

Class 8 MATHEMATICS

Chapter 1: Rational Numbers

From Notes Book

What Are Rational Numbers?

A **rational number** is any number that can be written in the form of $\frac{p}{q}$, where:

1. p and q are integers.
2. $q \neq 0$ (the denominator cannot be zero).

Examples:

- $\frac{3}{4}$, -7 , 0.6 (which is $\frac{3}{5}$).
- Whole numbers (e.g., 5 can be written as $\frac{5}{1}$).
- Integers (e.g. $-3 = -\frac{3}{1}$).

Key Point: Any number that can't be expressed as $\frac{p}{q}$ (e.g. $\sqrt{2}$, π) is **NOT** a rational number.

Detailed Properties of Rational Numbers

1. Closure Property

- When you **add, subtract, or multiply** two rational numbers, the result is also a rational number.
- **Example:**
 $\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}$ (Result is rational).

2. Commutative Property

- Rational numbers follow this property for **addition** and **multiplication**:
 $a + b = b + a$ or $a \times b = b \times a$
- **Example:**
 $\frac{2}{3} + \frac{4}{5} = \frac{4}{5} + \frac{2}{3}$.

3. Associative Property

- Grouping doesn't change the result for addition or multiplication:
 $(a + b) + c = a + (b + c)$.
- **Example:**
 $(\frac{1}{4} + \frac{1}{2}) + \frac{1}{5} = \frac{1}{4} + (\frac{1}{2} + \frac{1}{5})$.

4. Distributive Property

- Multiplication over addition or subtraction:
 $a \times (b + c) = (a \times b) + (a \times c)$.

- **Example:**

$$\frac{1}{2} \times (\frac{2}{3} + \frac{3}{4}) = (\frac{1}{2} \times \frac{2}{3}) + (\frac{1}{2} \times \frac{3}{4}).$$

5. Identity Property

- For addition: 0 is the additive identity ($a+0 = a$).
- For multiplication: 1 is the multiplicative identity ($a \times 1 = a$).

6. Inverse Property

- Additive inverse: For $a = \frac{2}{3}$, the additive inverse is $-a = -\frac{2}{3}$.
- Multiplicative inverse: For $a = \frac{2}{3}$, the multiplicative inverse is $\frac{3}{2}$.

Representation of Rational Numbers on the Number Line

Step-by-Step Process:

1. Draw a straight line and mark 0 in the middle.
2. Mark positive integers (1, 2, 3, ...) on the right and negative integers (-1, -2, -3, ...) on the left.
3. To mark a fraction $\frac{3}{4}$:
 - Divide the space between 0 and 1 into **4 equal parts**.
 - Count **3 steps** from 0.

Example: Place $-5/6$ on the number line:

- Divide space between 0 and -1 into **6 parts**.
 - Move **5 parts left** from 0.
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Operations on Rational Numbers

1. Addition and Subtraction

- Convert denominators to the same number (find LCM).
- Add or subtract numerators, keeping the denominator the same.
- Simplify if needed.

Example:

$$1/2 + 1/3 = 3/6 + 2/6 = 5/6.$$

2. Multiplication

- Multiply numerators and denominators directly.
- Simplify if possible.

Example:

$$3/4 \times 5/6 = 15/24 = 5/8.$$

3. Division

- Flip the second fraction (reciprocal) and multiply.

Example:

$$2/3 \div 4/5 = 2/3 \times 5/4 = 10/12 = 5/6.$$

Practice Questions

1. Identify Rational Numbers:

- Is $0.333...0.333...$ a rational number?
- Is $\sqrt{4}$ a rational number?
- Is $-7/3$ a rational number?

2. Closure Property Questions:

- Show that $1/3 + 1/6$ is a rational number.
- Multiply $-2/5 \times 7/9$. Is the result rational?

3. Represent on the Number Line:

- Represent $5/8$ on the number line.
- Represent $-3/4$ on the number line.

4. Addition/Subtraction:

- Solve: $(2/5) + (3/7)$.
- Solve: $(4/9) - (2/3)$.

5. Multiplication/Division:

- $3/8 \times 4/5$.
- $7/9 \div -2/3$.

Key Points to Remember:

1. Rational numbers can always be written as p/q with $q \neq 0$.
 2. Decimal forms of rational numbers can be **terminating** (e.g., 0.5) or **repeating** (e.g., 0.333...).
 3. Any integer or fraction is a rational number.
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