

## LESSON

**Practice B****8-3*****Adding and Subtracting Rational Expressions***

Find the least common multiple for each pair.

1.  $3x^2y^6$  and  $5x^3y^2$

2.  $x^2 + x - 2$  and  $x^2 - x - 6$

\_\_\_\_\_

\_\_\_\_\_

Add or subtract. Identify any  $x$ -values for which the expression is undefined.

3.  $\frac{2x-3}{x+4} + \frac{4x-5}{x+4}$

4.  $\frac{x+12}{2x-5} - \frac{3x-2}{2x-5}$

\_\_\_\_\_

\_\_\_\_\_

5.  $\frac{x+4}{x^2-x-12} + \frac{2x}{x-4}$

6.  $\frac{3x^2-1}{x^2-3x-18} - \frac{x+2}{x-6}$

\_\_\_\_\_

\_\_\_\_\_

7.  $\frac{x+2}{x^2-2x-15} + \frac{x}{x+3}$

8.  $\frac{x+6}{x^2-7x-18} - \frac{2x}{x-9}$

\_\_\_\_\_

\_\_\_\_\_

Simplify. Assume all expressions are defined.

9.  $\frac{\frac{x-1}{x+5}}{\frac{x+6}{x-3}}$

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

\_\_\_\_\_

\_\_\_\_\_

Solve.

11. A messenger is required to deliver 10 packages per day. Each day, the messenger works only for as long as it takes to deliver the daily quota of 10 packages. On average, the messenger is able to deliver 2 packages per hour on Saturday and 4 packages per hour on Sunday. What is the messenger's average delivery rate on the weekend?

\_\_\_\_\_

**LESSON** **Practice A**  
**8-3 Adding and Subtracting Rational Expressions**

Add or subtract. Identify any  $x$ -values for which the expression is undefined.

$$1. \frac{x}{x+1} + \frac{2x}{x+1} = \frac{3x}{x+1}; x \neq -1$$

$$2. \frac{3x-1}{2x-5} - \frac{5x-2}{2x-5} = \frac{-2x+1}{2x-5}; x \neq \frac{5}{2}$$

Find the least common multiple for each pair.

$$3. 4x \text{ and } 3x^2 \quad \underline{12x^2}$$

$$4. (x+1)(x+2) \text{ and } (x+2) \quad \underline{(x+1)(x+2)}$$

Add or subtract.

$$5. \frac{4x+1}{x-4} + \frac{2x+7}{x-4} = \frac{6x+8}{x-4}$$

$$6. \frac{6}{x} - \frac{2x}{x+2} = \frac{-2x^2+6x+12}{x^2+2x}$$

$$7. \frac{x}{x^2-3x-4} + \frac{3}{x-4} = \frac{4x+3}{x^2-3x-4}$$

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

Simplify.

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

$$10. \frac{\frac{1}{x+5}}{\frac{x}{2}} = \frac{2}{x^2+5x}$$

$$11. \frac{\frac{x+2}{3}}{\frac{3x+6}{9}} = 1$$

$$12. \frac{\frac{x}{x+3}}{\frac{x+1}{5}} = \frac{5x}{x^2+4x+3}$$

Solve.

13. A ferry shuttles from Seattle to Vancouver Island and back. Because of headwinds, the return trip is slower than the trip to the island. The average speed of the ferry, in miles per hour, is given by the expression:  $\frac{d}{50} \cdot \frac{d}{60}$ . What is the average speed of the ferry?  
**54.5 miles per hour**

**LESSON** **Practice B**  
**8-3 Adding and Subtracting Rational Expressions**

Find the least common multiple for each pair.

$$1. 3x^2y^6 \text{ and } 5x^3y^2 \quad \underline{15x^3y^6}$$

$$2. x^2 + x - 2 \text{ and } x^2 - x - 6 \quad \underline{(x-1)(x+2)(x-3)}$$

Add or subtract. Identify any  $x$ -values for which the expression is undefined.

$$3. \frac{2x-3}{x+4} + \frac{4x-5}{x+4} = \frac{6x-8}{x+4}; x \neq -4$$

$$4. \frac{x+12}{2x-5} - \frac{3x-2}{2x-5} = \frac{-2x+14}{2x-5}; x \neq \frac{5}{2}$$

$$5. \frac{x+4}{x^2-x-12} + \frac{2x}{x-4} = \frac{2x^2+7x+4}{x^2-x-12}; x \neq 4, x \neq -3$$

$$6. \frac{3x^2-1}{x^2-3x-18} - \frac{x+2}{x-6} = \frac{2x^2-5x-7}{x^2-3x-18}; x \neq 6, x \neq -3$$

$$7. \frac{x+2}{x^2-2x-15} + \frac{x}{x+3} = \frac{x^2-4x+2}{x^2-2x-15}; x \neq -3, x \neq 5$$

$$8. \frac{x+6}{x^2-7x-18} - \frac{2x}{x-9} = \frac{-2x^2-3x+6}{x^2-7x-18}; x \neq -2, x \neq 9$$

Simplify. Assume all expressions are defined.

$$9. \frac{\frac{x-1}{x+5}}{\frac{x+6}{x-3}} = \frac{x^2-4x+3}{x^2+11x+30}$$

$$10. \frac{\frac{x+3}{x^2+1}}{\frac{x-2}{x^2-24}} = \frac{12x-24}{x^3+3x^2+x+3}$$

Solve.

11. A messenger is required to deliver 10 packages per day. Each day, the messenger works only for as long as it takes to deliver the daily quota of 10 packages. On average, the messenger is able to deliver 2 packages per hour on Saturday and 4 packages per hour on Sunday. What is the messenger's average delivery rate on the weekend?  
**2.66 packages per hour**

**LESSON** **Practice C**  
**8-3 Adding and Subtracting Rational Expressions**

Add or subtract. Identify any  $x$ -values for which the expression is undefined.

$$1. \frac{5x-1}{x+3} + \frac{3x}{2x+6} = \frac{13x-2}{2x+6}; x \neq -3$$

$$2. \frac{7x-2}{3x^2-x+4} = \frac{x^2+28x}{3x^2(x+4)}; x \neq -4, x \neq 0$$

$$3. \frac{x}{x-4} + \frac{x+1}{3x+1} = \frac{4x^2-2x-4}{3x^2-11x-4}; x \neq -\frac{1}{3} \text{ and } x \neq 4$$

$$4. \frac{3}{x-5} - \frac{1}{x^2-7x+10} = \frac{3x-7}{x^2-7x+10}; x \neq 5, x \neq 2$$

$$5. \frac{x}{4x-2} + \frac{3x+3}{4x+2} = \frac{8x^2+4x-3}{8x^2-2}; x \neq \pm \frac{1}{2}$$

$$6. \frac{3x}{x^2-x-6} - \frac{5}{x^2-8x+15} = \frac{3x^2-20x-10}{x^3-6x^2-x+30}; x \neq -2, x \neq 3, x \neq 5$$

Simplify. Assume all expressions are defined.

$$7. \frac{\frac{x^2-8}{x+4}}{\frac{x+4}{x-2}} = \frac{x-2}{x^2-8}$$

$$8. \frac{\frac{x}{x+2}}{\frac{2x}{x+5}} = \frac{5}{11x+22}$$

$$9. \frac{\frac{x-7}{x+2}}{\frac{x-5}{x+6}} = \frac{x^2-x-42}{x^2-3x-10}$$

$$10. \frac{\frac{x-6}{x^2+3}}{\frac{x}{x^2+2x+1}} = \frac{x^3-4x^2-11x-6}{x^3+3x}$$

Solve.

11. The electric potential generated by a certain arrangement of electric charges is given by  $\frac{e}{x-4} + \frac{-e}{x+1}$ , where  $e$  is the fundamental unit of electric charge and  $x$  measures the location where the potential is being measured. Express the electric potential as a rational expression.  
 **$\frac{e(2x-3)}{x^2-3x-4}$**

**LESSON** **Review for Mastery**  
**8-3 Adding and Subtracting Rational Expressions**

Use a common denominator to add or subtract rational expressions.

Add:  $\frac{6x+4}{x+5} + \frac{2x-8}{x+5}$

**Step 1** Add.

$$\frac{6x+4}{x+5} + \frac{2x-8}{x+5} = \frac{6x+4+2x-8}{x+5} = \frac{8x-4}{x+5}$$

The denominators are the same. Add the numerators.  
Group like terms.  
Combine like terms.

**Step 2** Identify  $x$ -values for which the expression is undefined.  
 $x \neq -5$  because  $-5$  makes the denominator equal 0.

Subtract:  $\frac{4x-3}{2x-1} - \frac{8x+2}{2x-1}$

**Step 1** Subtract.

$$\frac{4x-3}{2x-1} - \frac{8x+2}{2x-1} = \frac{(4x-3)-(8x+2)}{2x-1} = \frac{4x-3-8x-2}{2x-1} = \frac{-4x-5}{2x-1}$$

The denominators are the same. Subtract the numerators.  
Use the Distributive Property.  
Combine like terms.

**Step 2** Identify  $x$ -values for which the expression is undefined.  
 $x \neq \frac{1}{2}$  because  $\frac{1}{2}$  makes the denominator equal 0.

Add or subtract.

$$1. \frac{x-5}{x^2-4} + \frac{3x+2}{x^2-4} = \frac{(x-5)+(3x+2)}{x^2-4} = \frac{4x-3}{x^2-4}; x \neq -2, 2$$

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

$$3. \frac{2x-1}{x-1} - \frac{5x+4}{x-1} = \frac{2x-1-(5x+4)}{x-1} = \frac{-3x-5}{x-1}; x \neq 1$$

$$4. \frac{4x+1}{3x+7} + \frac{9-x}{3x+7} = \frac{3x+10}{3x+7}; x \neq -\frac{7}{3}$$

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

$$6. \frac{5x+2}{x^2-1} - \frac{3x-7}{x^2-1} = \frac{2x+9}{x^2-1}; x \neq \pm 1$$