SHORT NOTES: CLASS 9
CHAPTER 1: NUMBER SYSTEMS

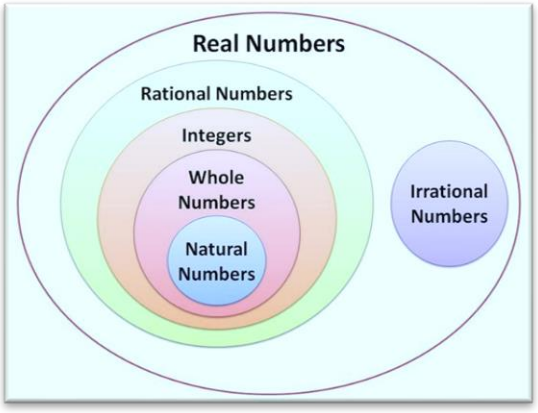
REAL NUMBERS:

a) Real numbers and imaginary numbers together form number systems.
b) Real numbers are the set of natural numbers, whole numbers, integers, rational and irrational numbers. Denoted by R

1. **RATIONAL NUMBERS:**
   a) These are those numbers that can be expressed in the form of fractions i.e., p/q where p and q are integers and q≠0.
   b) For example: 35,−29,−34 etc. http://www.physicsinduction.com
   c) Denoted by Q
   d) There are infinitely many rational numbers between any two rational numbers.
2. **IRRATIONAL NUMBERS:**
   a) Numbers which are not rational i.e., which cannot be expressed in the form of p/q where p and q are integers and q≠0. For example: e.g., √2, √5, π, …etc.
3. **NATURAL NUMBERS:**
   a) These are counting numbers starting from 1.
   b) The set {1,2,3,4,5,6,7....} is called natural numbers.
   c) Denoted by N
4. **WHOLE NUMBERS**:
   a) These are the set of natural numbers including 00.
   b) The set {0,1,2,3,4,5,6....} is called whole numbers.
   c) Denoted by W
5. **INTEGERS:**
   a) These are the set of negative numbers, positive numbers, and 00 excluding fractions.
   b) The set {....−3,−2,−1,0,1,2,3....} is called integers.
   c) Denoted by Z
6. **PRIME NUMBERS:** No factors other than 1 and the number itself.
7. **COPRIMES:** Two numbers a and b are said to be coprimes if HCF(a, b) = 1
8. **COMPOSITE NUMBERS:** More than two factors.

Note:

a) All integers are rational numbers. http://www.physicsinduction.com
b) All whole numbers are integers but all integers are not whole numbers.
c) All natural numbers are whole numbers but all whole numbers are not natural numbers



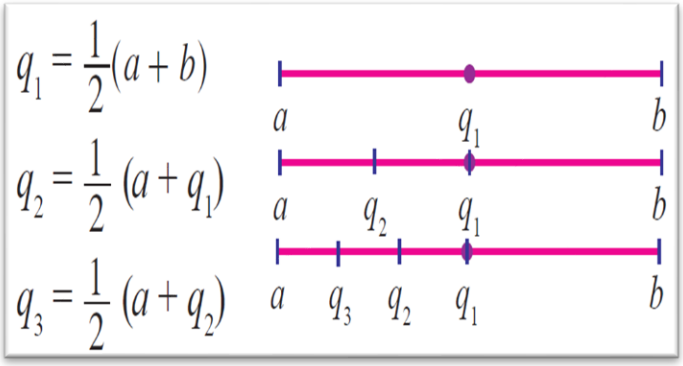
http://www.physicsinduction.com

DECIMAL REPRESENTATION OF A RATIONAL NUMBER:

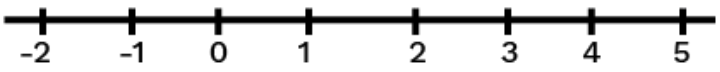
1. **Terminating decimal expression:** $\frac{7}{8}$ = 0.875
2. **Non- terminating, repeating decimal expression:** $\frac{9}{11}$ = 0.818181……..
3. **Non- terminating, non-repeating decimal expression:** π = 3.141592653589793283……

- Decimal expressions of rational numbers are either terminating or non-terminating, repeating.
- Decimal expressions of irrational numbers are either non-terminating and non-repeating.

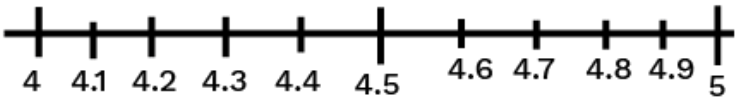
HOW TO FIND RATIONAL NUMBERS:



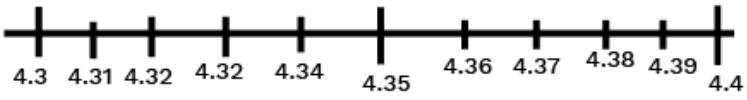
REPRESENTING REAL NUMBERS ON THE NUMBER LINE/SUCCESSIVE MAGNIFICATION:



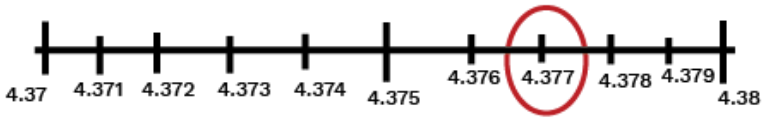
Magnifying between 4 and 5



Magnifying between 4.3 and 4.4



Magnifying between 4.37 and 4.38



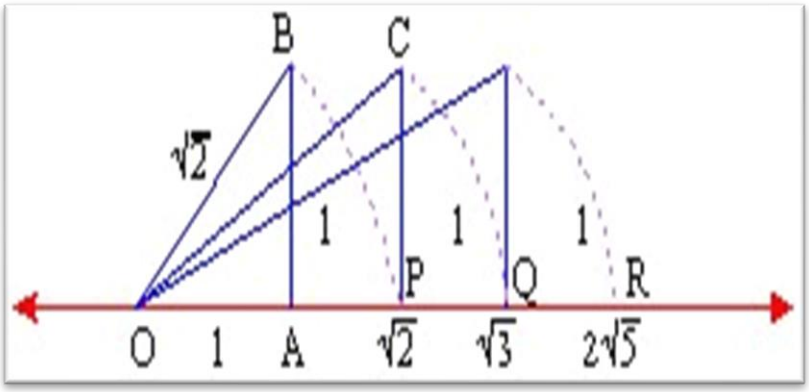
IRRATIONAL NUMBERS ON THE NUMBER LINE:

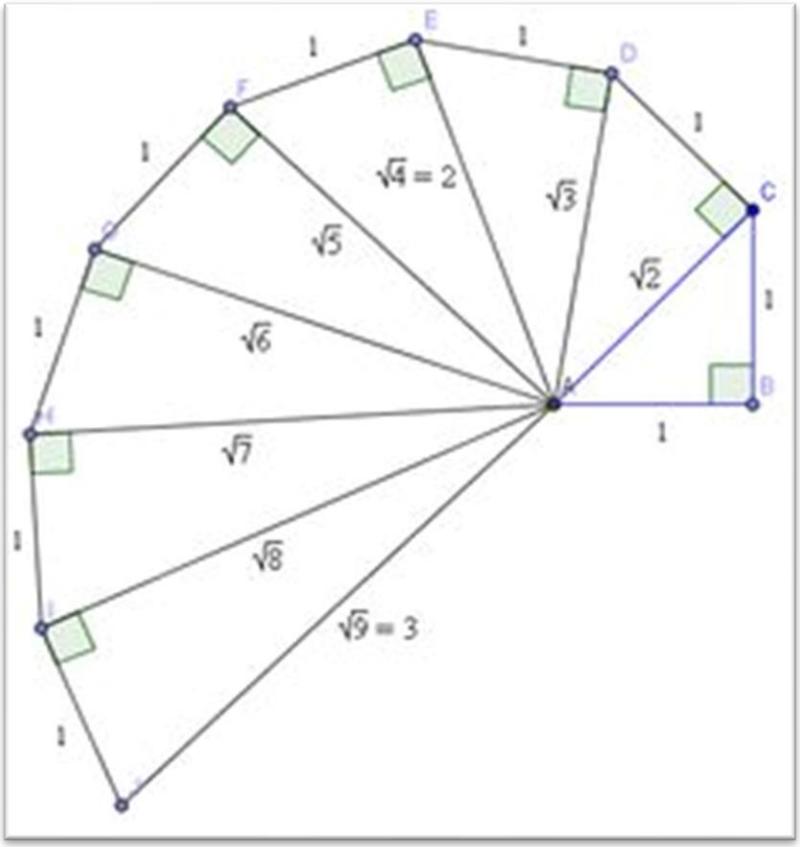
TO DRAW: √2 on the number line.

STEPS OF CONSTRUCTION:

i. Draw a number line.
ii. Mark the number 1 on the number line as point A.
iii. Draw a perpendicular at A using a compass such that ray AX ∟ OA
iv. With A as centre and radius 1 unit, draw an arc at AX. Mark the point as B
v. Join OB. OB = √2 units.

With O as center and OB as radius, draw an arc, cutting the number line at point P. OP = √2 units.





OPERATIONS ON REAL NUMBERS:

Real numbers can be added, subtracted, multiplied, and divided.

- Rational numbers satisfy the commutative, associative, and distributive laws for addition and multiplication. Moreover, if we add, subtract, multiply, or divide (except by zero) two rational numbers. We still get a rational number (i.e., rational numbers are 'closed' with respect to addition, subtraction, multiplication, and division).
- Irrational numbers also satisfy the commutative, associated, and distributive laws for addition and multiplication. However, the sum, difference, quotients, and products of irrational numbers are not always irrational.
  e.g., √5 + (-√5) = 0
  √15/√15 = 1 is rational.
  √3 is irrational.
  Hence, (5 + √3) is also irrational (√3 has a non-terminating, non-recurring decimal expansion).

SOME COMMON FACTS OF OPERATION ON REAL NUMBERS ARE: http://www.physicsinduction.com

a) The sum or difference between a rational number and an irrational number is irrational.

b) The product or quotient of a non-zero rational number with an irrational number is irrational.

c) If we add, subtract, multiply, or divide two irrationals, then the result may be rational or irrational.

RATIONALIZING DENOMINATOR:

a) When the denominator is irrational then the process of converting the denominator to rational is called rationalizing the denominator.

b) It is obtained by multiplying the numerator and denominator by the irrational term present in the denominator but with the opposite sign.

c) To rationalise the denominator of $1/\sqrt{a+b}$, it is multiplied by $\sqrt{a-b}/\sqrt{a-b}$, where a and b are integers. http://www.physicsinduction.com

LAWS OF EXPONENTS FOR REAL NUMBERS:

a) $x^0 = 1$

b) $x^{-m} = 1/x^m$

c) $x^m \cdot x^n = x^{m+n}$

d) $x^m/x^n = x^{m-n}$

e) $(x^m)^n = x^{mn}$

f) $X^m y^m = (xy)^m$

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