
 Answers to Unit 12

SECTION 1

Pages 411–412

Example 2

$$\begin{aligned}
 2x^2 &= (x + 2)(x + 3) \\
 2x^2 &= x^2 + 5x + 6 \\
 x^2 - 5x - 6 &= 0 \\
 (x + 1)(x - 6) &= 0 \\
 x + 1 = 0 & \qquad x - 6 = 0 \\
 x = -1 & \qquad x = 6
 \end{aligned}$$

The solutions are -1 and 6 .**Example 4**

$$\begin{aligned}
 x^2 + 81 &= 0 \\
 x^2 &= -81 \\
 \sqrt{x^2} &= \sqrt{-81} \\
 \sqrt{-81} &\text{ is not a real number.}
 \end{aligned}$$

The equation has no real number solution.

Pages 413–414

1. The solutions are -5 and 3 . 3. The solutions are 1 and 3 . 5. The solutions are -1 and -2 . 7. The solution is 3 .
 9. The solutions are 0 and $-\frac{2}{3}$. 11. The solutions are -2 and 5 . 13. The solutions are $\frac{2}{3}$ and 1 . 15. The solutions are -3 and $\frac{1}{3}$.
 17. The solution is $\frac{2}{3}$. 19. The solutions are $-\frac{1}{2}$ and $\frac{3}{2}$. 21. The solution is $\frac{1}{2}$.
 23. The solutions are -3 and 3 . 25. The solutions are $-\frac{1}{2}$ and $\frac{1}{2}$. 27. The solutions are -3 and 5 . 29. The solutions are 1 and 5 .
 31. The solutions are -1 and $\frac{13}{2}$. 33. The solutions are 7 and -7 . 35. The solutions are 8 and -8 .
 37. The solutions are $\frac{8}{3}$ and $-\frac{8}{3}$. 39. The solutions are $\frac{5}{2}$ and $-\frac{5}{2}$. 41. The solutions are $\frac{8}{5}$ and $-\frac{8}{5}$.
 43. The equation has no real number solution. 45. The solutions are $4\sqrt{3}$ and $-4\sqrt{3}$. 47. The solutions are 5 and -9 .
 49. The solutions are 8 and -2 . 51. The solutions are $\frac{3}{2}$ and $-\frac{15}{2}$. 53. The solutions are $\frac{26}{9}$ and $\frac{10}{9}$.
 55. The solutions are $-5 + 5\sqrt{2}$ and $-5 - 5\sqrt{2}$. 57. The equation has no real number solution. 59. The solutions are $-\frac{3}{4} + 2\sqrt{3}$ and $-\frac{3}{4} - 2\sqrt{3}$.

SECTION 2

Pages 415–418

Example 2

$$3x^2 - 6x - 2 = 0$$

$$3x^2 - 6x = 2$$

$$\frac{1}{3}(3x^2 - 6x) = \frac{1}{3} \cdot 2$$

$$x^2 - 2x = \frac{2}{3}$$

Complete the square.

$$x^2 - 2x + 1 = \frac{2}{3} + 1$$

$$(x - 1)^2 = \frac{5}{3}$$

$$\sqrt{(x - 1)^2} = \sqrt{\frac{5}{3}}$$

$$x - 1 = \pm \sqrt{\frac{5}{3}} = \pm \frac{\sqrt{15}}{3}$$

$$x - 1 = \frac{\sqrt{15}}{3} \quad x - 1 = -\frac{\sqrt{15}}{3}$$

$$x = 1 + \frac{\sqrt{15}}{3} \quad x = 1 - \frac{\sqrt{15}}{3}$$

$$= \frac{3 + \sqrt{15}}{3} \quad = \frac{3 - \sqrt{15}}{3}$$

The solutions are $\frac{3 + \sqrt{15}}{3}$ and $\frac{3 - \sqrt{15}}{3}$.**Example 4**

$$x^2 + 6x + 12 = 0$$

$$x^2 + 6x = -12$$

$$x^2 + 6x + 9 = -12 + 9$$

$$(x + 3)^2 = -3$$

$$\sqrt{(x + 3)^2} = \sqrt{-3}$$

 $\sqrt{-3}$ is not a real number.

The quadratic equation has no real number solution.

Example 6

$$x^2 + 8x + 8 = 0$$

$$x^2 + 8x = -8$$

$$x^2 + 8x + 16 = -8 + 16$$

$$(x + 4)^2 = 8$$

$$\sqrt{(x + 4)^2} = \sqrt{8}$$

$$x + 4 = \pm \sqrt{8} = \pm 2\sqrt{2}$$

$$x + 4 = 2\sqrt{2} \quad x + 4 = -2\sqrt{2}$$

$$x = -4 + 2\sqrt{2} \quad x = -4 - 2\sqrt{2}$$

$$= -4 + 2(1.414) \quad = -4 - 2(1.414)$$

$$= -4 + 2.828 \quad = -4 - 2.828$$

$$= -1.172 \quad = -6.828$$

The solutions are approximately -1.172 and -6.828 .

Pages 419–420

1. The solutions are 1 and -3 . 3. The solutions are 8 and -2 . 5. The solution is 2. 7. The quadratic equation has no real number solution. 9. The solutions are -1 and -4 . 11. The solutions are -8 and 1. 13. The solutions are $-2 + \sqrt{3}$ and $-2 - \sqrt{3}$. 15. The solutions are $-3 + \sqrt{14}$ and $-3 - \sqrt{14}$. 17. The solutions are $1 + \sqrt{2}$ and $1 - \sqrt{2}$. 19. The solutions are $\frac{-3 + \sqrt{13}}{2}$ and $\frac{-3 - \sqrt{13}}{2}$. 21. The solutions are 2 and 1. 23. The solutions are $\frac{-1 + \sqrt{13}}{2}$ and $\frac{-1 - \sqrt{13}}{2}$. 25. The solutions are $-5 + 4\sqrt{2}$ and $-5 - 4\sqrt{2}$. 27. The solutions are $\frac{3 + \sqrt{29}}{2}$ and $\frac{3 - \sqrt{29}}{2}$. 29. The solutions are $\frac{1 + \sqrt{17}}{2}$ and $\frac{1 - \sqrt{17}}{2}$. 31. The quadratic equation has no real number solution. 33. The solutions are 1 and $\frac{1}{2}$. 35. The solutions are -3 and $\frac{1}{2}$. 37. The solutions are 2 and $\frac{3}{2}$. 39. The solutions are 1 and $-\frac{1}{2}$. 41. The solutions are -2 and $\frac{1}{3}$. 43. The solutions are -2 and $-\frac{2}{3}$. 45. The solutions are $\frac{1}{2}$ and $-\frac{3}{2}$. 47. The solutions are $\frac{1}{3}$ and $-\frac{3}{2}$. 49. The solutions are $-\frac{1}{2}$ and $\frac{4}{3}$. 51. The solutions are $\frac{1 + \sqrt{2}}{2}$ and $\frac{1 - \sqrt{2}}{2}$.

- $\frac{1 - \sqrt{2}}{2}$. **53.** The solutions are $\frac{2 + \sqrt{5}}{2}$ and $\frac{2 - \sqrt{5}}{2}$. **55.** The solutions are 2 and 4. **57.** The solutions are $1 + \sqrt{6}$ and $1 - \sqrt{6}$. **59.** The solutions are approximately -4.193 and 1.193 . **61.** The solutions are approximately 2.766 and -1.266 . **63.** The solutions are approximately -1.652 and 0.152 .

SECTION 3 Pages 421–422

Example 2

$$\begin{aligned}
 3x^2 + 4x - 4 &= 0 \\
 a &= 3, b = 4, c = -4 \\
 x &= \frac{-4 \pm \sqrt{(4)^2 - 4(3)(-4)}}{2 \cdot 3} \\
 &= \frac{-4 \pm \sqrt{16 + 48}}{6} \\
 &= \frac{-4 \pm \sqrt{64}}{6} = \frac{-4 \pm 8}{6} \\
 x &= \frac{-4 + 8}{6} & x &= \frac{-4 - 8}{6} \\
 &= \frac{4}{6} = \frac{2}{3} & &= \frac{-12}{6} = -2
 \end{aligned}$$

The solutions are $\frac{2}{3}$ and -2 .

Example 4

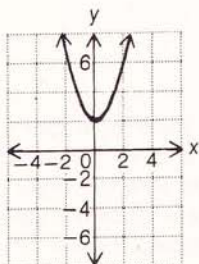
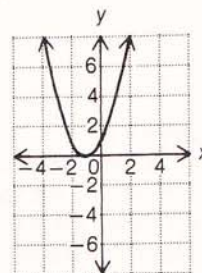
$$\begin{aligned}
 x^2 + 2x &= 1 \\
 x^2 + 2x - 1 &= 0 \\
 a &= 1, b = 2, c = -1 \\
 x &= \frac{-2 \pm \sqrt{(2)^2 - 4(1)(-1)}}{2 \cdot 1} \\
 &= \frac{-2 \pm \sqrt{4 + 4}}{2} = \frac{-2 \pm \sqrt{8}}{2} \\
 &= \frac{-2 \pm 2\sqrt{2}}{2} = -1 \pm \sqrt{2}
 \end{aligned}$$

The solutions are $-1 + \sqrt{2}$ and $-1 - \sqrt{2}$.

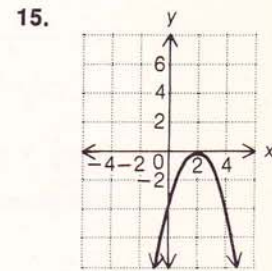
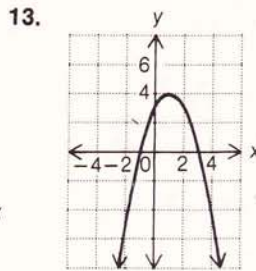
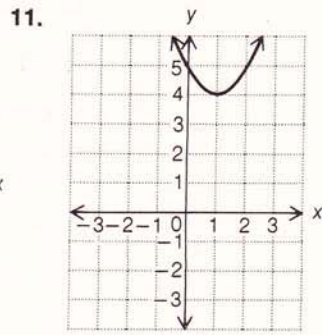
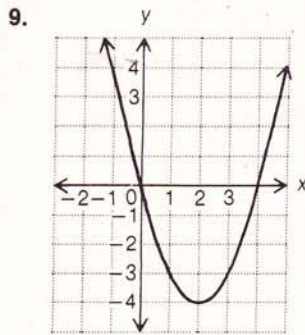
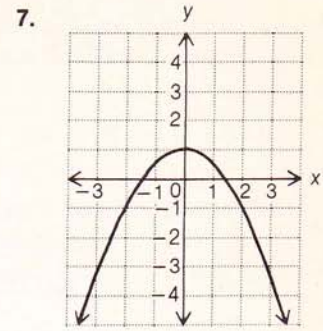
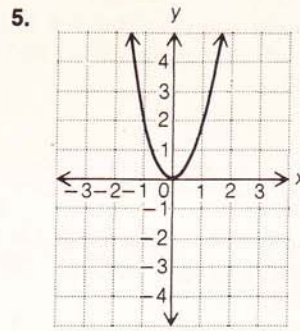
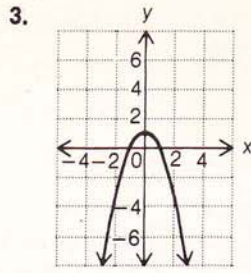
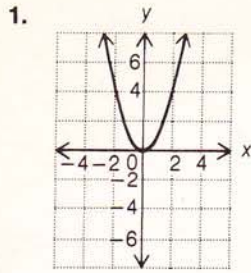
Pages 423–424

- 1.** The solutions are 5 and -1 . **3.** The solutions are -3 and 5. **5.** The solutions are -7 and 1. **7.** The solutions are 2 and -3 . **9.** The solutions are 3 and -1 . **11.** The solutions are -5 and 1. **13.** The solutions are $-\frac{1}{2}$ and 1. **15.** The quadratic equation has no real number solution. **17.** The solutions are 0 and 1. **19.** The solutions are $\frac{3}{2}$ and $-\frac{3}{2}$. **21.** The solutions are $\frac{3}{2}$ and $-\frac{5}{2}$. **23.** The solutions are 3 and $-\frac{2}{3}$. **25.** The solutions are -3 and $\frac{4}{5}$. **27.** The solutions are $-\frac{1}{2}$ and $\frac{2}{3}$. **29.** The quadratic equation has no real number solution. **31.** The solutions are $1 + \sqrt{6}$ and $1 - \sqrt{6}$. **33.** The solutions are $-3 + \sqrt{10}$ and $-3 - \sqrt{10}$. **35.** The solutions are $2 + \sqrt{13}$ and $2 - \sqrt{13}$. **37.** The solutions are $\frac{1 + \sqrt{2}}{2}$ and $\frac{1 - \sqrt{2}}{2}$. **39.** The solutions are $-3 + 2\sqrt{2}$ and $-3 - 2\sqrt{2}$. **41.** The solutions are $\frac{3 + 2\sqrt{6}}{2}$ and $\frac{3 - 2\sqrt{6}}{2}$. **43.** The solutions are $\frac{-1 + \sqrt{2}}{3}$ and $\frac{-1 - \sqrt{2}}{3}$. **45.** The solution is $-\frac{1}{2}$. **47.** The quadratic equation has no real number solution. **49.** The solutions are $\frac{-4 + \sqrt{5}}{2}$ and $\frac{-4 - \sqrt{5}}{2}$. **51.** The solutions are $\frac{1 + 2\sqrt{3}}{2}$ and $\frac{1 - 2\sqrt{3}}{2}$. **53.** The solutions are $\frac{-5 + \sqrt{2}}{3}$ and $\frac{-5 - \sqrt{2}}{3}$. **55.** The solutions are approximately 5.690 and -3.690 . **57.** The solutions are approximately 7.690 and -1.690 . **59.** The solutions are approximately 4.590 and -1.090 . **61.** The solutions are approximately -2.118 and 0.118 . **63.** The solutions are approximately 1.105 and -0.905 .

SECTION 4 Pages 425–426

Example 2

Example 4


Pages 427–428



SECTION 5

Pages 429–430

Example 2**Strategy**

- ▷ This is a geometry problem.
- ▷ Width of the rectangle: w
- Length of the rectangle: $w + 2$
- ▷ Use the equation $A = l \cdot w$.

Solution

$$A = l \cdot w$$

$$15 = (w + 2)w$$

$$15 = w^2 + 2w$$

$$0 = w^2 + 2w - 15$$

$$0 = (w + 5)(w - 3)$$

$$w + 5 = 0$$

$$w = -5$$

$$w - 3 = 0$$

$$w = 3$$

The solution -5 is not possible.

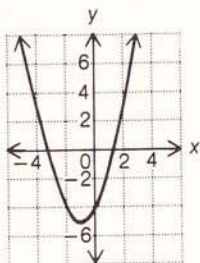
The width is 3 m.

Pages 431–432

1. The width is 4 ft. The length is 8 ft. 3. The base is 4 m. The height is 10 m. 5. The integers are 3 and 5. 7. The integers are -1 , 0 , and 1 . 9. The integer is 3. 11. The first car is 8 years old and the second car is 6 years old. 13. The first stamp is 27 years old and the second stamp is 9 years old. 15. It would take the larger pipe 4 h to fill the tank. It would take the smaller pipe 12 h to fill the tank. 17. The first machine can reproduce the report in 24 min. The second machine can reproduce the report in 8 min. 19. The rate of the boat during the first 24 mi was 12 mph. 21. The rate of the boat in calm water is 14 mph.

REVIEW/TESTS
Pages 433-434

- 1.1 The solutions are -4 and $\frac{5}{3}$. 1.2 The solutions are $-4 + 2\sqrt{5}$ and $-4 - 2\sqrt{5}$. 2.1a The solutions are $-2 + 2\sqrt{5}$ and $-2 - 2\sqrt{5}$. 2.1b The solutions are $\frac{-3 + \sqrt{41}}{2}$ and $\frac{-3 - \sqrt{41}}{2}$. 2.1c The solutions are $\frac{3 + \sqrt{7}}{2}$ and $\frac{3 - \sqrt{7}}{2}$. 2.1d The solutions are $\frac{-4 + \sqrt{22}}{2}$ and $\frac{-4 - \sqrt{22}}{2}$. 3.1a The solutions are $-2 + \sqrt{2}$ and $-2 - \sqrt{2}$. 3.1b The solutions are $\frac{3 + \sqrt{33}}{2}$ and $\frac{3 - \sqrt{33}}{2}$. 3.1c The solutions are 3 and $-\frac{1}{2}$. 3.1d The solutions are $\frac{1 + \sqrt{13}}{6}$ and $\frac{1 - \sqrt{13}}{6}$. 4.1



- 5.1a The width is 5 ft. The length is 8 ft. 5.1b The rate of the boat in calm water is 11 mph.

Pages 435-436

- 1.1 b 1.2 c 2.1a c 2.1b a 2.1c a 2.1d d 3.1a b 3.1b c 3.1c d 3.1d c 4.1 b
5.1a b 5.1b a