

Multiplying and Dividing Fractions and Mixed Numbers

Multiplying Fractions

To multiply two fractions, multiply the numerators together and multiply the denominators together. If $a, b, c,$ and d are numbers, and b and d are not 0, then

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

Example:

$$\frac{2}{5} \cdot \frac{3}{7} = \frac{2 \cdot 3}{5 \cdot 7} = \frac{6}{35}$$

Note: If the numerators and the denominators have common factors, then divide them by these common factors, then multiply the remaining factors in the numerators, and the remaining factors in the denominators.

Examples

$\frac{3}{5} \cdot \frac{4}{11} = \frac{12}{55}$	<p>Multiply 3 and 4. Then multiply 5 and 11.</p>
$\frac{\cancel{4}^1}{7} \cdot \frac{3}{\cancel{8}_2} = \frac{3}{14}$	<p>Reduce before multiplying, that is, divide both 4 and 8 by 4. Then multiply the remaining factors: $1 \cdot 3 = 3$ in the numerator. $7 \cdot 2 = 14$ in the denominator.</p>
$\frac{\cancel{3}^1}{7} \cdot \frac{\cancel{14}^2}{\cancel{27}_9} = \frac{2}{9}$	<p>Reduce before multiplying, that is, divide both 3 and 27 by 3, and both 7 and 14 by 7. Then multiply the remaining factors: $1 \cdot 2 = 2$ in the numerator. $1 \cdot 9 = 9$ in the denominator.</p>
$\frac{\cancel{3}^1}{7} \cdot \frac{\cancel{14}^2}{\cancel{27}_9} = \frac{2}{9}$	<p>Reduce before multiplying, that is, divide both 3 and 27 by 3, and both 7 and 14 by 7. Then multiply the remaining factors: $1 \cdot 2 = 2$ in the numerator. $1 \cdot 9 = 9$ in the denominator.</p>

Dividing Fractions

To divide two fractions, multiply the first fraction by the reciprocal of the second fraction (in other words, flip the second fraction upside-down).

If $a, b, c,$ and d are numbers, and b, c and d are not 0, then

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{a \cdot d}{b \cdot c}$$

Example:

$$\frac{2}{5} \div \frac{7}{9} = \frac{2}{5} \cdot \frac{9}{7} = \frac{2 \cdot 9}{5 \cdot 7} = \frac{18}{35}$$

Examples

$\frac{4}{5} \div \frac{3}{11} = \frac{4}{5} \cdot \frac{11}{3} = \frac{44}{15}$	Flip the second fraction and multiply. $4 \cdot 11 = 44$ $5 \cdot 3 = 15$
$\frac{3}{4} \div \frac{9}{5} = \frac{\overset{1}{\cancel{3}}}{4} \cdot \frac{5}{\underset{3}{\cancel{9}}} = \frac{5}{12}$	Flip the second fraction and multiply. Reduce before multiplying, that is, divide both 3 and 9 by 3. Then multiply the remaining factors: $1 \cdot 5 = 5$ in the numerator. $4 \cdot 3 = 12$ in the denominator.
$\frac{15}{4} \div \frac{9}{2} = \frac{\overset{5}{\cancel{15}}}{4} \cdot \frac{2}{\underset{3}{\cancel{9}}} = \frac{5}{6}$	Flip the second fraction and multiply. Reduce before multiplying, that is, divide both 15 and 9 by 3, and both 4 and 2 by 2. Then multiply the remaining factors: $5 \cdot 1 = 5$ in the numerator. $2 \cdot 3 = 6$ in the denominator.
$\frac{3}{7} \div \frac{27}{14} = \frac{\overset{1}{\cancel{3}}}{7} \cdot \frac{\overset{2}{\cancel{14}}}{\underset{9}{\cancel{27}}} = \frac{2}{9}$	Flip the second fraction and multiply. Reduce before multiplying, that is, divide both 3 and 27 by 3, and both 7 and 14 by 7. Then multiply the remaining factors: $1 \cdot 2 = 2$ in the numerator. $1 \cdot 9 = 9$ in the denominator.

Multiplying and Dividing Mixed Numbers

To multiply or divide two mixed numbers, first convert them to improper fractions and then multiply or divide them as usual.

Examples

$$\begin{aligned}
 & 2\frac{2}{7} \cdot 1\frac{4}{5} \\
 &= \frac{16}{7} \cdot \frac{9}{5} \\
 &= \frac{144}{35} \\
 &= 4\frac{4}{35}
 \end{aligned}$$

Convert each mixed number into an improper fraction.

Find the numerator of each improper fraction:

$$2 \cdot 7 + 2 = 16$$

$$1 \cdot 5 + 4 = 9$$

Keep the denominators the same.

Multiply the numerators:

$$16 \cdot 9 = 144$$

Then multiply the denominators:

$$7 \cdot 5 = 35$$

Convert $\frac{144}{35}$ into a mixed number using long division.

$$\begin{aligned}
 & 3\frac{1}{4} \div 2\frac{3}{6} \\
 &= \frac{13}{4} \div \frac{13}{6} \\
 &= \frac{13}{4} \cdot \frac{6}{13} \\
 &= \frac{\cancel{13}^1}{4} \cdot \frac{\cancel{6}_3}{\cancel{13}_1} \\
 &= \frac{3}{2} \\
 &= 1\frac{1}{2}
 \end{aligned}$$

Convert each mixed number into an improper fraction.

Find the numerator of each improper fraction:

$$3 \cdot 4 + 1 = 13$$

$$2 \cdot 6 + 3 = 15$$

Keep the denominators the same.

Convert division into multiplication and flip the second fraction.

Reduce before multiplying, that is, divide both 13 and 13 by 13, and both 4 and 6 by 2.

Then multiply the remaining factors:

$$1 \cdot 3 = 3 \text{ in the numerator.}$$

$$2 \cdot 1 = 2 \text{ in the denominator.}$$

Convert $\frac{3}{2}$ into a mixed number using long division.