

5.3

Adding and Subtracting Unlike Fractions

Goal: Add and subtract unlike fractions.

Example 1 Adding and Subtracting Fractions

$$\begin{aligned} \text{a. } \frac{7}{15} + \frac{1}{5} &= \frac{7}{15} + \frac{3}{15} \\ &= \frac{7+3}{15} \\ &= \frac{10}{15} \div 5 \\ &= \frac{2}{3} \end{aligned}$$

Write $\frac{1}{5}$ using LCD.

$$\frac{1}{5} \cdot \frac{3}{3} = \frac{3}{15}$$

Write sum of numerators over denominator.

Add.

Simplify.

$$\begin{aligned} \text{b. } -\frac{2}{3} - \frac{3}{4} &= \frac{-8}{12} + \frac{-9}{12} \\ &= \frac{-8-9}{12} \\ &= \frac{-17}{12} \leftarrow \text{Leave} \\ &= \square \end{aligned}$$

Write fractions using LCD.

Write difference of numerators over denominator.

Subtract.

Write fraction as a mixed number.

$$\begin{array}{r} -\frac{2}{3} \cdot \frac{4}{4} = \frac{-8}{12} \\ -\frac{3}{4} \cdot \frac{3}{3} = \frac{-9}{12} \\ \hline \frac{-17}{12} \end{array}$$

✓ Checkpoint Find the sum or difference.

$$\begin{aligned} \text{1. } \frac{3}{7} + \frac{5}{21} &= \frac{9}{21} + \frac{5}{21} \\ &= \frac{14}{21} \div 7 = \frac{2}{3} \end{aligned}$$

$$\begin{aligned} \text{2. } \frac{1}{4} + \frac{-3}{10} &= \frac{5}{20} + \frac{-6}{20} \\ \frac{1}{4} &= \frac{5}{20} \\ \frac{-3}{10} &= \frac{-6}{20} \\ &= \frac{-1}{20} \end{aligned}$$

$$\begin{array}{r} \frac{1}{4} \quad \frac{5}{20} \\ + \frac{-3}{10} \quad \frac{-6}{20} \\ \hline \frac{-1}{20} \end{array}$$

Example 2 Adding Mixed Numbers

$$\begin{aligned}
 -5\frac{1}{6} + \left(-2\frac{3}{10}\right) &= \frac{-31}{6} + \frac{-23}{10} \\
 &= \frac{-310}{60} + \frac{-138}{60} \\
 &= \frac{-310 + -138}{60} \\
 &= \frac{-448}{60} = \frac{-112}{15}
 \end{aligned}$$

Write mixed numbers as improper fractions.

Write fractions using LCD.

Write sum of numerators over denominator.

Add. Then write fraction as a mixed number.

Example 3 Subtracting Mixed Numbers

You are hiking a $12\frac{1}{5}$ -mile trail. You have already hiked $6\frac{1}{2}$ miles. How many more miles do you have to hike before reaching the end of the trail?

Solution

Your total hiking distance is $12\frac{1}{5}$. You have already hiked

$6\frac{1}{2}$. To find the remaining distance, subtract.

$$\begin{aligned}
 12\frac{1}{5} - 6\frac{1}{2} &= \frac{61}{5} - \frac{13}{2} \\
 &= \frac{122}{10} - \frac{65}{10} \\
 &= \frac{122 - 65}{10} \\
 &= \frac{57}{10} = 5\frac{7}{10}
 \end{aligned}$$

Write mixed numbers as improper fractions.

Write fractions using LCD.

Write difference of numerators over denominator.

Subtract. Then write fraction as a mixed number.

Answer: You need to hike $5\frac{7}{10}$ miles.

good to put as mixed # b/c story problems

✓ **Checkpoint** Find the sum or difference.

$$\frac{29}{6} \cdot \frac{3}{3} = \frac{87}{18}$$

$$\frac{22}{9} = \frac{44}{18}$$

3. $4\frac{5}{6} + 2\frac{4}{9}$

$$\frac{29}{6} + \frac{22}{9} =$$

$$\frac{87}{18} + \frac{44}{18} = \boxed{\frac{131}{18}}$$

4. $-2\frac{1}{3} - 3\frac{3}{7}$

$$-\frac{7}{3} - \frac{24}{7}$$

$$-\frac{7}{3} = \frac{-49}{21}$$

$$+\frac{-24}{7} = \frac{-72}{21} = \boxed{\frac{-121}{21}}$$

Example 4 Simplifying an Expression

Simplify the expression $\frac{a}{4} - \frac{a}{8}$.

$$\frac{a}{4} - \frac{a}{8} = \left(\frac{a}{4} \cdot \frac{2}{2} \right) - \frac{a}{8} \quad \text{Write } \frac{a}{4} \text{ using LCD.}$$

$$= \frac{2a}{8} - \frac{a}{8}$$

Multiply.

$$= \frac{2a - a}{8}$$

Write difference of numerators over denominator.

$$= \frac{a}{8}$$

Subtract.

✓ **Checkpoint** Find the sum or difference.

5. $\frac{b}{3} + \frac{b}{8}$

$$\frac{b}{3} = \frac{8b}{24}$$

$$\frac{b}{8} = \frac{3b}{24}$$

$$= \boxed{\frac{11b}{24}}$$

6. $\frac{c}{5} - \frac{c}{7}$

$$\frac{c}{5} = \frac{7c}{35}$$

$$+\frac{-c}{7} = \frac{-5c}{35}$$

$$\boxed{\frac{2c}{35}}$$