

Real Numbers

Session Highlights :

- Rational Numbers
- Irrational Numbers
- Terminating Decimals

Rational and Irrational Numbers:

Real Numbers

▪ Rational Numbers

The numbers which can be written in the form of p/q . (where p and q are co – prime integers and $q \neq 0$). They include numbers whose decimal representation is

- ✓ Terminating as $3/5, 5/8$ etc.
- ✓ No – Terminating Repeating as $1/3, 3/7$ etc.

▪ Irrational Numbers

The numbers whose decimal representation is non – terminating non – repeating.

- ✓ Surds such as $\sqrt{7}, \sqrt{5}$ etc
- ✓ π
- ✓ Numbers such as $2.101001000100001\dots$

The numbers that have no common factor i.e. their HCF is 1 are said to be co – prime numbers.

2 and 3, 8 and 15 represent pairs of co-prime numbers.

Terminating Decimals:

For a rational number of the form $\frac{p}{q}$ to have a terminating decimal representation following condition must be satisfied:

- The prime factorization of q must be of the form $2^m \times 5^n$, where p and q

are non – negative integers. Let's consider a few examples.

$$(i) \quad \frac{13}{3125} = \frac{13}{5^5}$$

The prime factorization of $q = 2^0 \times 5^5$ which is of the form $2^m \times 5^n$, thus

$\frac{13}{3125}$ is a terminating decimal.

$$(ii) \quad \frac{15}{1600} = \frac{3}{320} = \frac{3}{2^6 \times 5}$$

The prime factorization of $q = 2^6 \times 5$ which is of the form $2^m \times 5^n$, thus

$\frac{15}{1600}$ is a terminating decimal.

$$(iii) \quad \frac{77}{210} = \frac{11}{30} = \frac{11}{2 \times 3 \times 5}$$

The prime factorization of $q = 2 \times 3 \times 5$, thus it has a prime factor other than 2 and 5.

→ $\frac{77}{210}$ is a non terminating decimal.

Decimal Expansion of a Rational Number:

A rational number can be converted into a decimal merely by division. The decimal expansion may be terminating or non – terminating. In case the decimal expansion is terminating, division can be avoided (especially if the denominator has a large value) by following a simple working rule as:

$$(i) \quad \frac{13}{3125} = \frac{13}{5^5} \times \frac{2^5}{2^5}$$

$$= \frac{13 \times 32}{10^5} = \frac{416}{100000} = \mathbf{0.00416}$$

The basic idea is to equate the powers of 2 and 5.

$$(ii) \quad \frac{15}{1600} = \frac{3}{320} = \frac{3}{2^6 \times 5} \times \frac{5^5}{5^5}$$
$$= \frac{3 \times 3125}{10^6} = \frac{9375}{1000000} = \mathbf{0.009375}$$

It must be noted here that in case the denominator has a small value, division would be a better option as:

$$\frac{1}{2} = 0.5, \quad \frac{17}{8} = 2.125$$

Session concluded.

Questions for practice

- **NCERT Ex 1.4**

Thanks for joining.