

CONTINUED

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

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

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

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

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

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

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

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

1718

Review (p. 567)

$$x = 5 \quad 58. \quad 6 - \frac{1}{10}x = -1$$

$$x = 12 \quad \frac{1}{10}x = 7$$

$$x = 24 \quad x = 70$$

$$x = x - \frac{5}{6} \quad 60. \quad \frac{3}{8}x + 4 = -8$$

$$x = -\frac{4}{3} \quad \frac{3}{8}x = -12$$

$$x = \frac{16}{3} \quad x = -32$$

$$-3 = \frac{5}{2} \quad 62. \quad 2 = -\frac{4}{3}x + 10$$

$$-\frac{11}{2}x = \frac{11}{2} \quad \frac{4}{3}x = 8$$

$$x = -66 \quad x = 6$$

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

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

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

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

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

$$x = -8$$

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

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

$$x = 72$$

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

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

$$x = 8, \quad x = -3$$

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

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

$$x^2 = 20$$

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

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

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

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

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

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

$$x - 5 = \pm 3$$

$$x = 8, \quad x = 2$$

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

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

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

$$x + 7 = \pm 5$$

$$x = -12, \quad x = -2$$

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

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

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

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

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

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.

$$x^2 = 2x$$

$$x = 2$$

## Chapter 9 continued

$$5. \frac{7}{x} + \frac{3}{4} = \frac{5}{x}$$

$$\frac{2}{x} = -\frac{3}{4}$$

$$8 = -3x$$

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

$$7. 3x + \frac{x}{3} = 5$$

$$\frac{10x}{3} = 5$$

$$10x = 15$$

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

$$9. \frac{5}{x-3} = \frac{2x}{x^2-9}$$

$$\frac{5(x+3) - 2x}{x^2-9} = 0$$

$$\frac{5x+15-2x}{(x-3)(x+3)} = 0$$

$$\frac{3(x+5)}{(x-3)(x+3)} = 0$$

$$x = -5$$

$$10. \frac{5x}{x-1} + 5 = \frac{15}{x-1}$$

$$\frac{5x+5(x-1)-15}{x-1} = 0$$

$$\frac{5x+5x-5-15}{x-1} = 0$$

$$\frac{10x-20}{x-1} = 0$$

$$x = 2$$

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

$$2x^2 - 6x = 3x^2 + 9x$$

$$-15x = x^2$$

$$x = -15, 0$$

$$13. \frac{2x}{2x+4} = \frac{3x}{x+2}$$

$$\frac{x}{x+2} - \frac{3x}{x+2} = 0$$

$$\frac{-2x}{x+2} = 0$$

$$x = 0$$

$$6. \frac{x-2}{6} = \frac{x-2}{x-1}$$

$$x^2 - 3x + 2 = 6x - 12$$

$$x^2 - 9x + 14 = 0$$

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

$$x = 7, x = 2$$

$$8. \frac{x}{x-3} = 2 - \frac{2}{x-3}$$

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

$$x+2 = 2x-6$$

$$x = 8$$

12. no solution

$$14. 0.8 = \frac{12+x}{20+x}$$

$$16 + 0.8x = 12 + x$$

$$4 = 0.2x$$

$$20 = x$$

### 9.6 Practice and Applications (pp. 571–573)

$$15. \frac{2(-1)-3}{-1+3} = \frac{3(-1)}{-1+4}$$

$$\frac{-5}{2} \neq -1$$

no

$$17. \frac{4(2)-3}{2-4} + 1 = \frac{2}{2-3}$$

$$\frac{5}{-2} + 1 \neq -2$$

no

$$19. \frac{6}{6-3} = \frac{6}{6-3}$$

$$\frac{6}{3} = \frac{6}{3}$$

yes

$$21. \frac{3}{2} + \frac{1}{x} = 2$$

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

$$3x+2 = 4x$$

$$x = 2$$

$$23. \frac{3}{2x} - \frac{9}{2} = 6x$$

$$\frac{3-9x}{2x} = 6x$$

$$3-9x = 12x^2$$

$$12x^2 + 9x - 3 = 0$$

$$3(4x^2 + 3x - 1) = 0$$

$$3(4x-1)(x+1) = 0$$

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

$$25. \frac{3x}{x+1} + \frac{6}{2x} = \frac{7}{x}$$

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

$$4x+4 = 3x^2$$

$$3x^2 - 4x - 4 = 0$$

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

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

$$16. \frac{-1}{2(-1)+1} = \frac{5}{4-(-1)}$$

$$\frac{-1}{1} = \frac{5}{5}$$

$$1 = 1$$

yes

$$18. \frac{3(6)}{6-6} = 5 + \frac{18}{6-6}$$

$$\frac{18}{0} = 5 + \frac{18}{0}$$

no

$$20. \frac{2}{2(2+2)} + \frac{3}{2} = \frac{4}{2-2}$$

$$\frac{2}{8} + \frac{3}{2} = \frac{4}{0}$$

no

$$22. \frac{3}{x} + x = 4$$

$$\frac{3+x^2}{x} = 4$$

$$x^2 - 4x + 3 = 0$$

$$(x-3)(x-1) = 0$$

$$x = 3, x = 1$$

$$24. \frac{8}{x+2} + \frac{8}{2} = 5$$

$$\frac{8}{x+2} = 1$$

$$8 = x+2$$

$$x = 6$$

## Chapter 9 continued

$$26. \quad \frac{2}{3x} + \frac{2}{3} = \frac{8}{x+6}$$

$$\frac{2+2x}{3x} = \frac{8}{x+6}$$

$$24x = 2x^2 + 14x + 12$$

$$2(x^2 - 5x + 6) = 0$$

$$(x-3)(x-2) = 0$$

$$x = 3, x = 2$$

$$27. \quad \frac{6x}{x+4} + 4 = \frac{2x+2}{x-1}$$

$$\frac{6x+4x+16}{x+4} = \frac{2(x+1)}{x-1}$$

$$\frac{10x+16}{x+4} = \frac{2(x+1)}{x-1}$$

$$\frac{5x+8}{x+4} = \frac{x+1}{x-1}$$

$$5x^2 + 3x - 8 = x^2 + 5x + 4$$

$$4x^2 - 2x - 12 = 0$$

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

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

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

$$28. \quad \frac{x-3}{x-4} + 4 = \frac{3x}{x}$$

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

$$x-3 = -x+4$$

$$2x = 7$$

$$x = \frac{7}{2}$$

$$29. \quad \frac{7x+1}{2x+5} + 1 = \frac{10x-3}{3x}$$

$$\frac{9x+6}{2x+5} = \frac{10x-3}{3x}$$

$$27x^2 + 18x = 20x^2 + 44x - 15$$

$$7x^2 - 26x + 15 = 0$$

$$(7x-5)(x-3) = 0$$

$$x = \frac{5}{7}, x = 3$$

$$30. \quad \frac{10}{x(x-2)} + \frac{4}{x} = \frac{5}{x-2}$$

$$\frac{10+4x-8}{x(x-2)} = \frac{5x}{x(x-2)}$$

$$2 = x$$

no solution

$$31. \quad \frac{4(x-1)}{x-1} = \frac{2(x-1)}{x+1}$$

$$4(x^2-1) = 2(x^2-2x+1)$$

$$4x^2-4 = 2x^2-4x+2$$

$$2x^2+4x-6 = 0$$

$$2(x^2+2x-3) = 0$$

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

$$x = -3$$

$$32. \quad \frac{2(x+7)}{x+4} - 2 = \frac{2x+20}{2x+8}$$

$$\frac{2x+14-2x-8}{x+4} = \frac{x+10}{x+4}$$

$$\frac{6}{x+4} = \frac{x+10}{x+4}$$

$$6 = x+10$$

$$x = -4$$

no solution

$$33. \quad \frac{3}{4x} = \frac{5}{x+2}$$

$$3(x+2) = 20x$$

$$3x+6 = 20x$$

$$6 = 17x$$

$$x = \frac{6}{17}$$

$$34. \quad \frac{-3}{x+1} = \frac{4}{x-1}$$

$$-3x+3 = 4x+4$$

$$-7x = 1$$

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

$$35. \quad \frac{x}{x^2-8} = \frac{2}{x}$$

$$x^2 = 2x^2 - 16$$

$$0 = x^2 - 16$$

$$0 = (x+4)(x-4)$$

$$x = 4, x = -4$$

$$36. \quad \frac{x}{2x+7} = \frac{x-5}{x-1}$$

$$x^2-x = 2x^2-3x-35$$

$$x^2-2x-35 = 0$$

$$(x-7)(x+5) = 0$$

$$x = 7, x = -5$$

$$37. \quad \frac{-2}{x-1} = \frac{x-8}{x+1}$$

$$-2x-2 = x^2-9x+8$$

$$x^2-7x+10 = 0$$

$$(x-2)(x-5) = 0$$

$$x = 2, x = 5$$

## Chapter 9 continued

$$38. \frac{2(x-2)}{x^2 - 10x + 16} = \frac{2}{x+2}$$

$$x^2 - 4 = x^2 - 10x + 16$$

$$10x = 20$$

$$x = 2$$

$$39. \frac{8(x-1)}{x^2 - 4} = \frac{4}{x-2}$$

$$2(x-1)(x-2) = x^2 - 4$$

$$2x^2 - 6x + 4 = x^2 - 4$$

$$x^2 - 6x + 8 = 0$$

$$(x-2)(x-4) = 0$$

$$x = 4$$

$$40. \frac{x^2 - 3}{x + 2} = \frac{x - 3}{2}$$

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

$$x^2 + x = 0$$

$$x(x+1) = 0$$

$$x = 0, x = -1$$

$$41. \frac{-1}{x-3} = \frac{x-4}{x^2 - 27}$$

$$-x^2 + 27 = x^2 - 7x + 12$$

$$2x^2 - 7x - 15 = 0$$

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

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

$$42. \frac{x-2}{x+3} = \frac{3}{x}$$

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

$$x^2 - 5x - 6 = 0$$

$$(x-6)(x+1) = 0$$

$$x = 6, x = -1$$

$$43. \frac{3}{x+2} = \frac{6}{x-1}$$

$$x-1 = 2x+4$$

$$-5 = x$$

$$44. \frac{3x}{x+1} = \frac{12}{x^2 - 1} + 2$$

$$\frac{-3x(x-1) + 12 + 2(x^2 - 1)}{x^2 - 1} = 0$$

$$-3x^2 + 3x + 12 + 2x^2 - 2 = 0$$

$$-x^2 + 3x + 10 = 0$$

$$x^2 - 3x - 10 = 0$$

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

$$x = -2, x = 5$$

$$45. \frac{3x+6}{x^2 - 4} = \frac{x+1}{x-2}$$

$$3x+6 = (x+1)(x+2)$$

$$3x+6 = x^2 + 3x + 2$$

$$x^2 = 4$$

$$x = \pm 2$$

no solution

$$46. \frac{x-4}{x} = \frac{6}{x^2 - 3x}$$

$$(x-4)(x-3) = 6$$

$$x^2 - 7x + 6 = 0$$

$$(x-6)(x-1) = 0$$

$$x = 6, x = 1$$

$$47. \frac{2x}{4-x} = \frac{x^2}{x-4}$$

$$-2x = x^2$$

$$-2 = x$$

$$x = 0$$

$$48. \frac{2x}{x-3} = \frac{3x}{x^2 - 9} + 2$$

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

$$2x^2 + 6x = 3x + 2x^2 - 18$$

$$3x = -18$$

$$x = -6$$

$$49. \frac{x}{2x-6} = \frac{2}{x-4}$$

$$x(x-4) = 2(2x-6)$$

$$x^2 - 4x = 4x - 12$$

$$x^2 - 8x + 12 = 0$$

$$(x-6)(x-2) = 0$$

$$x = 6, x = 2$$

$$50. \frac{2}{x+1} + \frac{x}{x-1} = \frac{2}{x^2 - 1}$$

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

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

$$x^2 + 3x - 4 = 0$$

$$(x+4)(x-1) = 0$$

$$x = -4$$

51. Always true; when you solve by crossmultiplying, you get  $x = 1$  or  $x = a$  and  $x = a$  makes both fractions undefined.

52. Sometimes true; when  $a = x$  the equation has no solution.

53. Always true; when you multiply each side of the equation by  $x^2 - a^2$  you get  $x = a$ , making the fraction undefined.

$$\frac{4763}{7989} = \frac{326 + x}{575 + x}$$

$$138,725 + 4763x = 2,604,414 + 7989x$$

$$134,311 = 3226x$$

$$42 \approx x$$

$$s = \frac{200 + 5.7x}{x}$$

$$5x = 200 + 5.7x$$

$$-0.3x = 200$$

$$x \approx 87 \text{ cards}$$

$$0.88 = \frac{5}{12 + x} + \frac{5}{12 - x}$$

$$0.88(144 - x^2) = 60 - 5x + 60 + 5x$$

$$126.72 - 0.88x^2 = 120$$

$$0.88x^2 = 6.72$$

$$x^2 = 7.64$$

$$x = 2.76 \text{ mi/h}$$

$$15 = \frac{26.6d}{d + 0.0017}$$

$$15d + 0.0255 = 26.6d$$

$$0.255 = 11.6d$$

$$0.0022 \text{ flies per cm}^3 \approx d$$

$$2,198 \text{ flies per m}^3 = d$$

$$\$412.50 = \frac{9000 \times 1.10}{F}$$

$$\$12.50 F = 9900$$

$$F = 24 \text{ mi/gallon}$$

$$C = \frac{9000 \times 1.10}{25}$$

$$C = 396$$

$$\$412.50 - \$396 = \$16.50$$

A 61. C

$$12 = \frac{0.5(16) + x(10)}{0.5 + x}$$

$$6 + 12x = 8 + 10x$$

$$2x = 2$$

$$x = 1 \text{ liter}$$

**Mixed Review (p. 573)**

$$y = x + 3$$

$$\text{parallel} = 1$$

$$\text{perpendicular} = -1$$

$$64. y = 3x - 4$$

$$\text{parallel} = 3$$

$$\text{perpendicular} = -\frac{1}{3}$$

$$65. y = -\frac{2}{3}x + 15$$

$$\text{parallel} = -\frac{2}{3}$$

$$\text{perpendicular} = \frac{3}{2}$$

$$67. 2y - x = 7$$

$$y = \frac{x}{2} + \frac{7}{2}$$

$$\text{parallel} = \frac{1}{2}$$

$$\text{perpendicular} = -2$$

$$66. y + 3 = 3x + 2$$

$$y = 3x - 1$$

$$\text{parallel} = 3$$

$$\text{perpendicular} = -\frac{1}{3}$$

$$68. 4x - 3y = 17$$

$$y = \frac{4}{3}x - \frac{17}{3}$$

$$\text{parallel} = \frac{4}{3}$$

$$\text{perpendicular} = -\frac{3}{4}$$

$$69. \sqrt{48} = 4\sqrt{3} \quad 70. \sqrt{18} = 3\sqrt{2} \quad 71. \sqrt{108} = 6\sqrt{3}$$

$$72. \sqrt{432} = 12\sqrt{3} \quad 73. \sqrt{6} \cdot \sqrt{45} = 3\sqrt{30}$$

$$74. \sqrt{\frac{16}{72}} = \frac{4}{6\sqrt{2}} = \frac{\sqrt{2}}{3} \quad 75. \sqrt{75} \cdot \sqrt{3} = \sqrt{225} = 15$$

$$76. \sqrt{\frac{8}{49}} = \frac{2\sqrt{2}}{7} \quad 77. \text{pH} = -\log[1.6 \times 10^{-7}] \approx 6.796$$

**Quiz 2 (p. 574)**

$$1. \frac{3x^3y}{2xy^2} \cdot \frac{10x^4y^2}{9x} = \frac{30x^7y^3}{18x^2y^2} = \frac{5x^5y}{3}$$

$$2. \frac{x^2 - 3x - 40}{5x} \div (x + 5) = \frac{(x - 8)(x + 5)}{5x} \cdot \frac{1}{x + 5} = \frac{x - 8}{5x}$$

$$3. \frac{18x}{x^2 - 5x - 36} + \frac{2x}{x + 4} = \frac{18x}{(x + 4)(x - 9)} + \frac{2x(x - 9)}{(x + 4)(x - 9)} = \frac{18x + 2x^2 - 18x}{(x + 4)(x - 9)} = \frac{2x^2}{(x + 4)(x - 9)}$$

$$4. \frac{8x^2}{25x^2 - 36} - \frac{1}{10x + 12} = \frac{16x^2}{2(5x - 6)(5x + 6)} - \frac{5x - 6}{2(5x - 6)(5x + 6)} = \frac{16x^2 - 5x + 6}{2(5x - 6)(5x + 6)}$$

$$5. \frac{\frac{8}{x} + 11}{\frac{1}{6x} - 1} = \left(\frac{8 + 11x}{x}\right) \div \left(\frac{1 - 6x}{6x}\right) = \frac{8 + 11x}{x} \cdot \frac{6x}{1 - 6x} = \frac{6(8 + 11x)}{1 - 6x}$$

# Chapter 9 continued

$$6. \frac{36 - \frac{1}{x^2}}{\frac{1}{6x^2} - 6} = \left( \frac{36x^2 - 1}{x^2} \right) \div \left( \frac{1 - 36x^2}{6x^2} \right)$$

$$= \frac{36x^2 - 1}{x^2} \cdot \frac{-6x^2}{36x^2 - 1} = -6$$

$$7. \frac{\frac{2}{x^2 - 1} - \frac{1}{x + 1}}{\frac{1}{12x^2 - 3}} = \left( \frac{2 - x + 1}{x^2 - 1} \right) \div \left( \frac{1}{12x^2 - 3} \right)$$

$$= \frac{3 - x}{x^2 - 1} \cdot \frac{12x^2 - 3}{1}$$

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

$$8. \frac{\frac{1}{x - 5} - \frac{x}{x^2 - 25}}{\frac{5}{2x}} = \left( \frac{x + 5 - x}{x^2 - 25} \right) \div \frac{5}{2x}$$

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

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

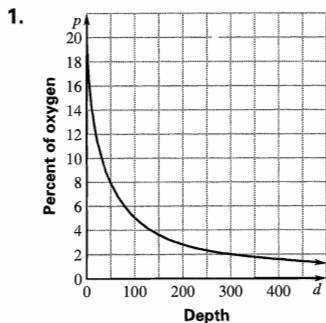
$$9. 4.50 = \frac{10 + 4x}{x}$$

$$4.50x = 10 + 4x$$

$$0.50x = 10$$

$$x = 20 \text{ dozen}$$

## Math and History (p. 574)



2. 99 ft    3. 0%

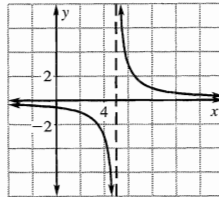
## Chapter 9 Review (pp. 576-578)

1. $y = \frac{5}{x}$	2. $y = \frac{10}{x}$	3. $y = \frac{2}{x}$
$y = \frac{5}{2}$	$y = 5$	$y = 1$
4. $y = -\frac{4}{x}$	5. $z = \frac{1}{3}xy$	6. $z = -\frac{1}{8}xy$
$y = -2$	$z = -10$	$z = \frac{15}{4}$

7.  $z = 3xy$

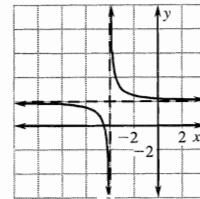
$z = -90$

8.  $y = \frac{3}{x - 5}$



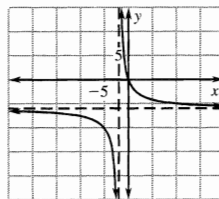
domain: all real numbers except 5; range: all real numbers except 0

9.  $y = \frac{1}{x + 4} + 2$



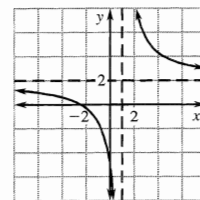
domain: all real numbers except -4; range: all real numbers except 2

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



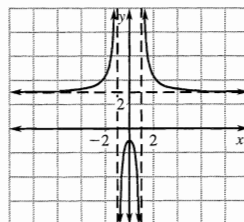
domain: all real numbers except -2; range: all real numbers except -6

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

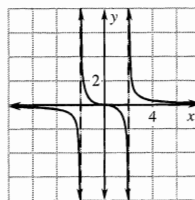


domain: all real numbers except 1; range: all real numbers except 2

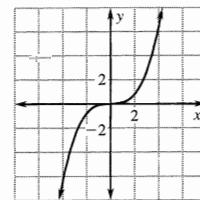
12.  $y = \frac{3x^2 + 1}{x^2 - 1}$



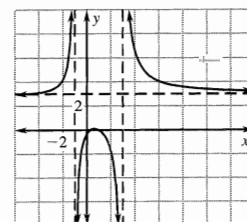
14.  $y = \frac{x}{x^2 - 4}$



13.  $y = \frac{x^3}{10}$



15.  $y = \frac{3x^2 - 4x + 1}{x^2 - 2x - 3}$



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

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

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