# CHAPTER 9

### Think & Discuss *(p. 531)*

1. $\frac{13{,}000}{1300} = 10; \frac{13{,}000}{800} = 16.25; \frac{13{,}000}{350} \approx 37.1$
2. Headfirst; this position has the highest ratio of volume to cross-sectional surface area.

### Skill Review *(p. 532)*

1. $y = \frac{5}{2}x$ 2. $y = \frac{1}{10}x$ 3. $y = -\frac{1}{4}x$ 4. $y = -4x$
5. $5(3x - 1) = 15x - 5$
6. $(x - 1)(x + 4)^2 = (x - 1)(x^2 + 8x + 16)$
   $= x^3 + 7x^2 + 8x - 16$
7. $-x(x^2 - 5) = -x^3 + 5x$
8. $x(x - 1)(x + 8) = x(x^2 + 7x - 8) = x^3 + 7x^2 - 8x$
9. $x^2 - 6x + 9 = (x - 3)^2$
10. $4x^3 - 4 = 4(x^3 - 1) = 4(x - 1)(x^2 + x + 1)$
11. $8x^3 - 162x = 2x(4x^2 - 81 = 2x(2x - 9)(2x + 9)$
12. $6x^2 + 7x - 5 = (2x - 1)(3x + 5)$
13. $y = x^2 + 2x$
    $0 = x(x + 2)$
    $x = 0, x = -2$
14. $y = x^2 + 2x - 15$
    $0 = (x + 5)(x - 3)$
    $x = -5, x = 3$
15. $y = x^3 - 2x^2 - 7x - 4$
    $0 = (x + 1)(x^2 - 3x - 4)$
    $0 = (x + 1)(x - 4)(x + 1)$
    $x = -1, x = 4$

### Lesson 9.1

#### *Developing Concepts Activity 9.1 (p. 533)*

1. No; as the distance increases, the apparent height decreases.
2. The product of distance and apparent height is approximately constant.
3. Equations may vary but should have the form $dh = c$ where $d$ is the distance between partners, $h$ is the height of the person standing against the wall, and $c$ the constant from Ex. 2.
4. Answers may vary but should be consistent with the equation from Ex. 3.

#### *9.1 Guided Practice (p. 537)*

1. jointly
2. Each product $xy$ will be approximately equal to the same number.
3. It will be constant.
4. inverse variation 5. direct variation 6. neither
7. inverse variation 8. direct variation
9. inverse variation 10. inverse variation 11. neither
12. yes 13. yes 14. no 15. yes 16. no 17. yes
18. yes 19. yes
20. $F = \frac{(250 \times 6)}{l} = \frac{1500}{l}$
    $F = \frac{1500}{24} = 62.5$ lb

#### *9.1 Practice and Applications (pp. 537–539)*

21. inverse variation 22. inverse variation
23. neither 24. direct variation 25. inverse variation
26. direct variation 27. direct variation 28. neither
29. $(5x - 2) = k$
    $y = \frac{-10}{x}$
    $y = \frac{-10}{2} = -5$
30. $(4 \times 8) = k$
    $y = \frac{32}{x}$
    $y = \frac{32}{2} = 16$
31. $(7 \times 1) = k$
    $y = \frac{7}{x}$
    $y = \frac{7}{2} = 3.5$
32. $\left(\frac{1}{2} \times 10\right) = k$
    $y = \frac{5}{x}$
    $y = \frac{5}{2} = 2.5$
33. $\left(-\frac{2}{3} \times 6\right) = k$
    $y = \frac{-4}{x}$
    $y = \frac{-4}{2} = -2$
34. $\left(\frac{3}{4} \times \frac{3}{8}\right) = k$
    $y = \frac{9}{32x}$
    $y = \frac{9}{32 \times 2} = \frac{9}{64}$
35. inverse variation 36. direct variation 37. neither
38. inverse variation

**39.** $k = \frac{6}{3 \times 8} = \frac{1}{4}$

$z = \frac{1}{4}xy$

$z = \frac{-4 \times 7}{4} = -7$

**40.** $k = \frac{2}{-12 \times 4} = \frac{-1}{24}$

$z = \frac{-1}{24}xy$

$z = \frac{-4 \times 7}{-24} = \frac{7}{6}$

**41.** $k = \frac{5}{1 \times \frac{1}{3}} = 15$

$z = 15xy$

$z = 15(-4 \times 7) = -420$

**42.** $k = \frac{\frac{2}{5}}{-6 \times 3} = \frac{-1}{45}$

$z = \frac{-1}{45}xy$

$z = \frac{-4 \times 7}{-45} = \frac{28}{45}$

**43.** $k = \frac{8}{\frac{5}{6} \times \frac{3}{10}} = 32$

$z = 32xy$

$z = 32 \times -4 \times 7$

$z = -896$

**44.** $k = \frac{\frac{3}{2}}{\frac{3}{8} \times \frac{16}{17}} = \frac{17}{4}$

$z = \frac{17}{4}xy$

$z = \frac{17 \times -4 \times 7}{4} = -119$

**45.** $x = \frac{kz}{y}$ **46.** $y = kz\sqrt{x}$ **47.** $w = \frac{kyz}{x}$ **48.** no

**49.** yes; $l = \frac{45\pi}{8A}$

**50.** $A = \pi r^2 = \pi\left(\frac{3}{8}\right)^2 = \frac{9\pi}{64}$

$l = \frac{45\pi}{8\left(\frac{9\pi}{64}\right)} = \frac{360\pi}{9\pi} = 40$ in.

**51.** $D = \frac{k\sqrt{L}}{T^2}$

**52.** $D = \frac{33{,}640{,}000\sqrt{10{,}000}}{(5800)^2}$

$D = 100$

**53.** $100 \times 1{,}390{,}000 = 139{,}000{,}000$ km

**54.** $I = \frac{k}{d^2}$

$k = 10 \times 1^2 = 10$ watts/m$^2$

$I = \frac{10}{(15)^2} = \frac{10}{225} = 0.044$ watts/m$^2$

**55.** $k = \frac{2116.8}{(1.8 \times 120)} = \frac{49}{5}$

$W = \frac{49}{5}mh$

$W = \frac{49}{5}(100 \times 1.5) = 1470$ joules

**56.** $h = kAd$

**57.** $k = \frac{5.7}{1 \times 1} = 5.7$

$h = 5.7 \times 2.5 \times 20$

$h = 285$ watts

**58.** $k = \frac{36}{4 \times 18} = \frac{1}{2}$

$A = \frac{1}{2}h(b_1 + b_2)$

**59.** $P = \frac{kWD^2}{L}$

**a.** It stays the same.

**b.** It is multiplied by a factor of 8.

**c.** It is multiplied by a factor of 4.

**d.** *Sample answer:* Double only the depth or make the beam 4 times as wide.

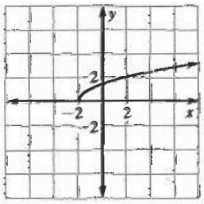
**60.** $x = \frac{k_1}{y} \quad y = \frac{k_2}{z}$

$x = \frac{k_1}{k_2}z = kz$

$x$ varies directly with $z$.

***9.1 Mixed Review (p. 539)***

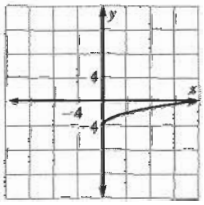
**61.** $y = \sqrt{x + 2}$



Domain: $x \geq -2$

Range: $y \geq 0$

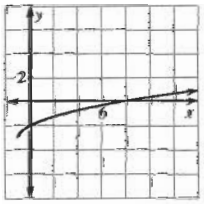
**62.** $y = \sqrt{x} - 4$



Domain: $x \geq 0$

Range: $y \geq -4$

**63.** $y = \sqrt{x + 1} - 3$



Domain: $x \geq -1$

Range: $y \geq -3$

**64.** $\sqrt{x} = 22$

$x = 484$

**65.** $\sqrt[4]{2x} + 2 = 6$

$\sqrt[4]{2x} = 4$

$2x = 256$

$x = 128$

**66.** $x^{1/3} - 7 = 0$

$x^{1/3} = 7$

$x = 343$

**67.** $\sqrt[3]{x + 12} = 5$

$x + 12 = 125$

$x = 113$

**68.** $(x - 2)^{3/2} = -8$

no solution

**69.** $\sqrt{3x + 1} = \sqrt{x + 15}$

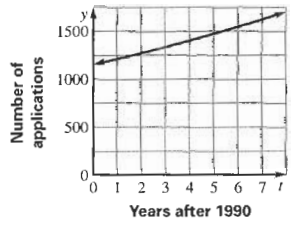
$3x + 1 = x + 15$

$2x = 14$

$x = 7$

**70. a.** $A = 1152(1.05)^t$

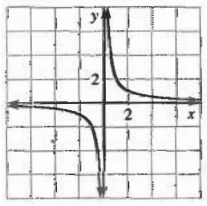
**b.** 1994

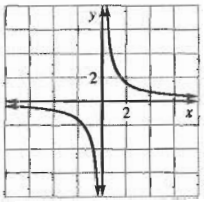



## Lesson 9.2

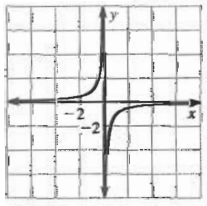
***Activity (p. 540)***

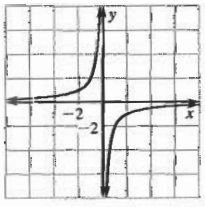
**1. a.** $y = \frac{2}{x}$ **b.** $y = \frac{3}{x}$





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





**2.** If $a > 0$, the branches of the hyperbola are in the first and third quadrants. If $a < 0$, then the branches are in the second and fourth quadrants.

**3.** As $|a|$ gets larger, the branches move further away from the origin.

***9.2 Guided Practice (p. 543)***

**1.** hyperbola

**2.** The vertical asymptote should be $x = -3$.

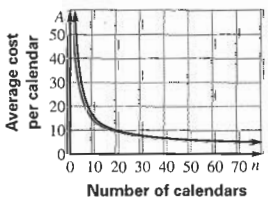
**3.** Both are all real nonzero numbers.

**4.** $x = 3, y = 4$ **5.** $x = -4, y = 2$ **6.** $x = -3, y = 1$

**7.** $x = 2, y = \frac{1}{2}$ **8.** $x = -8, y = -10$

**9.** $x = 6, y = -5$

**10.** $A = \frac{125 + 3.25n}{n}$




**11.** $x = 0, y = 2$

about 70 calendars

domain: all real numbers except 0; range: all real numbers except 2

***9.2 Practice and Applications (pp. 543–545)***

**12.** $y = 2; x = 3$; domain: all real numbers except 3; range: all real numbers except 2

**13.** $y = -2; x = -3$; domain: all real numbers except $-3$; range: all real numbers except $-2$

**14.** $y = 1; x = 3$; domain: all real numbers except 3; range: all real numbers except 1

**15.** $y = \frac{2}{3}; x = -\frac{1}{3}$; domain: all real numbers except $-\frac{1}{3}$; range: all real numbers except $\frac{2}{3}$

**16.** $y = \frac{3}{4}; x = -\frac{5}{4}$; domain: all real numbers except $-\frac{5}{4}$; range: all real numbers except $\frac{3}{4}$

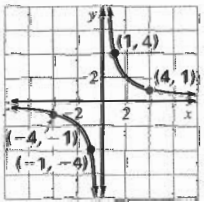
**17.** $y = -17; x = -43$; domain: all real numbers except $-43$; range: all real numbers except $-17$

**18.** $y = \frac{17}{8}; x = -\frac{1}{4}$; domain: all real numbers except $-\frac{1}{4}$; range: all real numbers except $\frac{17}{8}$

**19.** $y = 19; x = 6$; domain: all real numbers except 6; range: all real numbers except 19

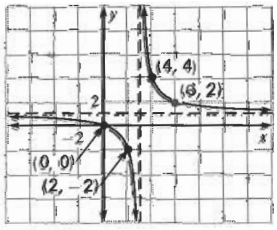
**20.** B **21.** C **22.** C

**23.** $y = \frac{4}{x}$



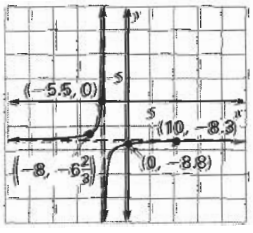

domain: all real numbers except 0; range: all real numbers except 0

**24.** $y = \frac{3}{x - 3} + 1$



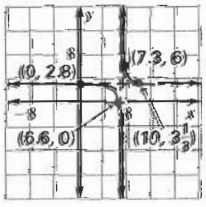

domain: all real numbers except 3; range: all real numbers except 1

**25.** $y = \frac{-4}{x + 5} - 8$



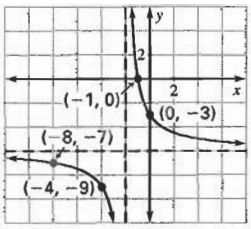

domain: all real numbers except $-5$; range: all real numbers except $-8$

**26.** $y = \frac{1}{x - 7} + 3$



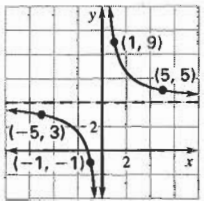

domain: all real numbers except 7; range: all real numbers except 3

**27.** $y = \frac{6}{x+2} - 6$



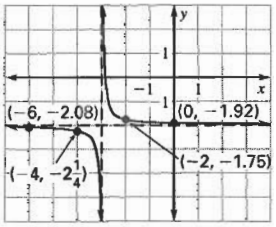

domain: all real numbers except $-2$; range: all real numbers except $-6$

**28.** $y = \frac{5}{x} + 4$



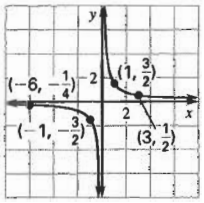

domain: all real number except 0; range: all real numbers except 4

**29.** $y = \frac{1}{4x+12} - 2$



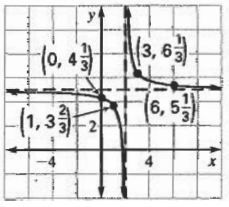

domain: all real numbers except $-3$; range: all real numbers except $-2$

**30.** $y = \frac{3}{2x}$



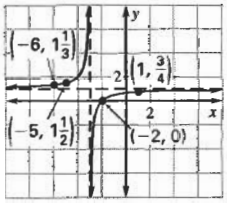

domain: all real numbers exept 0; range: all real numbers except 0

**31.** $y = \frac{4}{3x-6} + 5$



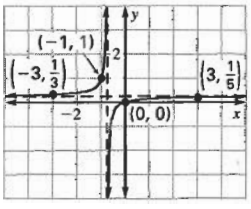

domain: all real numbers except 2; range: all real numbers except 5

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



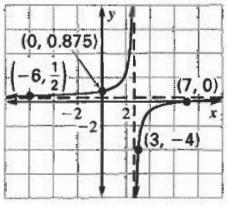

domain: all real numbers except $-3$; range: all real numbers except 1

**33.** $y = \frac{x}{4x+3}$



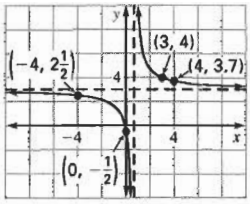

domain: all real numbers except $-\frac{3}{4}$; range: all real numbers except $\frac{1}{4}$

**34.** $y = \frac{x-7}{3x-8}$



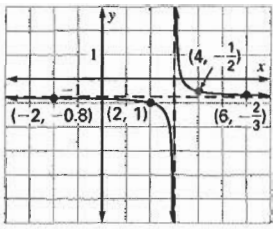

domain: all real numbers except $\frac{8}{3}$; range: all real numbers except $\frac{1}{3}$

**35.** $y = \frac{9x+1}{3x-2}$



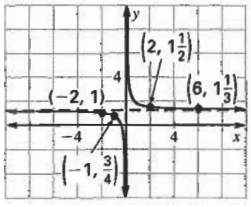

domain: all real numbers except $\frac{2}{3}$; range: all real numbers except 3

**36.** $y = \frac{-3x+10}{4x-12}$



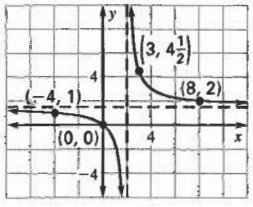

domain: all real numbers except 3; range: all real numbers except $-\frac{3}{4}$

**37.** $y = \frac{5x+2}{4x}$



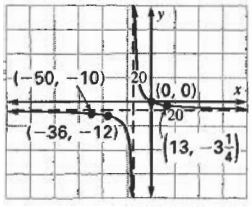

domain: all real numbers except 0; range: all real numbers except $\frac{5}{4}$

**38.** $y = \frac{3x}{2x-4}$



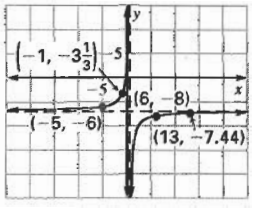

domain: all real numbers except 2; range: all real numbers except $\frac{3}{2}$

**39.** $y = \frac{7x}{-x-15}$




domain: all real numbers except $-15$; range: all real numbers except $-7$

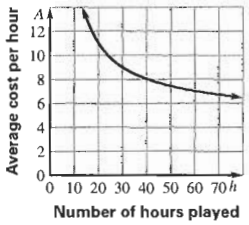
**40.** $y = \frac{-14x-4}{2x-1}$




domain: all real numbers exept $\frac{1}{2}$; range: all real numbers except $-7$

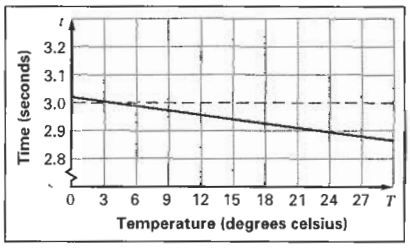
**41.** *Sample answer:* $y = \frac{1}{x + 4} + 3$

**42.** $A = \frac{120 + 5h}{h}$ **43.** 30



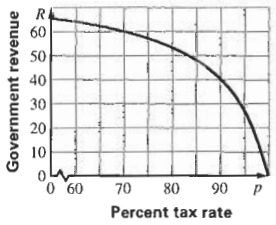

$A = 5$; the average cost per hour will approach \$5.

**44.**



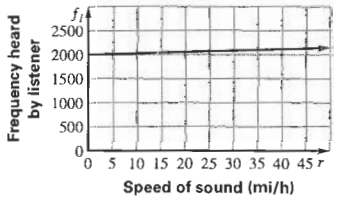

about 3.89°C

**45.**




**46.** 70% **47.** $f_l = \frac{740 \times 2000}{740 - r} = \frac{1{,}480{,}000}{740 - r}$

**48.**




As $r$ increases, the frequency increases.

**49.** It is symmetric in the line $y = x$ and in the line $y = -x$. Because it is symmetric in the line $y = x$, the function and its inverse are the same.

**50.** A **51.** E

**52.** $f(x) = \frac{3}{x - 5} + 10$

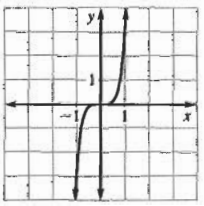
$= \frac{3}{x - 5} + \frac{10(x - 5)}{(x - 5)}$

$= \frac{3 + 10x - 50}{x - 5}$

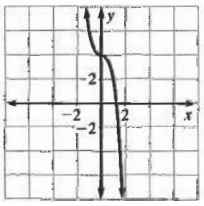
$= \frac{10x - 47}{x - 5}$

***9.2 Mixed Review (p. 545)***

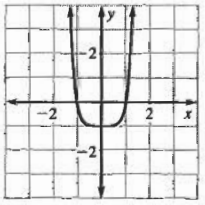
**53.** $f(x) = 3x^5$



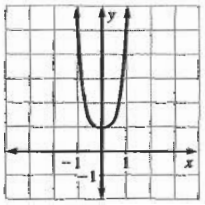

**54.** $f(x) = 4 - 2x^3$



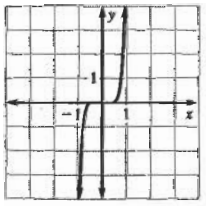

**55.** $f(x) = x^6 - 1$



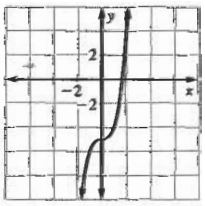

**56.** $f(x) = 4x^4 + 1$




**57.** $f(x) = 6x^7$




**58.** $f(x) = x^3 - 5$




**59.** $8x^3 - 125 = (2x - 5)(4x^2 + 10x + 25)$

**60.** $3x^3 + 81 = 3(x^3 + 27) = 3(x + 3)(x^2 - 3x + 9)$

**61.** $x^3 + 3x^2 + 3x + 9 = x^2(x + 3) + 3(x + 3)$

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

**62.** $5x^3 + 10x^2 + x + 2 = 5x^2(x + 2) + (x + 2)$

$= (x + 2)(5x^2 + 1)$

**63.** $81x^4 - 1 = (9x^2 - 1)(9x^2 + 1)$

$= (3x - 1)(3x + 1)(9x^2 + 1)$

**64.** $4x^4 - 4x^2 - 120 = 4(x^4 - x^2 - 30)$

$= 4(x^2 - 6)(x^2 + 5)$

**65.** $\frac{e^x}{5e} = \frac{1}{5}e^{x-1}$

**66.** $7e^{-5}e^{8} = 7e^{3}$ **67.** $e^{x}e^{4x+1} = e^{5x+1}$ **68.** $\dfrac{6e^{x}}{e^{6x}} = \dfrac{6}{e^{5x}}$

**69.** $e^{4}e^{2x}e^{-3x} = e^{-x+4}$ **70.** $e^{3}e^{-5} = e^{-2} = \dfrac{1}{e^{2}}$

***Technology Activity 9.2 (p. 546)***

**1.** $-10 \le x \le 10$
$-7 \le y \le 13$

**2.** $-10 \le x \le 10$
$-1 \le y \le 19$

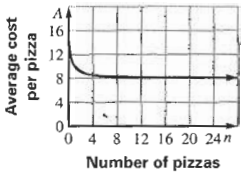
**3.** $-4 \le x \le 16$
$-5 \le y \le 15$

**4.** $-10 \le x \le 10$
$-4 \le y \le 16$

**5.** $-9 \le x \le 11$
$-9 \le y \le 11$

**6.** $-5 \le x \le 15$
$-15 \le y \le 5$

**7.** $A = \dfrac{2 + 8n}{n}$




The average cost approaches \$8.

## Lesson 9.3

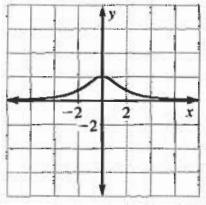
***9.3 Guided Practice (p. 550)***

**1.** greater than

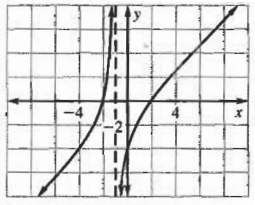
**2.** The $x$-intercepts are the real zeros of $p(x)$. The graph has a vertical asymptote of each real zero of $q(x)$.

**3.** The graph approaches the horizontal asymptote of $y = 4$.

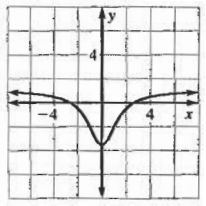
**4.** $y = \dfrac{6}{x^2 + 3}$



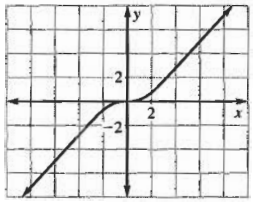

**5.** $y = \dfrac{x^2 - 4}{x + 1}$



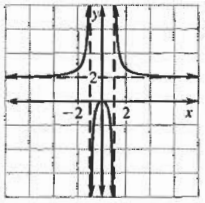

**6.** $y = \dfrac{x^2 - 7}{x^2 + 2}$



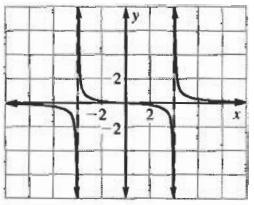

**7.** $y = \dfrac{x^3}{x^2 + 7}$




**8.** $y = \dfrac{2x^2}{x^2 - 1}$




**9.** $y = \dfrac{x}{x^2 - 16}$




**10.** $342 = \pi r^2 h$

$\dfrac{342}{\pi r^2} = h$

$S = 2\pi r^2 + 2\pi r\left(\dfrac{342}{\pi r^2}\right)$

$S = 2\pi r^2 + \dfrac{684}{r}$

$r \approx 3.79$ cm

$h \approx \dfrac{342}{3.79^2\pi} = 7.6$ cm

The actual can is taller and more narrow than the can with minimum surface area.

***9.3 Practice and Applications (pp. 550–552)***

**11.** $x$-intercept: 0
vertical asymptotes: $x = \pm 3$

**12.** $x$-intercepts: none
vertical asymptote: $x = 1$

**13.** $x$-intercepts: $-\frac{1}{2}, 5$
vertical asymptotes: $x = \pm 4$

**14.** $x$-intercept: $-\frac{3}{2}$
vertical asymptote: $x = 0$

**15.** $x$-intercepts: $-5, 1$
vertical asymptote: $x = 6$

**16.** $x$-intercepts: $1, \frac{10}{3}$
vertical asymptotes: none

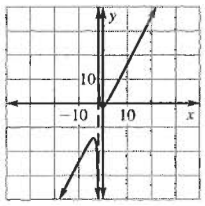
**17.** $x$-intercept: $-4$
vertical asymptotes: $x = \pm\sqrt{3}$

**18.** $x$-intercepts: $0, -\frac{1}{2}$
vertical asymptotes: none

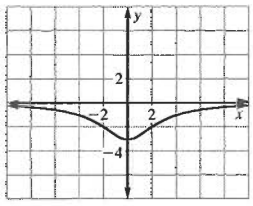
**19.** $x$-intercept: 3
vertical asymptote: $x = 0$

**20.** A **21.** C **22.** B **23.** B **24.** A **25.** C

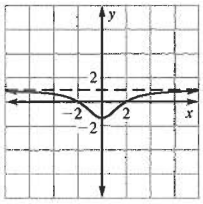
**26.** $y = \dfrac{2x^2 - 3}{x + 2}$



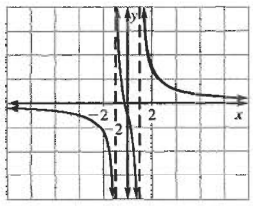
**27.** $y = \dfrac{-24}{x^2 + 8}$



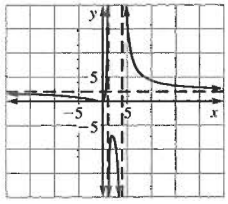
**28.** $y = \dfrac{x^2 - 4}{x^2 + 3}$



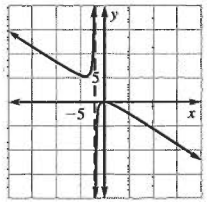
**29.** $y = \dfrac{4x + 1}{x^2 - 1}$



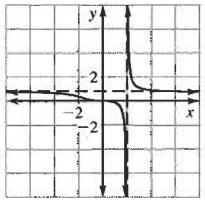
**30.** $y = \dfrac{2x^2 + 3x + 1}{x^2 - 5x + 4}$



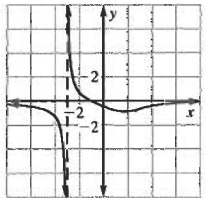
**31.** $y = \dfrac{-2x^2}{3x + 6}$



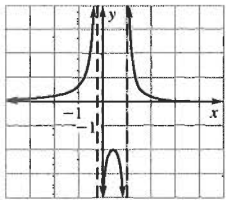
**32.** $y = \dfrac{3x^3 + 1}{4x^3 - 32}$



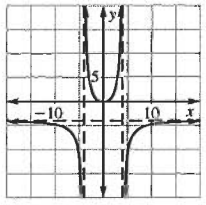
**33.** $y = \dfrac{x^2 - 11x - 12}{x^3 + 27}$



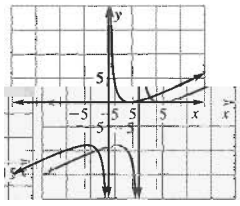
**34.** $y = \dfrac{4 - x}{5x^2 - 4x - 1}$



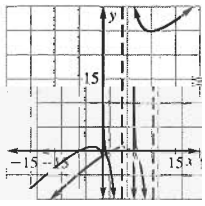
**35.** $y = \dfrac{-4x^2}{x^2 - 16}$



**36.** $y = \dfrac{x^2 - 9x + 20}{2x}$



**37.** $y = \dfrac{x^3 + 5x^2 - 1}{x^2 - 4x}$



**38.** $A = 200$

$l \times w = 200$

$l = \dfrac{200}{w}$

$P = l + 2w$

$P = \dfrac{200}{w} + 2w$

$P = \dfrac{200 + 2w^2}{w}$

min $w = 10$ $P = 40$

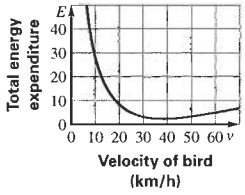
$l = \dfrac{200}{10} = 20$

$20 \times w = 200$

$w = 10$

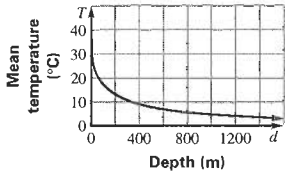
20 ft × 10 ft

**39.**



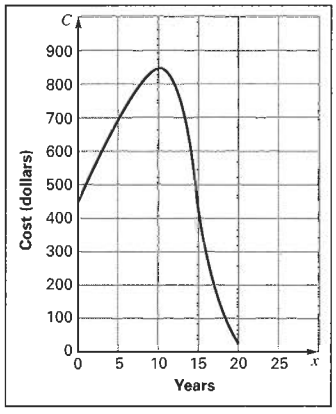

about 39 km/h

**40.**

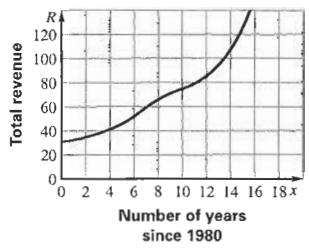



about 1240 m

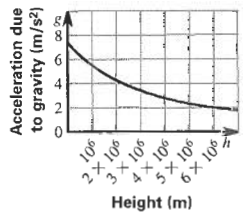
**41.**




No, this model predicts an average daily cost close to zero after 2005 and this is not realistic.

**42.** 

1990

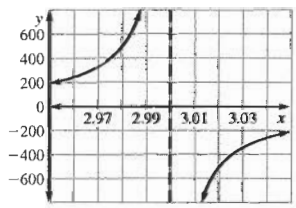
**43.** 

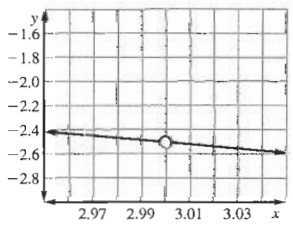

**44.** about 3.08 m/sec$^2$ **45.** $g'$ decreases as $h$ increases.

**46.** *Sample answer:* $y = \dfrac{x}{x^2 - 9x + 14}$ **47.** B **48.** D

**49. a.**

| $x$ | $f(x)$ | $g(x)$ |
|---|---|---|
| 2.95 | 190.76 | −2.42 |
| 2.96 | 240.71 | −2.43 |
| 2.97 | 323.99 | −2.45 |
| 2.98 | 490.60 | −2.47 |
| 2.99 | 990.55 | −2.48 |
| 3 | na | na |
| 3.01 | −1009.55 | −2.52 |
| 3.02 | −509.61 | −2.54 |
| 3.03 | −342.99 | −2.55 |
| 3.04 | −259.71 | −2.57 |
| 3.05 | −209.77 | −2.59 |

**b.** 


**c.** $f(x)$ has vertical asymptote at $x = 3$. The values of $g(x)$ gets close to $-2.5$.

**d.** The graph has a hole at $x = k$.

***9.3 Mixed Review (p. 553)***

**50.** $\dfrac{x^{-3}y}{xy^4} = \dfrac{1}{x^4y^3}$ **51.** $\dfrac{x^6y^5}{xy} = x^5y^4$ **52.** $\dfrac{3x^3y^3}{6x^{-1}y} = \dfrac{x^4y^2}{2}$

**53.** $\dfrac{12x^5y^{-2}}{3x^{-2}y^5} = \dfrac{4x^7}{y^7}$ **54.** $\left(\dfrac{x^2y^2}{x^3y}\right)^2 = \left(\dfrac{y}{x}\right)^2 = \dfrac{y^2}{x^2}$

**55.** $\left(\dfrac{5x^3}{25xy^2}\right)^3 = \left(\dfrac{x^2}{5y^2}\right)^3 = \dfrac{x^6}{125y^6}$

**56.** $z = -\dfrac{xy}{9}$

$z = \dfrac{-(-3)(2)}{9} = \dfrac{2}{3}$

**57.** $z = -\dfrac{3xy}{40}$

$z = \dfrac{-3(-3)(2)}{40} = \dfrac{9}{20}$

**58.** $z = -\dfrac{xy}{12}$

$z = \dfrac{-(-3)(2)}{12} = \dfrac{1}{2}$

**59.** $z = 8xy$

$z = (-3)(2)8 = -48$

**60.** $f(g(x)) = f(2x + 6) = \dfrac{(2x + 6)}{2} - 3 = x + 3 - 3 = x$

$g(f(x)) = g\left(\frac{1}{2}x - 3\right) = 2\left(\frac{1}{2}x - 3\right) + 6$

$= x - 6 + 6 = x$

**61.** $f(g(x)) = f\left(-\frac{1}{3}x + \frac{2}{3}\right) = -3\left(-\frac{1}{3}x + \frac{2}{3}\right) + 2$

$= x - 2 + 2 = x$

$g(f(x)) = g(-3x + 2) = -\frac{1}{3}(-3x + 2) + \frac{2}{3}$

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

**62.** $f(g(x)) = f\left[\left(\dfrac{x-2}{5}\right)^{1/3}\right] = 5\left[\left(\dfrac{x-2}{5}\right)^{1/3}\right]^3 + 2$

$= 5\left(\dfrac{x-2}{5}\right) + 2 = x - 2 + 2 = x$

$g(f(x)) = g(5x^3 + 2) = \left(\dfrac{5x^3 + 2 - 2}{5}\right)^{1/3}$

$= \left(\dfrac{5x^3}{5}\right)^{1/3} = [x^3]^{1/3} = x$

**63.** $f(g(x)) = f\left(\dfrac{\sqrt[4]{x}}{2}\right) = 16\left(\dfrac{\sqrt[4]{x}}{2}\right)^4 = \dfrac{16x}{16} = x$

$g(f(x)) = g(16x^4) = \dfrac{\sqrt[4]{16x^4}}{2} = \dfrac{2x}{2} = x$

***Quiz 1 (p. 553)***

**1.** $y = -\frac{12}{x}$

$y = \frac{-12}{-3} = 4$

**2.** $y = \frac{66}{x}$

$y = \frac{66}{-3} = -22$

**3.** $y = \frac{6}{x}$

$y = \frac{6}{-3} = -2$

**4.** $x = -\frac{yz}{6}$

$4 = -\frac{y}{6}$

$y = -24$

**5.** $x = 4yz$

$4 = 4y$

$y = 1$

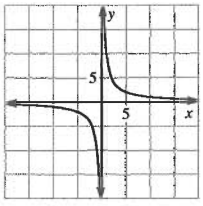
**6.** $x = -\frac{5yz}{4}$

$4 = -\frac{5y}{4}$

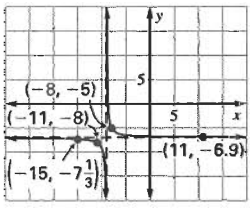
$16 = -5y$

$y = -\frac{16}{5}$

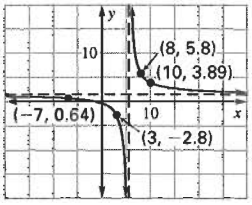
**7.** $y = \frac{10}{x}$



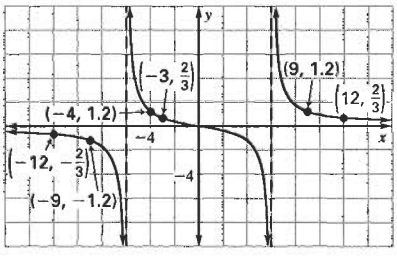

**8.** $y = \frac{2}{x+9} - 7$



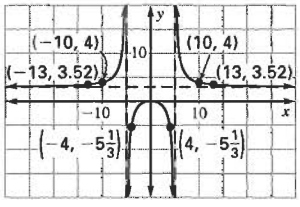

**9.** $y = \frac{3x+5}{2x-11}$



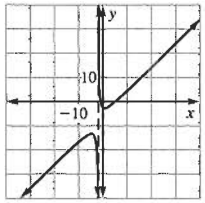

**10.** $y = \frac{6x}{x^2-36}$



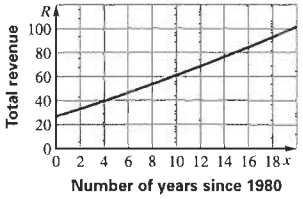

**11.** $y = \frac{3x^2}{x^2-25}$




**12.** $y = \frac{x^2-4x-5}{x+2}$




**13.**

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## Lesson 9.4

***9.4 Guided Practice (p. 558)***

**1.** A rational expression is in simplified form if its numerator and denominator have no common factors.

**2.** The $5x$'s cannot be canceled in the second line.

**3.** $\frac{4x^2}{4x^3+12x} = \frac{4x^2}{4x(x^2+3)} = \frac{x}{x^3+3}$

**4.** $\frac{x^2+4x-5}{x^2-1} = \frac{(x+5)(x-1)}{(x-1)(x+1)} = \frac{x+5}{x+1}$

**5.** $\frac{x^2+10x-4}{x^2+10x}$; in simplified form

**6.** $\frac{6x^2-4x-3}{3x^2+x}$; in simplified form

**7.** $\frac{x^2-9}{2x+1}$; in simplified form

**8.** $\frac{2x^3-32x}{x^2+8x+16} = \frac{2x(x^2-16)}{(x+4)(x+4)}$

$= \frac{2x(x-4)(x+4)}{(x+4)(x+4)} = \frac{2x(x-4)}{x+4}$

**9.** $\frac{16x^3}{5y^9} \cdot \frac{x^5y^8}{80x^3y} = \frac{16x^8y^8}{400x^3y^{10}} = \frac{x^5}{25y^2}$

**10.** $\frac{7x^4y^3}{5xy} \cdot \frac{2x^7}{21y^5} = \frac{14x^{11}y^3}{105xy^6} = \frac{2x^{10}}{15y^3}$

**11.** $\frac{x^2+x-6}{2x^2} \cdot \frac{2x+8}{x^2+7x+12}$

$= \frac{(x+3)(x-2) \cdot 2(x+4)}{2x^2(x+3)(x+4)} = \frac{x-2}{x^2}$

**12.** $\frac{144}{4xy} \div \frac{54y^3}{3x^3y} = \frac{144 \cdot 3x^3y}{4xy \cdot 54y^3} = \frac{432x^3y}{216xy^4} = \frac{2x^2}{y^3}$

**13.** $\frac{16xy}{3x^5y^5} \div \frac{8x^2}{9xy^7} = \frac{16xy \cdot 9xy^7}{3x^5y^5 \cdot 8x^2} = \frac{144x^2y^8}{24x^7y^5} = \frac{6y^3}{x^5}$