

8-5

Adding and Subtracting Rational Expressions



Content Standard

A.APR.7 ... Add, subtract, multiply, and divide rational expressions.

Objective To add and subtract rational expressions

DAY 2

A **complex fraction** is a rational expression that has at least one fraction in its numerator or denominator or both. Here are some examples.

$$\frac{\frac{1}{x} + \frac{1}{y}}{\frac{1}{xy}}$$

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

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

**Problem 4** Simplifying a Complex Fraction

What is a simpler form of the complex fraction?

$$\frac{\frac{\frac{1}{x} + \frac{x}{y}}{\frac{1}{y} + 1}}$$



Got It? 4. What is a simpler form of the complex fraction?

a. $\frac{x}{\frac{1}{x} + \frac{1}{y}}$

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

Simplify each complex fraction.

◆ See Problem 4.

$$22. \frac{\frac{1}{x}}{\frac{2}{y}}$$

$$23. \frac{1 - \frac{1}{4}}{2 - \frac{3}{5}}$$

$$24. \frac{\frac{2}{x+y}}{3}$$

$$25. \frac{\frac{1}{3}}{\frac{3}{b}}$$

$$26. \frac{1}{1 + \frac{x}{y}}$$

$$27. \frac{3}{\frac{2}{x} + y}$$

$$28. \frac{\frac{2}{x+y}}{\frac{5}{x+y}}$$

$$29. \frac{\frac{3}{x-4}}{1 - \frac{2}{x-4}}$$

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A complex fraction is a rational expression that has at least one fraction in its numerator or denominator or both. Here are some examples.

$$\frac{\frac{1}{x} + \frac{1}{y}}{\frac{1}{xy}} \quad \frac{\frac{x+3}{2}}{x-4} \quad \frac{\frac{x+3}{x^2-2x+1} + \frac{x}{x^2-3x+2}}{\frac{x}{x^2-4x+4} - \frac{2}{x^2-4}}$$

flip

Problem 4 Simplifying a Complex Fraction

What is a simpler form of the complex fraction?

$$\frac{\frac{y\frac{1}{x} + \frac{x}{y}}{\frac{1}{y} + 1}}{\frac{1}{y} + 1} \rightarrow \frac{\frac{y}{xy} + \frac{x^2}{xy}}{\frac{1}{y} + \frac{y}{y}} \rightarrow \frac{\frac{y+x^2}{xy}}{\frac{1+y}{y}}$$

$$\frac{y+x^2}{xy} \cdot \frac{y}{1+y} = \frac{(x^2+y)}{x(1+y)}$$

Got It? 4. What is a simpler form of the complex fraction?

a. $\frac{\frac{x}{\frac{1}{x} + \frac{1}{y}}}{\frac{x}{1}}$

$$\frac{\frac{x}{\frac{1}{x} + \frac{1}{y}}}{\frac{x}{1}} = \frac{x}{\frac{1}{x} + \frac{1}{y}} \cdot \frac{1}{x} \leftarrow \text{flip}$$

$$\frac{x}{1} \cdot \frac{xy}{y+x} = \frac{x^2y}{x+y}$$

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

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

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

$$\frac{2(x+2)}{(x-1)(x+1)} \leftarrow \text{denominator}$$

$$\frac{(x+2)(x-1)}{x(x+1)} \leftarrow \text{Numerator}$$

Simplify each complex fraction.

See Problem 4.

22. $\frac{\frac{1}{x}}{\frac{2}{y}}$

$$\frac{1}{x} \cdot \frac{y}{2}$$

$$\frac{y}{2x}$$

23. $\frac{1 - \frac{1}{4}}{\frac{2 - \frac{3}{5}}{1}}$ $\frac{\frac{4}{4} - \frac{1}{4} = \frac{3}{4}}{\frac{10}{5} - \frac{3}{5} = \frac{7}{5}}$ 24. $\frac{\frac{2}{x+y}}{\frac{3}{1}}$

$$\frac{\frac{3}{4}}{\frac{7}{5}}$$

$$\frac{3}{4} \cdot \frac{5}{7} = \frac{15}{28}$$

$$\frac{2}{x+y} \cdot \frac{1}{3}$$

$$\frac{2}{3(x+y)}$$

25. $\frac{\frac{1}{3}}{\frac{3}{b}}$

$$\frac{1}{3} \cdot \frac{b}{3}$$

$$\frac{b}{9}$$

26. $\frac{1}{1 + \frac{x}{y}}$ $\frac{1}{\frac{y}{y} + \frac{x}{y}}$

$$\frac{1}{\frac{y+x}{y}}$$

$$\frac{1}{1} \cdot \frac{y}{y+x} = \frac{y}{y+x}$$

$$\frac{y}{x+y}$$

27. $\frac{3}{\frac{2}{x} + \frac{y}{x}}$ $\frac{\frac{3}{1}}{\frac{2+xy}{x}}$

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

$$\frac{3x}{2+xy}$$

28. $\frac{\frac{2}{x+y}}{\frac{5}{x+y}}$

$$\frac{\frac{2}{\cancel{x+y}}}{\frac{5}{\cancel{x+y}}}$$

$$\frac{2}{5}$$

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

$$\frac{x-4-2}{x-4} = \frac{x-6}{x-4}$$

$$\frac{\frac{3}{x-4}}{\frac{x-6}{x-4}} = \frac{3}{\cancel{x-4}} \cdot \frac{\cancel{x-4}}{x-6}$$

$$\frac{3}{x-6}$$

