

Operations with Rational Numbers

Set of rational numbers: $Q = \{\frac{a}{b} \mid a, b \in I, b \neq 0\}$

Addition and Subtraction

To add or subtract rationals, you need to find a common denominator.

Division

To divide by a rational number, multiply by the reciprocal.

$$\begin{aligned}\frac{a}{b} \div \frac{c}{d} &= \frac{a}{b} \times \frac{d}{c} \\ &= \frac{ad}{bc}\end{aligned}$$

Example 1

Simplify $\frac{-2}{5} + \frac{3}{-2} - \frac{3}{10}$.

Solution

$$\begin{aligned}\frac{-2}{5} + \frac{3}{-2} - \frac{3}{10} &= \frac{-4}{10} + \frac{-15}{10} - \frac{3}{10} \\ &= \frac{-4 - 15 - 3}{10} \\ &= \frac{-22}{10} \\ &= \frac{-11}{5} \text{ or } -2\frac{1}{5}\end{aligned}$$

Multiplication

$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$, but first reduce to lowest terms where possible.

More Than One Operation

Follow the order of operations.

Example 2

Simplify $\frac{3}{4} \times \frac{-4}{5} \div \frac{-3}{7}$.

Solution

$$\begin{aligned}\frac{3}{4} \times \frac{-4}{5} \div \frac{-3}{7} &= \frac{3}{4} \times \frac{-4}{5} \times \frac{-7}{3} \\ &= \frac{\cancel{3}^1}{\cancel{4}_1} \times \frac{\cancel{-4}^{-1}}{5} \times \frac{-7}{\cancel{3}_1} \\ &= \frac{7}{5} \text{ or } 1\frac{2}{5}\end{aligned}$$

Practise

1. Evaluate

- | | |
|--|---|
| (a) $\frac{1}{4} + \frac{-3}{4}$ | (b) $\frac{1}{2} - \frac{-2}{3}$ |
| (c) $\frac{-3}{4} - \frac{1}{-4}$ | (d) $\frac{-3}{5} + \frac{3}{-4}$ |
| (e) $\frac{-1}{4} - 1\frac{1}{3}$ | (f) $-8\frac{1}{4} - \frac{-1}{-3}$ |
| (g) $\frac{2}{-3} - 1\frac{5}{6}$ | (h) $\frac{5}{-6} - 2\frac{1}{3}$ |
| (i) $\frac{-3}{5} + \frac{-3}{4} - \frac{7}{10}$ | (j) $\frac{2}{3} - \frac{-1}{2} - \frac{1}{-6}$ |

2. Evaluate

- | | |
|---|--|
| (a) $\frac{4}{5} \times \frac{-20}{25}$ | (b) $\frac{3}{-2} \times \frac{6}{5}$ |
| (c) $(\frac{-1}{3})(\frac{2}{-5})$ | (d) $(\frac{9}{4})(\frac{-2}{-3})$ |
| (e) $(\frac{1}{-2})(\frac{-2}{5})$ | (f) $\frac{-4}{5} \times \frac{10}{-4}$ |
| (g) $(\frac{-5}{12})(-24)$ | (h) $(-2\frac{1}{4})(\frac{2}{-9})$ |
| (i) $(-1\frac{1}{10})(3\frac{1}{11})$ | (j) $-4\frac{1}{6} \times -7\frac{3}{4}$ |