

# Sec. 11.4 Adding and Subtracting Rational Expressions

Problem 1:  
What is the sum?

$$a. \frac{2}{5a} + \frac{1}{5a} = \frac{2+1}{5a} = \frac{3}{5a}$$

$$2 \cdot \boxed{\frac{1}{5a}} + 1 \cdot \boxed{\frac{1}{5a}}$$

$$b. \frac{7p}{x+4} + \frac{3p}{x+4} = \frac{7p+3p}{x+4} = \frac{10p}{x+4}$$

Problem 2:  
What is the difference?

$$\frac{3x}{5x^2+9x-2} - \frac{-2x+1}{5x^2+9x-2}$$

$$= \frac{3x - (-2x+1)}{5x^2+9x-2} = \frac{3x+2x-1}{5x^2+9x-2}$$

$$= \frac{5x-1}{5x^2+9x-2} = \frac{(5x-1)}{(5x-1)(x+2)} = \boxed{\frac{1}{x+2}}$$

$$\begin{array}{r} 5x^2 - 1x + 10x - 2 \\ \underline{-10} \\ x(5x-1) + 2(5x-1) \end{array}$$

$$(x+5)(5x-1)$$

Problem 3:

What is the sum?

$$a. \frac{2x}{9x \cdot x} + \frac{3}{3 \cdot 3x^2} = \frac{2x}{9x^2} + \frac{3}{9x^2}$$

$$\text{LCD: } 9x^2 = \frac{2x+3}{9x^2}$$

$$b. \frac{3}{3 \cdot 7y^4} + \frac{2}{3y^2} \cdot \frac{3}{7y^2} = \frac{9}{21y^4} + \frac{6}{21y^4}$$

$$\text{LCD: } 3 \cdot 7y^4 = \frac{15 \cdot 5}{21y^4} = \frac{5}{7y^4}$$

Problem 4:

What is the difference?

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

$$\text{LCD: } (x+2)(x-3)$$

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

$$\frac{4x-12-x-2}{(x-3)(x+2)} = \frac{3x-14}{(x-3)(x+2)}$$

$$* x \neq 3, -2$$

$$b. \frac{x(x-2)}{(3x-1)(x-2)} - \frac{4(3x-1)}{(x-2)(3x-1)}$$

$$\text{LCD: } (3x-1)(x-2)$$

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

$$\frac{x^2 - 2x - 12x + 4}{(3x-1)(x-2)} = \frac{x^2 - 14x + 4}{(3x-1)(x-2)}$$

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

## Problem 5:

You paddle a canoe 3 mi downstream and then paddle back upstream to your starting point. On the return trip, your speed is reduced 40% due to the current of the stream. Let  $s$  be your speed in mi/hr downstream. What is an expression that represents your total time in hours riding downstream and upstream?

hrs downstream + hrs upstream

$$\frac{x}{d}$$

$$x =$$

$$d = \frac{r}{t}$$

$$t = \frac{r}{d}$$

# Sec. 11.5 Solving Rational Equations

## Problem 1

What is the solution of

$$10x \left( \frac{2}{5x} - \frac{1}{2x} \right) = 10x \left( -\frac{1}{2} \right)$$

$$\cancel{5} \cdot \frac{4}{\cancel{5}} x + 7 \cdot 7x = 39^5$$

$$4x + 35x = 195$$

LCD:  $2 \cdot 5x = 10x$

$$\cancel{10x} \cdot \frac{2}{\cancel{5x}} - \frac{\cancel{5} \cdot 1}{\cancel{2x}} = \frac{\cancel{5}}{\cancel{10x}} \left( -\frac{1}{2} \right)$$

$$4 - 5 = -5x$$

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

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

$$1 \div \frac{2}{5}$$

$$1 \cdot \frac{5}{2} = \frac{5}{2}$$

Check:

$$\frac{2}{5 \left( \frac{1}{5} \right)} - \frac{1}{2 \left( \frac{1}{5} \right)} = -\frac{1}{2}$$

$$2 - \boxed{\frac{1}{\frac{2}{5}}} = -\frac{1}{2}$$

$$\frac{2}{2} \cdot 2 - \frac{5}{2} = -\frac{1}{2}$$

$$\frac{4}{2} - \frac{5}{2} = -\frac{1}{2}$$

$$-\frac{1}{2} = -\frac{1}{2}$$

Problem 2:

What are the solutions of

$$x^2 \left( 1 - \frac{2}{x} \right) = \frac{8}{x^2}$$

LCD:  $x^2$

$$x^2 \cdot 1 - \cancel{x^2} \left( \frac{2}{\cancel{x}} \right) = \cancel{x^2} \left( \frac{8}{\cancel{x} \cancel{x} \cancel{x^2}} \right)$$

$$\rightarrow x^2 - 2x = 8$$

---

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

$$\frac{-8}{1 \cdot 8}$$

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

$$x + 2 = 0$$

$$\begin{array}{r} -2 \\ -2 \end{array}$$

$$\boxed{x = -2}$$

$$x - 4 = 0$$

$$\begin{array}{r} +4 \\ +4 \end{array}$$

$$\boxed{x = 4}$$

### Problem 3:

You can mow the lawn in 1 h 15 min using a push mower. Your father can mow the lawn in 30 minutes on a riding mower. How long would it take you and your father to mow the lawn together?

fraction of lawn  
you mow in 1 min.

$$\frac{1}{75}$$

fraction of lawn  
dad mows in 1 min.

$$\frac{1}{30}$$

$t$  = time, in minutes to mow the lawn working together

fraction of lawn  
you + dad mow together

$$\frac{2}{150t} + \frac{5}{150t} = \frac{1}{t}$$

$\frac{2}{75} + \frac{5}{30} = \frac{1}{t}$   
5 · 15      2 · 15

LCD: 75

$$2 \cdot 5 \cdot 15 t$$

$$150t$$

$$2t + 5t = 150$$

$$\frac{7t}{7} = \frac{150}{7}$$

$$t = \frac{150}{7}$$

$$t = 21 \frac{3}{7} \text{ min.}$$

Problem 4:  
what is the solution?

$$\frac{10}{(6x+7)} = \frac{6}{(2x+9)}$$

$x \neq -\frac{7}{6}, -\frac{9}{2}$

$$10(2x+9) = 6(6x+7)$$

$$20x + 90 = 36x + 42$$

$$\begin{array}{r} -20x \\ \hline 90 = 16x + 42 \\ -42 \quad -42 \\ \hline 48 = 16x \\ \frac{48}{16} = \frac{16x}{16} \\ 3 = x \end{array}$$

~~$\frac{a}{b} = \frac{c}{d}$~~   
ad = bc

Problem 5:

what is the solution of

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

EV:  $x \neq -1$

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

$$x^2 + 1x - 3x - 3 = x + 1$$

$$\begin{array}{r} x^2 - 2x - 3 = x + 1 \\ -x \quad -1 \quad -x - 1 \\ \hline \end{array}$$

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

$$\frac{-4 \pm \sqrt{16}}{2 \cdot 2}$$

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

$$x+1=0$$

$$\begin{array}{r} -1 - 1 \\ \hline x = -1 \end{array}$$

$$x-4=0$$

$$\begin{array}{r} +4 + 4 \\ \hline x = 4 \end{array}$$

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

$$\begin{array}{r} -1-3 \\ -1+1 \\ \hline -\frac{4}{0} = \frac{1}{0} \end{array}$$

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

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