

Show all work for full credit. Please use pencil and write legibly.
(4 points each numbered problem)

<p>1. State the domain of</p> <p>(a) $\frac{10}{12y}$</p> <p>Domain: $\{y \in \mathbb{R} \mid y \neq 0\}$</p> <p>(b) $\frac{x}{x-1}$</p> $\begin{array}{r} x - 1 = 0 \\ \quad +1 \quad +1 \\ \hline \quad \quad x = 1 \end{array}$ <p>Domain: $\{x \in \mathbb{R} \mid x \neq 1\}$</p>	<p>2. Simplify completely.</p> <p>(a) $\frac{4x}{12x-6y} = \frac{\overset{2}{\cancel{4}}x}{\underset{3}{\cancel{6}}(2x-y)} = \frac{2x}{3(2x-y)}$</p> <p>(b) $\frac{1-y^2}{y-1}$</p> $= \frac{(1+y)(1-y)}{-1(1-y)} = -(1+y) = -1-y$
<p>3. Write in the missing numerator.</p> <p>(a) $12x = \frac{12x(3x-2)}{3x-2}$</p> <p>because $12x = \frac{12x}{1} = \frac{12x}{1} \cdot \frac{(3x-2)}{(3x-2)}$</p> <p>(b) $\frac{4x}{x-2} = \frac{4x(x-1)}{x^2-3x+2}$</p> <p>because</p> $\frac{4x}{x-2} = \frac{4x}{(x-2)} \cdot \frac{(x-1)}{(x-1)} = \frac{4x(x-1)}{x^2-3x+2}$	<p>4. Multiply and simplify.</p> <p>(a) $\frac{5x^2}{y} \cdot \frac{5xy^3}{15y^2} = \frac{25}{15} \cdot \frac{x^3}{1} \cdot \frac{y^3}{y^3} = \frac{5x^3}{3}$</p> <p>(b) $\frac{x^2-25}{x^2+x-20} \cdot \frac{x^2+7x+12}{x^2-2x-15}$</p> $= \frac{\cancel{(x+5)}(x-5)}{\cancel{(x+5)}(x-4)} \cdot \frac{\cancel{(x+3)}(x+4)}{\cancel{(x-5)}(x+3)}$ $= \frac{x+4}{x-4}$

5. Divide and simplify.

$$\begin{aligned} \text{(a)} \quad 20y \div \frac{12x^2}{5y^2} &= \frac{20y}{1} \cdot \frac{5y^2}{12x^2} \\ &= \frac{\cancel{5}20 \cdot 5y^3}{\cancel{3}12x^2} = \frac{25y^3}{3x^2} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \frac{2u}{3v} \div u^2 &= \frac{2u}{3v} \cdot \frac{1}{u^2} \\ &= \frac{2\cancel{u}}{3v} \cdot \frac{1}{\cancel{u} \cdot u} = \frac{2}{3uv} \end{aligned}$$

6. Divide and simplify.

$$\begin{aligned} \text{(a)} \quad \frac{x-6}{x^2-12x+36} \div \frac{x^2+7x+12}{x^2-3x-18} \\ &= \frac{\cancel{x-6}}{(x-6)(\cancel{x-6})} \cdot \frac{(x-6)(x+3)}{(\cancel{x+3})(x+4)} = \frac{1}{x+4} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \frac{5x^2+17x-12}{3x^2+7x-20} \div \frac{x^2-16}{3x-5} \\ &= \frac{(5x-3)(\cancel{x+4})}{(\cancel{3x-5})(x+4)} \cdot \frac{\cancel{3x-5}}{(x+4)(x-4)} = \frac{5x-3}{(x+4)(x-4)} \end{aligned}$$

7. Add and simplify.

$$\text{(a)} \quad \frac{9w^2}{7} + \frac{2w^2}{7} = \frac{11w^2}{7}$$

$$\begin{aligned} \text{(b)} \quad \frac{x+8}{x-2} - \frac{x-7}{x-2} \\ \frac{x+8-(x-7)}{x-2} = \frac{x+8-x+7}{x-2} = \frac{15}{x-2} \end{aligned}$$

8. Find the LCM.

$$\text{(a)} \quad \text{LCM}(3x^5yz^2, 12xy^5z^3)$$

$$\text{LCM} = 12x^5y^5z^3$$

$$\text{(b)} \quad \text{LCM}(3x-1, 9x^2-1)$$

$$= \text{LCM}(3x-1, (3x-1)(3x+1))$$

$$\text{LCM} = (3x-1)(3x+1)$$

9. Add and simplify.

$$\begin{aligned} \text{(a)} \quad & \frac{1}{2x-1} + \frac{1}{2x+1} \\ &= \frac{1 \cdot (2x+1)}{(2x-1)(2x+1)} + \frac{1 \cdot (2x-1)}{(2x+1) \cdot (2x-1)} \\ &= \frac{2x+1+2x-1}{(2x-1)(2x+1)} = \frac{4x}{(2x-1)(2x+1)} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & \frac{2x-1}{5x+4} + 9 \\ &= \frac{2x-1}{5x+4} + \frac{9}{1} = \frac{2x-1}{5x+4} + \frac{9(5x+4)}{1(5x+4)} \\ &= \frac{2x-1+45x+36}{5x+4} = \frac{47x+35}{5x+4} \end{aligned}$$

10. Subtract and simplify.

$$\begin{aligned} \text{(a)} \quad & \frac{1}{x+5} - \frac{2}{x^2+7x+10} \\ &= \frac{1 \cdot (x+2)}{(x+5)(x+2)} - \frac{2}{(x+2)(x+5)} \\ &= \frac{x+2-2}{(x+5)(x+2)} = \frac{x}{(x+5)(x+2)} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & \frac{1}{x^2-8x+15} - \frac{1}{5-x} \\ &= \frac{1}{(x-3)(x-5)} - \frac{1}{-1(x-5)} \\ &= \frac{1}{(x-3)(x-5)} + \frac{1(x-3)}{(x-5)(x-3)} \\ &= \frac{1+x-3}{(x-5)(x-3)} = \frac{x-2}{(x-5)(x-3)} \end{aligned}$$

11. Simplify.

$$\frac{\frac{5}{m}}{\frac{2}{n}} = \frac{\frac{5}{\cancel{m}} \cdot \cancel{mn}}{\frac{2}{\cancel{n}} \cdot \cancel{mn}} = \frac{5n}{2m}$$

12. Simplify.

$$\begin{aligned} \frac{\frac{1}{5x} + \frac{1}{4x}}{\frac{1}{2x}} &= \frac{\left(\frac{1}{5x} + \frac{1}{4x}\right) \cdot 20x}{\frac{1}{2x} \cdot 20x} \\ &= \frac{\frac{1}{\cancel{5x}} \cdot \cancel{4} \cdot 20x + \frac{1}{\cancel{4x}} \cdot \cancel{5} \cdot 20x}{\frac{1}{\cancel{2x}} \cdot \cancel{10} \cdot 20x} = \frac{4+5}{10} = \frac{9}{10} \end{aligned}$$

13. Simplify.

$$\frac{7x + \frac{1}{2x}}{3y - \frac{1}{3y}} = \frac{\left(7x + \frac{1}{2x}\right) \cdot 6xy}{\left(3y - \frac{1}{3y}\right) \cdot 6xy}$$

$$= \frac{7x \cdot 6xy + \frac{1}{2x} \cdot 6xy}{3y \cdot 6xy - \frac{1}{3y} \cdot 6xy} = \frac{42x^2y + 3y}{18xy^2 - 2x}$$

14. Solve.

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

$$\frac{3}{4x} \cdot 4x = \left(\frac{5}{2x} - \frac{7}{4}\right) \cdot 4x$$

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

$$3 = 10 - 7x$$

$$\frac{-10}{-7} = \frac{-10}{-7}$$

$$-7 = 0 - 7x$$

$$-7 = -7x$$

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

$$1 = x$$

$$1 = x$$

15. Solve.

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

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

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

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

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

$$3x - 8 = x + 2$$

$$\frac{-x}{-x} \quad \frac{-x}{-x}$$

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

$$2x - 8 = 2$$

$$\frac{+8}{+8} \quad \frac{+8}{+8}$$

$$2x + 0 = 10$$

$$2x = 10$$

$$\frac{2x}{2} = \frac{10}{2}$$

$$x = 5$$

16. Solve.

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

$$(x-4)(2x-1) = (x+6)(2x+3)$$

$$2x^2 - 9x + 4 = 2x^2 + 15x + 18$$

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

$$0 - 9x + 4 = 0 + 15x + 18$$

$$\frac{+9x}{+9x} \quad \frac{+9x}{+9x}$$

$$0 + 4 = 24x + 18$$

$$\frac{-18}{-18} \quad \frac{-18}{-18}$$

$$-14 = 24x$$

$$\frac{-14}{24} = \frac{24x}{24}$$

$$\frac{-14}{24} = \frac{24x}{24}$$

$$-\frac{7}{12} = x$$

$$-\frac{7}{12} = x$$

$$\text{Solution set: } \left\{ -\frac{7}{12} \right\}$$

17. Solve.

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

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

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

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

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

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

$$\frac{-3x}{-3x} \quad \frac{-3x}{-3x}$$

$$0 + 5 = x - 8$$

$$\frac{+8}{+8} \quad \frac{+8}{+8}$$

$$13 = x$$

Solution set: {13}

18. What number must be subtracted from the numerator and added to the denominator of $\frac{59}{60}$ to get a fraction equivalent to $\frac{7}{10}$?

Let x be the number.

$$\frac{59-x}{60+x} = \frac{7}{10}$$

$$10(59-x) = 7(60+x)$$

$$590 - 10x = 420 + 7x$$

$$\frac{+10x}{+10x} \quad \frac{+10x}{+10x}$$

$$590 + 0 = 420 + 17x$$

$$\frac{-420}{-420} \quad \frac{-420}{-420}$$

$$170 = 0 + 17x$$

$$\frac{170}{17} = \frac{17x}{17}$$

$$10 = x$$

The number is 10.

19. Andrew can tile a floor in 8 hours, and Angela can tile the same floor in 9 hours. How long would it take them working together to tile the floor? (Write your answer in hours and minutes)

Let t = the time it takes them working together.

	Rate	Time	Amt Work Done
Andrew	$\frac{1}{8}$	t	$\frac{1}{8}t$
Angela	$\frac{1}{9}$	t	$\frac{1}{9}t$

$$\frac{1}{8}t + \frac{1}{9}t = 1$$

$$\left(\frac{1}{8}t + \frac{1}{9}t\right) \cdot 72 = 1 \cdot 72$$

$$9t + 8t = 72$$

$$17t = 72$$

$$\frac{17t}{17} = \frac{72}{17}$$

$$t = 4\frac{4}{17} \text{ hours}$$

$$= 4 \text{ hrs } 14 \text{ mins}$$

It will take them 4 hours 14 minutes working together.

20. A boat can travel 12 miles upstream in the same time it takes to travel 20 miles downstream in the same river. If the boat's speed is 32 mph in still water, what is the speed of the current?

Let x = the speed of the current.

	Rate	Time	Distance
upstream	$32-x$	$\frac{12}{32-x}$	12
downstream	$32+x$	$\frac{20}{32+x}$	20

$$\frac{12}{32-x} = \frac{20}{32+x}$$

$$12(32+x) = 20(32-x)$$

$$384 + 12x = 640 - 20x$$

$$\frac{+20x}{+20x} \quad \frac{+20x}{+20x}$$

$$384 + 32x = 640 + 0$$

$$\frac{-384}{-384} \quad \frac{-384}{-384}$$

$$0 + 32x = 256$$

$$\frac{32x}{32} = \frac{256}{32}$$

$$x = 8$$

The speed of the current is 8 mph.