

$$3-35) \quad a) \quad (x+2)^2 + (y-13)^2 = 144$$

$$b) \quad (x+1)^2 + (y+4)^2 = 1$$

$$c) \quad x^2 - 6x + y^2 + 16y + 57 = 0$$

Complete the squares

$$x^2 - 6x + 9 + y^2 + 16y + 57 - 9 = 0$$

$$(x-3)(x-3) + y^2 + 16y + 48$$

$$(x-3)^2 + y^2 + 16y + 64 + 48 - 64 = 0$$

$$(x-3)^2 + (y+8)^2 - 16 = 0$$

$$(x-3)^2 + (y+8)^2 = 16$$

$$3-36) \quad a) \quad \frac{6 \text{ blocks}}{15 \text{ min}} \cdot \frac{60 \text{ min}}{\text{hr}} = 24 \text{ blocks/hr}$$

$$b) \quad \frac{6 \text{ blocks}}{20 \text{ min}} \cdot \frac{60 \text{ min}}{\text{hr}} = 18 \text{ blocks/hr}$$

$$c) \quad \frac{12 \text{ blocks}}{65 \text{ min}} \cdot \frac{60 \text{ min}}{\text{hr}} = 11.08 \text{ blocks/hr}$$

OPTION 3-90 \rightarrow 3-96 For 12/12

$$3-90) \quad a) \quad \frac{(x-1)}{3(2x-1)} \cdot \frac{2x(x+5)}{(x+5)(x+1)} = \frac{2x}{3(2x-1)}$$

$$b) \quad \frac{6x^2 - x - 1}{3x^2 + 25x + 8} \cdot \frac{(x+8)(x-4)}{2x^2 + 7x - 4} = \frac{6x^2 - 3x + 2x - 1}{3x^2 + 24x + 1x + 8} \cdot \frac{(x+8)(x-4)}{2x^2 + 8x - x - 4}$$

$$6 \cdot -1 = -6$$

$$-3 \quad 1$$

$$-3 \quad 2$$

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

$$3 \cdot 8 = 24$$

$$24 \quad 1$$

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

$$2 \cdot -4 = -8$$

$$3-91) a) x \neq -4 \quad x \neq 2$$

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

$$b) \frac{2\cancel{8}(x+2)\cancel{(x+2)}\cancel{(x+2)}\cancel{(x-3)}\cancel{(x-3)}\cancel{(x-3)}}{4\cancel{(x+2)}\cancel{(x+2)}(x-3)\cancel{(x-3)}\cancel{(x-3)}\cancel{(x-3)}\cancel{(x-3)}} \\ \frac{2(x+2)}{(x-3)^2}$$

3-92) Find common denominator of 15

$$\frac{5}{5} \cdot \frac{1}{3} + \frac{3}{3} \cdot \frac{2}{5} = \frac{5}{15} + \frac{6}{15} = \frac{11}{15}$$

$$3-93) a) \begin{cases} 3x-3=y \\ 6x-5y=12 \end{cases}$$

$$\begin{aligned} 6x-5(3x-3) &= 12 \\ 6x-15x+15 &= 12 \\ -9x+15 &= 12 \\ -15 & \quad -15 \end{aligned}$$

$$y = 3\left(\frac{1}{3}\right) - 3 = +1 - 3 = -2 \\ \left(\frac{1}{3}, -2\right)$$

$$\begin{aligned} -9x &= -3 \\ \frac{-9x}{-9} &= \frac{-3}{-9} \quad x = +\frac{1}{3} \end{aligned}$$

$$b) \begin{cases} 3(3x-2y=30) \\ 2(2x+3y=-19) \end{cases}$$

$$\begin{aligned} 9x-6y &= 90 \\ 4x+6y &= -38 \\ \hline 13x &= 52 \end{aligned} \quad x=4$$

$$\begin{aligned} 3(4)-2y &= 30 \\ -2y &= 18 \\ \frac{-2y}{-2} &= \frac{18}{-2} \\ y &= -9 \end{aligned}$$

$$(4, -9)$$

$$3-94) 72,000,000 = n = 3^{15}$$

$$n = \frac{72,000,000}{3^{15}} = 5 \text{ bacteria @ first}$$

3-95) even because it is reflected across the y-axis resulting in the same graph

3-96) a) $\frac{m}{6} = \frac{m+1}{5}$

$$\begin{aligned} 5m &= 6m + 6 \\ -6m & \quad -6m \\ -m &= 6 \\ -1 & \quad -1 \end{aligned}$$

$$\boxed{m = -6}$$

b) $\frac{3x-5}{2} = \frac{4x+1}{4}$

$$\begin{aligned} 4(3x-5) &= 2(4x+1) \\ 12x - 20 &= 8x + 2 \\ 4x &= 22 \\ \boxed{x = 5.5} \end{aligned}$$

c) $\frac{8}{k} = \frac{14}{k+3}$

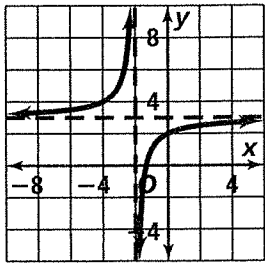
$$\begin{aligned} 8k + 24 &= 14k \\ -8k & \quad -8k \\ 24 &= 6k \\ 6 & \quad 6 \\ \boxed{k = 4} \end{aligned}$$

d) $\frac{x}{9} = \frac{10}{1}$

$$\boxed{x = 90}$$

Chapter 9 Answers (continued)

12. $x = -2, y = 3$



Reteaching 9-3

1. asymptotes at $x = 3$ and -3 2. asymptote at $x = 0$
3. asymptote at $x = 1$ 4. asymptotes at $x = 1$ and -5
5. asymptote at $x = -1$ 6. asymptote at $x = 0$
7. asymptote at $x = 0$ and hole at $x = -2$ 8. asymptote at $x = -2$ and hole at $x = -1$ 9. asymptote at $x = 3$ and hole at $x = -1$

Reteaching 9-4

1. $\frac{1}{x} - \frac{1}{y}$ 2. $\frac{a+2}{a-5}$ 3. $\frac{3x-12}{2x+8}$ 4. $\frac{2}{3}$ 5. $x - 2$
6. $\frac{1-x}{4x^2+16x}$ 7. 5 8. $\frac{1}{x^2+4x+4}$ 9. $\frac{8}{3}$ 10. $\frac{x-7}{x^2}$
11. $\frac{x-2}{x}$ 12. $\frac{x+2}{3x-6}$ 13. $\frac{3}{x}$ 14. $\frac{3x+6}{2x+6}$ 15. 3 16. $\frac{1}{x^4}$

Reteaching 9-5

1. 1 2. $\frac{y-2}{y-1}$ 3. $\frac{3x-4}{(x+2)(x-2)}$ 4. $\frac{3y-10}{(y-5)(y+4)}$
5. $\frac{x-3}{(x+1)(x+3)}$ 6. $\frac{x-5}{(x+2)(x-2)}$ 7. $-\frac{43}{28x}$
8. $\frac{12x^2-x-39}{3(x+11)}$ 9. $\frac{4x^2-3x+15}{x^2(x+3)(x-2)}$

Reteaching 9-6

1. $\frac{3}{4}$ 2. 5, $-\frac{3}{2}$ 3. $\frac{8}{5}$ 4. 6 5. -5 6. 4 7. $\frac{3}{2}, \frac{8}{3}$
8. no solution 9. 1 10. 0.5 11. -0.5 12. 25
13. Quinn: 3.75 h, Jack: 15 h

Reteaching 9-7

1. $\frac{7}{10}$ 2. $\frac{7}{15}$ 3. $\frac{37}{45}$

Enrichment 9-1

ALFRED WEGENER

1. 1 2. 6 3. 13 4. 5 5. 9 6. 11 7. 3 8. 10 9. 2 10. 12
11. 4 12. 14 13. 8

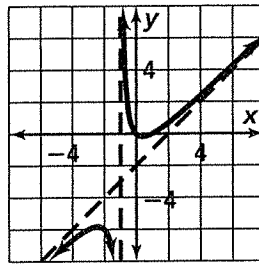
Enrichment 9-2

1. 2.7500; 3.5000 2. 0.3438; 1.0938 3. 0.0281; 0.7781
4. -0.5500 ; 0.2000 5. -0.2292 ; 0.5208 6. -0.0270 ; 0.7230

Enrichment 9-3

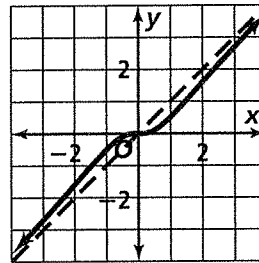
1. $x - 2$

2.-4.



4. -6 ; -6 ; 0 ; $\frac{2}{3}$; $\frac{3}{2}$ 5. x

6.-8.



8. $-\frac{27}{10}$; $-\frac{8}{5}$; 0 ; $\frac{8}{5}$; $\frac{27}{10}$ 9. x^2 ; parabola

Enrichment 9-4

$\frac{2}{3}, \frac{7}{8}, \frac{117}{118} \dots$
 $\frac{2}{3}, \frac{7}{8}, \frac{117}{118} \dots$

1. The second columns are exactly the same; it took less time to complete Table 2. 2. 9; 3

3. $\frac{(x-7)(x-2)}{(x-5)(x+1)}$ 4. 10

Enrichment 9-5

$3^2; 25 + 22\sqrt{2}; 47.2$

1. about 47.2 watts/m² 2. $\frac{30x^2 - 120x + 1000}{x^2(x^2 - 12x + 100)}$

3. $\frac{30x^2 + 240x + 1360}{(x^2 + 12x + 36)(x^2 + 64)}$

Enrichment 9-6

1. $\frac{GMm}{D^2}$ 2. $\frac{4GMm}{(6-D)^2}$ 3. 2 light yr 4. 9:1 5. $R^2:1$

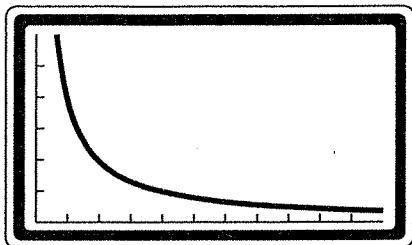
6. 17:4

Enrichment 9-7

1. 0.14; 0.12 2. 0.23 3. about 0.60

Chapter 9 Answers (continued)

31a. $y = \frac{0.02x + 3500}{x}$, where x = number of pages;



31b. at least 2365 pages 31c. 3571 pages 31d. 7292 pages
31e. $x = 0$; $y = 0.02$

Practice 9-4

1. $\frac{2x+1}{x}$; $x \neq 0$ 2. 2; $x \neq -\frac{3}{2}$ 3. 3; $y \neq 1$ or -1
4. $\frac{4}{3}$; $x \neq -5$ 5. $\frac{x+1}{x+2}$; $x \neq 0$ or -2 6. $\frac{3}{5}$; $x \neq -2$
7. $\frac{2}{y+6}$; $y \neq 0$ or -6 8. $\frac{x}{x+5}$; $x \neq 5$ or -5
9. $\frac{x-3}{x-6}$; $x \neq 6$ or -6 10. $\frac{x+8}{x-7}$; $x \neq 7$ or -5
11. $\frac{3x-6}{x-3}$; $x \neq 3$ or -2 12. $\frac{4x-12}{x+7}$; $x \neq -3$ or -7
13. $\frac{2x+1}{3x+2}$; $x \neq -5$ or $-\frac{2}{3}$ 14. $\frac{2x+3}{x-1}$; $x \neq 1$ or $\frac{2}{3}$
15. $\frac{7}{x+4}$; $x \neq 4$ or -4 16. $\frac{x-3}{2}$; $x \neq -3$
17. 10; $a \neq -1, 0$ 18. -1 ; $x \neq -\frac{2}{5}, 0, \pm 3$
19. $x^2 - 1$; $x \neq -4, 2$ 20. $x + 3$; $x \neq -4, -3, -1$
21. $\frac{7y-28}{6y+24}$; $y \neq -5, -4$ 22. $\frac{3x^2+3x}{x-5}$; $x \neq 0, \pm 5$
23. $\frac{5y^2+10y+5}{36y+72}$; $y \neq -2, -1$ 24. $\frac{3x-6}{14}$; $x \neq -1, 2$
25. $\frac{y}{y-2}$; $y \neq 2, \pm 9$ 26. $\frac{3}{2}$; $y \neq \pm 6$ 27. $\frac{y}{5}$; $y \neq 0, \pm 7$
28. $\frac{x+2}{x-2}$; $x \neq \frac{1}{2}, 2, 3, 5$ 29. $\frac{x^2-16}{x^2-9}$; $x \neq \pm 1, \pm 3$
30. 1; $x \neq -3, 0, 5$ 31. $\frac{x^2-5x+6}{x^2+5x+6}$; $x \neq -3, -2$
32. $\frac{1}{x}$; $x \neq 0, \pm 6$ 33. $x + 8$; $x \neq -2, \pm 8$ 34. $\frac{4}{y}$; $x, y \neq 0$
35. $\frac{4x-16}{3x}$; $x \neq 0, \frac{1}{3}, 5, \pm 4$ 36. $\frac{x^3}{6y}$; $x, y \neq 0$
37. $3x$; $x \neq 0, -2$ 38. $\frac{x}{3}$; $x \neq -6, -4, 2$
39. $\frac{x^2-2x+1}{x^2+14x+49}$; $x \neq -7, -3, 4$
40. $\frac{x^2+2x+1}{x^2+x-2}$; $x \neq -2, \pm 1$

Practice 9-5

1. $6x(x+2)(2x-3)$ 2. $6(x-1)(x-2)^2(x+10)$
3. $(2x+3)^2(2x-3)$ 4. $10x(x+3)^2(x-3)$ 5. $\frac{2x^2}{5}$
6. $\frac{x^2+2x-2}{12}$ 7. $\frac{3}{xy^3}$ 8. $\frac{2-n}{n-4}$ 9. $-\frac{x}{9}$

10. $\frac{7y+5}{3y}$ 11. $\frac{3(3y-1)}{y^2-5}$ 12. $\frac{12y+5x}{10x^2y^2}$
13. $\frac{3-2x^2y^2}{8x^3y^3}$ 14. $\frac{10x-26}{(x+5)(x-5)(x+1)}$
15. $\frac{9y+4x}{21x^2y^2}$ 16. $\frac{x^2y}{x^2-4}$ 17. $\frac{3}{x+2}$
18. $\frac{(5x+1)(x+3)}{(x-3)(x+2)(x+5)(x+1)}$
19. $\frac{7x+5}{2(3x-1)(2x-3)(2x+3)}$ 20. $\frac{2(x+2)}{x(x-3)}$
21. $\frac{4x+1}{(x+5)(x+1)(x-2)}$ 22. $\frac{4x^2-36x+3}{x-9}$
23. $\frac{3x^2+14}{x^2+5}$ 24. $\frac{5x^2-25x+31}{x^2-5x+6}$ 25. $\frac{5x+6}{3x-1}$
26. $\frac{5a^2+2a}{a^2-4}$ 27. $\frac{8c^2}{c^2-9}$ 28. $\frac{2}{gh}$ 29. $-\frac{6t}{t^2-25}$
30. $\frac{8r^2}{r^2-4}$ 31. $\frac{x^2+y^2}{x^2+xy}$ 32. $\frac{2y}{3x}$ 33. $\frac{x+2}{4x-6}$
34. $\frac{x}{2x^2-3x-2}$ 35. $\frac{y-2}{4y}$ 36. $\frac{15}{4}$ 37. $2x+3$
38. $\frac{3x-3}{5x+5}$ 39. $\frac{2y+6xy}{x}$ 40. $\frac{3y(y-2)}{(y-6)(y+2)(y-4)}$
- 41a. $\frac{24}{17}$ ohms 41b. $\frac{4}{3}$ ohms

Practice 9-6

1. ± 3 2. ± 4 3. $-\frac{4}{11}$ 4. $-\frac{9}{17}$ 5. $\frac{9}{4}$ 6. -2 7. -0.2
8. -0.5 9. 3 10. -2 11. 0 12. -17 13. 12 14. 6
15. $\frac{3}{16}$ 16. no solution 17. -9 18. 7 19. 11 20. 41
21. 5 22. -3 23. 0 24. $-\frac{19}{25}$ 25. -3 26. 18 27. $\frac{60}{7}$
28. -5 29. no solution 30. 12 31. 4 32. $\frac{14}{3}$
33. no solution 34. 6 35. -5 36. -1
37. about 13 mi/h tail wind 38. about 14 mi/h head wind
39. about 1.3 days 40. Tom: 125 min, Huck: 500 min

Practice 9-7

1. no 2. yes 3. yes 4. no 5. dependent 6. independent
7. independent 8. dependent 9. 20% 10a. 0.6 10b. 1
- 10c. 0.7 10d. 0.6 11a. $\frac{2}{3}$ 11b. $\frac{2}{3}$ 11c. $\frac{2}{3}$ 11d. $\frac{1}{6}$
12. about 69.6% 13. 12.5% 14. $\frac{1}{20}$ 15. 0.16 16. $\frac{1}{20}$
17. $\frac{11}{12}$ 18. 55% 19. 38%

Reteaching 9-1

1. 3.5 h 2. 5 h 3. about 28 items 4. 6.75 cm

Problems

Multiply or divide each pair of rational expressions. Simplify the result. Assume the denominator is not equal to zero.

1. $\frac{x^2+5x+6}{x^2-4x} \cdot \frac{4x}{x+2}$
2. $\frac{x^2-2x}{x^2-4x+4} \div \frac{4x^2}{x-2}$
3. $\frac{x^2-16}{(x-4)^2} \cdot \frac{x^2-3x-18}{x^2-2x-24}$
4. $\frac{x^2-x-6}{x^2+3x-10} \cdot \frac{x^2+2x-15}{x^2-6x+9}$
5. $\frac{x^2-x-6}{x^2-x-20} \cdot \frac{x^2+6x+8}{x^2-x-6}$
6. $\frac{x^2-x-30}{x^2+13x+40} \cdot \frac{x^2+11x+24}{x^2-9x+18}$
7. $\frac{15-5x}{x^2-x-6} \div \frac{5x}{x^2+6x+8}$
8. $\frac{17x+119}{x^2+5x-14} \div \frac{9x-1}{x^2-3x+2}$
9. $\frac{2x^2-5x-3}{3x^2-10x+3} \cdot \frac{9x^2-1}{4x^2+4x+1}$
10. $\frac{x^2-1}{x^2-6x-7} \div \frac{x^3+x^2-2x}{x-7}$
11. $\frac{3x-21}{x^2-49} \div \frac{3x}{x^2+7x}$
12. $\frac{x^2-y^2}{x+y} \cdot \frac{1}{x-y}$
13. $\frac{y^2-y}{w^2-y^2} \div \frac{y^2-2y+1}{1-y}$
14. $\frac{y^2-y-12}{y+2} \div \frac{y-4}{y^2-4y-12}$
15. $\frac{x^2+7x+10}{x+2} \div \frac{x^2+2x-15}{x+2}$

Answers

KEY TO SET 2

1. $\frac{4(x+3)}{x-4}$
2. $\frac{1}{4x}$
3. $\frac{x+3}{x-4}$
4. $\frac{x+2}{x-2}$
5. $\frac{x+2}{x-5}$
6. $\frac{x+3}{x-3}$
7. $\frac{-x-4}{x}$
8. $\frac{17(x-1)}{9x-1}$
9. $\frac{3x+1}{2x+1}$
10. $\frac{1}{x(x+2)}$
11. 1
12. 1
13. $\frac{-y}{w^2-y^2}$
14. $(y+3)(y-6)$
15. $\frac{x+2}{x-3}$

Problems

Simplify each of the following expressions completely. Assume the denominator does not equal zero.

- | | | | | | |
|-----|---|-----|---|-----|---|
| 1. | $\frac{2(x+3)}{4(x-2)}$ | 2. | $\frac{2(x-3)}{6(x+2)}$ | 3. | $\frac{2(x+3)(x-2)}{6(x-2)(x+2)}$ |
| 4. | $\frac{4(x-3)(x-5)}{6(x-3)(x+2)}$ | 5. | $\frac{3(x-3)(4-x)}{15(x+3)(x-4)}$ | 6. | $\frac{15(x-1)(7-x)}{25(x+1)(x-7)}$ |
| 7. | $\frac{24(y-4)(y-6)}{16(y+6)(6-y)}$ | 8. | $\frac{36(y+4)(y-16)}{32(y+16)(16-y)}$ | 9. | $\frac{(x+3)^2(x-2)^4}{(x+3)^4(x-2)^3}$ |
| 10. | $\frac{(5-x)^2(x-2)^2}{(x+5)^4(x-2)^3}$ | 11. | $\frac{(5-x)^4(3x-1)^2}{(x-5)^4(3x-2)^3}$ | 12. | $\frac{12(x-7)(x+2)^4}{20(x-7)^2(x+2)^5}$ |
| 13. | $\frac{x^2+5x+6}{x^2+x-6}$ | 14. | $\frac{2x^2+x-3}{x^2+4x-5}$ | 15. | $\frac{x^2+4x}{2x+8}$ |
| 16. | $\frac{24(3x-7)(x+1)^6}{20(3x-7)^3(x+1)^5}$ | 17. | $\frac{x^2-1}{(x+1)(x-2)}$ | 18. | $\frac{x^2-4}{(x+1)^2(x-2)}$ |
| 19. | $\frac{x^2-4}{x^2+x-6}$ | 20. | $\frac{x^2-16}{x^3+9x^2+20x}$ | 21. | $\frac{2x^2-x-10}{3x^2+7x+2}$ |

Answers (KEY TO SET 3)

- | | | | | | |
|-----|--------------------------------|-----|-----------------------------|-----|--------------------------|
| 1. | $\frac{(x+3)}{2(x-2)}$ | 2. | $\frac{(x-3)}{3(x+2)}$ | 3. | $\frac{(x+3)}{3(x+2)}$ |
| 4. | $\frac{2(x-5)}{3(x+2)}$ | 5. | $-\frac{(x-3)}{5(x+3)}$ | 6. | $-\frac{3(x-1)}{5(x+1)}$ |
| 7. | $-\frac{3(y-4)}{2(y+6)}$ | 8. | $-\frac{9(y+4)}{8(y+16)}$ | 9. | $\frac{(x-2)}{(x+3)^2}$ |
| 10. | $\frac{(5-x)^2}{(x+5)^4(x-2)}$ | 11. | $\frac{(3x-1)^2}{(3x-2)^3}$ | 12. | $\frac{3}{5(x-7)(x+2)}$ |
| 13. | $\frac{x+2}{x-2}$ | 14. | $\frac{2x+3}{x+5}$ | 15. | $\frac{x}{2}$ |
| 16. | $\frac{6(x+1)}{5(3x-7)^2}$ | 17. | $\frac{x-1}{x-2}$ | 18. | $\frac{x+2}{(x+1)^2}$ |
| 19. | $\frac{x+2}{x+3}$ | 20. | $\frac{x-4}{x(x+5)}$ | 21. | $\frac{2x-5}{3x+1}$ |