

Activity - 5

Subject	MATHEMATICS
Class	XI
Chapter/Unit	Complex numbers and quadratic equations
Topic	Complex numbers
Time	40 min
Nature of Activity	Individual

What will I learn (Learning Outcome)?

To interpret geometrically the meaning of square root of -1 and its integral powers

Skills: Logical ability, Analytical thinking, Deductive reasoning, Creativity, Accuracy.

What I have to do?

To interpret geometrically the meaning of $i = \sqrt{-1}$ and its integral powers

What do I require?

Cardboard, chart paper, sketch pen, ruler, compasses, adhesive, nails, thread.

What do I need to know?

Irrational numbers, Quadratic equations with negative discriminants, unit imaginary number

How will I proceed?

➤ **Teacher's Activity**

Teacher will guide the students to

1. Paste a graph paper on the cardboard .
2. Draw two mutually perpendicular lines $X'OX$ and $Y'OY$ intersecting at the point O (see Fig. 5.1 to 5.5).
3. Take a thread of a unit length representing the number 1 along OX . Fix one end of the thread to the nail at O and the other end at A as shown in the figures 5.1 to 5.5
4. Set free the other end of the thread at P and rotate the thread through angles of 90° , 180° , 270° and 360° and mark the free end of the thread in different cases as P_0 , P_1 , P_2 , P_3 and P_4 , respectively, as shown in the figure 5.1 to 5.5

➤ **Student's Activity**

Student will draw

1. In the argand plane, OP_0 , OP_1 , OP_2 , OP_3 , OP_4 represent, respectively, i , -1 , $-i$, 1 .
2. $OP_0 = i^0 = 1$, $OP_1 = i^1 = 1 \times i$, $OP_2 = -1 = i \times i = i^2$, $OP_3 = -i = i \times i \times i = i^3$, $OP_4 = i^4 = 1$ and so on.
3. Each time, rotation of OP by 90° is equivalent to multiplication by i . Thus, i is referred to as the multiplying factor for a rotation of 90° .

FIG 5.1

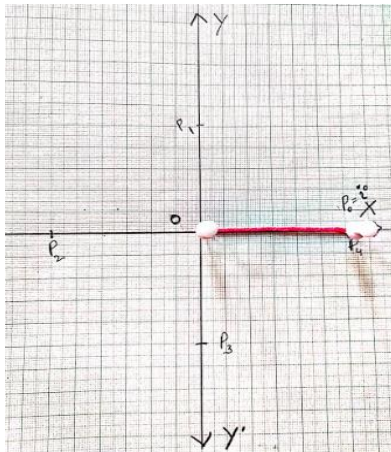


FIG 5.2

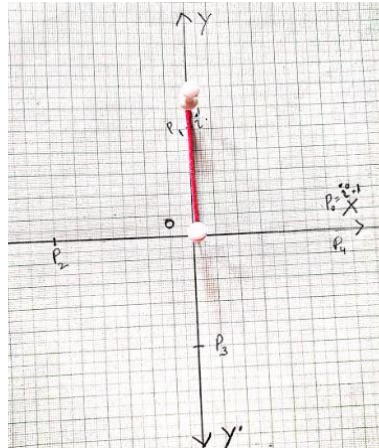
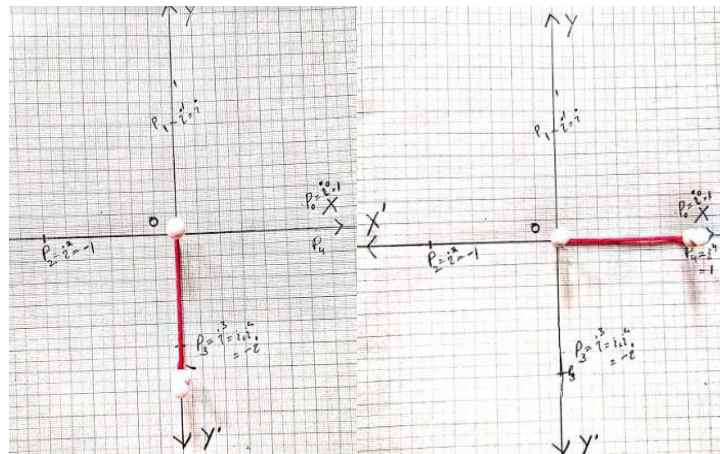
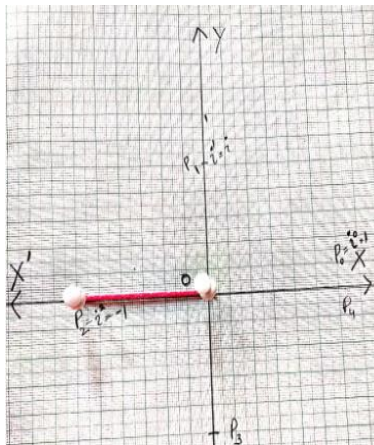


FIG 5.3

FIG 5.4

FIG 5.5

**What have I observed?**

S.No		
<u>1</u>	On rotating OP through 90° , $OP_1 = 1 \times i =$	_____
<u>2</u>	On rotating OP through an angle of 180° , $OP_2 =$	$1 \times \underline{\quad} \times \underline{\quad} = \underline{\quad}$
<u>3</u>	. On rotation of OP through 270° (3 right angles), OP_3	$1 \times \underline{\quad} \times \underline{\quad} \times \underline{\quad} =$ _____.
<u>4</u>	On rotating OP through 360° (4 right angles), OP_4	$1 \times \underline{\quad} \times \underline{\quad} \times \underline{\quad} \times$ _____ = _____.
<u>5</u>	On rotating OP through n -right angles OP_n	$= 1 \times \underline{\quad} \times \underline{\quad} \times \underline{\quad} \times$ _____ $\times \dots n$ times = _____

What have I learnt?

This activity may be used to evaluate any integral power of i .

What am I curious to learn?

Integral powers of “ i ” that is i^{23} , i^{-17} , i^{97} etc

Let me evaluate myself

Write the value of $i + i^{10} + i^{20} + i^{30}$

Q1.

Write the additive Inverse of $6i - i\sqrt{-49}$

Q2.

Q3 If $(1 + i^2 + i^4 + i^6 + \dots + i^{208}) = a + ib$, then the value of (ab) is

(a) -1

(b) 1

(c) 0

(d) ± 1 .

Q4. Express the complex number in the form $a + ib$: $\left(-2 - \frac{i}{3}\right)^3$

Write in the form of $a + ib$: $\frac{1}{-2 + \sqrt{-3}}$

Q5.

Q 6 Multiply $2 - 3i$ by its conjugate