

1. Simplify  $-\frac{1}{2} + \frac{1}{4}\left(-\frac{1}{3}\right)$ .
2. Simplify  $\frac{1}{3}\left(-\frac{1}{2}\right) + 2\left(\frac{1}{3}\right)$ .
3. Simplify  $\frac{2}{3}\left(\frac{1}{2}\right) - \frac{2}{3}\left(-\frac{3}{4}\right)$ .
4. Simplify  $1 - \frac{2}{5}\left(\frac{1}{3}\right)$ .
5. Simplify  $1 - \frac{2}{5} \div \left(\frac{1}{3}\right)$ .
6. Simplify  $\frac{5}{8}\left(\frac{1}{2} + \frac{1}{3}\right)$
7. Simplify  $\frac{3}{4} + \frac{2}{3} \cdot \frac{3}{5} - \frac{1}{2} \cdot \frac{1}{5}$ .
8. Simplify  $\frac{3}{4} + \frac{5}{3}\left(-\frac{1}{2}\right)^3$
9. Simplify  $2\left(-\frac{1}{2}\right)^2 + 4\left(-\frac{1}{2}\right)$ .
10. Simplify  $\frac{14}{15} - \left(\frac{1}{2}\right)^2 \cdot \left(\frac{2}{3} + \frac{4}{5}\right)$

## KEYS

**Remember**

- Numerical and algebraic expressions often contain more than one operation. A rule is needed to let you know which operation to perform first. The rule is called the order of operations:
- Simplify the expressions inside grouping symbols, such as parentheses ( ), Order of brackets [ ], and braces { }, and as indicated by fraction bars.
- Evaluate all powers.
- Do all multiplications and divisions from left to right.
- Do all additions and subtractions from left to right.

1. Simplify  $-\frac{1}{2} + \frac{1}{4}\left(-\frac{1}{3}\right)$

Multiply first, then add.

$$-\frac{1}{2} + \frac{1}{4}\left(-\frac{1}{3}\right) = -\frac{1}{2} + \left(-\frac{1}{12}\right) \quad \text{Multiply } \frac{1}{4}\left(-\frac{1}{3}\right) = -\frac{1}{12}.$$

$$= -\frac{1 \cdot 6}{2 \cdot 6} + \left(-\frac{1}{12}\right) \quad \text{Equivalent fractions, LCD = 12.}$$

$$= -\frac{6}{12} + \left(-\frac{1}{12}\right) \quad \text{Simplify numerator and denominator.}$$

$$= -\frac{7}{12} \quad \text{Add over common denominator.}$$

2. Simplify  $\frac{1}{3}\left(-\frac{1}{2}\right) + 2\left(\frac{1}{3}\right)$

Multiply first, then add.

$$\frac{1}{3}\left(-\frac{1}{2}\right) + 2\left(\frac{1}{3}\right) = -\frac{1}{6} + \frac{2}{3} \quad \text{Multiply } \frac{1}{3}\left(-\frac{1}{2}\right) = -\frac{1}{6} \text{ and } 2\left(\frac{1}{3}\right) = \frac{2}{3}.$$

$$= -\frac{1}{6} + \frac{2 \cdot 2}{3 \cdot 2} \quad \text{Equivalent fractions, LCD = 6.}$$

$$= -\frac{1}{6} + \frac{4}{6} \quad \text{Simplify numerator and denominator.}$$

$$= \frac{3}{6} \quad \text{Add over common denominator.}$$

$$= \frac{1}{2} \quad \text{Simplify.}$$

3. Simplify  $\frac{2}{3}\left(\frac{1}{2}\right) - \frac{2}{3}\left(-\frac{3}{4}\right)$

Multiply first, then add.

$$\frac{2}{3}\left(\frac{1}{2}\right) - \frac{2}{3}\left(-\frac{3}{4}\right) = \frac{2}{6} + \frac{6}{12} \quad \text{Multiply } \frac{2}{3}\left(\frac{1}{2}\right) = \frac{2}{6} \text{ and } \frac{2}{3}\left(-\frac{3}{4}\right) = -\frac{6}{12}.$$

$$= \frac{1 \cdot 2}{6 \cdot 2} + \frac{6}{12} \quad \text{Equivalent fractions, LCD = 12.}$$

$$= \frac{2}{12} + \frac{6}{12} \quad \text{Simplify numerator and denominator.}$$

$$= \frac{8}{12} \quad \text{Add over common denominator.}$$

$$= \frac{2}{3} \quad \text{Simplify.}$$

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

Multiply first, then subtract.

$$1 - \frac{2}{5}\left(\frac{1}{3}\right) = 1 - \frac{2}{15} \quad \text{Multiply } \frac{2}{5}\left(\frac{1}{3}\right) = \frac{2}{15}.$$

$$= \frac{1}{1} - \frac{2}{15} \quad \text{Make 1 into } \frac{1}{1}$$

$$= \frac{1 \cdot 15}{1 \cdot 15} - \frac{2}{15} \quad \text{Equivalent fractions, LCD = 15.}$$

$$= \frac{15}{15} - \frac{2}{15} \quad \text{Simplify numerator and denominator.}$$

$$= \frac{13}{15}$$

Subtract over common denominator.

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

Divide first, then subtract.

$$1 - \frac{2}{5} \div \left(\frac{1}{3}\right) = 1 - \frac{2}{5} \left(\frac{3}{1}\right)$$

Multiply by the reciprocal,  $\frac{3}{1}$ .

$$1 - \frac{2}{5} \left(\frac{3}{1}\right) = 1 - \frac{6}{5}$$

Multiply  $\frac{2}{5} \left(\frac{3}{1}\right) = \frac{6}{5}$

$$= \frac{1}{1} - \frac{6}{5}$$

Make 1 into  $\frac{1}{1}$

$$= \frac{1 \cdot 5}{1 \cdot 5} - \frac{6}{5}$$

Equivalent fractions, LCD = 5.

$$= \frac{5}{5} - \frac{6}{5}$$

Simplify numerator and denominator.

$$= -\frac{1}{5}$$

Subtract over common denominator.

6. Simplify  $\frac{5}{8} \left(\frac{1}{2} + \frac{1}{3}\right)$

$$\frac{5}{8} \left(\frac{1}{2} + \frac{1}{3}\right) = \frac{5}{8} \left(\frac{3}{6} + \frac{2}{6}\right)$$

Change to equivalent fractions with 6 as LCD.

$$= \frac{5}{8} \left(\frac{5}{6}\right)$$

Add the fractions in parentheses.

$$= \frac{25}{48}$$

Multiply

7. Simplify  $\frac{3}{4} + \frac{2}{3} \cdot \frac{3}{5} - \frac{1}{2} \cdot \frac{1}{5}$ .

$$\frac{3}{4} + \frac{2}{3} \cdot \frac{3}{5} - \frac{1}{2} \cdot \frac{1}{5} = \frac{3}{4} + \frac{2}{5} - \frac{1}{10}$$

Perform the two multiplications.

$$= \frac{15}{20} + \frac{8}{20} - \frac{2}{20}$$

Change to equivalent fractions with 20 as LCD.

$$= \frac{15+8-2}{20}$$

Add the numerators.

$$= \frac{21}{20}$$

8. Simplify  $\frac{3}{4} + \frac{5}{3} \left(-\frac{1}{2}\right)^3$

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

Evaluate  $\left(-\frac{1}{2}\right)^3 = \left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right) = -\frac{1}{8}$

$$= \frac{3}{4} + \left(-\frac{5}{24}\right)$$

Multiply  $\frac{5}{3} \left(-\frac{1}{8}\right) = -\frac{5 \cdot 1}{3 \cdot 8} = -\frac{5}{24}$

$$= \frac{3}{4} \cdot \frac{6}{6} + \left(-\frac{5}{24}\right)$$

Prepare to add the fractions: Their LCD is 24. To build the first fraction so that its denominator is 24, multiply it by a form of 1.

$$= \frac{18}{24} + \left(-\frac{5}{24}\right)$$

Multiply the numerators:  $3 \cdot 6 = 18$ .  
Multiply the denominators:  $4 \cdot 6 = 24$ .

$$= \frac{13}{24}$$

Add the numerators:  $18 + (-5) = 13$ .  
Write the sum over the common denominator 24.

9. Simplify  $2 \left(-\frac{1}{2}\right)^2 + 4 \left(-\frac{1}{2}\right)$ .

Exponents first, then multiply, then add.

$$2 \left(-\frac{1}{2}\right)^2 + 4 \left(-\frac{1}{2}\right) = 2 \left(\frac{1}{4}\right) + 4 \left(-\frac{1}{2}\right)$$

Exponent  $\left(-\frac{1}{2}\right)^2 = \frac{1}{4}$

$$= \frac{1}{2} + \left(-\frac{2}{1}\right)$$

Multiply  $2 \left(\frac{1}{4}\right) = \frac{1}{2}$   
and  $4 \left(-\frac{1}{2}\right) = -\frac{2}{1}$

$$= \frac{1}{2} + \left(-\frac{2 \cdot 2}{1 \cdot 2}\right)$$

Equivalent fractions, LCD = 2.

$$= \frac{1}{2} + \left(-\frac{4}{2}\right)$$

Simplify numerator and denominator.

$$= -\frac{3}{2}$$

Add over common denominator.

10. Simplify  $\frac{14}{15} - \left(\frac{1}{2}\right)^2 \cdot \left(\frac{2}{3} + \frac{4}{5}\right)$

$$\frac{14}{15} - \left(\frac{1}{2}\right)^2 \cdot \left(\frac{2}{3} + \frac{4}{5}\right) =$$

Perform operations in parentheses.

$$= \frac{14}{15} - \left(\frac{1}{2}\right)^2 \cdot \frac{22}{15}$$

Simplify expressions with exponents.

$$= \frac{14}{15} - \frac{1}{4} \cdot \frac{22}{15}$$

Do multiplication and division as they occur from left to right.

$$= \frac{14}{15} - \frac{22}{60}$$

Change to equivalent fractions with 60 as LCD.

$$= \frac{56}{60} - \frac{22}{60}$$

Subtract

$$= \frac{34}{60}$$

Simplify

$$= \frac{17}{60}$$