



Unit 1:
Lesson 06

***Putting it all together with fractions**

When **adding or subtracting** fractions, find a **common denominator**.

Example 1: Simplify $3\left(\frac{3x}{4} - \frac{x}{3}\right)$

$$3\left(\frac{3x}{4} \cdot \frac{3}{3} - \frac{x}{3} \cdot \frac{4}{4}\right) = 3\left(\frac{9x}{12} - \frac{4x}{12}\right) = 3\left(\frac{5x}{12}\right)$$

$$= \frac{15x}{12} = \boxed{\frac{5x}{4}}$$

When **multiplying** fractions, **multiply numerators** to produce the new numerator. **Multiply denominators** to produce the new denominator.

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$$

Example 2: $-\frac{4}{5}\left(\frac{3}{8}x - \frac{5}{6}y\right)$

$$-\frac{4}{5}\left(\frac{3}{8}x - \frac{5}{6}y\right) = \frac{-12x}{40} + \frac{20y}{30} = \boxed{\frac{-3x}{10} + \frac{2y}{3}}$$

When **dividing** by a fraction, multiply the numerator by the **reciprocal** of that fraction.

Example 3: Simplify $\frac{3x/(5y)}{4a/(20b)}$

$$\frac{\frac{3x}{5y}}{\frac{4a}{20b}} = \frac{3x}{5y} \cdot \frac{20b}{4a} = \frac{60xb}{20ay} = \boxed{\frac{3xb}{ay}}$$

***Example 4:** Combine like terms in $4\left[\left(\frac{3}{4}\right)x + \left(\frac{2}{5}\right)x - 2\right]$ and evaluate at $x = 3$.

$$\begin{aligned}
 4\left[\frac{3}{4}x + \frac{2}{5}x - 2\right] &= 4\left[\frac{3x}{4} + \frac{2x}{5} - 2\right] \\
 &= 4\left[\frac{3x}{4} \cdot \frac{5}{5} + \frac{2x}{5} \cdot \frac{4}{4} - 2\right] \\
 &= 4\left[\frac{15x}{20} + \frac{8x}{20} - 2\right] = 4\left[\frac{23x}{20} - 2\right] \\
 &= \frac{92x}{20} - 8 = \frac{23x}{5} - 8 = \frac{23 \cdot 3}{5} - \frac{8 \cdot 5}{1 \cdot 5} = \frac{69 - 40}{5} = \boxed{\frac{29}{5}}
 \end{aligned}$$

Example 5: Simplify $(11x - (5/4)x)/(2/3)$

$$\begin{aligned}
 \left(\frac{11x}{1} - \frac{5x}{4}\right) \frac{3}{2} &= \left(\frac{11x}{1} \cdot \frac{4}{4} - \frac{5x}{4}\right) \frac{3}{2} \\
 &= \left(\frac{44x}{4} - \frac{5x}{4}\right) \frac{3}{2} = \frac{39x}{4} \cdot \frac{3}{2} = \boxed{\frac{117x}{8}}
 \end{aligned}$$

See **Calculator Appendix B** (and an associated video) for how to handle the grouping of numerators and denominators on a graphing calculator. Common pitfalls are discussed.

Assignment:

1. Simplify $\frac{7}{8} + \frac{2}{3}$

$$\frac{7}{8} \frac{3}{3} + \frac{2}{3} \frac{8}{8}$$

$$= \frac{21}{24} + \frac{16}{24} = \boxed{\frac{37}{24}}$$

2. Simplify $\frac{2}{7} \frac{3}{4} \div \frac{2}{3}$

$$\frac{2}{7} \frac{3}{4} \div \frac{2}{3} = \frac{6}{28} \frac{3}{2}$$

$$= \frac{18}{56} = \boxed{\frac{9}{28}}$$

3. Simplify $-\frac{5}{3} \left(\frac{1}{7}m - \frac{2}{3}n \right)$

$$-\frac{5}{3} \left(\frac{1}{7}m - \frac{2}{3}n \right) = \boxed{\frac{-5m}{21} + \frac{10n}{9}}$$

4. Simplify $\left(\frac{2x}{5} - \frac{x}{4} \right)$

$$\frac{2x}{5} \frac{4}{4} - \frac{x}{4} \frac{5}{5} = \frac{8x}{20} - \frac{5x}{20}$$

$$= \boxed{\frac{3x}{20}}$$

5. Simplify $-\left(\frac{2x}{5} - \frac{x}{3} \right) + 4x$

$$-\left(\frac{2x}{5} \frac{3}{3} - \frac{x}{3} \frac{5}{5} \right) + 4x = -\left(\frac{6x}{15} - \frac{5x}{15} \right) + 4x$$

$$= -\left(\frac{1x}{15} \right) + \frac{4x}{1} = \frac{-1x}{15} + \frac{4x}{1} \frac{15}{15} = \frac{-1x + 60x}{15}$$

$$= \boxed{\frac{59x}{15}}$$

6. Combine like terms in $5\left[\left(\frac{3}{4}\right)y + \left(\frac{5}{3}\right)y - 1\right]$ and evaluate at $y = -3$.

$$\begin{aligned}
 5 \left[\frac{3}{4}y + \frac{5}{3}y - 1 \right] &= 5 \left[\frac{3y}{4} \cdot \frac{3}{3} + \frac{5y}{3} \cdot \frac{4}{4} - \frac{1}{1} \cdot \frac{12}{12} \right] \\
 &= 5 \left[\frac{9y + 20y - 12}{12} \right] = \frac{5}{1} \left[\frac{29y - 12}{12} \right] \\
 &= \frac{145y - 60}{12} = \frac{145(-3) - 60}{12} = \boxed{\frac{-165}{4}}
 \end{aligned}$$

7. Simplify $(11q - \frac{7}{3}q) / (-8)$

$$\begin{aligned}
 &\left(\frac{11q}{1} - \frac{7q}{3}\right) \left(-\frac{1}{8}\right) \\
 &= \left(\frac{11q}{1} \cdot \frac{3}{3} - \frac{7q}{3}\right) \left(-\frac{1}{8}\right) = \left(\frac{33q}{3} - \frac{7q}{3}\right) \left(-\frac{1}{8}\right) \\
 &= \left(\frac{26q}{3}\right) \left(-\frac{1}{8}\right) = -\frac{26q}{24} = \boxed{-\frac{13q}{12}}
 \end{aligned}$$

8. Simplify $\frac{3x}{7} - \frac{1}{5} + \frac{2x}{3}$ and evaluate when $x = -1$.

$$\begin{aligned}
 &\frac{3x}{7} \cdot \frac{3}{3} - \frac{1}{5} + \frac{2x}{3} \cdot \frac{7}{7} \\
 &= \frac{9x}{21} - \frac{1}{5} + \frac{14x}{21} = \frac{23x}{21} - \frac{1}{5} \\
 &= \frac{23(-1)}{21} - \frac{1}{5} = \frac{-23}{21} - \frac{1}{5} = \frac{-23}{21} \cdot \frac{5}{5} - \frac{1}{5} \cdot \frac{21}{21} \\
 &= \frac{-115}{105} - \frac{21}{105} = \boxed{\frac{-136}{105}}
 \end{aligned}$$

*9. Simplify $(\frac{2}{3}) \{-[\frac{1}{5} - \frac{1}{2}] + 2| \frac{1}{3} + \frac{2}{1} \frac{3}{3} | \}$

$$\begin{aligned}
 & \frac{2}{3} \left\{ - \left[\frac{1}{5} \frac{2}{2} - \frac{1}{2} \frac{5}{5} \right] + 2 \left| \frac{1}{3} + \frac{2}{1} \frac{3}{3} \right| \right\} \\
 &= \frac{2}{3} \left\{ - \left[\frac{-3}{10} \right] + \frac{2}{1} \left| \frac{7}{3} \right| \right\} \\
 &= \frac{2}{3} \left\{ \frac{3}{10} + \frac{2}{1} \frac{7}{3} \right\} = \frac{2}{3} \left\{ \frac{3}{10} + \frac{14}{3} \right\} \\
 &= \frac{2}{3} \left\{ \frac{3}{10} \frac{3}{3} + \frac{14}{3} \frac{10}{10} \right\} = \frac{2}{3} \left\{ \frac{9}{30} + \frac{140}{30} \right\} = \frac{2}{3} \frac{149}{30} \\
 &= \frac{298}{90} = \frac{149}{45}
 \end{aligned}$$

*10. Combine like terms in $\frac{-4}{5x} - \frac{3}{2x} + 1$ and then evaluate at $x = 2$.

$$\begin{aligned}
 & \frac{-4}{5x} \frac{2}{2} - \frac{3}{2x} \frac{5}{5} + 1 = \frac{-8}{10x} - \frac{15}{10x} + 1 \\
 &= \frac{-8-15}{10x} + 1 = \frac{-23}{10x} + 1 \\
 &= \frac{-23}{10(2)} + \frac{20}{20} \quad \text{sub in 2} \\
 &= \frac{-23+20}{20} \\
 &= \boxed{\frac{-3}{20}}
 \end{aligned}$$