

Answers for Lesson 9-1 Exercises

1. $y = \frac{11}{x}$ 2. $y = -\frac{1300}{x}$ 3. $y = \frac{1}{x}$
4. $y = -\frac{56}{x}$ 5. $y = \frac{3.6}{x}$ 6. $y = \frac{250}{x}$
7. direct; $y = 5x$ 8. inverse; $y = \frac{42}{x}$ 9. direct; $y = 2x$
10. inverse; $y = \frac{0.3}{x}$ 11. inverse; $y = \frac{1}{x}$ 12. neither
13. $y = \frac{100}{x}; 10$ 14. $y = -\frac{80}{x}; -8$ 15. $y = -\frac{5}{3x}; -\frac{1}{6}$
16. A varies directly with the square of r .
17. A varies jointly with b and h .
18. h varies directly with A and inversely with b .
19. V varies jointly with B and h .
20. V varies jointly with h and the square of r .
21. h varies directly with V and inversely with the square of r .
22. V varies jointly with ℓ , w , and h .
23. ℓ varies directly with V and inversely with the product of w and h .
24. $z = \frac{5x}{y}; \frac{20}{9}$ 25. $z = 10xy; 360$
26. $z = \frac{3x^2}{y}; \frac{16}{3}$ 27. $z = \frac{4}{xy}; \frac{1}{9}$
28. a. 14,000 b. 226
29. 18 30. 3.6 31. $\frac{1}{4}$ 32. 6
33. 9 34. 16 35. 7200 rpm 36. $F = k\frac{m}{d^2}$
37. $18\frac{2}{3}$ 38. 10 39. 2 40. 5.4
41. ≈ 4.277 42. 3.64 43. 2.625 44. 2.5
45. 8 46. 15 47. 11.786 48. ≈ 1.857
49. 32 50. $\frac{3}{16}$ 51. $\frac{40}{3}$

Answers for Lesson 9-1 Exercises (cont.)

52. a. $A = \frac{300}{d}$

b. $600 \text{ ft}^2; 300 \text{ ft}^2; 200 \text{ ft}^2$

c. $d = \frac{300}{\pi r^2}$

53. 32

54. doubled; tripled

55. quartered; divided by 16

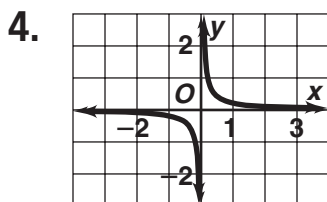
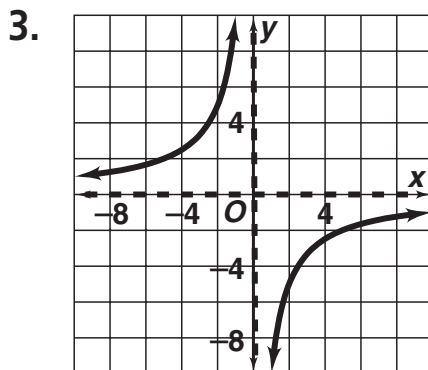
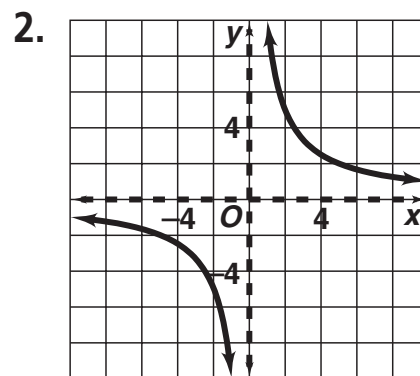
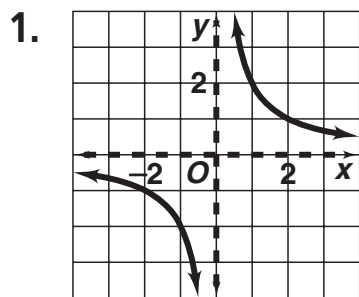
56. Division by zero is undefined.

57. $x_1y_1 = k$ and $x_2y_2 = k$ def. of inverse variation $x_1y_1 = x_2y_2$
transitivity $\frac{x_1}{x_2} = \frac{y_2}{y_1}$ Divide both sides by x_2y_1 .

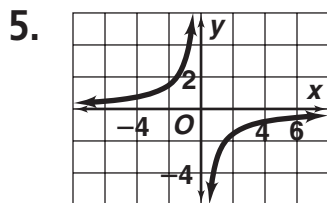
58. Answers may vary. Sample: Quadruple the volume and leave the radius constant, halve the radius and leave the volume constant, multiply the volume by 16 and double the radius, and multiply the volume and radius by $\frac{1}{4}$.

59. $\text{BMI} \approx \frac{705 w}{h^2}$

Answers for Lesson 9-2 Exercises

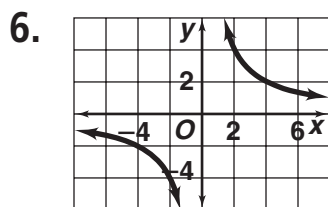


The graph is in Quadrant I and Quadrant III.

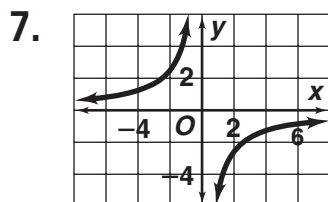


The graph is in Quadrant II and Quadrant IV. The graph is a reflection of the graph of $y = \frac{3}{x}$.

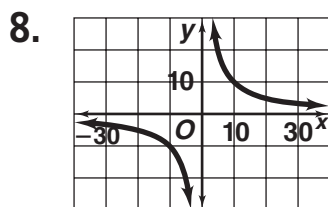
Answers for Lesson 9-2 Exercises (cont.)



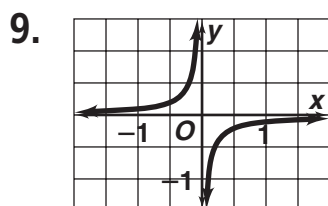
The graph is in Quadrant I and Quadrant III.



The graph is in Quadrant II and Quadrant IV. The graph is a reflection of the graph of $y = \frac{5}{x}$.



The graph is in Quadrant I and Quadrant III.



The graph is in Quadrant II and Quadrant IV. The graph is a reflection of the graph of $\frac{0.1}{x}$.

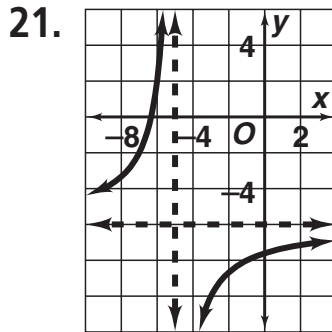
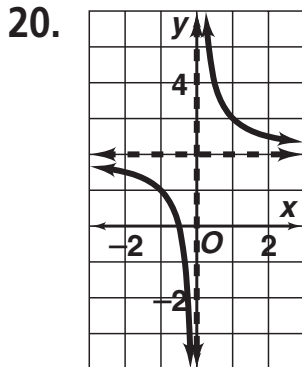
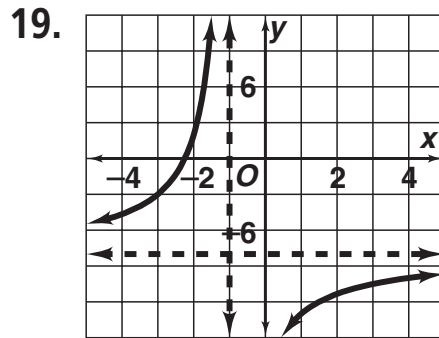
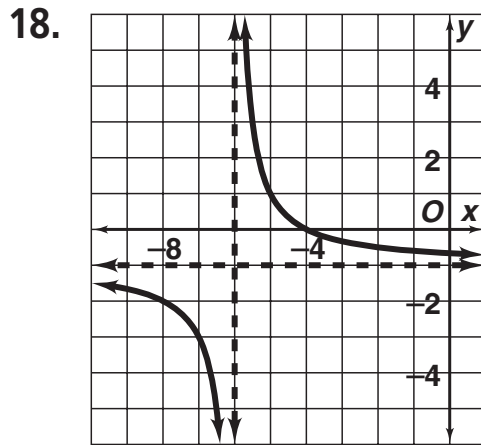
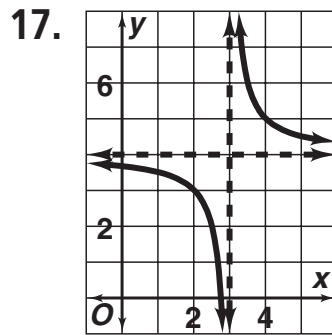
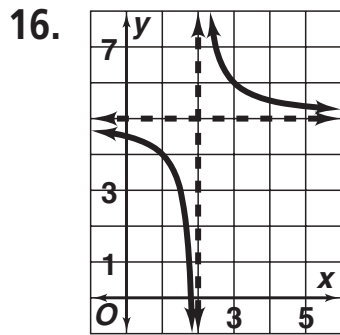
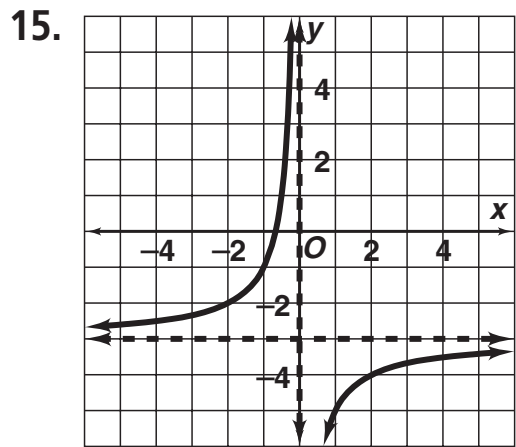
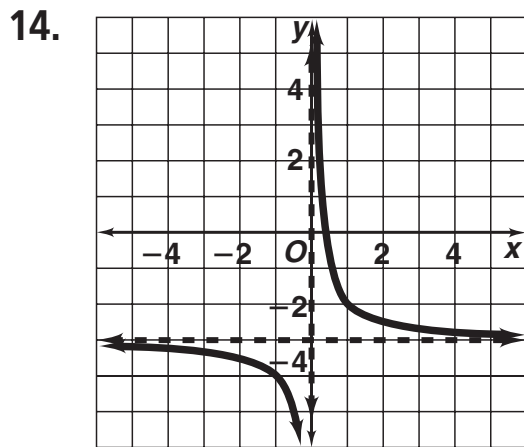
10. 18.4 ft

11. 7.67 ft

12. 3.83 ft

13. 1.84 ft

Answers for Lesson 9-2 Exercises (cont.)



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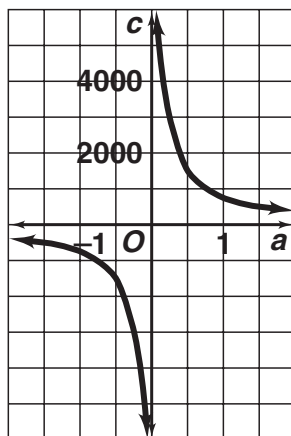
Answers for Lesson 9-2 Exercises (cont.)

22. $y = \frac{2}{x} + 4$

23. $y = \frac{2}{x+2} + 3$

24. $y = \frac{2}{x-4} - 8$

25. a. $c = \frac{750}{a}$



$a = 0, c = 0$

b. Answers may vary. Sample: If the number of awards is large, the amount of money available for each award approaches 0. If there are a small number of awards, then the amount of money available for each award gets larger.

26. Check students' work.

27. $y = \frac{0.5}{x}$

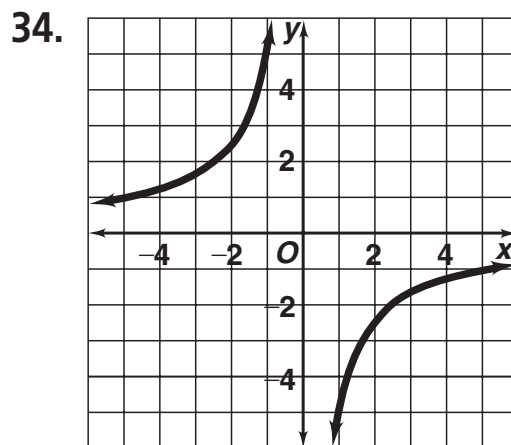
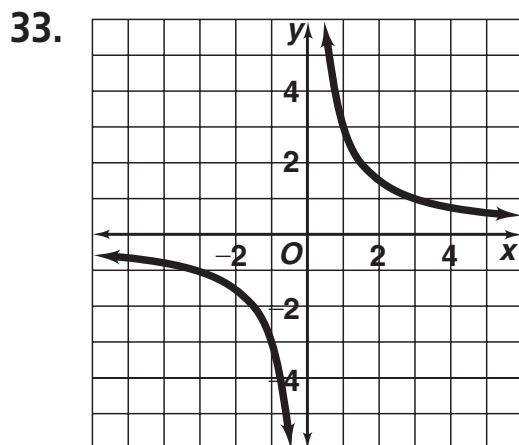
28. $y = \frac{0.75}{x}$

29. $y = \frac{-8.\bar{3}}{x}$

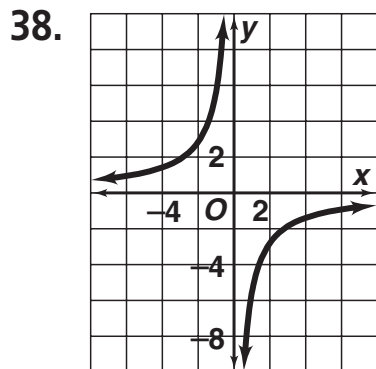
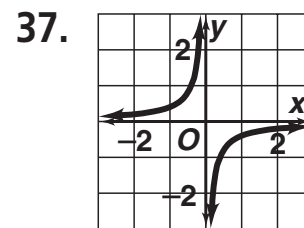
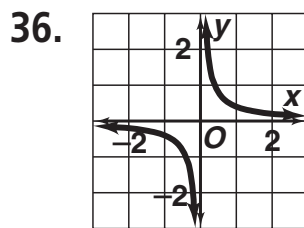
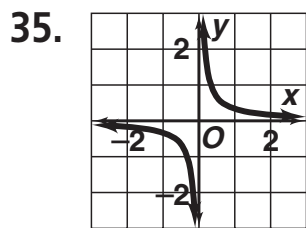
30. $y = \frac{-0.01}{x}$

31. $y = \frac{4}{x}$

32. $y = \frac{-1.4}{x}$

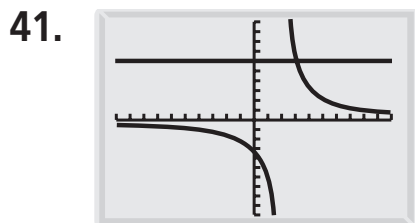


Answers for Lesson 9-2 Exercises (cont.)

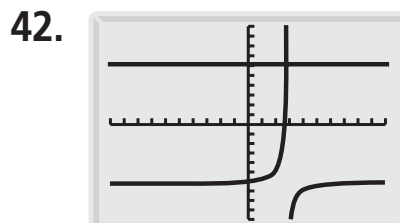


39. Answers may vary. Sample: The graph of the translation looks similar to the graph of $y = \frac{k}{x}$, so knowing the asymptotes helps to position the translation; check students' work.

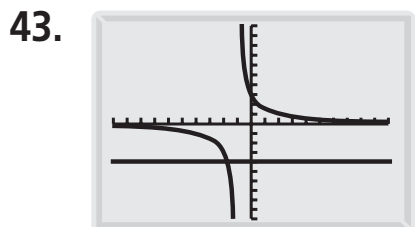
40. B



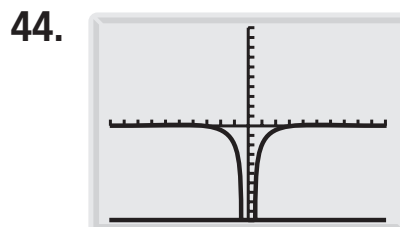
(3, 6)



(2.92, 6.2)

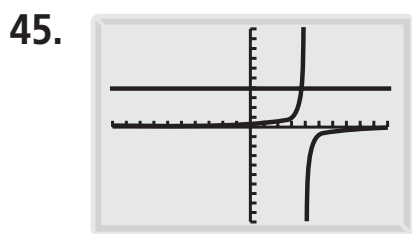


(-1.75, -4)

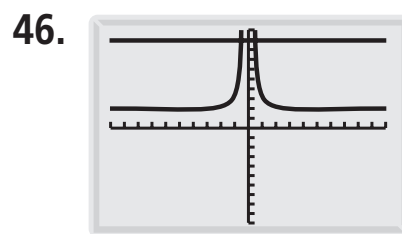


(-0.45, -10) and (0.45, -10)

Answers for Lesson 9-2 Exercises (cont.)

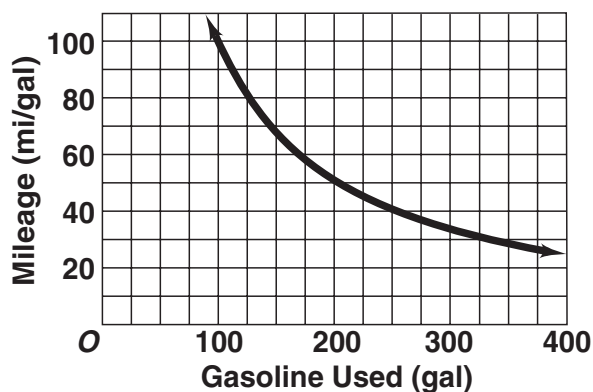


(3.76, 4.2)

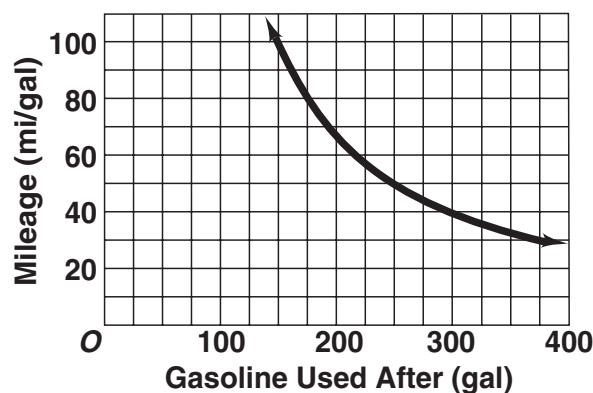


(-0.76, 9) and (0.76, 9)

47. a. $m = \frac{10,000}{g}$



b. $m = \frac{10,000}{g-50}$



c. 25 mi/gal, 28.57 mi/gal

48. The branches of $y = \frac{1}{x}$ are in Quadrants I and III. The branches of $y = \left| \frac{1}{x} \right|$ are in Quadrants I and II. The graphs intersect at all points on $y = \frac{1}{x}$ in Quadrant I.

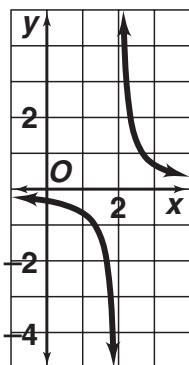
Answers for Lesson 9-2 Exercises (cont.)

49. The branches of $y = \frac{1}{x^2}$ are in Quadrants I and II. The branches of $y = \frac{1}{x}$ are in Quadrants I and III. The graphs intersect at $(1, 1)$. The graph of $y = \frac{1}{x^2}$ is closer to the x -axis for $x > 1$, and the graph of $y = \frac{1}{x}$ is closer to the y -axis for $0 < x < 1$.

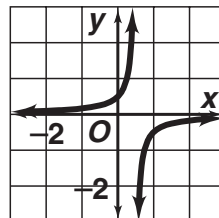
50. The branches of both graphs are in Quadrants I and II. They intersect at $(1, 1)$ and $(-1, 1)$. The graph of $y = \frac{1}{x^2}$ is closer to the x -axis for $x > 1$ and $x < -1$. The graph of $y = \left| \frac{1}{x} \right|$ is closer to the y -axis for $-1 < x < 0$ and $0 < x < 1$.

51. $y = \frac{16}{x}, y = -\frac{16}{x}$

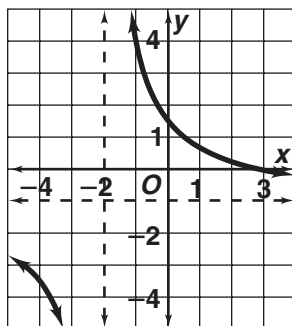
52. a. $y = \frac{0.\bar{6}}{x - 2}$



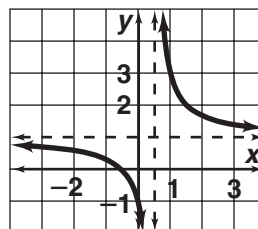
b. $y = \frac{-0.25}{x - 0.5}$



c. $y = \frac{5}{x + 2} - 1$

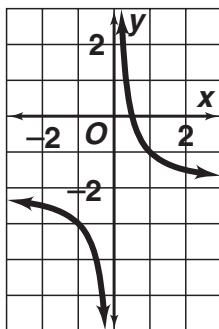


d. $y = \frac{2}{2x - 1} + 1$

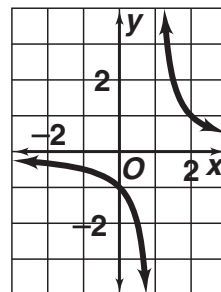


Answers for Lesson 9-2 Exercises (cont.)

e. $y = \frac{1}{x} - 2$

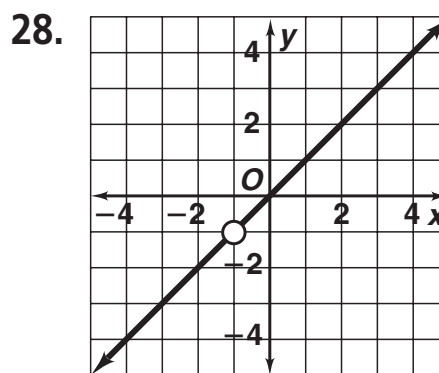
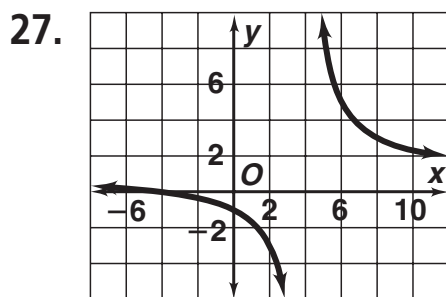
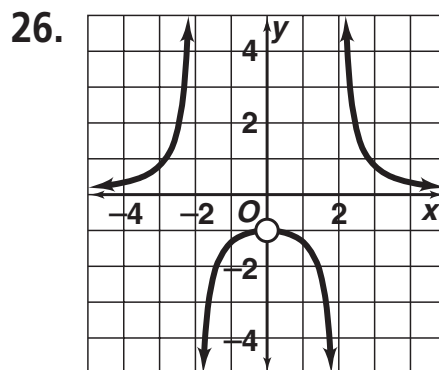
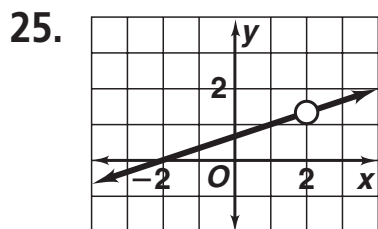


f. $y = \frac{1}{x - 1}$

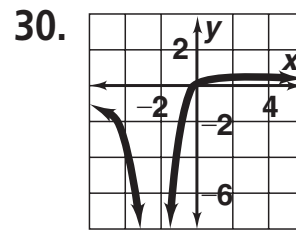
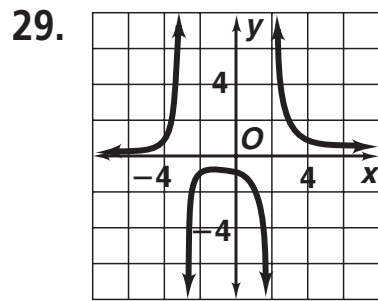


Answers for Lesson 9-3 Exercises

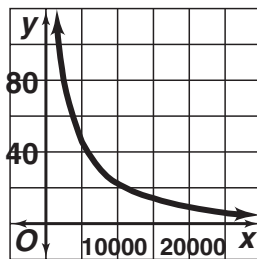
1. $x = 0, x = 2$ 2. none 3. $x = 1, x = -1$
 4. $x = 2, x = 3$ 5. $x = -3$ 6. $x = -\frac{7}{2}, x = 1$
 7. $x = 2$ 8. none
 9. $x = -2.77, x = 1.277$
 10. vertical asymptote at $x = -2$
 11. hole at $x = -5$
 12. vertical asymptotes at $x = -\frac{3}{2}$ and $x = 1$
 13. vertical asymptote at $x = -1$, hole at $x = 2$
 14. hole at $x = -2$ 15. none
 16. holes at $x = \pm 3$ 17. none
 18. vertical asymptote at $x = -5$, hole at $x = -\frac{2}{3}$
 19. $y = 0$ 20. $y = 0$ 21. $y = 1$
 22. $y = \frac{1}{2}$ 23. $y = 0$ 24. $y = \frac{3}{4}$



Answers for Lesson 9-3 Exercises (cont.)



31. a.
$$y = \frac{0.19x + 210,000}{x - 500}$$



b. \$46.88; \$14.68

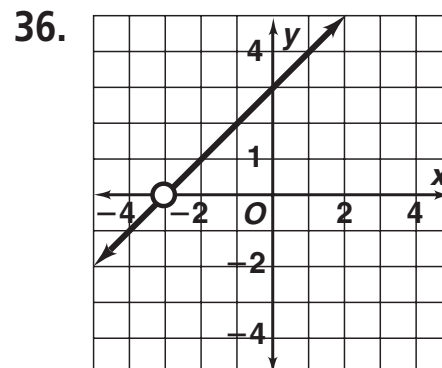
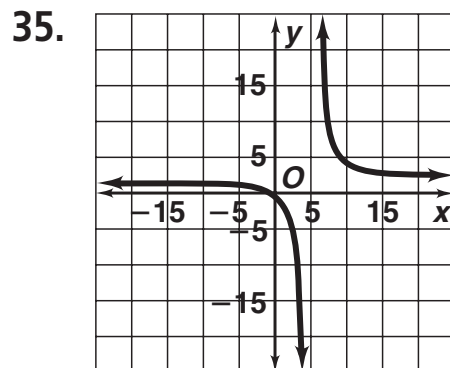
c. more than 21,916 discs

d. $x = 500, y = 0.19$

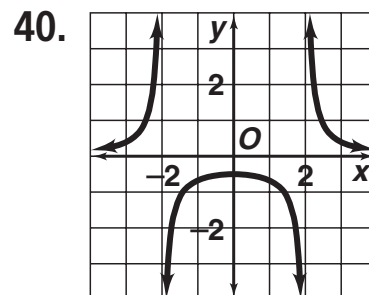
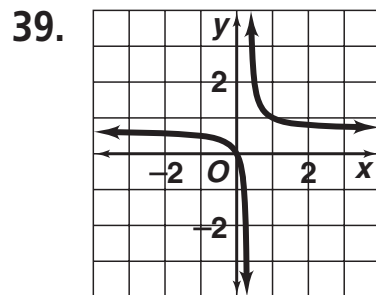
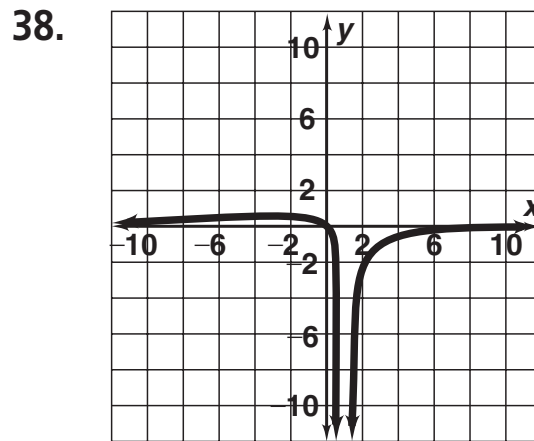
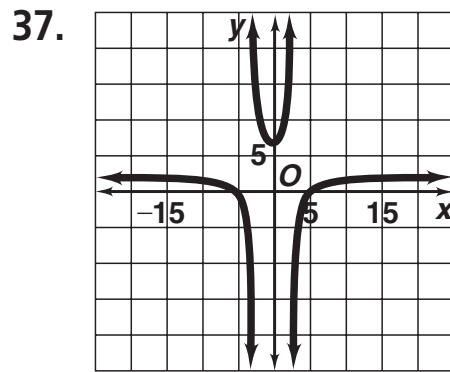
32. vertical asymptotes at $x = -3$ and $x = 3$, horizontal asymptote at $y = 0$

33. vertical asymptote at $x = -2$

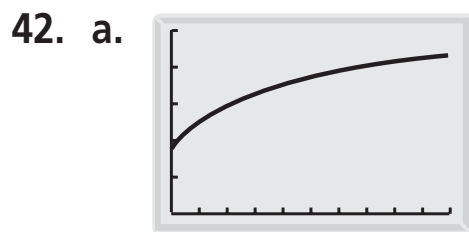
34. horizontal asymptote at $y = 0$



Answers for Lesson 9-3 Exercises (cont.)



41. Answers may vary. Sample: There is no value of x for which the denominator equals 0.



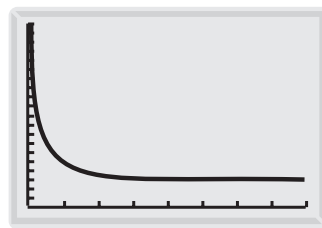
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WINDOW FORMAT
Xmin=0
Xmax=100
Xscl=10
Ymin=-.5
Ymax=1
Yscl=.1
    
```

b. 6 free throws

Answers for Lesson 9-3 Exercises (cont.)

43. a. $y = \frac{20,000x + 200,000}{x + 1}$



WINDOW **FORMAT**
 Xmin=0
 Xmax=40
 Xscl=4
 Ymin=0
 Ymax=200000
 Yscl=10000

b. \$65,000; \$25,806.45

c. Answers may vary. Sample: No; the president's salary throws off the average; the median or mode would be a better measure.

44. a. $P(n) = 4n^2$

b. $R(n) = 4n + 1$

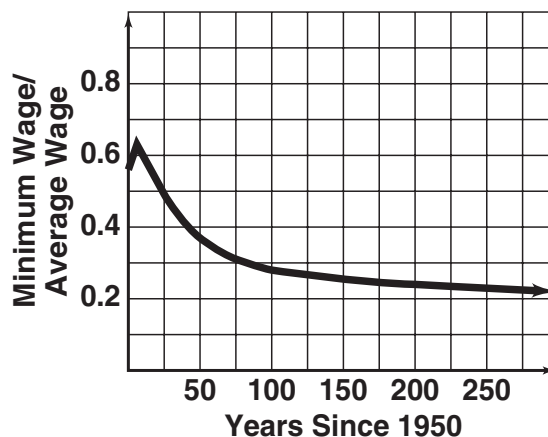
c. $y = \frac{4n^2}{4n + 1}; \frac{64}{17}$ check students' work.

45. a. The increase in production workers' average hourly wage is greater.

b. rational

c. $R(x) = \frac{M(x)}{A(x)}$

d.



around the year 2106

Answers for Lesson 9-4 Exercises

1. $\frac{1}{2x-1}; x \neq 0$ or $\frac{1}{2}$
2. $2c + 3; c \neq 0$
3. $b + 1; b \neq 1$
4. $z - 7; z \neq -7$
5. $\frac{2}{x+5}; x \neq -5$
6. $\frac{x+4}{x-6}; x \neq 6$ or -4
7. $\frac{7}{15x^2}; x \neq 0, y \neq 0$
8. $\frac{xy}{4}; x \neq 0, y \neq 0$
9. $\frac{4}{3}; y \neq \frac{1}{2}$ or 3
10. $\frac{4(x+6)}{3(3x+8)}; x \neq 3$ or $-\frac{8}{3}$
11. $\frac{x-2}{x(x-1)}; x \neq 0, 1, -1,$ or -2
12. $1; x \neq -2, -1, 2,$ or 3
13. $\frac{2}{3x^2y^2}; x \neq 0, y \neq 0$
14. $\frac{y}{2x^2}; x \neq 0, y \neq 0$
15. $\frac{5(x+y)}{3}; x \neq y$
16. $1; y \neq -2$ or 4
17. $\frac{x(x-1)}{3(x+1)}; x \neq -1, 1,$ or 0
18. $\frac{4(y-3)}{y(y+5)}; y \neq 2, -5,$ or 0
19. $\frac{x-8}{x-10}; x \neq -3$ or 10
20. $\frac{y+6}{y-2}; y \neq 2$
21. $\frac{y(y+3)}{12(y+4)}; x \neq 0, y \neq -4$ or 3
22. $\frac{6(a+1)}{a-3}$
23. The student is not correct; $x = 2$ will make the denominator of $\frac{x}{x-2}$ equal 0, so $x = 2$ is not a solution.
24. Check students' work.
25. The numerator and the denominator have no common factors; check students' work.

Answers for Lesson 9-4 Exercises (cont.)

26. a. $\frac{\frac{2}{3}\pi r^3}{2\pi r^2 + \pi r^2} = \frac{2r}{9}$
 b. $\frac{\pi r^2(r)}{2\pi r^2 + 2\pi r(r)} = \frac{r}{4}$
 c. The ratio for the cylindrical tank is larger.
 d. The cylindrical tank will have a larger volume.
27. $\frac{a+3}{(a-3)(a-3)}$; $a \neq -4, -3, \text{ or } 3$
28. $\frac{2(b-5)}{b+5}$; $b \neq -5$ 29. $\frac{4}{x}$; $x \neq 0, -5, 4, \text{ or } 1$
30. $\frac{18x}{(x+9)(x+3)}$; $x \neq -9, -3, \text{ or } 3$
31. $\frac{x+1}{x-4}$; $x \neq -3, \frac{1}{2}, 2, \text{ or } 4$ 32. $\frac{x+1}{x-1}$; $x \neq -\frac{1}{2}, \frac{1}{2}, 1, \text{ or } -2$
33. $\frac{x(x-1)^3}{(x+4)}$; $x \neq -4, 0, 1$ 34. 2 ; $x \neq -3, 1$
35. $\frac{18x^5}{y^2}$; $y \neq 0$ 36. $\frac{2(a+8)}{2a+5}$
37. a. 1.2 m/s^2
 b. $\approx 2.68 \text{ m/s}^2$
38. a. $2x^n + 1$
 b. 2 is a factor of $2x^n$, so $2x^n$ is even, and $2x^n + 1$ is odd.
39. $\frac{4x}{3y}$; $x \neq 0 \text{ or } -1, y \neq 0$ 40. $-\frac{3a^2b^2}{4}$; $a \neq 0 \text{ or } b, b \neq 0$
41. $\frac{15}{4n^2}$; $m \neq 0 \text{ or } -\frac{2}{3}n, n \neq 0$

Answers for Lesson 9-5 Exercises

1. $\frac{120}{59} \approx 2.03$ in.
2. $\frac{240}{119} \approx 2.02$ in.
3. For distances greater than 10 ft, d_i is nearly constant.
4. $9(x + 2)(2x - 1)$
5. $(x - 1)(x + 1)(x + 1)$
6. $10(x - 2)(x + 3)^2$
7. $18(2x - 7)(x + 3)$
8. $5(y + 4)(y - 4)$
9. $2(x + 5)(x^2 - 32x - 10)$
10. $\frac{1}{x}$
11. $\frac{2(d - 2)}{2d + 1}$
12. $\frac{xy + 8y + 4}{2xy^2}$
13. $\frac{7x^2 + 20x - 18}{(x - 3)(x + 3)(x + 4)}$
14. $\frac{-x + 6}{(x - 3)(x + 3)}$
15. $\frac{5x^2 + 14x - 12}{(x - 3)(x + 2)^2}$
16. $-\frac{3}{x}$
17. $\frac{-3(2y + 1)}{2y - 1}$
18. $\frac{y - 6}{2(y + 2)}$
19. $\frac{x^2 - 24}{3x(x + 3)}$
20. $\frac{-5(y + 8)}{(y - 5)(y + 5)}$
21. $\frac{-2x(x + 3)}{(x - 2)(x - 1)(x + 1)}$
22. $\frac{y}{2x}$
23. $\frac{15}{28}$
24. $\frac{2}{3(x + y)}$
25. $\frac{b}{9}$
26. $\frac{y}{x + y}$
27. $\frac{3x}{2 + xy}$
28. $\frac{2}{5}$
29. $\frac{3}{x - 6}$
30. $\frac{-3x}{5 + xy}$
31. $\frac{3x - 8}{4x^2}$
32. $\frac{x^2 + 4x - 3}{(x + 1)(x - 1)}$
33. $\frac{2x^3 - x^2 + 1}{x^2(x + 1)(x - 1)}$
34. $\frac{7x - 17}{(x - 3)(x + 3)}$
35. $\frac{x^2 + 9x - 1}{(x - 1)(2x + 1)}$
36. $\frac{4x - 1}{2x(2x - 1)}$
37. $\frac{5x^2 + 6x + 12}{(x - 3)(x + 2)^2}$
38. $\frac{x(3x^2 + x - 1)}{x^2 - 2}$
39. $\frac{4y^3 + 12y^2 - y - 2}{y(y + 3)}$
40. $\frac{3(4y - 21)}{y(y - 7)}$
41. Check students' work.

Answers for Lesson 9-5 Exercises (cont.)

42. Factoring is used to determine the least common multiple of the denominators; check students' work.
43. Answers may vary. Sample: Substitute 0 for x in the three expressions, and show that $\frac{4}{-9} + \frac{7}{3} \neq \frac{25}{-9}$.
44. $\frac{3x + 2y}{7x - 5y}$ 45. $\frac{2x - 5y}{2(3x + 2y)}$ 46. $\frac{2(x + 2)}{4x + 3}$
47. x 48. $\frac{2(x + 5)}{x + 7}$ 49. $\frac{-5x + 13}{2(x - 4)}$
50. Check students' work.
51. $x \neq -2, -3, -4$; those values result in division by 0, which is undefined.
52. $\frac{2}{3}, \frac{3}{5}, \frac{2}{3}$
53. a. $\frac{24}{7}$ mi/h
b. $\frac{24}{7}$
c. $\frac{400}{9}$ mi/h
d. $\frac{2x(x + a)}{2x + a}$ mi/h
54. a. $\frac{R_1 R_2 R_3}{R_1 R_2 + R_1 R_3 + R_2 R_3}$
b. ≈ 0.88 ohms
55. a. $f = \frac{d_i d_o}{d_i + d_o}$
b. $\frac{x(2x + 1)}{3x + 1} = f$

Answers for Lesson 9-6 Exercises

1. 5 2. no solution 3. 10 4. 2 or -5
5. $\frac{4}{3}$ 6. $-\frac{5}{2}$ or 4 7. $\frac{7}{3}$ 8. 3
9. -1 10. $\frac{2}{9}$ 11. 10 12. 4
13. 2 14. -1 or 2 15. -1 or 12 16. $-\frac{1}{12}$
17. about -1.45 or 1.65
18. 1 19. $-3, -2$ 20. -9 21. 1
22. Carlos: 32 mi/h, Paul: 12 mi/h
23. passenger train: 112 mi/h, freight train: 92 mi/h
24. $2\frac{2}{3}$ h 25. $1\frac{5}{7}$ h
26. $E = \frac{mV^2}{2}$ 27. $E = mc^2$
28. $F = ma$ 29. $c = \pm\sqrt{a^2 - b^2}$
30. $T = \pm 2\pi\sqrt{\frac{\ell}{g}}$ 31. $B = \pm\frac{1}{r}\sqrt{\frac{2Vm}{q}}$
32. $2\frac{2}{5}$ days 33. D
34. a. $c(x) = \frac{5.50x + 60}{x}$
 b. 14 students
35. a. $L = \frac{24(R-r)}{T}$
 b. 32 in., about 28.24 in., about 25.26 in.
36. a. \$1000
 b. $\frac{15,000}{24 + x}(1.60)$
 c. $1000 - \frac{15,000}{24 + x}(1.60)$
 d. 30 mi/gal
37. Check students' work.

Answers for Lesson 9-6 Exercises (cont.)

38. a. about 2037

b. Check students' work.

39. 3

40. no solution

41. no solution

42. 30

43. 5

44. $\frac{38}{21}$

45. no solution

46. -4

47. 21

48. -4

49. no solution

50. 6

51. $1, -\frac{2}{3}$

52. -1

53. $x \approx 4.5$ ft

54. Check students' work.

55. a. $t = \frac{d}{s}$

b. $\frac{35}{18}$ h

c. $\frac{d}{t} + x$

d. $\frac{700}{360} + \frac{700}{360 + x} = 3.5; 90$ mi/h

56. a–c. Check students' work. 57. about 44.44 mi/h

58. 5 attendants

Answers for Lesson 9-7 Exercises

1. independent 2. dependent 3. dependent
4. independent 5. $\frac{1}{6}$ 6. $\frac{9}{34}$
7. 0.54 8. $\frac{2}{x}$ 9. $\frac{9}{25}$
10. Not mutually exclusive since 2 is a prime number and less than 4.
11. Mutually exclusive since if the numbers are equal, then the sum is even.
12. Not mutually exclusive since $6 \cdot 4 = 24$, which is greater than 20 and a multiple of 3.
13. 47% 14. $\frac{3}{4}$ 15. $\frac{14}{15}$
16. 39% 17. $\frac{26}{35}$ 18. $\frac{1}{2}$
19. $\frac{1}{2}$ 20. $\frac{5}{6}$ 21. $\frac{5}{6}$
22. $\frac{2}{3}$ 23. $\frac{5}{6}$ 24. $\frac{5}{6}$
25. 1 26. $\frac{1}{3}$ 27. $\frac{7}{12}$
28. $\frac{2}{5}$ 29. $\frac{31}{56}$
30. C
31. 16% 32. 27.6% 33. 86.9% 34. 37.6%
35. 72.4% 36. $\frac{4}{15}$ 37. $\frac{4}{15}$ 38. $\frac{8}{15}$
39. $\frac{1}{15}$ 40. $\frac{7}{15}$ 41. $\frac{1}{11}$ 42. $\frac{5}{12}$
43. $\frac{7}{15}$ 44. $\frac{5}{2x}$

Answers for Lesson 9-7 Exercises (cont.)

45. a. $\frac{1}{4}$

b. $\frac{1}{64}$

46. Check students' work.

47. F and G are mutually exclusive, so $P(F \text{ or } G) = P(F) + P(G) \geq 0$ and $P(F \text{ and } G) = 0$.
So $P(F \text{ or } G) \geq P(F \text{ and } G)$.

48. 5%

49. 6%

50. 11.4%

51. $\frac{4}{9}$

52. a. $\frac{2}{x+2}$

b. $\frac{x-3}{2x-1}$

c. $\frac{2(x-3)}{(x+2)(2x-1)}$

d. $\frac{x-1}{2x-1}$