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Fundamental Facts

A fraction represents a part of a whole. It is expressed as $\frac{\text{Numerator}}{\text{Denominator}}$, where the denominator is not zero. To write a fraction correctly, all parts counted must be equal in size.

Introduction to Fractions

A fraction is a number that denotes a part of a whole or a group. It is written as $\frac{a}{b}$ where $b \neq 0$. Fractions can be represented on a number line by dividing the segment between 0 and 1 into b equal parts and locating the point at a parts.

Types of fractions include:

- **Proper fraction:** Numerator less than denominator, e.g., $\frac{1}{3}$.
- **Improper fraction:** Numerator greater than or equal to denominator, e.g., $\frac{5}{3}$.
- **Mixed fraction:** Combination of a whole number and a proper fraction, e.g., $3\frac{4}{5}$.

Equivalent fractions are fractions that represent the same value, found by multiplying or dividing numerator and denominator by the same non-zero number.

A fraction is in simplest form if numerator and denominator have no common factors other than 1.

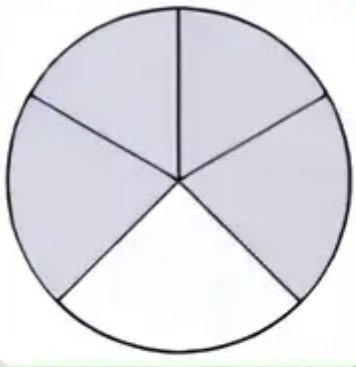
Fractions

A fraction $\frac{3}{5}$ means the whole is divided into 5 equal parts and 3 parts are taken. Examples include half $\frac{1}{2}$ and quarter $\frac{1}{4}$.

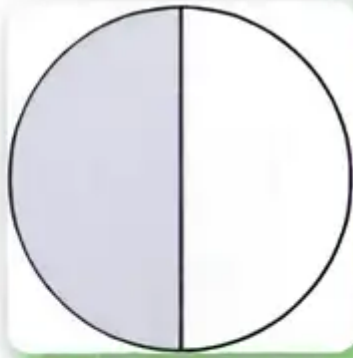
Example 1

Write the fraction of the shaded portions.

1.



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



$$= \frac{1}{2}$$

First circle: 5 equal parts, 4 shaded, fraction $\frac{4}{5}$.

Second circle: 2 equal parts, 1 shaded, fraction $\frac{1}{2}$.

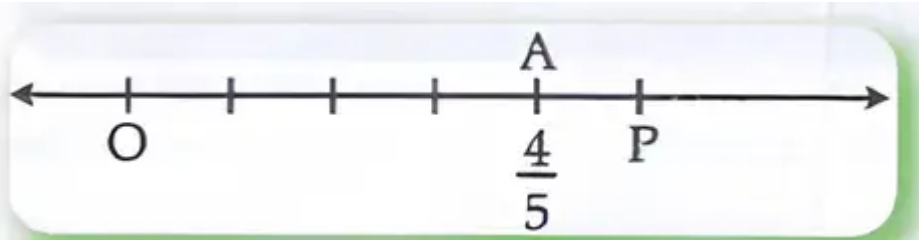
Unit fractions are fractions with numerator 1, e.g., $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$.

Keywords

- Fraction: part of a whole
- Numerator: number of parts taken
- Denominator: total equal parts

Fractions on the Number Line

To represent $\frac{4}{5}$ on a number line, divide the segment from 0 to 1 into 5 equal parts and mark the point at 4 parts.



Proper, Improper and Mixed Fractions

Proper fraction: Numerator less than denominator, e.g., $\frac{1}{3}$.

Improper fraction: Numerator greater than or equal to denominator, e.g., $\frac{5}{3}$.

Mixed fraction: Whole number plus proper fraction, e.g., $3\frac{4}{5}$.

Conversion formulas:

Improper fraction to mixed number:

a. Divide numerator by denominator:

Quotient = q , Remainder = r

b. Write as $q + \frac{r}{\text{denominator}}$

Mixed number to improper fraction:

$$\text{Improper fraction} = \frac{\text{denominator} \times \text{whole number} + \text{numerator}}{\text{denominator}}$$

Keywords

- Proper fraction: numerator < denominator
- Improper fraction: numerator $\geq$ denominator
- Mixed fraction: whole number + fraction

Equivalent Fractions

Fractions representing the same part of a whole are equivalent. For example,

$$\frac{1}{4} = \frac{2}{8} = \frac{3}{12} = \frac{4}{16}.$$

To find equivalent fractions, multiply or divide numerator and denominator by the same non-zero number.

Example: Find 5 equivalent fractions for $\frac{11}{15}$:

$$\frac{11 \times 2}{15 \times 2} = \frac{22}{30}, \frac{11 \times 3}{15 \times 3} = \frac{33}{45}, \frac{11 \times 5}{15 \times 5} = \frac{55}{75}, \frac{11 \times 10}{15 \times 10} = \frac{110}{150}, \frac{11 \times 20}{15 \times 20} = \frac{220}{300}$$

Simplest Form of a Fraction

A fraction is in simplest form if the highest common factor (HCF) of numerator and denominator is 1.

Example: Simplify $\frac{36}{24}$

HCF of 36 and 24 is 12.

Divide numerator and denominator by 12:

$$\frac{36}{24} = \frac{36 \div 12}{24 \div 12} = \frac{3}{2}$$

Any fraction can be simplified by dividing numerator and denominator by their HCF.

Keywords

- Simplest form: numerator and denominator have no common factor except 1
- HCF: highest common factor

Example: Simplify $\frac{54}{108}$

HCF of 54 and 108 is 54.

$$\frac{54}{108} = \frac{54 \div 54}{108 \div 54} = \frac{1}{2}$$

Like and Unlike Fractions

Fractions with the same denominator are called like fractions, e.g., $\frac{7}{13}$, $\frac{6}{13}$.

Fractions with different denominators are unlike fractions, e.g., $\frac{2}{6}$, $\frac{1}{5}$.

Keywords

- Like fractions: same denominators
- Unlike fractions: different denominators

Comparing Fractions

To compare fractions, determine which is larger or smaller.

Comparing like fractions: Compare numerators directly.

Comparing unlike fractions:

1. Find LCM of denominators to get common denominator.
2. Convert fractions to equivalent fractions with common denominator.
3. Compare numerators.

Example: Compare $\frac{1}{2}$ and $\frac{2}{5}$

LCM of 2 and 5 is 10.

$$\frac{1}{2} = \frac{1 \times 5}{2 \times 5} = \frac{5}{10}$$

$$\frac{2}{5} = \frac{2 \times 2}{5 \times 2} = \frac{4}{10}$$

Since $5 > 4$, $\frac{1}{2} > \frac{2}{5}$.

Fundamental Facts

If numerators are equal, the fraction with smaller denominator is larger.

Example: $\frac{3}{5} > \frac{3}{6}$

Addition and Subtraction of Fractions

Like fractions: Add or subtract numerators, keep denominator same.

Example: $\frac{1}{7} + \frac{2}{7} + \frac{3}{7} = \frac{1+2+3}{7} = \frac{6}{7}$

Unlike fractions:

1. Find LCM of denominators.
2. Convert fractions to equivalent fractions with common denominator.
3. Add or subtract numerators.
4. Simplify the result.

Example: Subtract $\frac{2}{9}$ from $\frac{3}{10}$

LCM of 9 and 10 is 90.

$$\frac{3}{10} = \frac{3 \times 9}{10 \times 9} = \frac{27}{90}$$

$$\frac{2}{9} = \frac{2 \times 10}{9 \times 10} = \frac{20}{90}$$

Subtract:

$$\frac{27}{90} - \frac{20}{90} = \frac{27 - 20}{90} = \frac{7}{90}$$

Keywords

- LCM: Least common multiple