# Fractions

# Example: Adding and Subtracting Fractions

$$\frac{2}{7} + \frac{3}{5} = \frac{10}{35} + \frac{21}{35} = \frac{31}{35}$$

$$\frac{4}{9} - \frac{1}{4} = \frac{16}{36} - \frac{9}{36} = \frac{5}{36}$$

# Method Comparison

To calculate $\frac{1}{6} + \frac{3}{4}$, there are two methods

**Multiply denominators**

$$\frac{4}{24} + \frac{18}{24} = \frac{22}{24} = \frac{11}{12}$$

**Lowest common multiple**

$$\frac{2}{12} + \frac{9}{12} = \frac{11}{12}$$

Which method do you think is better?

# Test Your Understanding

**1)** $\frac{8}{9} - \frac{7}{15}$

**2)** $\frac{2}{15} + \frac{7}{10}$

**3)** $\frac{1}{4} + \frac{5}{12}$

**4)** $\frac{8}{9} - \frac{3}{4}$

**5)** $\frac{1}{4} + \frac{3}{10} - \frac{4}{25}$

**6)** $\frac{5}{9} + \frac{3}{8} + \frac{5}{72}$

# Answers

**1)** $\frac{8}{9} - \frac{7}{15} = \frac{19}{45}$

**2)** $\frac{2}{15} + \frac{7}{10} = \frac{25}{30} = \frac{5}{6}$

**3)** $\frac{1}{4} + \frac{5}{12} = \frac{8}{12} = \frac{2}{3}$

**4)** $\frac{8}{9} - \frac{3}{4} = \frac{32}{36} - \frac{27}{36} = \frac{5}{36}$

**5)** $\frac{1}{4} + \frac{3}{10} - \frac{4}{25} = \frac{25}{100} + \frac{30}{100} - \frac{16}{100} = \frac{39}{100}$

**6)** $\frac{5}{9} + \frac{3}{8} + \frac{5}{72} = \frac{40}{72} + \frac{27}{72} + \frac{5}{72} = \frac{72}{72} = 1$

# Exercise 1

Please complete the worksheet.

# Example: Adding Mixed Numbers

Calculate: $1\frac{1}{4} + 3\frac{1}{12}$

**Improper fractions**

$$1\frac{1}{4} = \frac{5}{4}$$

$$3\frac{1}{12} = \frac{37}{12}$$

$$\frac{5}{4} = \frac{5 \times 3}{4 \times 3} = \frac{15}{12}$$

Add:

$$\frac{15}{12} + \frac{37}{12} = \frac{52}{12} = 4\frac{4}{12} = 4\frac{1}{3}$$

**Partitioning**

Integers:

$$1 + 3 = 4$$

Fractions:

$$\frac{1}{4} + \frac{1}{12} = \frac{3}{12} + \frac{1}{12} = \frac{4}{12} = \frac{1}{3}$$

Combine:

$$4 + \frac{1}{3} = 4\frac{1}{3}$$

# Test Your Understanding

Calculate, giving your answer as a mixed number in its simplest form:

**1)** $2\frac{4}{7} + 5\frac{2}{3}$

**2)** $6\frac{2}{5} + 3\frac{9}{10}$

**3)** $8\frac{7}{8} + 4\frac{5}{6}$

**4)** $7\frac{7}{9} + 3\frac{11}{18}$

**5)** $12\frac{6}{11} + 1\frac{5}{8}$

**6)** $3\frac{13}{18} + 5\frac{7}{24}$

# Answers

**1)** $2\frac{4}{7} + 5\frac{2}{3} = 8\frac{5}{21}$

**2)** $6\frac{2}{5} + 3\frac{9}{10} = 10\frac{3}{10}$

**3)** $8\frac{7}{8} + 4\frac{5}{6} = 13\frac{17}{24}$

**4)** $7\frac{7}{9} + 3\frac{11}{18} = 11\frac{7}{18}$

**5)** $12\frac{6}{11} + 1\frac{5}{8} = 14\frac{15}{88}$

**6)** $3\frac{13}{18} + 5\frac{7}{24} = 9\frac{1}{72}$

# Example: Subtracting Mixed Numbers

Calculate: $7\frac{1}{12} - 5\frac{3}{4}$ Give your answer as a mixed number in its simplest form.

**Improper Fractions**

$$7\frac{1}{12} = \frac{7 \times 12 + 1}{12} = \frac{85}{12}$$

$$5\frac{3}{4} = \frac{5 \times 4 + 3}{4} = \frac{23}{4} = \frac{69}{12}$$

Subtract:

$$\frac{85}{12} - \frac{69}{12} = \frac{16}{12} = 1\frac{4}{12} = 1\frac{1}{3}$$

**Partitioning**

Split into whole and fractional parts:

Integers:

$$7 - 5 = 2$$

Fractions:

$$\frac{1}{12} - \frac{3}{4} = \frac{1}{12} - \frac{9}{12} = -\frac{8}{12} = -\frac{2}{3}$$

Combine:

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

# Exercise 2

Please complete the worksheet.

# Example: Multiplying Fractions

$$\frac{4}{9} \times \frac{3}{5} = \frac{4 \times 3}{9 \times 5} = \frac{12}{45} = \frac{4}{15}$$

You can cancel after you multiply, but it's usually better to cancel before:

$$\frac{12}{25} \times \frac{20}{21} = \frac{\boxed{3} \times 4}{5 \times \boxed{5}} \times \frac{\boxed{5} \times 4}{\boxed{3} \times 7} = \frac{4}{5} \times \frac{4}{7} = \frac{16}{35}$$

# Test your understanding

By cancelling **before** you multiply, calculate the following:

**1)** $\dfrac{3 \times 4}{8 \times 5}$

**2)** $\dfrac{7}{9} \times \dfrac{4}{21}$

**3)** $\dfrac{8}{15} \times \dfrac{9}{10}$

**4)** $\dfrac{11}{24} \times \dfrac{12}{55}$

**5)** $\dfrac{10}{21} \times \dfrac{49}{60}$

**6)** $\dfrac{40}{63} \times \dfrac{27}{32}$

# Answers

**1)** $\frac{3}{10}$

**2)** $\frac{4}{27}$

**3)** $\frac{12}{25}$

**4)** $\frac{1}{10}$

**5)** $\frac{7}{18}$

**6)** $\frac{15}{28}$

# Example: Powers and Roots of Fractions

Squaring means multiplying by itself, so to square a fraction you simply square the numerator and square the denominator:

$$\left(\frac{3}{7}\right)^2 = \frac{3}{7} \times \frac{3}{7} = \frac{3 \times 3}{7 \times 7} = \frac{9}{49}$$

The same goes for cubing:

$$\left(\frac{2}{5}\right)^3 = \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} = \frac{8}{125}$$

To square root, you square root the numerator and square root the denominator:

$$\sqrt{\frac{4}{25}} = \frac{\sqrt{4}}{\sqrt{25}} = \frac{2}{5}$$

# Test Your Understanding

Calculate:

**1)** $\left(\frac{1}{6}\right)^2$

**2)** $\left(\frac{2}{5}\right)^2$

**3)** $\left(-\frac{7}{12}\right)^2$

**4)** $\left(\frac{3}{4}\right)^3$

**5)** $\left(\frac{1}{10}\right)^5$

**6)** $\sqrt{\frac{81}{121}}$

# Answers

**1)** $\left(\frac{1}{6}\right)^2 = \frac{1}{36}$

**2)** $\left(\frac{2}{5}\right)^2 = \frac{4}{25}$

**3)** $\left(-\frac{7}{12}\right)^2 = \frac{49}{144}$

**4)** $\left(\frac{3}{4}\right)^3 = \frac{27}{64}$

**5)** $\left(\frac{1}{10}\right)^5 = \frac{1}{100000}$

**6)** $\sqrt{\frac{81}{121}} = \frac{9}{11}$

# Exercise 3

Please complete the worksheet.

# Example: Multiplying Mixed Numbers

To multiply mixed numbers, first convert them to improper fractions:

$$4\frac{2}{5} \times 1\frac{7}{8} = \frac{22}{5} \times \frac{15}{8} = \frac{11 \times \boxed{2}}{\boxed{5}} \times \frac{3 \times \boxed{5}}{\boxed{2} \times 4} = \frac{11 \times 3}{4} = \frac{33}{4}$$

# Exercise 4

Please complete the worksheet.

# Example: Dividing by a Unit Fraction

Consider a calculation like $5 \div \frac{1}{3}$

This means *How many thirds go into five?*

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We can explain this in terms of **multiplying by the reciprocal**:

$$5 \div \frac{1}{3} = 5 \times \frac{3}{1} = 15$$

# Example: Dividing by Other Fractions

To divide by other fractions, we can use the same technique: multiplying by the reciprocal:

$$4 \div \frac{2}{5} = 4 \times \frac{5}{2} = \frac{4}{1} \times \frac{5}{2} = \frac{20}{2} = 10$$

Don't forget to continue to cancel before multiplying if you can:

$$\frac{5}{12} \div \frac{3}{8} = \frac{5}{12} \times \frac{8}{3} = \frac{5}{\boxed{4} \times 3} \times \frac{\boxed{4} \times 2}{3} = \frac{10}{9} = 1\frac{1}{9}$$

# Test Your Understanding

Calculate:

**1)** $\frac{4}{9} \div \frac{7}{5}$

**2)** $\frac{2}{7} \div \frac{3}{11}$

**3)** $\frac{6}{7} \div \frac{3}{10}$

# Answers

**1)** $\frac{20}{63}$

**2)** $1\frac{1}{21}$

**3)** $2\frac{6}{7}$

# Exercise 5

Please complete the worksheet.

# Example: Dividing Mixed Numbers

Like with multiplying mixed numbers, the first step in dividing mixed numbers is to convert them to improper fractions:

$$1\frac{3}{7} \div \frac{1}{5} = \frac{10}{7} \div \frac{1}{5} = \frac{10}{7} \times \frac{5}{1} = \frac{50}{7} = 7\frac{1}{7}$$

$$1\frac{5}{9} \div 2\frac{4}{5} = \frac{14}{9} \div \frac{14}{5} = \frac{14}{9} \times \frac{5}{14} = \frac{1}{9} \times \frac{5}{1} = \frac{5}{9}$$

# Test Your Understanding

Calculate:

**1)** $2\frac{3}{5} \div \frac{1}{4}$

**2)** $3\frac{3}{7} \div \frac{4}{5}$

**3)** $3\frac{3}{7} \div 1\frac{3}{5}$

# Answers

**1)** $10\frac{2}{5}$

**2)** $4\frac{2}{7}$

**3)** $2\frac{1}{7}$

# Exercise 6

Please complete the worksheet.