14. $w = 9.1$ m, $l = 18.2$ m 15. 7, 8, 9
16. a) $x = 3$ or $x = 1$ b) $x = 1$ or $x = -3$ c) no real roots
d) $x = 3$ e) $x = 1$ f) $x = -\frac{1}{2}$ or $x = -\frac{3}{2}$ g) $p = 1$ h) $q = 1$
or $q = -7$ 17. a) $x^2 - x - 12 = 0$ b) $x = 4$ or $x = -3$
c) The roots of the equation are the negatives of the

two numerical terms in the factored for equation. 18. a) $c < 0$ b) $c = 0$ c) $c > 0$ 1
b) $c < 49$ c) $c > 49$ 20. a) $b = \pm 10$ b) $b >$
c) $-10 < b < 10$ 21. a) $b = 0$ b) $x = 0$ alw
22. a) $x \geq 4$ or $x \leq -4$ b) $-5 \leq x \leq 5$

Modelling Math p. 277

20 m

Section 5.2 pp. 282-285

Practice 1. a) $x = -1$ or $x = -2$ b) $x = -3$ or $x = 1$

c) $x = 5$ d) $x = 2$ or $x = -3$ e) $x = -\frac{1}{2}$ or $x = 3$

f) $x = -\frac{4}{3}$ or $x = \frac{1}{2}$ g) $x = 0$ or $x = -9$ h) $x = 0$ or $x = 4$

2. a) $x^2 - 2x - 6 = 0$ b) $2y^2 - 3y + 2 = 0$

c) $3z^2 + 4z + 3 = 0$ d) $x^2 + 2x - 3 = 0$ e) $4m^2 - 3m = 0$

f) $2x^2 - x - 2 = 0$ 3. a) $x^2 - 3x + 2 = 0$

b) $3x^2 + 2x - 6 = 0$ c) $x^2 + 10x + 16 = 0$ 4. a) $n = -3$ or
 $n = -4$ b) $y = 1$ or $y = 2$ c) $x = -2$ or $x = 3$ d) $a = 4$

e) $p = -7$ or $p = 5$ f) $m = -2$ or $m = 9$

5. a) $a = -2$ or $a = \frac{1}{2}$ b) $s = 1$ or $s = \frac{1}{3}$

c) $t = -5$ or $t = -\frac{1}{2}$ d) $x = \frac{2}{3}$ or $x = -3$

e) $m = -\frac{1}{2}$ or $m = \frac{3}{2}$ f) $y = 1$ or $y = \frac{3}{5}$

6. a) $x = 0$ or $x = -2$ b) $y = 0$ or $y = 3$

c) $m = 0$ or $m = -\frac{2}{3}$ d) $n = 0$ or $n = \frac{8}{5}$ e) $t = 0$ or $t = 4$

f) $x = 0$ or $x = -\frac{4}{3}$ 7. a) $x = 5$ or $x = -5$

b) $y = 6$ or $y = -6$ c) $n = 4$ or $n = -4$

d) $m = 10$ or $m = -10$ e) $x = 1$ or $x = -1$

f) $z = 0.5$ or $z = -0.5$ g) $x = 4$ or $x = -4$

h) $x = 3$ or $x = -3$ i) $x = 2$ or $x = -2$ j) $y = 7$ or $y = -7$

8. a) $x = -3$ or $x = 5$ b) $w = 3$ or $w = 7$

c) $p = -3$ or $p = 1$ d) $t = \frac{3}{2}$ e) $r = 0$ or $r = \frac{2}{5}$

f) $x = 2$ or $x = 18$ g) $a = -2$ or $a = -6$ h) $b = 0$ or $b = 6$

9. a) $x = \frac{1}{2}$ or $x = -5$ b) $x = -2$ or $x = 6$

c) $x = -2$ or $x = -10$ d) $x = -3$ or $x = 6$

e) $x = 0$ or $x = -\frac{7}{2}$ f) $x = -\frac{2}{3}$ or $x = 2$

10. a) $z = 6$ or $z = -6$ b) $x = 4$ or $x = -4$

c) $y = 1$ or $y = -1$ d) $n = 5$ or $n = -5$

Applications and Problem Solving 11. 9 cm \times 4 cm

12. 2 cm 13. 11, 5 or -5, -11 14. 9, 10 or -10, -9

15. 16, 18 or -18, -16 16. 0 or -10 17. 12 or -12