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## Introduction to Fractions

A fraction represents a part of a whole or a group of objects. The whole must be divided into equal parts, and the fraction indicates how many of those parts are considered.

For example, if a poori is divided into two equal halves, each half is  $\frac{1}{2}$  of the whole poori.

Visualizing fractions helps understand their meaning. Consider a semicircle, which is half of a circle. If half of this semicircle is shaded, the shaded area represents  $\frac{1}{4}$  of the full circle.

Formulas for areas:

Area of full circle:

$$A_{\text{circle}} = \pi r^2$$

Area of semicircle:

$$A_{\text{semicircle}} = \frac{1}{2}\pi r^2$$

Area of shaded half of semicircle:

$$A_{\text{shaded}} = \frac{1}{4}\pi r^2$$

Similarly, a circle divided into four equal parts has each part as  $\frac{1}{4}$  of the whole.

Fractions like  $\frac{3}{4}$ ,  $\frac{3}{7}$ , and  $\frac{1}{8}$  represent parts of a whole divided into 4, 7, and 8 equal parts respectively.

**Practice Set:**

- Identify fractions in daily life situations.
- Visualize fractions using shapes like circles and rectangles.

## Glossary

- **Fraction:** A number representing part of a whole.
- **Numerator:** Number of parts taken.
- **Denominator:** Number of equal parts the whole is divided into.

## A Fraction

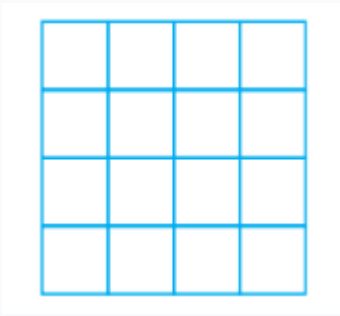
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A fraction  $\frac{a}{b}$  consists of numerator  $a$  and denominator  $b$ . The denominator indicates into how many equal parts the whole is divided, and the numerator indicates how many parts

are taken.

Example:  $\frac{5}{12}$  means 5 parts out of 12 equal parts.

Fractions can be represented on grids and number lines for better understanding.



#### Practice Set:

- Identify numerator and denominator in given fractions.
- Shade given fractions on grids.

## Fraction on the Number Line

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Fractions can be represented on a number line between 0 and 1 by dividing the segment into equal parts according to the denominator.

To represent  $\frac{1}{2}$ , divide the segment between 0 and 1 into 2 equal parts and mark the first part.

Similarly,  $\frac{1}{3}$  is marked by dividing into 3 equal parts, and  $\frac{2}{3}$  is two parts out of three.

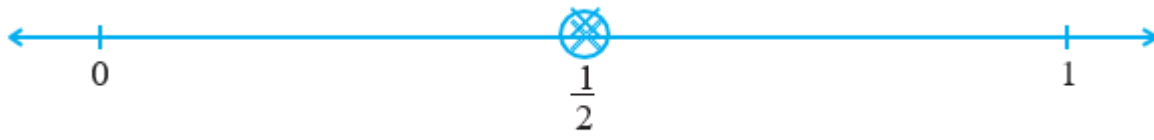


Fig 7.5



Fig 7.6



Fig 7.7

Zero fraction  $\frac{0}{3}$  corresponds to 0, and whole fraction  $\frac{3}{3}$  corresponds to 1.

### Practice Set:

- Mark fractions like  $\frac{3}{5}$ ,  $\frac{1}{10}$ ,  $\frac{5}{10}$ , and  $\frac{10}{10}$  on number lines.
- Find fractions between 0 and 1 and represent them.

## Proper Fraction

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A proper fraction is a fraction where the numerator is less than the denominator, representing a part less than one whole.

Examples:  $\frac{3}{4}$ ,  $\frac{1}{2}$ ,  $\frac{9}{10}$

All proper fractions lie between 0 and 1 on the number line.

### Practice Set:

- Identify proper fractions from a list.
- Create proper fractions with given conditions on numerator and denominator.

## Improper and Mixed Fraction

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An improper fraction has numerator greater than or equal to the denominator, representing a value equal to or greater than one.

Example:  $\frac{5}{4}$  means 5 parts out of 4 equal parts.

A mixed fraction combines a whole number and a proper fraction, e.g.,  $1\frac{1}{4}$ .

Conversion between improper and mixed fractions:

To convert improper fraction  $\frac{n}{d}$  to mixed fraction:

Divide  $n$  by  $d$ :  $n = qd + r$ , then mixed fraction is  $q\frac{r}{d}$ .

To convert mixed fraction  $q\frac{r}{d}$  to improper fraction:

$$\frac{qd + r}{d}$$

## Practice Set:

- Convert improper fractions to mixed fractions and vice versa.
- Write improper fractions with given denominators or numerators.

## Equivalent Fractions

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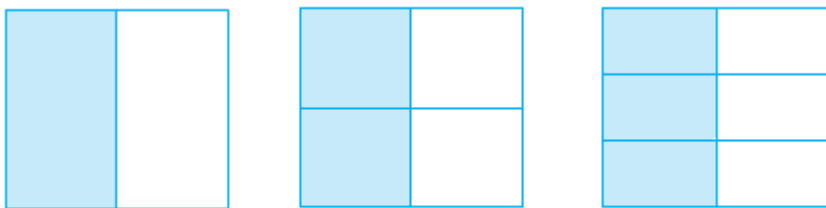
Equivalent fractions represent the same part of a whole, even if numerators and denominators differ.

Example:  $\frac{1}{2} = \frac{2}{4} = \frac{3}{6}$

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

Cross multiplication test for equivalence:

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



*Fig 7.10*



$\frac{4}{6}$  is shaded here.



$\frac{2}{3}$  is shaded here.

Fig 7.11

### Practice Set:

- Find equivalent fractions for given fractions.
- Use cross multiplication to check equivalence.

## Simplest Form of a Fraction

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

To simplify a fraction, divide numerator and denominator by their highest common factor (HCF).

Example:

$$\frac{36}{54} = \frac{36 \div 18}{54 \div 18} = \frac{2}{3}$$

### Practice Set:

- Simplify given fractions to their lowest terms.
- Check if fractions are in simplest form.

## Like and Unlike Fractions

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Like fractions have the same denominator, e.g.,  $\frac{1}{15}$ ,  $\frac{2}{15}$ .

Unlike fractions have different denominators, e.g.,  $\frac{7}{27}$ ,  $\frac{7}{28}$ .

### Practice Set:

- Identify like and unlike fractions.
- Write pairs of like and unlike fractions.

## Comparing Fractions

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To compare fractions:

### Comparing Like Fractions

Fractions with the same denominator can be compared by comparing numerators.

Example:  $\frac{5}{8} > \frac{3}{8}$  because  $5 > 3$ .



## Comparing Unlike Fractions

For fractions with different denominators, find equivalent fractions with a common denominator (preferably LCM of denominators) and compare numerators.

Example: Compare  $\frac{4}{5}$  and  $\frac{5}{6}$ .

LCM of 5 and 6 is 30.

$$\frac{4}{5} = \frac{24}{30}, \quad \frac{5}{6} = \frac{25}{30}$$

Since  $25 > 24$ ,  $\frac{5}{6} > \frac{4}{5}$ .

### Practice Set:

- Compare given pairs of fractions.
- Arrange fractions in ascending and descending order.

## Addition and Subtraction of Fractions

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Fractions can be added or subtracted by following these rules:

### Adding or Subtracting Like Fractions

Add or subtract numerators and keep the denominator same.

$$\frac{a}{d} + \frac{b}{d} = \frac{a+b}{d} \quad , \quad \frac{a}{d} - \frac{b}{d} = \frac{a-b}{d}$$

Example:  $\frac{5}{6} - \frac{2}{6} = \frac{3}{6} = \frac{1}{2}$

## Adding or Subtracting Unlike Fractions

Find equivalent fractions with common denominator (LCM of denominators), then add or subtract numerators.

Example:  $\frac{1}{2} - \frac{1}{5}$

LCM of 2 and 5 is 10.

$$\frac{1}{2} = \frac{5}{10}, \quad \frac{1}{5} = \frac{2}{10}$$

$$\frac{5}{10} - \frac{2}{10} = \frac{3}{10}$$

## Addition and Subtraction of Mixed Fractions

Convert mixed fractions to improper fractions or add/subtract whole and fractional parts separately.

Example: Add  $2\frac{4}{5} + 3\frac{5}{6}$

Convert fractional parts to common denominator 30:

$$\frac{4}{5} = \frac{24}{30}, \quad \frac{5}{6} = \frac{25}{30}$$

Sum of fractional parts:  $\frac{24}{30} + \frac{25}{30} = \frac{49}{30} = 1\frac{19}{30}$

Add whole parts and fractional sum:

$$2 + 3 + 1\frac{19}{30} = 6\frac{19}{30}$$

**Practice Set:**

- Add and subtract like and unlike fractions.
- Add and subtract mixed fractions using both methods.

## Answer Key

Answers to practice problems should include step-by-step calculations as shown in examples.

## Quick Reference

- Fraction:  $\frac{a}{b}$ , numerator  $a$ , denominator  $b$ .
- Proper fraction: numerator < denominator.
- Improper fraction: numerator  $\geq$  denominator.
- Mixed fraction: whole number + proper fraction.
- Equivalent fractions: multiply/divide numerator and denominator by same number.
- Simplest form: numerator and denominator have no common factors except 1.

- Like fractions: same denominator.
- Unlike fractions: different denominators.
- Compare fractions by converting to common denominator.
- Add/subtract like fractions: add/subtract numerators, keep denominator.
- Add/subtract unlike fractions: convert to equivalent fractions with common denominator.

## Glossary

- **Numerator:** Number of parts taken.
- **Denominator:** Number of equal parts the whole is divided into.
- **Proper fraction:** Fraction with numerator less than denominator.
- **Improper fraction:** Fraction with numerator greater than or equal to denominator.
- **Mixed fraction:** Combination of whole number and proper fraction.
- **Equivalent fractions:** Different fractions representing the same value.
- **HCF (Highest Common Factor):** Largest number dividing numerator and denominator.
- **LCM (Least Common Multiple):** Smallest common multiple of denominators.