Represent Some Irrational Numbers on the Number Line

OBJECTIVE

To represent some irrational numbers on the number line.

Materials Required

1. Two cuboidal wooden strips
2. Thread
3. Nails
4. Hammer
5. Two photocopies of a scale
6. A screw with nut
7. Glue
8. Cutter

Prerequisite Knowledge

1. Concept of number line.
2. Concept of irrational numbers.
3. Pythagoras theorem.
4. Representation of rational number on number line.

Theory

1. The concept of number line refer to Activity 1.
2. For concept of irrational numbers refer to Activity 1.
3. For Pythagoras theorem refer to Activity 1.
4. Representation of Irrational Number on Number Line.

We know that a real number is either rational or irrational. So, we can say that every real number is represented by a unique point on the number line.
Also, every point on the number line represents a unique real number. So, we can locate some of the irrational number of the form $\sqrt{n}$, where n is a positive integer on the number line by using following steps.
Step I – Write the given number (without root) as the sum of the squares of two natural numbers (say a and b, where $a > b$).
Step II – Take the distance equal to these two natural numbers on the number line (a on number line and b vertically) starting from 0 (say OA and AB) in such a way that one is perpendicular to other (say $AB \perp OA$).

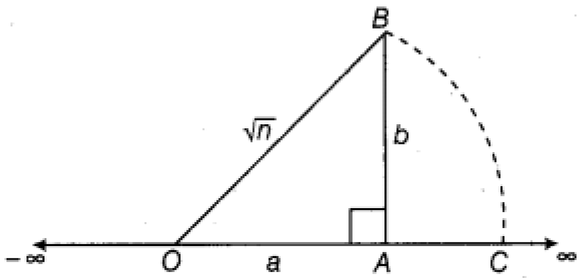

Fig. 2.1

Step III – Use Pythagoras theorem to find the distance OB.
Step IV – Take O as centre and OB as radius, draw an arc, which cut the number line at C (say).
Thus, the point C will represent the location of $\sqrt{n}$ on the number line, (see Fig. 2.1)

Procedure

1. Make a straight slit on the top of one of the the wooden strips. Now, fix another wooden strip on the slit perpendicular to the former strip with a screw at the bottom, so that it can move freely along the slit, (see Fig. 2.2)
2. Paste one photocopy of the scale on the horizontal (movable) strip and another photocopy of the scale on the perpendicular strip, (see Fig. 2.2)
3. Fix nails at a distance of 1 unit each, starting from O, on both the strips, (see Fig. 2.2)
4. Now, tie a thread at the nail at 0 on the horizontal strip, (see Fig. 2.2)

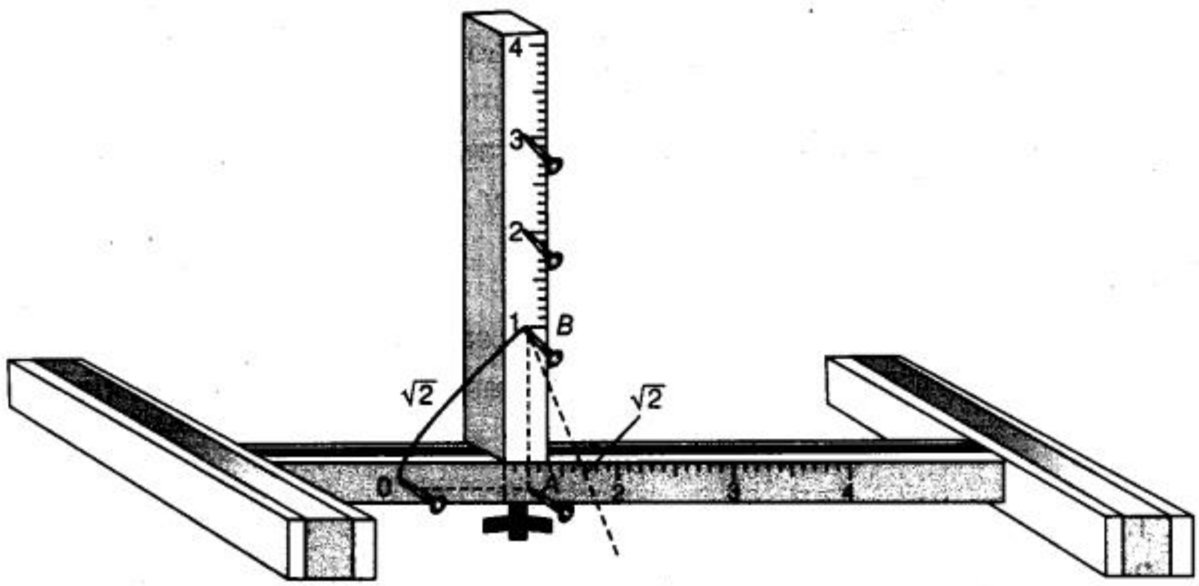

Fig. 2.2

Demonstration

1. With the help of screw, fix the perpendicular wooden strip at 1, which is 1 unit on horizontal scale.
2. Tie the other end of the thread to unit 1 on the perpendicular strip.
3. Remove the thread from unit 1 on the perpendicular strip and place it on the horizontal strip to represent √2 on the horizontal strip.
   ΔOAB is a right angled triangle.
   So, from Pythagoras theorem, $OB^2 = OA^2 + AB^2$
   Here, OA = 1 unit, AB = 1 unit,
   $OB^2 = (1)^2 + (1)^2 \Rightarrow OB^2 = 2 \Rightarrow OB = \sqrt{2}$ Similarly, to represent √3, fix the perpendicular wooden strip at √2 and repeat the above process.
   Thus, we conclude to represent √a, a > 1 fix the perpendicular scale at $\sqrt{a-1}$ and proceed as above to get √a.

Note: To find √a such as √13 by fixing the perpendicular strip at 3 on the horizontal strip and tying the other end of thread at 2 on the vertical strip.

Observation

On actual measurement, we get a -1 = ……….. , √a =…………

Result

Any irrational number can be represented on the number line by using this method.

Application

This activity may help to student in representing some irrational numbers like √2, √3, √5, √6, √7,…, etc., on the number line.

Viva Voce

Question 1:
Is every irrational number, a real number?
Answer:
Yes, because real numbers consist of both rational and irrational numbers.

Question 2:
Can we apply Pythagoras theorem in any triangle?
Answer:
No, Pythagoras theorem is applicable only in right angled triangle.

Question 3:
Isrca rational or an irrational number? What is value of TC up to three decimal places?
Answer:
π is an irrational number. The value of π is 3.142.

Question 4:
"Sum of two irrational numbers is an irrational number". Is this statement true?
Answer:
No, its not true, sum of two irrational numbers may be irrational or rational.

Question 5:
Is the product of two irrational numbers, an irrational number?
Answer:
No, it is not necessary that, the product of two irrational numbers is irrational number.

Question 6:
Does the square roots of all positive integers, irrational? Give reason.
Answer:
No, square roots of all positive integers are not irrational, e.g. S = $\sqrt{9} = 3^2$, which is a rational number.

Question 7:
How would you find a base of a right angled triangle, if hypotenuse and perpendicular are given?
Answer:
Base = $\sqrt{(hypotenuse)2 - (perpendicular)2}$

Question 8:
Is it possible to say that $\sqrt{\infty}$ is defined on number line?
Answer:
No

Question 9:
Is it possible that the sum of two irrational numbers can be represented on number line?
Answer:
Yes

Suggested Activity
Represent other irrational numbers such as $\sqrt{3}$, $\sqrt{5}$, $\sqrt{7}$,…, etc., on the number line.