Activity 27

OBJECTIVE

To explain the concept of octants by three mutually perpendicular planes in space.

MATERIAL REQUIRED

A piece of plywood, saw, wires, rulers wooden-board, coloured papers, scissors, cutter, thin sheet of wood, wires.

METHOD OF CONSTRUCTION

1. Cut out three square sheets each of size 30 cm × 30 cm from a piece of plywood and paste chart paper of different colours on both sides of sheets.

2. Fix two sheets in such a way that they intersect orthogonally in the middle of each other (see Fig. 27)

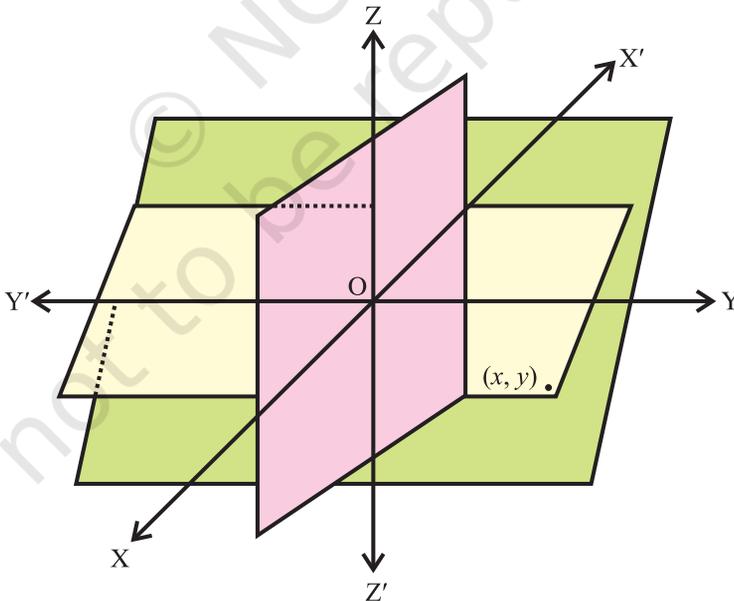3. Cut the third sheet into two equal rectangles.

Fig. 27

4. Insert one rectangle from one side in the middle cutting the two orthogonally, and the other rectangle from the other side (see Fig. 27). The space is divided into eight parts by these three sheets. Each part is referred to as an octant.

5. Fix the model on a wooden board.

6. In one of the octants, fix rulers to represent x-axis, y-axis and z-axis. Extend each of the axis piercing to other sides to represent XX′, YY′ and ZZ′ . Mark the point of intersection of XX′, YY′ and ZZ′ as origin O.

DEMONSTRATION

1. Fix a rod perpendicular to xy-plane at a point P (x, y) and parallel to z-axis.

2. Fix a wire joining the origin to the upper tip P′ (x, y, z) of this perpendicular rod.

3. The distance of point P on xy-plane with coordinates (x, y) from the origin is $\sqrt{x^2 + y^2}$.

4. The distance of P′ with coordinates (x, y, z) in space from the origin is
$$\sqrt{\left(\sqrt{x^2 + y^2}\right)^2 + z^2} = \sqrt{x^2 + y^2 + z^2} .$$

OBSERVATION

1. The three planes are intersecting at right angles at a point and they divide the space into _____ parts. Each part is called an _____.

2. Distance of the point $(5, 4)$ on the xy plane from origin is _____.

3. Distance of the point $(3, 2, 1)$ from the origin is _____.

4. If we fix a wire perpendicular to any of the planes, then it will represent _____ to plane.

5. If two normals are drawn to any two of the planes, then these normals are _____ to each other.

APPLICATION

1. Model can be used to visualise the position and coordinates of a point in space.

2. Model can be used to explain the distance of the origin from a point in the plane or in the space.

3. Model can also be used to explain the concept of a normal to a plane.