

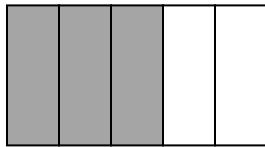
# FRACTIONS REFERENCE SHEET

$\frac{a}{b}$

**numerator:** How many pieces are being considered from the whole

**denominator:** How many pieces the whole has been divided into altogether

**Ex:**  $\frac{3}{5}$



The whole has been divided into 5 pieces altogether, and **3** of those pieces are being considered.

“Three-fifths” equals “3 out of 5”

## Improper Fractions vs. Mixed Numbers

In an **improper fraction**, the numerator (top) is larger than the denominator (bottom).

### Improper → Mixed Number:

$$\frac{a}{b} = a \div b \rightarrow \text{whole number} \frac{\text{remainder}}{\text{divisor}}$$

Use division

(Top ÷ bottom)

**Ex:**  $\frac{13}{5} = 13 \div 5 \rightarrow 2\frac{3}{5}$

### Mixed Number → Improper:

1) Multiply denominator x whole number

**Ex:**  $5 \times 2 = 10$

2) Add result to numerator

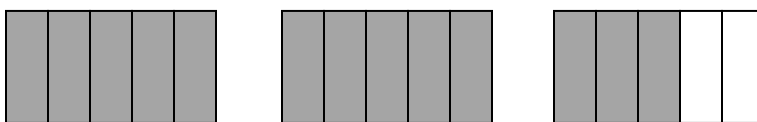
**Ex:**  $10 + 3 = 13$

3) Put new result over original denominator

**Ex:** 13 over 5

**Ex:**  $2\frac{3}{5} = 2\frac{+3}{\times 5} = \frac{13}{5}$

Study the picture to understand **why**  $\frac{13}{5} = 2\frac{3}{5}$  :



$\frac{13}{5}$  is 13 of the shaded fifths (count them!), while  $2\frac{3}{5}$  is 2 wholes and 3 of the shaded fifths.

## OPERATIONS ON FRACTIONS

**Canceling:** To *simplify* a fraction, cancel any *common factors* between top & bottom:

$$\frac{a \cdot n}{b \cdot n} = \frac{a \cdot \cancel{n}}{b \cdot \cancel{n}} = \frac{a}{b} \qquad \text{Ex: } \frac{25}{35} = \frac{5 \cdot 5}{7 \cdot 5} = \frac{5 \cdot \cancel{5}}{7 \cdot \cancel{5}} = \frac{5}{7}$$

**Multiplication:** Multiply numerators together and denominators together.

$$\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d} \qquad \text{Ex: } \frac{2}{5} \times \frac{3}{7} = \frac{2 \times 3}{5 \times 7} = \frac{6}{35}$$

You may cancel common factors vertically or diagonally before multiplying:

$$\text{Ex: } \frac{15}{16} \times \frac{8}{25} = \frac{\overset{3}{\cancel{15}}}{\underset{2}{\cancel{16}}} \times \frac{\overset{1}{\cancel{8}}}{\underset{5}{\cancel{25}}} = \frac{3}{2} \times \frac{1}{5} = \frac{3}{10}$$

**Division:** “Invert and multiply”. Multiply the original first fraction by the reciprocal of the second fraction.

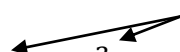
$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

1) If either fraction is a mixed number, convert to improper first.  
2) Invert the second fraction before any canceling.

$$\text{Ex: } 2\frac{4}{5} \div \frac{7}{2} = \frac{14}{5} \div \frac{7}{2} = \frac{14}{5} \times \frac{2}{7} = \frac{\overset{2}{\cancel{14}}}{5} \times \frac{2}{\underset{1}{\cancel{7}}} = \frac{2}{5} \times \frac{2}{1} = \frac{4}{5}$$

**Addition and Subtraction:** You must have *common denominators* before adding or subtracting fractions.

$$\text{Ex: } \frac{11}{14} - \frac{5}{14} = \frac{11-5}{14} = \frac{6}{14} = \frac{3}{7}$$

Simplify at the end if necessary. 

If necessary, multiply by  $\frac{n}{n}$  first to obtain equivalent fractions with common denom.

$$\text{Ex: } \frac{3}{8} + \frac{1}{4} = \frac{3}{8} + \frac{1}{4} \cdot \left(\frac{2}{2}\right) = \frac{3}{8} + \frac{2}{8} = \frac{5}{8}$$