

$$16. (x^2 + 2x) \cdot \frac{5}{x^2 - 4} = \frac{x(x+2)5}{(x-2)(x+2)}$$

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

$$17. \frac{4}{3(x-1)} \cdot \frac{12x}{6(x^2+2x-3)} = \frac{4(12x)}{3(x-1)6(x+3)(x-1)}$$

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

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

$$18. \frac{5u}{3(u+v)} \cdot \frac{2(u^2-v^2)}{3v} \div \frac{25u^2}{18(u-v)} = \frac{5u \cdot 2(u-v)(u+v) \cdot 18(u-v)}{3(u+v)(3v)(25u^2)}$$

$$= \frac{4(u-v)^2}{5uv}$$

$$19. \frac{\frac{9t^2}{3-t}}{6t} \cdot \frac{t-3}{t-3} = \frac{-9t^2}{6t} = -\frac{3t}{2}$$

$$20. \frac{\frac{10}{x^2+2x}}{15} = \frac{\frac{10}{x(x+2)}}{15} \cdot \frac{x(x+2)(x+1)}{x(x+2)(x+1)}$$

$$= \frac{10(x+1)}{15x}$$

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

21. (a) Verbal Model:

Average cost

 =

Total cost

 \div

Number of units

Equation: Average cost = $\frac{6000 + 10.50x}{x}$

(b) Average cost when $x = 500$ units are produced = $\frac{6000 + 10.50(500)}{500} = \22.50

Section 4.4 Adding and Subtracting Rational Expressions

$$1. \frac{5}{8} + \frac{7}{8} = \frac{5+7}{8} = \frac{12}{8} = \frac{3}{2}$$

$$3. \frac{5x}{8} - \frac{7x}{8} = \frac{-2x}{8} = \frac{-x}{4}$$

$$5. \frac{2}{3a} - \frac{11}{3a} = \frac{2-11}{3a} = \frac{-9}{3a} = \frac{-3}{a}$$

$$7. \frac{x}{9} - \frac{x+2}{9} = \frac{x-(x+2)}{9} = \frac{x-x-2}{9} = \frac{-2}{9}$$

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

$$11. \frac{2x+5}{3} + \frac{1-x}{3} = \frac{2x+5+1-x}{3} = \frac{x+6}{3}$$

$$13. \frac{3y}{3} - \frac{3y-3}{3} - \frac{7}{3} = \frac{3y-(3y-3)-7}{3}$$

$$= \frac{3y-3y+3-7}{3}$$

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

$$15. \frac{3y-22}{y-6} - \frac{2y-16}{y-6} = \frac{3y-22-(2y-16)}{y-6}$$

$$= \frac{3y-22-2y+16}{y-6}$$

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

$$= 1, y \neq 6$$

$$\begin{aligned}
 17. \quad \frac{2x-1}{x(x-3)} + \frac{1-x}{x(x-3)} &= \frac{2x-1+1-x}{x(x-3)} \\
 &= \frac{x}{x(x-3)} \\
 &= \frac{1}{x-3}, \quad x \neq 0
 \end{aligned}$$

$$\begin{aligned}
 21. \quad 9y^3 &= 3 \cdot 3 \cdot y \cdot y \cdot y \\
 12y &= 2 \cdot 2 \cdot 3 \cdot y \\
 \text{LCM} &= 3 \cdot 3 \cdot 2 \cdot 2 \cdot y \cdot y \cdot y = 36y^3
 \end{aligned}$$

$$\begin{aligned}
 25. \quad 63z^2(z+1) &= 7 \cdot 9 \cdot z \cdot z(z+1) \\
 14(z+1)^4 &= 7 \cdot 2 \cdot (z+1)^4 \\
 \text{LCM} &= 126z^2(z+1)^4
 \end{aligned}$$

$$\begin{aligned}
 29. \quad 6(x^2-4) &= 6(x-2)(x+2) \\
 2x(x+2) &= 2 \cdot x \cdot (x+2) \\
 \text{LCM} &= 6x(x-2)(x+2)
 \end{aligned}$$

$$33. \quad \frac{5r(u+1)}{3v(u+1)} = \frac{5r}{3v}, \quad u \neq -1$$

$$\begin{aligned}
 37. \quad \frac{n+8}{3n-12} &= \frac{n+8}{3(n-4)} = \frac{n+8(2n^2)}{3(n-4)(2n^2)} = \frac{2n^2(n+8)}{6n^2(n-4)} \\
 \frac{10}{6n^2} &= \frac{10}{3 \cdot 2n^2} = \frac{10(n-4)}{3 \cdot 2n^2(n-4)} = \frac{10(n-4)}{6n^2(n-4)} \\
 \text{LCD} &= 6n^2(n-4)
 \end{aligned}$$

$$\begin{aligned}
 41. \quad \frac{v}{2v^2+2v} &= \frac{v}{2v(v+1)} = \frac{v(3v)}{2v(v+1)(3v)} = \frac{3v^2}{6v^2(v+1)} \\
 \frac{4}{3v^2} &= \frac{4(2(v+1))}{3v^2(2(v+1))} = \frac{8v+8}{6v^2(v+1)} \\
 \text{LCD} &= 6v^2(v+1)
 \end{aligned}$$

$$45. \quad \frac{5}{4x} - \frac{3}{5} = \frac{5(5)}{4x(5)} - \frac{3(4x)}{5(4x)} = \frac{25}{20x} - \frac{12x}{20x} = \frac{25-12x}{20x}$$

$$\begin{aligned}
 19. \quad 5x^2 &= 5 \cdot x \cdot x \\
 20x^3 &= 5 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \\
 \text{LCM} &= 20x^3
 \end{aligned}$$

$$\begin{aligned}
 23. \quad 15x^2 &= 5 \cdot 3 \cdot x \cdot x \\
 3(x+5) &= 3 \cdot (x+5) \\
 \text{LCM} &= 15x^2(x+5)
 \end{aligned}$$

$$\begin{aligned}
 27. \quad 8t(t+2) &= 2 \cdot 2 \cdot 2 \cdot t \cdot (t+2) \\
 14(t^2-4) &= 2 \cdot 7 \cdot (t+2)(t-2) \\
 \text{LCM} &= 2 \cdot 2 \cdot 2 \cdot 7 \cdot t \cdot (t+2)(t-2) = 56t(t^2-4)
 \end{aligned}$$

$$31. \quad \frac{7x^2}{4a(x^2)} = \frac{7}{4a}, \quad x \neq 0$$

$$\begin{aligned}
 35. \quad \frac{7y(-1(x+2))}{4-x^2} &= \frac{7y}{x-2}, \quad x \neq -2 \\
 4-x^2 &= (2-x)(2+x) \\
 &= -1(x-2)(2+x)
 \end{aligned}$$

$$\begin{aligned}
 39. \quad \frac{2}{x^2(x-3)} &= \frac{2(x+3)}{x^2(x-3)(x+3)} \\
 \frac{5}{x(x+3)} &= \frac{5x(x-3)}{x^2(x+3)(x-3)} \\
 \text{LCD} &= x^2(x-3)(x+3) = x^2(x^2-9)
 \end{aligned}$$

$$\begin{aligned}
 43. \quad \frac{x-8}{x^2-25} &= \frac{x-8}{(x-5)(x+5)} \\
 &= \frac{(x-8)(x-5)}{(x-5)(x+5)(x-5)} = \frac{(x-8)(x-5)}{(x-5)^2(x+5)} \\
 \frac{9x}{x^2-10x+25} &= \frac{9x}{(x-5)^2} \\
 &= \frac{9x(x+5)}{(x-5)^2(x+5)} = \frac{9x(x+5)}{(x-5)^2(x+5)} \\
 \text{LCD} &= (x-5)^2(x+5)
 \end{aligned}$$

$$47. \quad \frac{7}{a} + \frac{14}{a^2} = \frac{7(a)}{a(a)} + \frac{14(1)}{a^2(1)} = \frac{7a}{a^2} + \frac{14}{a^2} = \frac{7a+14}{a^2}$$

$$\begin{aligned}
 49. \quad \frac{20}{x-4} + \frac{20}{4-x} &= \frac{20(1)}{(x-4)(1)} + \frac{20(-1)}{(4-x)(-1)} \\
 &= \frac{20}{x-4} - \frac{20}{x-4} \\
 &= \frac{20-20}{x-4} = 0, \quad x \neq 4
 \end{aligned}$$

$$\begin{aligned}
 51. \quad \frac{3x}{x-8} - \frac{6}{8-x} &= \frac{3x(1)}{(x-8)(1)} - \frac{6(-1)}{(8-x)(-1)} \\
 &= \frac{3x}{x-8} + \frac{6}{x-8} \\
 &= \frac{3x+6}{x-8}
 \end{aligned}$$

$$\begin{aligned}
 53. \quad 25 + \frac{10}{x+4} &= \frac{25(x+4)}{1(x+4)} + \frac{10(1)}{(x+4)(1)} \\
 &= \frac{25(x+4)}{x+4} + \frac{10}{x+4} \\
 &= \frac{25x+100+10}{x+4} = \frac{25x+110}{x+4}
 \end{aligned}$$

$$\begin{aligned}
 55. \quad \frac{3x}{3x-2} + \frac{2}{2-3x} &= \frac{3x(1)}{3x-2(1)} + \frac{2(-1)}{(2-3x)(-1)} \\
 &= \frac{3x}{3x-2} + \frac{-2}{3x-2} \\
 &= \frac{3x-2}{3x-2} = 1, \quad x \neq \frac{2}{3}
 \end{aligned}$$

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

$$\begin{aligned}
 59. \quad \frac{x}{x+3} - \frac{5}{x-2} &= \frac{x(x-2)}{(x+3)(x-2)} - \frac{5(x+3)}{(x-2)(x+3)} \\
 &= \frac{x(x-2)}{(x+3)(x-2)} - \frac{5(x+3)}{(x-2)(x+3)} \\
 &= \frac{x^2-2x-5x-15}{(x+3)(x-2)} \\
 &= \frac{x^2-7x-15}{(x+3)(x-2)}
 \end{aligned}$$

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

$$\begin{aligned}
 63. \quad \frac{3}{x-5} + \frac{2}{x+5} &= \frac{3(x+5)}{(x-5)(x+5)} + \frac{2(x-5)}{(x+5)(x-5)} \\
 &= \frac{3(x+5)}{(x-5)(x+5)} + \frac{2(x-5)}{(x+5)(x-5)} \\
 &= \frac{3x+15+2x-10}{(x-5)(x+5)} \\
 &= \frac{5x+5}{(x-5)(x+5)}
 \end{aligned}$$

$$\begin{aligned}
 65. \quad \frac{4}{x^2} - \frac{4}{x^2+1} &= \frac{4(x^2+1)}{x^2(x^2+1)} - \frac{4x^2}{(x^2+1)x^2} \\
 &= \frac{4(x^2+1)}{x^2(x^2+1)} - \frac{4x^2}{x^2(x^2+1)} \\
 &= \frac{4x^2+4-4x^2}{x^2(x^2+1)} \\
 &= \frac{4}{x^2(x^2+1)}
 \end{aligned}$$

$$\begin{aligned}
 67. \frac{x}{x^2-9} + \frac{3}{x^2-5x+6} &= \frac{x}{(x-3)(x+3)} + \frac{3}{(x-3)(x-2)} \\
 &= \frac{x(x-2)}{(x-2)(x-3)(x+3)} + \frac{3(x+3)}{(x-2)(x-3)(x+3)} \\
 &= \frac{x^2-2x+3x+9}{(x-2)(x-3)(x+3)} \\
 &= \frac{x^2+x+9}{(x-2)(x-3)(x+3)}
 \end{aligned}$$

$$\begin{aligned}
 69. \frac{4}{x-4} + \frac{16}{(x-4)^2} &= \frac{4(x-4)}{(x-4)(x-4)} + \frac{16(1)}{(x-4)^2(1)} \\
 &= \frac{4x-16}{(x-4)^2} + \frac{16}{(x-4)^2} \\
 &= \frac{4x-16+16}{(x-4)^2} \\
 &= \frac{4x}{(x-4)^2}
 \end{aligned}$$

$$\begin{aligned}
 71. \frac{y}{x^2+xy} - \frac{x}{xy+y^2} &= \frac{y}{x(x+y)} - \frac{x}{y(x+y)} \\
 &= \frac{y(y)}{x(x+y)(y)} - \frac{x(x)}{y(x+y)(x)} \\
 &= \frac{y^2}{xy(x+y)} - \frac{x^2}{xy(x+y)} \\
 &= \frac{y^2-x^2}{xy(x+y)} \\
 &= \frac{(y-x)(y+x)}{xy(x+y)} = \frac{y-x}{xy}, \quad x \neq -y
 \end{aligned}$$

$$\begin{aligned}
 73. \frac{4}{x} - \frac{2}{x^2} + \frac{4}{x+3} &= \frac{4x(x+3)}{x(x)(x+3)} - \frac{2(x+3)}{x^2(x+3)} + \frac{4(x^2)}{(x+3)x^2} \\
 &= \frac{4x^2+12x}{x^2(x+3)} - \frac{2x+6}{x^2(x+3)} + \frac{4x^2}{x^2(x+3)} \\
 &= \frac{4x^2+12x-2x-6+4x^2}{x^2(x+3)} \\
 &= \frac{8x^2+10x-6}{x^2(x+3)} \\
 &= \frac{2(4x^2+5x-3)}{x^2(x+3)}
 \end{aligned}$$

$$\begin{aligned}
 75. \frac{3u}{u^2-2uv+v^2} + \frac{2}{u-v} - \frac{u}{u-v} &= \frac{3u}{(u-v)^2} + \frac{2-u}{u-v} \\
 &= \frac{3u}{(u-v)^2} + \frac{2-u}{u-v} \\
 &= \frac{3u(1)}{(u-v)^2(1)} + \frac{(2-u)(u-v)}{(u-v)(u-v)} \\
 &= \frac{3u}{(u-v)^2} + \frac{2u-2v-u^2+uv}{(u-v)^2} \\
 &= \frac{3u+2u-2v-u^2+uv}{(u-v)^2} \\
 &= \frac{5u-2v-u^2+uv}{(u-v)^2} \\
 &= -\frac{u^2-uv-5u+2v}{(u-v)^2}
 \end{aligned}$$

$$\begin{aligned}
 77. \frac{x+2}{x-1} - \frac{2}{x+6} - \frac{14}{x^2+5x-6} &= \frac{(x+2)(x+6)}{(x-1)(x+6)} - \frac{2(x-1)}{(x+6)(x-1)} - \frac{14(1)}{(x+6)(x-1)(1)} \\
 &= \frac{x^2+8x+12}{(x-1)(x+6)} - \frac{2x-2}{(x+6)(x-1)} - \frac{14}{(x+6)(x-1)} \\
 &= \frac{x^2+8x+12-2x+2-14}{(x-1)(x+6)} \\
 &= \frac{x^2+6x}{(x-1)(x+6)} \\
 &= \frac{x(x+6)}{(x-1)(x+6)} \\
 &= \frac{x}{x-1}, \quad x \neq -6
 \end{aligned}$$

79. Keystrokes:

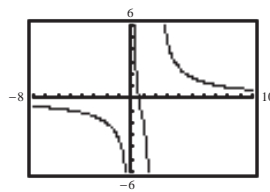
$$y_1 \text{ [Y=] [] 2 [] [X,T,\theta] [] + [] 4 [] [] \div}$$

$$[] [X,T,\theta] [] - 2 [] [] [] \text{ [ENTER]}$$

$$y_2 \text{ [] 6 [X,T,\theta] [] - 4 [] [] \div [] [X,T,\theta] [] [X,T,\theta] [] - 2 [] [] [] \text{ [GRAPH]}$$

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

$$y_1 = y_2$$



$$81. \frac{\frac{1}{2}}{\left(3 + \frac{1}{x}\right)} = \frac{\frac{1}{2}}{\left(3 + \frac{1}{x}\right)} \cdot \frac{2x}{2x}$$

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

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

$$= \frac{x}{2(3x + 1)}, \quad x \neq 0$$

$$83. \frac{\left(\frac{4}{x} + 3\right)}{\left(\frac{4}{x} - 3\right)} = \frac{\left(\frac{4}{x} + 3\right)}{\left(\frac{4}{x} - 3\right)} \cdot \frac{x}{x}$$

$$= \frac{4 + 3x}{4 - 3x}, \quad x \neq 0$$

$$85. \frac{\left(16x - \frac{1}{x}\right)}{\left(\frac{1}{x} - 4\right)} = \frac{\left(16x - \frac{1}{x}\right)}{\left(\frac{1}{x} - 4\right)} \cdot \frac{x}{x}$$

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

$$= \frac{16x^2 - 1}{1 - 4x}$$

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

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

$$= -4x - 1, \quad x \neq 0, \frac{1}{4}$$

$$87. \frac{\left(3 + \frac{9}{x-3}\right)}{\left(4 + \frac{12}{x-3}\right)} = \frac{\left(3 + \frac{9}{x-3}\right)}{\left(4 + \frac{12}{x-3}\right)} \cdot \frac{x-3}{x-3}$$

$$= \frac{3(x-3) + \frac{9}{x-3}(x-3)}{4(x-3) + \frac{12}{x-3}(x-3)}$$

$$= \frac{3x - 9 + 9}{4x - 12 + 12}$$

$$= \frac{3x}{4x} = \frac{3}{4}, \quad x \neq 0, 3$$

$$\begin{aligned}
 89. \frac{\left(\frac{3}{x^2} + \frac{1}{x}\right)}{\left(2 - \frac{4}{5x}\right)} &= \frac{\left(\frac{3}{x^2} + \frac{1}{x}\right)}{\left(2 - \frac{4}{5x}\right)} \cdot \frac{5x^2}{5x^2} \\
 &= \frac{15 + 5x}{10x^2 - 4x} \\
 &= \frac{5(3 + x)}{2x(5x - 2)}
 \end{aligned}$$

$$\begin{aligned}
 91. \frac{\left(\frac{y-x}{x-y}\right)}{\left(\frac{x+y}{xy}\right)} &= \frac{\left(\frac{y-x}{x-y}\right)}{\left(\frac{x+y}{xy}\right)} \cdot \frac{xy}{xy} \\
 &= \frac{\frac{y}{x}(xy) - \frac{x}{y}(xy)}{\left(\frac{x+y}{xy}\right)xy} \\
 &= \frac{y^2 - x^2}{x+y} \\
 &= \frac{(y-x)(y+x)}{x+y} \\
 &= y - x, \quad x \neq 0, y \neq 0, x \neq -y
 \end{aligned}$$

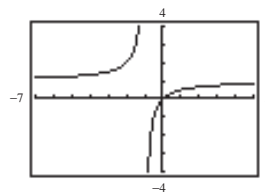
$$\begin{aligned}
 93. \frac{\left(\frac{1-\frac{1}{y}}{1-4y}\right)}{\left(\frac{y-3}{y-3}\right)} &= \frac{\left(\frac{1-\frac{1}{y}}{1-4y}\right)}{\left(\frac{y-3}{y-3}\right)} \cdot \frac{y(y-3)}{y(y-3)} \\
 &= \frac{y(y-3) - (y-3)}{y(1-4y)} \\
 &= \frac{y^2 - 3y - y + 3}{y - 4y^2} \\
 &= \frac{y^2 - 4y + 3}{-y(-1 + 4y)} \\
 &= -\frac{(y-3)(y-1)}{y(4y-1)}, \quad y \neq 3
 \end{aligned}$$

$$\begin{aligned}
 95. \frac{\left(\frac{x}{x-3} - \frac{2}{3}\right)}{\left(\frac{10}{3x} + \frac{x^2}{x-3}\right)} &= \frac{\left(\frac{x}{x-3} - \frac{2}{3}\right)}{\left(\frac{10}{3x} + \frac{x^2}{x-3}\right)} \cdot \frac{3x(x-3)}{3x(x-3)} \\
 &= \frac{3x^2 - 2x(x-3)}{10(x-3) + 3x^2} \\
 &= \frac{3x^2 - 2x^2 + 6x}{10x - 30 + 3x^2} \\
 &= \frac{x^2 + 6x}{3x^2 + 10x - 30}, \quad x \neq 0, x \neq 3
 \end{aligned}$$

$$\begin{aligned}
 97. \frac{f(2+h) - f(2)}{h} &= \frac{\frac{1}{2+h} - \frac{1}{2}}{h} \\
 &= \frac{\frac{1}{2+h} - \frac{1}{2}}{h} \cdot \frac{2(2+h)}{2(2+h)} \\
 &= \frac{2 - (2+h)}{2h(2+h)} \\
 &= \frac{2 - 2 - h}{2h(2+h)} \\
 &= \frac{-h}{2h(2+h)} \\
 &= \frac{-1}{2(2+h)}
 \end{aligned}$$

99.

x	-3	-2	-1	0	1	2	3
$\frac{1 - \frac{1}{x}}{1 - \frac{1}{x^2}}$	$\frac{3}{2}$	2	Undef.	Undef.	Undef.	$\frac{2}{3}$	$\frac{3}{4}$
$\frac{x}{x+1}$	$\frac{3}{2}$	2	Undef.	0	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$



Keystrokes:

y_1 $\boxed{Y=}$ \boxed{C} $\boxed{1}$ $\boxed{-}$ $\boxed{1}$ $\boxed{\div}$ $\boxed{X,T,\theta}$ $\boxed{)}$ $\boxed{\div}$

\boxed{C} $\boxed{1}$ $\boxed{-}$ $\boxed{1}$ $\boxed{\div}$ $\boxed{X,T,\theta}$ $\boxed{x^2}$ $\boxed{)}$ \boxed{ENTER}

y_2 $\boxed{X,T,\theta}$ $\boxed{\div}$ \boxed{C} $\boxed{X,T,\theta}$ $\boxed{+}$ $\boxed{1}$ $\boxed{)}$ \boxed{GRAPH}

Zero and one are not in the domain of

$$\frac{1 - \frac{1}{x}}{1 - \frac{1}{x^2}}$$

but are in the domain of $\frac{x}{x+1}$. The two expressions are equivalent except at $x = 0$ and $x = 1$.

$$\begin{aligned} 101. \quad \frac{t}{4} + \frac{t}{6} &= \frac{t(3)}{4(3)} + \frac{t(2)}{6(2)} \\ &= \frac{3t}{12} + \frac{2t}{12} \\ &= \frac{5t}{12} \end{aligned}$$

$$\begin{aligned} 103. \quad \frac{\frac{x}{4} + \frac{x}{6}}{2} &= \frac{\left(\frac{x}{4} + \frac{x}{6}\right)}{2} \cdot \frac{12}{12} \\ &= \frac{\frac{x}{4}(12) + \frac{x}{6}(12)}{2(12)} \\ &= \frac{3x + 2x}{24} \\ &= \frac{5x}{24} \end{aligned}$$

$$105. \quad \frac{\frac{x}{3} - \frac{x}{5}}{3} \cdot \frac{15}{15} = 5x - 3x = \frac{2x}{45}$$

Thus,

$$x_1 = \frac{x}{5} + \frac{2x}{45} = \frac{9x}{45} + \frac{2x}{45} = \frac{11x}{45}$$

$$x_2 = \frac{11x}{45} + \frac{2x}{45} = \frac{13x}{45}$$

$$\begin{aligned} 107. \quad \frac{1}{\left(\frac{1}{R_1} + \frac{1}{R_2}\right)} &= \frac{1}{\left(\frac{1}{R_1} + \frac{1}{R_2}\right)} \cdot \frac{R_1 R_2}{R_1 R_2} \\ &= \frac{R_1 R_2}{\frac{1}{R_1}(R_1 R_2) + \frac{1}{R_2}(R_1 R_2)} \\ &= \frac{R_1 R_2}{R_2 + R_1} \end{aligned}$$

109. (a) Verbal Model:

$$\boxed{\text{Distance}} = \boxed{\text{Rate}} \cdot \boxed{\text{Time}}$$

$$\frac{\text{Distance}}{\text{Rate}} = \text{Time}$$

Equation: Upstream $t = \frac{10}{5-x}$

Downstream $t = \frac{10}{5+x}$

(b) Total time = $t(x) = \frac{10}{5-x} + \frac{10}{5+x}$

$$\begin{aligned} \text{(c) } t(x) &= \frac{10(5+x)}{(5-x)(5+x)} + \frac{10(5-x)}{(5-x)(5+x)} \\ &= \frac{50 + 10x + 50 - 10x}{(5-x)(5+x)} \\ &= \frac{100}{(5-x)(5+x)} \end{aligned}$$

111. Rewrite each fraction in terms of the lowest common denominator, combine the numerators, and place the result over the lowest common denominator.

$$\begin{aligned} 113. \frac{x-1}{x+4} - \frac{4x-11}{x+4} &= \frac{(x-1) - (4x-11)}{x+4} \\ &= \frac{x-1-4x+11}{x+4} \\ &= \frac{-3x+10}{x+4} \end{aligned}$$

The subtraction must be distributed to both terms of the numerator of the second fraction.

Section 4.5 Dividing Polynomials

$$1. \frac{6z+10}{2} = \frac{6z}{2} + \frac{10}{2} = 3z + 5$$

$$\begin{aligned} 3. \frac{10z^2+4z-12}{4} &= \frac{10z^2}{4} + \frac{4z}{4} - \frac{12}{4} \\ &= \frac{5z^2}{2} + z - 3 \end{aligned}$$

$$\begin{aligned} 5. (7x^3 - 2x^2) \div x &= \frac{7x^3 - 2x^2}{x} \\ &= \frac{7x^3}{x} - \frac{2x^2}{x} \\ &= 7x^2 - 2x, \quad x \neq 0 \end{aligned}$$

$$\begin{aligned} 7. \frac{m^4 + 2m^2 - 7}{m} &= \frac{m^4}{m} + \frac{2m^2}{m} - \frac{7}{m} \\ &= m^3 + 2m - \frac{7}{m}, \quad m \neq 0 \end{aligned}$$

$$\begin{aligned} 9. \frac{50z^3 + 30z}{-5z} &= \frac{50z^3}{-5z} + \frac{30z}{-5z} \\ &= -10z^2 - 6, \quad z \neq 0 \end{aligned}$$

$$\begin{aligned} 11. \frac{8z^3 + 3z^2 - 2z}{2z} &= \frac{8z^3}{2z} + \frac{3z^2}{2z} - \frac{2z}{2z} \\ &= 4z^2 + \frac{3}{2}z - 1, \quad z \neq 0 \end{aligned}$$

$$\begin{aligned} 13. (5x^2y - 8xy + 7xy^2) \div 2xy &= \frac{5x^2y - 8xy + 7xy^2}{2xy} \\ &= \frac{5x^2y}{2xy} - \frac{8xy}{2xy} + \frac{7xy^2}{2xy} \\ &= \frac{5x}{2} - 4 + \frac{7}{2}y, \quad x \neq 0, y \neq 0 \end{aligned}$$

$$\begin{array}{r} x - 5, \quad x \neq 3 \\ 15. \frac{x^2 - 8x + 15}{x - 3} = x - 3 \overline{)x^2 - 8x + 15} \\ \underline{x^2 - 3x} \\ -5x + 15 \\ \underline{-5x + 15} \\ 0 \end{array}$$

$$\begin{array}{r} x + 10, \quad x \neq -5 \\ 17. (x^2 + 15x + 50) \div (x + 5) = x + 5 \overline{)x^2 + 15x + 50} \\ \underline{x^2 + 5x} \\ 10x + 50 \\ \underline{10x + 50} \\ 0 \end{array}$$

$$\begin{array}{r} x - 3 + \frac{2}{x-2} \\ 19. x - 2 \overline{)x^2 - 5x + 8} \\ \underline{x^2 - 2x} \\ -3x + 8 \\ \underline{-3x + 6} \\ 2 \end{array}$$

$$\begin{array}{r} x + 7, \quad x \neq 3 \\ 21. -x + 3 \overline{)-x^2 - 4x + 21} \\ \underline{-x^2 + 3x} \\ -7x + 21 \\ \underline{-7x + 21} \\ 0 \end{array}$$