

Lesson 11-4 Adding & Subtracting Rational Expressions

The hardest operations to do with fractions are addition and subtraction, because of the need for a common denominator, or LCD. In this activity, you will practice adding and subtracting rational expressions with the same denominator, then simplifying the results.

Example 1:

$$\begin{aligned} \frac{a}{15m} + \frac{2a}{15m} &= \\ &= \frac{a+2a}{15m} \quad (\text{LCD is } 15m) \\ &= \frac{3a}{15m} \quad (\text{add the numerators}) \\ &= \frac{\cancel{3} \cdot a}{\cancel{3} \cdot 5 \cdot m} = \frac{a}{5m} \end{aligned}$$

Example 2:

$$\begin{aligned} \frac{2m+3}{m-4} - \frac{m-2}{m-4} &= \\ &= \frac{(2m+3)-(m-2)}{m-4} \quad (\text{LCD is } m-4) \\ &= \frac{2m+3-m+2}{m-4} \quad -(m-2) = -m+2 \\ &= \frac{m+5}{m-4} \quad (\text{add the numerators}) \end{aligned}$$

Find each sum or difference. Express answers in simplest form.

1. $\frac{5x}{7} + \frac{2x}{7} =$

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

3. $\frac{7}{3m} - \frac{4}{3m} =$

4. $\frac{3}{a+2} + \frac{7}{a+2} =$

5. $\frac{2m}{m+3} + \frac{6}{m+3} =$

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

$$7. \quad \frac{m}{3} + \frac{2m}{3} =$$

$$8. \quad \frac{5a}{12} - \frac{7a}{12} =$$

$$9. \quad \frac{x}{2} - \frac{x-4}{2} =$$

$$10. \quad \frac{y}{y-2} + \frac{2}{y-2} =$$

$$11. \quad \frac{-5}{3x-5} + \frac{3x}{3x-5} =$$

$$12. \quad \frac{2x}{x+2} + \frac{2x}{x+2} =$$

$$13. \quad \frac{2y}{y+3} + \frac{-6}{y+3} =$$

$$14. \quad \frac{4x}{2x+3} - \frac{-6}{2x+3} =$$

More Lesson 11-4 Adding & Subtracting Rational Expressions

Finally, it is time to try adding and subtracting rational expressions with unlike denominators. These can be difficult – study the examples and follow them carefully.

Example 1:

$$\frac{7}{3m} + \frac{5}{6m^2} =$$

$$3m = 3 \cdot m \quad (\text{factor the denominator})$$

$$6m^2 = 2 \cdot 3 \cdot m \cdot m \quad (\text{factor the denominator})$$

$$\text{LCD is } 2 \cdot 3 \cdot m \cdot m, \text{ or } 6m^2$$

$$= \frac{7 \cdot (2m)}{3m \cdot (2m)} + \frac{5}{6m^2} \quad (\text{multiply by missing parts})$$

$$= \frac{14 \cdot m}{6 \cdot m \cdot m} + \frac{5}{6 \cdot m \cdot m} \quad (\text{now both have LCD})$$

$$= \frac{14m+5}{6m^2} \quad (\text{add numerators})$$

Example 2:

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

$$\text{LCD is } (s+3)(s-4)$$

$$= \frac{s}{s+3} \cdot \frac{s-4}{s-4} + \frac{3}{s-4} \cdot \frac{s+3}{s+3}$$

$$= \frac{s(s-4)}{(s+3)(s-4)} + \frac{3(s+3)}{(s-4)(s+3)}$$

$$= \frac{s^2 - 4s}{(s+3)(s-4)} + \frac{3s+9}{(s-4)(s+3)}$$

$$= \frac{s^2 - 4s + 3s + 9}{(s+3)(s-4)} \quad (\text{add numerators})$$

$$= \frac{s^2 - s + 9}{(s+3)(s-4)} \quad (\text{numerator does not factor})$$

Find each sum or difference. Express answers in simplest form.

1. $\frac{7}{15m^2} + \frac{3}{5m} =$

2. $\frac{11}{3y^2} - \frac{7}{6y} =$

3. $\frac{m}{4} + \frac{3m}{5} =$

4. $\frac{x}{7} - \frac{2x}{9} =$

5. $\frac{m+1}{m} + \frac{m-3}{3m} =$

6. $\frac{7}{x} + \frac{3}{xyz} =$

$$7. \quad \frac{7}{6a^2} - \frac{5}{3a} =$$

$$8. \quad \frac{2}{st^2} - \frac{3}{s^2t} =$$

$$9. \quad \frac{3}{z+5} + \frac{4}{z-4} =$$

$$10. \quad \frac{k}{k+5} - \frac{2}{k+3} =$$

$$11. \quad \frac{10}{3r-2} - \frac{9}{r-5} =$$

$$12. \quad \frac{5}{2m-3} - \frac{m}{6-4m} =$$

$$13. \quad \frac{w}{5w+2} - \frac{4}{15w+6} =$$

$$14. \quad \frac{n+2}{n^2+4n+3} - \frac{6}{n+3} =$$

Even More Lesson 11-4 All Eyes On the Unlike Denominators!

Add or subtract as indicated. Simplify if possible.

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

2. $\frac{3}{4x^2} - \frac{1}{8x}$

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

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

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

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

7. $\frac{x-2}{x+8} - \frac{x-2}{x^2+6x-16}$

8. $\frac{x}{x+6} - \frac{72}{x^2-36}$

9. $\frac{4x}{x^2-16} - \frac{2}{x+4}$

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

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

12. $\frac{x}{x-5} - \frac{50}{x^2-25}$

13. $\frac{3x}{x^2-9} + \frac{2}{x-3}$

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

Scrambled answers: $\frac{5}{6x}$; $\frac{(x-3)}{x+8}$; $\frac{x+10}{x+5}$; $\frac{2}{x-4}$; $\frac{2x-5}{2x+2}$; $\frac{8x+15}{6x^2}$; $\frac{x-12}{x-6}$; $\frac{x^2-3x+3}{(x+1)(x-1)}$; $\frac{x+4}{x+2}$
 $\frac{-2(x+6)}{x(x+3)}$; $\frac{6-x}{8x^2}$; $\frac{4(2x+1)}{(x+2)(x-2)}$; $\frac{5x+6}{(x+3)(x-3)}$; $\frac{7-3x}{x(2x-3)}$