

Chapter 9 continued

Quiz 1 (p. 553)

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

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

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

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

5. $x = 4yz$

$4 = 4y$

$y = 1$

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

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

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

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

$y = -24$

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

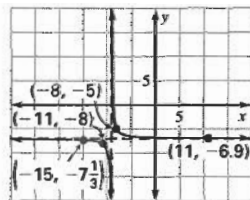
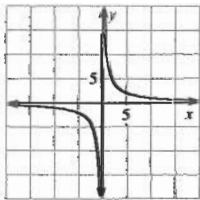
$4 = -\frac{5y}{4}$

$16 = -5y$

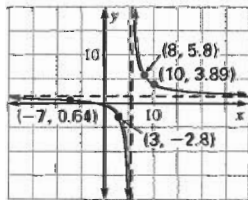
$y = -\frac{16}{5}$

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

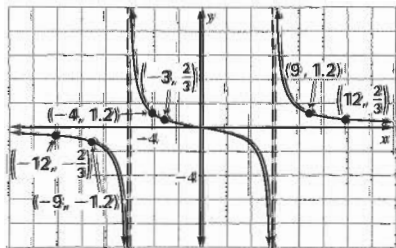
8. $y = \frac{2}{x+9} - 7$



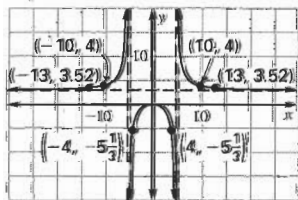
9. $y = \frac{3x+5}{2x-11}$



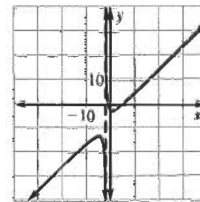
10. $y = \frac{6x}{x^2-36}$



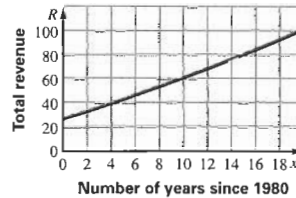
11. $y = \frac{3x^2}{x^2-25}$



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



13.



1992

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

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

Chapter 9 continued

14. $\frac{5x^2 + 10x}{x^2 - x - 6} \div \frac{15x^3 + 45x^2}{x^2 - 9}$
 $= \frac{5x(x+2) \cdot (x-3)(x+3)}{(x+2)(x-3) \cdot 15x^2(x+3)}$
 $= \frac{1}{3x}$
15. $\frac{\text{Volume}}{\text{Surface Area}} = \frac{104x^3}{70x^2} = 1.5x$
 $14x = 65$
 $x = 4.6$
 $1.5(4.6) = 6.9$ with
 $\frac{\text{Volume}}{\text{Surface Area}} = \frac{104x^3}{52x^2} = 2x$
 $14x = 65$
 $x = 4.6$
 $2(4.6) = 9.2$ without
16. $\frac{3x^3}{12x^2 + 9x} = \frac{3x^3}{3x(4x+3)} = \frac{x^2}{4x+3}$
17. $\frac{x^2 - x - 6}{x^2 + 8x + 16}$; in simplified form
18. $\frac{x^2 - 3x + 2}{x^2 + 5x - 6} = \frac{(x-2)(x-1)}{(x-1)(x+6)} = \frac{x-2}{x+6}$
19. $\frac{x^2 + 2x - 4}{x^2 + x - 6}$; in simplified form
20. $\frac{x^2 - 2x - 3}{x^2 - 7x + 12} = \frac{(x-3)(x+1)}{(x-3)(x-4)} = \frac{x+1}{x-4}$
21. $\frac{3x^2 - 3x - 6}{x^2 - 4} = \frac{3(x^2 - x - 2)}{(x-2)(x+2)} = \frac{3(x-2)(x+1)}{(x-2)(x+2)}$
 $= \frac{3(x+1)}{x+2}$
22. $\frac{x-2}{x^3 - 8} = \frac{x-2}{(x-2)(x^2 + 2x + 4)} = \frac{1}{x^2 + 2x + 4}$
23. $\frac{x^3 - 27}{x^3 + 3x^2 + 9x} = \frac{(x-3)(x^2 + 3x + 9)}{x(x^2 + 3x + 9)} = \frac{x-3}{x}$
24. $\frac{x^2 + 6x + 9}{x^2 - 9} = \frac{(x+3)(x+3)}{(x+3)(x-3)} = \frac{x+3}{x-3}$
25. $\frac{15x^2 - 8x - 18}{-20x^2 + 14x + 12}$ in simplified form
26. $\frac{x^3 - 2x^2 + x - 2}{3x^2 - 3x - 8}$; in simplified form
27. $\frac{x^3 + 3x^2 - 2x - 6}{x^3 + 27} = \frac{(x^2 - 2)(x + 3)}{(x+3)(x^2 - 3x + 9)}$
 $= \frac{x^2 - 2}{x^2 - 3x + 9}$
28. $\frac{4xy^3}{x^2y} \cdot \frac{y}{8x} = \frac{4xy^4}{8x^3y} = \frac{y^3}{2x^2}$
29. $\frac{80x^4}{y^3} \cdot \frac{xy}{5x^2} = \frac{80x^5y}{5x^2y^3} = \frac{16x^3}{y^2}$
30. $\frac{2x^2 - 10}{x+1} \cdot \frac{x+2}{3x^2 - 15} = \frac{2(x^2 - 5)(x+2)}{(x+1)3(x^2 - 5)} = \frac{2(x+2)}{3(x+1)}$
31. $\frac{x-3}{2x-8} \cdot \frac{6x^2 - 96}{x^2 - 9} = \frac{(x-3)6(x-4)(x+4)}{2(x-4)(x-3)(x+3)}$
 $= \frac{3(x+4)}{x+3}$
32. $\frac{x^2 - x - 6}{4x^3} \cdot \frac{x+1}{x^2 + 5x + 6} = \frac{(x-3)(x+2)(x+1)}{4x^3(x+2)(x+3)}$
 $= \frac{(x-3)(x+1)}{4x^3(x+3)}$
33. $\frac{2x^2 - 2}{x^2 - 6x - 7} \cdot (x^2 - 10x + 21)$
 $= \frac{2(x-1)(x+1)(x-3)(x-7)}{(x-7)(x+1)} = 2(x-1)(x-3)$
34. $\frac{x^3 + 5x^2 - x - 5}{x^2 - 25} \cdot (x+1) = \frac{(x^2 - 1)(x+5)(x+1)}{(x+5)(x-5)}$
 $= \frac{(x-1)(x+1)^2}{(x-5)}$
35. $\frac{x-3}{-x^3 + 3x^2} \cdot (x^2 + 2x + 1) = \frac{(x-3)(x+1)(x+1)}{-x^2(x-3)}$
 $= \frac{(x+1)^2}{-x^2}$
36. $\frac{32x^3y}{y^9} \div \frac{8x^4}{y^6} = \frac{32x^3y \cdot y^6}{y^9 \cdot 8x^4} = \frac{32x^3y^7}{8x^4y^9} = \frac{4}{xy^2}$
37. $\frac{2xyz}{x^2z^2} \div \frac{6y^3}{3xz} = \frac{2xyz \cdot 3xz}{x^2z^2 \cdot 6y^3} = \frac{6x^2yz^2}{6x^2y^3z^2} = \frac{1}{y^2}$
38. $\frac{3x^2 + x - 2}{x^2 + 3x + 2} \div \frac{2x}{x+2} = \frac{(3x-2)(x+1)(x+2)}{(x+2)(x+1)2x}$
 $= \frac{3x-2}{2x}$
39. $\frac{x^2 - 14x + 48}{x^2 - 6x} \div (3x - 24) = \frac{(x-8)(x-6)}{x(x-6) \cdot 3(x-8)}$
 $= \frac{1}{3x}$
40. $\frac{2x^2 - 12x}{x^2 - 7x + 6} \div \frac{2x}{3x-3} = \frac{2x(x-6) \cdot 3(x-1)}{(x-6)(x-1)2x} = 3$
41. $\frac{x^2 + 8x + 16}{x+2} \div \frac{x^2 + 6x + 8}{x^2 - 4}$
 $= \frac{(x+4)(x+4)(x-2)(x+2)}{(x+2)(x+2)(x+4)} = \frac{(x+4)(x-2)}{x+2}$
42. $\frac{x^2 + 6x - 7}{3x^2} \div \frac{x+7}{6x} = \frac{(x+7)(x-1)6x}{3x^2(x+7)} = \frac{2(x-1)}{x}$
43. $(x^2 + 6x - 27) \div \frac{3x^2 + 27x}{x+5} = \frac{(x+9)(x-3)(x+5)}{3x(x+9)}$
 $= \frac{(x-3)(x+5)}{3x}$

Chapter 9 continued

$$44. (x-5) \div \frac{x^2-11x+30}{x^2+7x+12} \cdot (x-6)$$

$$= (x-5) \cdot \frac{(x+3)(x+4)}{(x-5)(x-6)} \cdot (x-6)$$

$$= (x+3)(x+4)$$

$$45. \frac{x^2-x-12}{8x^2} \div \frac{x^3+3x^2}{8x^3-2x^2} \div \frac{4x-1}{x+2}$$

$$= \frac{(x-4)(x+3)}{8x^2} \cdot \frac{2x^2(4x-1)}{x^2(x+3)} \cdot \frac{(x+2)}{(4x-1)}$$

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

$$46. \frac{x^2+11x}{x-2} \div (3x^2+6x) \cdot \frac{x^2-4}{x+11}$$

$$= \frac{x(x+11)}{(x-2)} \cdot \frac{1}{3x(x+2)} \cdot \frac{(x-2)(x+2)}{(x+11)} = \frac{1}{3}$$

$$47. \frac{2x^2+x-15}{2x^2-11x-21} \cdot (6x+9) \div \frac{2x-5}{3x-21}$$

$$= \frac{(2x-5)(x+3)}{(2x+3)(x-7)} \cdot 3(2x+3) \cdot \frac{3(x-7)}{(2x-5)} = 9(x+3)$$

$$48. (x^3+8) \cdot \frac{x-2}{x^2-2x+4} \div \frac{x^2-4}{x-6}$$

$$= (x+2)(x^2-2x+4) \cdot \frac{(x-2)}{(x^2-2x+4)} \cdot \frac{(x-6)}{(x-2)(x+2)}$$

$$= x-6$$

$$49. \frac{x^2+12x+20}{4x^2-9} \cdot \frac{6x^3-9x^2}{x^3+10x^2} \cdot (2x+3)$$

$$= \frac{(x+2)(x+10)}{(2x+3)(2x-3)} \cdot \frac{3x^2(2x-3)}{x^2(x+10)} \cdot (2x+3)$$

$$= 3(x+2)$$

$$50. \frac{\text{heat generated}}{\text{heat released}} = \frac{k_1 H^3 V^2}{k_2 H^2} = \frac{k_1 H V^2}{k_2}$$

$$51. H = \frac{k_2}{k_1 V^2}; \text{ shorter runner has an advantage.}$$

$$52. A = L \div F = \frac{43.3t + 999}{0.0482t + 1} \div \frac{0.101t^2 + 2.20}{0.0500t^2 + 1}$$

$$= \frac{(43.3t + 999)(0.0500t^2 + 1)}{(0.0482t + 1)(0.101t^2 + 2.20)}$$

$$53. \text{ when } t = 6, \frac{(43.3(6) + 999)(0.0500(6)^2 + 1)}{(0.0482(6) + 1)(0.101(6)^2 + 2.20)}$$

$$= \frac{3524.64}{7.5237712} \approx 468.5 \text{ acres}$$

$$54. V = W \cdot P$$

$$= \frac{(-0.0112t^5 + 0.193t^4 - 1.17t^3 + 2.82t^2 - 1.76t + 10.4)(53.4t^2 - 243t + 385)}{(0.00146t^3 + 0.122t^2 - 0.586t + 1)}$$

$$55. \text{ when } t = 4, P \approx 381.22 \quad W \approx 11.54$$

$$W \cdot P = \$4.4 \text{ billion}$$

$$56. \frac{\text{Vol. of rectangular prism}}{\text{Vol. of cylinder}} = \frac{(4x)(4x)(7x+1)}{\pi(2x)^2(7x+1)}$$

$$= \frac{16x^2(7x+1)}{4x^2\pi(7x+1)} = \frac{4}{\pi}$$

$$57. \text{ a. } \frac{2\pi r^2 + 2\pi r h}{\pi^2 h} = \frac{2\pi r(r+h)}{\pi^2 h} = \frac{2(r+h)}{\pi r h}$$

$$\text{ b. when } h = 2r, \frac{2(r+2r)}{r \cdot 2r} = \frac{2(3r)}{2r^2} = \frac{3}{r}$$

$$\text{ c. } r = 2\frac{5}{8}, h = 3\frac{7}{8}$$

$$\frac{2\left(2\frac{5}{8} + 3\frac{7}{8}\right)}{\left(2\frac{5}{8}\right)\left(3\frac{7}{8}\right)} = \frac{2\left(\frac{52}{8}\right)}{\left(\frac{651}{64}\right)} = \left(\frac{52}{4}\right)\left(\frac{64}{651}\right) = \frac{832}{651} \approx 1.278$$

$$r = 5\frac{1}{8}, h = 6\frac{1}{2}$$

$$\frac{2\left(5\frac{1}{8} + 6\frac{1}{2}\right)}{\left(5\frac{1}{8}\right)\left(6\frac{1}{2}\right)} = \frac{2\left(\frac{93}{8}\right)}{\left(\frac{533}{16}\right)} = \left(\frac{93}{4}\right)\left(\frac{16}{533}\right) = \frac{372}{533} \approx 0.698$$

$$r = 6\frac{3}{16}, h = 7$$

$$\frac{2\left(6\frac{3}{16} + 7\right)}{\left(6\frac{3}{16}\right)(7)} = \frac{2\left(\frac{211}{16}\right)}{\left(\frac{693}{16}\right)} = \left(\frac{211}{8}\right)\left(\frac{16}{693}\right) = \frac{422}{693} \approx 0.609$$

d. 3 pound can, 2 pound can, soup can; reducing the surface area to volume ratio makes the can more efficient.

58. Sample answer:

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

$$\frac{x(x-1)}{x+2} = \frac{x^2}{g(x)}, \quad g(x) = \frac{x^2(x+2)}{x(x-1)} = \frac{x(x+2)}{(x-1)}$$

Chapter 9 continued

59. Sample answer:

$$f(x) \cdot g(x) = x - 1$$

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

$$\frac{f(x)}{x-1}$$

$$\frac{[f(x)]^2}{x-1} = \frac{(x+1)^2(x-1)}{x^4}$$

$$[f(x)]^2 = \frac{(x+1)^2(x-1)^2}{x^4}$$

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

$$\frac{f(x)}{g(x)} = \frac{(x+1)^2(x-1)}{x^4}$$

$$g(x) = x - 1 \div \frac{(x+1)(x-1)}{x^2}$$

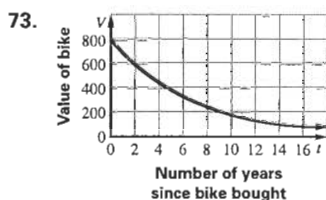
$$g(x) = \frac{(x-1)x^2}{(x+1)(x-1)} = \frac{x^2}{x+1}$$

9.4 Mixed Review (p. 560)

60. $96 = 2^5 \cdot 3$ 61. $120 = 3 \cdot 5 \cdot 2^3$
 $160 = 2^5 \cdot 5$ $165 = 3 \cdot 5 \cdot 11$
 GCF (96, 160) = 32 GCF (120, 165) = 15
 LCD (96, 160) = 480 LCD (120, 165) = 1320
62. $48 = 2^4 \cdot 3$ 63. $72 = 2^3 \cdot 3^2$
 $108 = 2^2 \cdot 3^3$ $84 = 2^2 \cdot 3 \cdot 7$
 GCF (48, 108) = 12 GCF (72, 84) = 12
 LCD (48, 108) = 432 LCD (72, 84) = 504
64. $238 = 2 \cdot 7 \cdot 17$ 65. $480 = 2^5 \cdot 3 \cdot 5$
 $51 = 3 \cdot 17$ $600 = 5^2 \cdot 3 \cdot 2^3$
 GCF (238, 51) = 17 GCF (480, 600) = 120
 LCD (238, 51) = 714 LCD (480, 600) = 2400
66. $x(x^2 + 7x - 1) = x^3 + 7x^2 - x$
 67. $(x+7)(x-1) = x^2 + 7x - x - 7 = x^2 + 6x - 7$
 68. $(x+10)(x-3) = x^2 - 3x + 10x - 30$
 $= x^2 + 7x - 30$
 69. $(x+3)(x^2 + 3x + 2) = x^3 + 3x^2 + 2x + 3x^2 + 9x + 6$
 $= x^3 + 6x^2 + 11x + 6$
 70. $(2x-2)(x^3 - 4x^2) = 2x^4 - 8x^3 - 2x^2 + 8x^2$
 $= 2x^4 - 10x^3 + 8x^2$
 71. $x(x^2 - 4)(5 - 6x^3) = (x^3 - 4x)(5 - 6x^3)$
 $= 5x^3 - 6x^6 - 20x + 24x^4$
 $= -6x^6 + 24x^4 + 5x^3 - 20x$

72. $V = 800(0.86)^t$

when $t = 4$, $V = 800(0.86)^4 \approx \438



about 6.5 years

Technology Activity 9.4 (p. 561)

- $\frac{x^2 - 3x}{x^2 + x - 12} = \frac{x(x-3)}{(x+4)(x-3)} = \frac{x}{x+4}$
- $\frac{2x^2 - 10x}{x^2 - 4x - 5} = \frac{2x(x-5)}{(x-5)(x+1)} = \frac{2x}{x+1}$
- $\frac{x^2 + x - 6}{x^2 + 4x + 3} = \frac{(x+3)(x-2)}{(x+3)(x+1)} = \frac{x-2}{x+1}$
- $\frac{x-1}{2x^2} \cdot \frac{x+2}{x-1} = \frac{x+2}{2x^2}$
- $\frac{2x^2 - 10x}{3x+3} \div \frac{x-5}{x+1} = \frac{2x(x-5)}{3(x+1)} \cdot \frac{(x+1)}{(x-5)} = \frac{2x}{3}$
- $\frac{x^2 - x - 12}{x^2 + 6x + 6} \cdot \frac{x^2 + 3x + 2}{x^2 + 5x + 6}$
 $= \frac{(x-4)(x+3)(x+2)(x+1)}{(x^2 + 6x + 6)(x+2)(x+3)} = \frac{(x-4)(x+1)}{x^2 + 6x + 6}$

Lesson 9.5

9.5 Guided Practice (p. 565)

- Sample answers: $4 + \frac{1}{x} - \frac{5}{x+1} + 3$
 $2 - \frac{3}{2x+5}$
- You need common denominators to add (or subtract) rational expressions or numerical fractions.
- a. Write the numerator and denominator as a single fraction. Then divide by multiplying the numerator by the reciprocal of the denominator.
 b. Multiply the numerator and denominator by the least common denominator of every fraction in the numerator and denominator.
- $(x+1)^3$ is a common denominator, but not the lowest. The LCD is $(x+1)^2$.
- $\frac{2x}{x+5} + \frac{7}{x+5} = \frac{2x+7}{x+5}$
- $\frac{7}{5x} + \frac{8}{3x} = \frac{21}{15x} + \frac{40}{15x} = \frac{61}{15x}$

Chapter 9 continued

$$7. \frac{x}{x-4} - \frac{6}{x+3} = \frac{x(x+3)}{(x-4)(x+3)} - \frac{6(x-4)}{(x-4)(x+3)}$$

$$= \frac{x^2 + 3x - 6x + 24}{(x-4)(x+3)}$$

$$= \frac{x^2 - 3x + 24}{(x-4)(x+3)}$$

$$8. \frac{\frac{x}{5} + 4}{8 + \frac{1}{x}} = \frac{\frac{x+20}{5}}{\frac{8x+1}{x}} = \frac{x+20}{5} \cdot \frac{x}{8x+1} = \frac{x(x+20)}{5(8x+1)}$$

$$9. \frac{\frac{x+2}{5} - 5}{8 + \frac{4}{x}} = \frac{\frac{x+2-25}{5}}{\frac{8x+4}{x}} = \frac{x-23}{5} \cdot \frac{x}{8x+4}$$

$$= \frac{x(x-23)}{20(2x+1)}$$

$$10. \frac{\frac{15}{2x+2} - \frac{1}{x}}{\frac{1}{2}} = \frac{\frac{15}{2(x+1)} - \frac{1}{x}}{\frac{1}{2}} = \frac{15}{2(x+1)} \cdot \frac{2x}{12-x}$$

$$= \frac{15x}{(x+1)(12-x)}$$

$$11. m = \frac{Pi}{1 - \left(\frac{1}{1+i}\right)^{12t}} = \frac{Pi}{1 - \frac{1}{(1+i)^{12t}}}$$

$$= \frac{Pi(1+i)^{12t}}{(1+i)^{12t} - 1} \cdot (1+i)^{12t}$$

$$= \frac{Pi(1+i)^{12t}}{(1+i)^{12t} - 1}$$

9.5 Practice and Applications (pp. 565-567)

$$12. \frac{7}{6x} + \frac{11}{6x} = \frac{18}{6x} = \frac{3}{x} \quad 13. \frac{23}{10x^2} - \frac{x}{10x^2} = \frac{23-x}{10x^2}$$

$$14. \frac{4x}{x+1} - \frac{3}{x+1} = \frac{4x-3}{x+1}$$

$$15. \frac{5x^2}{x+8} + \frac{5x}{x+8} = \frac{5x^2+5x}{x+8} = \frac{5x(x+1)}{x+8}$$

$$16. \frac{6x^2}{x-2} - \frac{12x}{x-2} = \frac{6x^2-12x}{x-2} = \frac{6x(x-2)}{(x-2)} = 6x$$

$$17. \frac{x}{x^2-5x} - \frac{5}{x^2-5x} = \frac{x-5}{x^2-5x} = \frac{(x-5)}{x(x-5)} = \frac{1}{x}$$

$$18. \text{LCD} \left(\frac{14}{4(x+1)}, \frac{7}{4x} \right) = 4x(x+1)$$

$$19. \text{LCD} \left(\frac{4}{21x^2}, \frac{x}{3x^2-15x} \right) = 21x^2(x-5)$$

$$20. \text{LCD} \left(\frac{5x+2}{4x^2-1}, \frac{3}{x}, \frac{9x}{2x+1} \right) = x(2x+1)(2x-1)$$

$$21. \text{LCD} \left(\frac{1}{x(x-6)}, \frac{12}{x^2-3x-18} \right) = x(x+3)(x-6)$$

$$22. \text{LCD} \left(\frac{3x+1}{x(x-7)}, \frac{3}{x^2-6x-7} \right) = x(x+1)(x-7)$$

$$23. \text{LCD} \left(\frac{1}{x^2-3x-28}, \frac{x}{x^2+6x+8} \right)$$

$$= (x-7)(x+2)(x+4)$$

24. Sometimes; the LCD will be the product of the denominators if the denominators have no common factors.

25. Always; each denominator must be a factor of the LCD, so the LCD must have degree greater than or equal to each of the separate denominators.

$$26. \frac{6}{4x^2} + \frac{2}{5x} = \frac{30}{20x^2} + \frac{8x}{20x^2} = \frac{30+8x}{20x^2} = \frac{15+4x}{10x^2}$$

$$27. \frac{4}{7x} - \frac{5}{3x} = \frac{12}{21x} - \frac{35}{21x} = \frac{-47}{21x}$$

$$28. \frac{7}{6(x-2)} - \frac{x+3}{6x} = \frac{7x}{6x(x-2)} - \frac{(x+3)(x-2)}{6x(x-2)}$$

$$= \frac{7x - x^2 - x + 6}{6x(x-2)}$$

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

$$29. \frac{6x+1}{x^2-9} + \frac{4}{x-3} = \frac{6x+1}{(x-3)(x+3)} + \frac{4(x+3)}{(x-3)(x+3)}$$

$$= \frac{6x+1+4x+12}{(x-3)(x+3)}$$

$$= \frac{10x+13}{(x-3)(x+3)}$$

$$30. \frac{10}{x^2-5x-14} + \frac{2}{x-7}$$

$$= \frac{10}{(x-7)(x+2)} + \frac{2(x+2)}{(x-7)(x+2)}$$

$$= \frac{10+2x+4}{(x-7)(x+2)}$$

$$= \frac{2x+14}{(x-7)(x+2)}$$

$$= \frac{2(x+7)}{(x-7)(x+2)}$$

$$31. \frac{5x-1}{x^2+2x-8} - \frac{6}{x+4}$$

$$= \frac{5x-1}{(x+4)(x-2)} - \frac{6(x-2)}{(x+4)(x-2)}$$

$$= \frac{5x-1-6x+12}{(x+4)(x-2)}$$

$$= \frac{-x+11}{(x+4)(x-2)}$$

Chapter 9 continued

$$\begin{aligned}
 32. \quad \frac{4x^2}{3x+5} - \frac{10}{x+8} &= \frac{4x^2(x+8)}{(3x+5)(x+8)} - \frac{10(3x+5)}{(3x+5)(x+8)} \\
 &= \frac{4x^3 + 32x^2 - 30x - 50}{(3x+5)(x+8)} \\
 &= \frac{2(2x^3 + 16x^2 - 15x - 25)}{(3x+5)(x+8)}
 \end{aligned}$$

$$\begin{aligned}
 33. \quad \frac{2-5x}{x-10} + \frac{1}{3x+2} \\
 &= \frac{(2-5x)(3x+2)}{(x-10)(3x+2)} + \frac{(x-10)}{(x-10)(3x+2)} \\
 &= \frac{-15x^2 - 10x + 6x + 4 + x - 10}{(x-10)(3x+2)} \\
 &= \frac{-15x^2 - 3x - 6}{(x-10)(3x+2)} \\
 &= \frac{-3(5x^2 + x + 2)}{(x-10)(3x+2)}
 \end{aligned}$$

$$\begin{aligned}
 34. \quad \frac{x^2+x-3}{x^2-12x+32} + \frac{3x}{x-8} \\
 &= \frac{x^2+x-3}{(x-4)(x-8)} + \frac{3x(x-4)}{(x-4)(x-8)} \\
 &= \frac{x^2+x-3+3x^2-12x}{(x-4)(x-8)} \\
 &= \frac{4x^2-11x-3}{(x-4)(x-8)} \\
 &= \frac{(4x+1)(x-3)}{(x-4)(x-8)}
 \end{aligned}$$

$$\begin{aligned}
 35. \quad \frac{2x+1}{x^2+8x+16} - \frac{3}{x^2-16} \\
 &= \frac{(2x+1)(x-4)}{(x+4)^2(x-4)} - \frac{3(x+4)}{(x+4)^2(x-4)} \\
 &= \frac{2x^2-7x-4-3x-12}{(x+4)^2(x-4)} \\
 &= \frac{2x^2-10x-16}{(x+4)^2(x-4)} \\
 &= \frac{2(x^2-5x-8)}{(x+4)^2(x-4)}
 \end{aligned}$$

$$\begin{aligned}
 36. \quad \frac{4x}{x+1} + \frac{5}{2x-3} - \frac{4}{x} \\
 &= \frac{4x(2x-3)x + 5(x+1)x - 4(x+1)(2x-3)}{x(x+1)(2x-3)} \\
 &= \frac{8x^3 - 15x^2 + 9x + 12}{x(x+1)(2x+3)} \\
 &= \frac{8x^3 - 12x^2 + 5x^2 + 5x - 8x^2 + 4x + 12}{x(x+1)(2x+3)}
 \end{aligned}$$

$$\begin{aligned}
 37. \quad \frac{10x}{3(x-1)(x+1)} + \frac{4}{x-1} + \frac{5}{6x} \\
 &= \frac{(10x)(2x) + 4(6x)(x+1) + 5(x-1)(x+1)}{6x(x-1)(x+1)} \\
 &= \frac{20x^2 + 24x^2 + 24x + 5x^2 - 5}{6x(x-1)(x+1)} \\
 &= \frac{49x^2 + 24x - 5}{6x(x-1)(x+1)}
 \end{aligned}$$

$$38. \quad \frac{\frac{x}{2} - 5}{6 + \frac{3}{x}} = \frac{\frac{x-10}{2}}{\frac{6x+3}{x}} = \frac{x-10}{2} \cdot \frac{x}{6x+3} = \frac{x(x-10)}{6(2x+1)}$$

$$39. \quad \frac{\frac{20}{x+1}}{\frac{1}{4} - \frac{7}{x+1}} = \frac{\frac{20}{x+1}}{\frac{x+1-28}{4(x+1)}} = \frac{20}{x+1} \cdot \frac{4(x+1)}{x-27} = \frac{80}{x-27}$$

$$\begin{aligned}
 40. \quad \frac{\frac{1}{2x^2-2}}{\frac{2}{x+1} + \frac{x}{x^2-2x-3}} &= \frac{\frac{1}{2(x^2-1)}}{\frac{2(x-3)+x}{(x+1)(x-3)}} \\
 &= \frac{1}{2(x+1)(x-1)} \cdot \frac{(x+1)(x-3)}{3(x-2)} \\
 &= \frac{(x-3)}{6(x-1)(x-2)}
 \end{aligned}$$

$$41. \quad \frac{\frac{1}{x} - \frac{x}{\frac{1}{x} + 1}}{\frac{3}{x}} = \frac{\frac{1}{x} - \frac{x}{\frac{1+x}{x}}}{\frac{3}{x}}$$

$$\begin{aligned}
 &= \frac{\frac{1}{x} - \left(\frac{x}{1} \cdot \frac{x}{1+x}\right)}{\frac{3}{x}} \\
 &= \frac{\frac{x+1-x^3}{x(1+x)} \cdot \frac{x}{3}}{\frac{3}{x}} \\
 &= \frac{-x^3+x+1}{3(x+1)}
 \end{aligned}$$

$$\begin{aligned}
 42. \quad \frac{\frac{1-x}{x^4}}{\frac{1}{x^2} - \frac{2}{x^2(x+1)}} &= \left(\frac{1-x}{x^4}\right) \div \left[\frac{x+1-2}{x^2(x+1)}\right] \\
 &= \frac{1-x}{x^4} \cdot \frac{-x^2(x+1)}{(-x+1)} = \frac{x+1}{x^2}
 \end{aligned}$$

$$\begin{aligned}
 43. \quad \frac{\frac{1}{4x+3} - \frac{5}{3(4x+3)}}{\frac{x}{4x+3}} &= \left(\frac{3-5}{3(4x+3)}\right) \div \frac{3x}{3(4x+3)} \\
 &= \frac{-2}{3(4x+3)} \cdot \frac{3(4x+3)}{3x} = -\frac{2}{3x}
 \end{aligned}$$

Chapter 9 continued

$$44. \frac{\frac{4}{x^2-9} + \frac{2}{x-3}}{\frac{1}{x+3} + \frac{1}{x-3}} = \frac{\left[\frac{4 + 2(x+3)}{(x+3)(x-3)} \right]}{\left[\frac{x-3 + x+3}{(x+3)(x-3)} \right]}$$

$$= \frac{2(x+5)}{(x+3)(x-3)} \cdot \frac{(x+3)(x-3)}{2x}$$

$$= \frac{x+5}{x}$$

$$45. \frac{\frac{1}{x^3+64}}{\frac{5}{x^2-16} - \frac{2}{3x^2+12x}} = \frac{\frac{1}{(x+4)(x^2-4x+16)}}{\frac{5}{(x+4)(x-4)} - \frac{2}{3x(x+4)}}$$

$$= \frac{1}{(x+4)(x^2-4x+16)} \div \frac{5(3x) - 2(x-4)}{3x(x+4)(x-4)}$$

$$= \frac{1}{(x+4)(x^2-4x+16)} \cdot \frac{3x(x+4)(x-4)}{13x+8}$$

$$= \frac{3x(x-4)}{(13x+8)(x^2-4x+16)}$$

$$46. \frac{\frac{3}{2x^2+6x+18} + \frac{x}{x^3-27}}{\frac{5x}{3x-9} - \frac{3}{x-3}}$$

$$= \frac{\frac{3}{2(x^2+3x+9)} + \frac{x}{(x-3)(x^2+3x+9)}}{\frac{5x}{3(x-3)} - \frac{3}{x-3}}$$

$$= \frac{3(x-3) + 2x}{2(x-3)(x^2+3x+9)} \div \frac{5x-9}{3(x-3)}$$

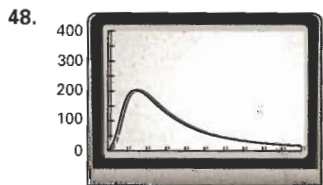
$$= \frac{5x-9}{2(x-3)(x^2+3x+9)} \cdot \frac{3(x-3)}{5x-9}$$

$$= \frac{3}{2(x^2+3x+9)}$$

47. $M = G - F$

$$= \frac{7560t^2 + 978,000}{0.00418t^2 + 1} - \frac{-19,600t + 493,000}{-0.0580t + 1}$$

$$\approx \frac{357t^3 + 5500t^2 - 37,100t + 485,000}{(0.00418t^2 + 1)(-0.0580t + 1)}$$

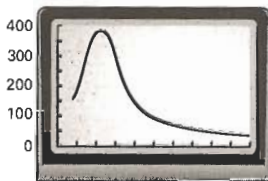


49. $A = \frac{391(t-1)^2 + 0.112}{0.218(t-1)^4 + 0.991(t-1)^2 + 1}$ for $t \geq 1$

50.

$$A = \frac{391t^2 + 0.112}{0.218t^4 + 0.991t^2 + 1} + \frac{391(t-1)^2 + 0.112}{0.218(t-1)^4 + 0.991(t-1)^2 + 1}$$

for $t \geq 1$



51. about 1.2 hr after the second dose

$$52. \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}} = 1 \div \frac{R_2R_3 + R_1R_3 + R_1R_2}{R_1R_2R_3}$$

$$= \frac{R_1R_2R_3}{R_1R_2 + R_2R_3 + R_1R_3}$$

$$53. \frac{(6)(12)(24)}{(6)(12) + (12)(24) + (6)(24)} = \frac{1728}{72 + 288 + 144}$$

$$= \frac{1728}{504} = \frac{24}{7}$$

54. a.

$$\frac{5783 + 1134(1)}{1 + 0.025(1)} - \frac{5783}{1} = \left(\frac{6917}{1.025} - \frac{5783}{1} \right) \frac{1}{5783}$$

$$= \frac{6917 - (1.025)(5783)}{1.025(5783)} \approx 16.7\%$$

b. $C = \frac{98,942.5}{(0.025t + 1.025)(5783 + 1134t)}$

c. The percent change is getting smaller.

55. $2 + \frac{1}{1 + \frac{1}{2}} = 2 + \frac{1}{\frac{3}{2}} = 2 + \frac{2}{3} = \frac{8}{3}$

$$2 + \frac{1}{1 + \frac{1}{2 + \frac{2}{3}}} = 2 + \frac{1}{1 + \frac{3}{8}} = 2 + \frac{8}{11} = \frac{30}{11}$$

$$2 + \frac{1}{1 + \frac{1}{2 + \frac{2}{3 + \frac{3}{4}}}} = 2 + \frac{1}{1 + \frac{1}{2 + \frac{8}{15}}} = 2 + \frac{1}{1 + \frac{15}{38}}$$

$$= 2 + \frac{38}{53} = \frac{144}{53}$$

—CONTINUED—

Chapter 9 continued

55. —CONTINUED—

$$2 + \frac{1}{1 + \frac{1}{2 + \frac{1}{3 + \frac{1}{4 + \frac{1}{5}}}}} = 2 + \frac{1}{1 + \frac{1}{2 + \frac{1}{3 + \frac{5}{8}}}}$$

$$= 2 + \frac{1}{1 + \frac{1}{2 + \frac{16}{29}}}$$

$$= 2 + \frac{1}{1 + \frac{29}{74}}$$

$$= 2 + \frac{74}{103} = \frac{280}{103}$$

$$2 + \frac{1}{1 + \frac{1}{2 + \frac{1}{3 + \frac{1}{4 + \frac{1}{5 + \frac{1}{6}}}}}}$$

$$= 2 + \frac{1}{1 + \frac{1}{2 + \frac{1}{3 + \frac{105}{164}}}} = 2 + \frac{1}{1 + \frac{1}{2 + \frac{2}{3 + \frac{105}{164}}}}$$

$$= 2 + \frac{1}{1 + \frac{1}{2 + \frac{328}{597}}} = 2 + \frac{1}{1 + \frac{597}{1522}}$$

$$= 2 + \frac{1522}{2119} = \frac{5760}{2119}$$

56. $e \approx 2.718$

9.5 Mixed Review (p. 567)

57. $\frac{1}{2}x - 7 = 5$

$$\frac{1}{2}x = 12$$

$$x = 24$$

59. $\frac{3}{4}x + \frac{1}{2} = x - \frac{5}{6}$

$$-\frac{1}{4}x = -\frac{4}{3}$$

$$x = \frac{16}{3}$$

61. $-\frac{1}{12}x - 3 = \frac{5}{2}$

$$-\frac{1}{12}x = \frac{11}{2}$$

$$x = -66$$

58. $6 - \frac{1}{10}x = -1$

$$\frac{1}{10}x = 7$$

$$x = 70$$

60. $\frac{3}{8}x + 4 = -8$

$$\frac{3}{8}x = -12$$

$$x = -32$$

62. $2 = -\frac{4}{3}x + 10$

$$\frac{4}{3}x = 8$$

$$x = 6$$

63. $-5x - \frac{3}{4}x = \frac{51}{2}$

$$-\frac{23x}{4} = \frac{51}{2}$$

$$x = -\frac{102}{23}$$

65. $x = 12 + \frac{5}{6}x$

$$\frac{1}{6}x = 12$$

$$x = 72$$

67. $5x^2 - 8 = 4(x^2 + 3)$

$$5x^2 - 8 = 4x^2 + 12$$

$$x^2 = 20$$

$$x = \pm 2\sqrt{5}$$

69. $3(x - 5)^2 = 27$

$$(x - 5)^2 = 9$$

$$x - 5 = \pm 3$$

$$x = 8, x = 2$$

71. $2x(x + 6) = 7 - x$

$$2x^2 + 12x = 7 - x$$

$$2x^2 + 13x - 7 = 0$$

$$(2x - 1)(x + 7) = 0$$

$$x = \frac{1}{2}, x = -7$$

64. $2x + \frac{7}{8}x = -23$

$$\frac{23}{8}x = -23$$

$$x = -8$$

66. $x^2 - 5x - 24 = 0$

$$(x - 8)(x + 3) = 0$$

$$x = 8, x = -3$$

68. $6x^2 + 13x - 5 = 0$

$$(2x + 5)(3x - 1) = 0$$

$$x = -\frac{5}{2}, x = \frac{1}{3}$$

70. $2(x + 7)^2 - 1 = 49$

$$2(x + 7)^2 = 50$$

$$(x + 7)^2 = 25$$

$$x + 7 = \pm 5$$

$$x = -12, x = -2$$

Lesson 9.6

9.6 Guided Practice (p. 571)

1. Sample answer: $\frac{3}{x + 1} = \frac{5x}{x + 8}$

2. 3 is extraneous; it makes both fractions undefined.

3. a. Multiply each term on both sides of the equation by the LCD of the terms. Simplify and solve the resulting polynomial equation.

b. cross multiplying to solve a simple rational equation for which each side of the equation is a single rational expression

Multiplying by the LCD can always be used because cross multiplying can only be used if each side of the equation is a single rational expression.

4. $\frac{1}{x} = \frac{2}{x^2}$; the graph does not intersect at the extraneous solutions.

$$x^2 = 2x$$

$$x = 2$$