

Number system

Natural and Whole Number

$$N = \{1, 2, 3, 4, 5, \dots\}$$

$$W = \{0, 1, 2, 3, 4, 5, \dots\}$$

So all natural Number are whole number but all whole numbers are not natural numbers

Integers

$$Z = \{\dots, -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, \dots\}$$

Rational and Irrational Numbers

Rational Number: A number is called rational if it can be expressed in the form p/q where p and q are integers ($q > 0$).

Example : $\frac{1}{2}$, $\frac{4}{3}$, $\frac{5}{7}$, 1 etc.

- every integers, natural and whole number is a rational number
- There are infinite rational number between two rational number
- They either have termination decimal expression or repeating non terminating decimal expression
- The sum, difference and the product of two rational numbers is always a rational number. The quotient of a division of one rational number by a non-zero rational number is a rational number. Rational numbers satisfy the closure property under addition, subtraction, multiplication and division.

Irrational Number: A number is called irrational if it cannot be expressed in the form p/q where p and q are integers ($q > 0$).

Example : $\sqrt{3}$, $\sqrt{2}$, $\sqrt{5}$, π etc

- Pythagoras Theorem: In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides. Using this theorem we can represent the irrational numbers on the number line.
- They have non terminating and non repeating decimal expression

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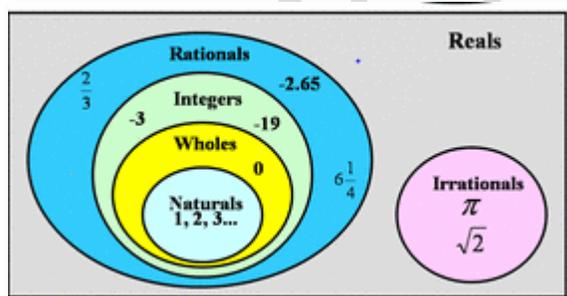
- c) The sum, difference, multiplication and division of irrational numbers are not always irrational. Irrational numbers do not satisfy the closure property under addition, subtraction, multiplication and division

Real Numbers:

All rational and all irrational number makes the collection of real number. It is denoted by the letter R

- a) Real numbers satisfy the commutative, associative and distributive laws. These can be stated as :
- Commutative Law of Addition: $a + b = b + a$
 - Commutative Law of Multiplication: $a \times b = b \times a$
 - Associative Law of Addition: $a + (b + c) = (a + b) + c$
 - Associative Law of Multiplication: $a \times (b \times c) = (a \times b) \times c$
 - Distributive Law: $a \times (b + c) = a \times b + a \times c$ or $(a + b) \times c = a \times c + b \times c$
- b) We can represent real numbers on the number line. The square root of any positive real number exists and that also can be represented on number line
- c) The sum or difference of a rational number and an irrational number is an irrational number.
- d) The product or division of a rational number with an irrational number is an irrational number.
- e) This process of visualization of representing a decimal expansion on the number line is known as the process of successive magnification

Summary



Laws of exponents

Let $a > 0$ be a real number and p and q be rational numbers. Then, we have

$$1) a^p \cdot a^q = a^{p+q}$$

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- 2) $\frac{a^p}{a^q} = a^{p-q}$
- 3) $(a^p)^q = a^{pq}$
- 4) $a^p \cdot b^p = ab^p$
- 5) $a^{-p} = \frac{1}{a^p}$
- 6) $a^0 = 1$
- 7) $a^1 = a$

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