Activity 1

Objective

To construct a square-root spiral.

Material Required

Coloured threads, adhesive, drawing pins, nails, geometry box, sketch pens, marker, a piece of plywood.

Method of Construction

1. Take a piece of plywood with dimensions 30 cm × 30 cm.
2. Taking 2 cm = 1 unit, draw a line segment AB of length one unit.
3. Construct a perpendicular BX at the line segment AB using set squares (or compasses).
4. From BX, cut off BC = 1 unit. Join AC.
5. Using blue coloured thread (of length equal to AC) and adhesive, fix the thread along AC.
6. With AC as base and using set squares (or compasses), draw CY perpendicular to AC.
7. From CY, cut-off CD = 1 unit and join AD.

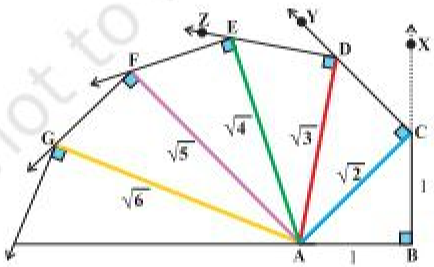

Fig. 1

8. Fix orange coloured thread (of length equal to AD) along AD with adhesive.
9. With AD as base and using set squares (or compasses), draw DZ perpendicular to AD.
10. From DZ, cut off DE = 1 unit and join AE.
11. Fix green coloured thread (of length equal to AE) along AE with adhesive [see Fig. 1].

Repeat the above process for a sufficient number of times. This is called "a square root spiral".

Demonstration

1. From the figure, $AC^2 = AB^2 + BC^2 = 12 + 12 = 2$ or $AC = \sqrt{2}$.

   $AD^2 = AC^2 + CD^2 = 2 + 1 = 3$ or $AD = \sqrt{3}$.

2. Similarly, we get the other lengths AE, AF, AG, ... as $\sqrt{4}$ or 2, $\sqrt{5}$, $\sqrt{6}$ ....

Observation

On actual measurement

AC = ... , AD = ... , AE = ... , AF = ... , AG = ...

$\sqrt{2}$ = AC = ... (approx.),

$\sqrt{3}$ = AD = ... (approx.),

$\sqrt{4}$ = AE = ... (approx.),

$\sqrt{5}$ = AF = ... (approx.)

Application

Through this activity, existence of irrational numbers can be illustrated.

Activity 6

OBJECTIVE

To verify the algebraic identity :

$(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

MATERIAL REQUIRED

Hardboard, adhesive, coloured papers, white paper.

METHOD OF CONSTRUCTION

1. Take a hardboard of a convenient size and paste a white paper on it.
2. Cut out a square of side a units from a coloured paper [see Fig. 1].
3. Cut out a square of side b units from a coloured paper [see Fig. 2].
4. Cut out a square of side c units from a coloured paper [see Fig. 3].
5. Cut out two rectangles of dimensions $a \times b$, two rectangles of dimensions $b \times c$ and two rectangles of dimensions $c \times a$ square units from a coloured paper [see Fig. 4].

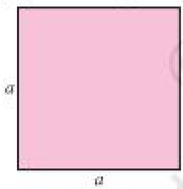

Fig. 1

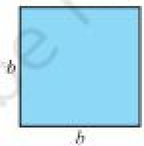

Fig. 2

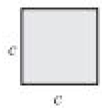

Fig. 3

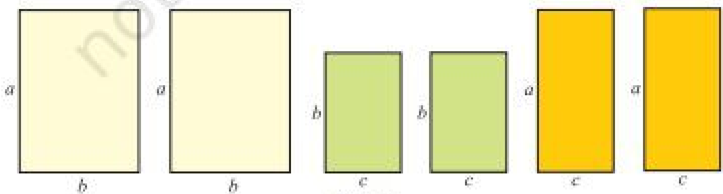

Fig. 4

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6. Arrange the squares and rectangles on the hardboard as shown in Fig. 5.

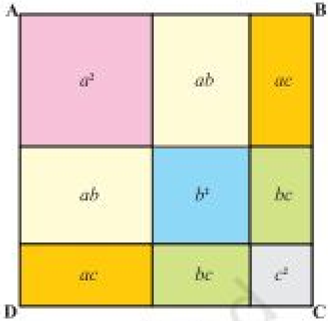

Fig. 5

Demonstration

From the arrangement of squares and rectangles in Fig. 5, a square ABCD is obtained whose side is $(a+b+c)$ units.

Area of square ABCD = $(a+b+c)^2$.

Therefore, $(a+b+c)^2$ = sum of all the squares and rectangles shown in Fig. 1 to Fig. 4.

$= a^2 + ab + ac + ab + b^2 + bc + ac + bc + c^2$

$= a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

Here, area is in square units.

Observation

On actual measurement:

a = ..., b = ..., c = ...,

So, a^2 = ..., b^2 = ..., c^2= ...., ab= ....,

bc= ...., ca = ..., $2ab$ = ..., $2bc$ = ...,

$2ca$= ...., $a+b+c$ = ..., $(a+b+c)^2$ = ...,

Therefore, $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

Application

The identity may be used for

1. simiplification/factorisation of algebraic expressions
2. calculating the square of a number expressed as a sum of three convenient numbers.

Activity 12

Objective

To find a hidden picture by plotting and joining the various points with given coordinates in a plane.

Material Required

Cardboard, white paper, cutter, adhesive, graph paper/squared paper, geometry box, pencil.

Method of Construction

1. Take a cardboard of a convenient size and paste a white paper on it.
2. Take a graph paper and paste it on the white paper.
3. Draw two rectangular axes X′OX and Y′OY as shown in Fig. 1.
4. Plot the points A, B, C, ... with given coordinates (a, b), (c, d), (e, f), ..., respectively as shown in Fig. 2.
5. Join the points in a given order say A→B→C→D→.....→A [see Fig. 3].

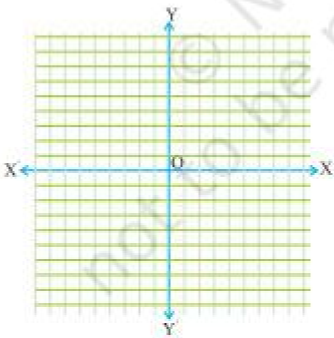

Fig. 1

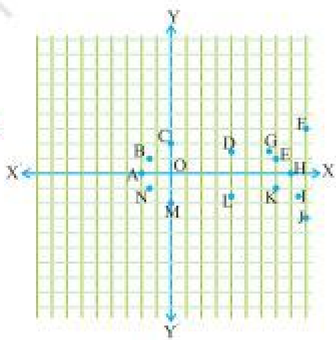

Fig. 2

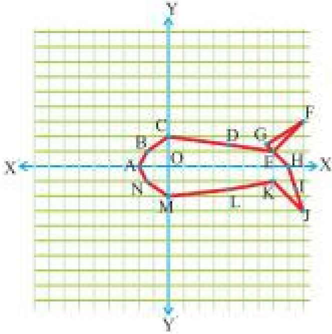

Fig. 3

Demonstration

By joining the points as per given instructions, a 'hidden' picture of an 'aeroplane' is formed.

Observation

In Fig. 3:

Coordinates of points A, B, C, D, ...

are ...., ..., ..., ..., ..., ..., ...

Hidden picture is of _____________.

Application

This activity is useful in understanding the plotting of points in a cartesian plane which in turn may be useful in preparing the road maps, seating plan in the classroom, etc.

Activity 16

Objective

To verify exterior angle property of a triangle.

Material Required

Hardboard sheet, adhesive, glazed papers, sketch pens/pencils, drawing sheet, geometry box, tracing paper, cutter, etc.

Method of Construction

1. Take a hardboard sheet of a convenient size and paste a white paper on it.
2. Cut out a triangle from a drawing sheet/glazed paper and name it as ΔABC and paste it on the hardboard, as shown in Fig. 1.
3. Produce the side BC of the triangle to a point D as shown in Fig. 2.

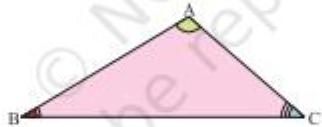

Fig. 1

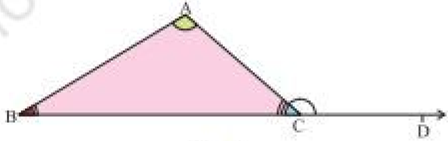

Fig. 2

4. Cut out the angles from the drawing sheet equal to ∠A and ∠B using a tracing paper [see Fig. 3].
5. Arrange the two cutout angles as shown in Fig. 4.

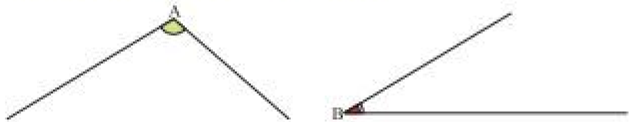

Fig. 3

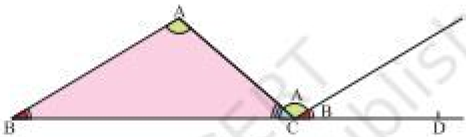

Fig. 4

Demonstration

∠ACD is an exterior angle.

∠A and ∠B are its two interior opposite angles.

∠A and ∠B in Fig. 4 are adjacent angles.

From the Fig. 4, ∠ACD = ∠A + ∠B.

Observation

Measure of ∠A= __________, Measure of ∠B = __________, Sum (∠A + ∠B) = _______, Measure of ∠ACD = ______.

Therefore, ∠ACD = ∠A + ∠B.

Application

This property is useful in solving many geometrical problems.

Activity 17

Objective

To verify experimentally that the sum of the angles of a quadrilateral is 360°.

Material Required

Cardboard, white paper, coloured drawing sheet, cutter, adhesive, geometry box, sketch pens, tracing paper.

Method of Construction

1. Take a rectangular cardboard piece of a convenient size and paste a white paper on it.
2. Cut out a quadrilateral ABCD from a drawing sheet and paste it on the cardboard [see Fig. 1].
3. Make cut-outs of all the four angles of the quadrilateral with the help of a tracing paper [see Fig. 2]

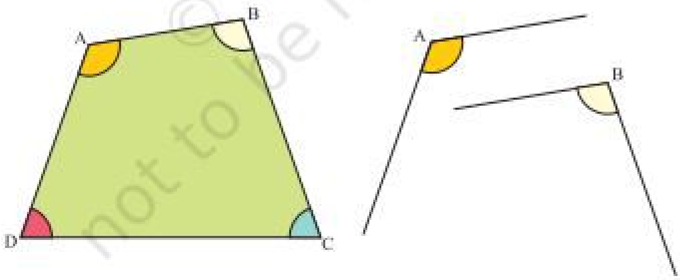

Fig. 1

Fig. 2

4. Arrange the four cut-out angles at a point O as shown in Fig. 3.

Demonstration

1. The vertex of each cut-out angle coincides at the point O.
2. Such arrangement of cut-outs shows that the sum of the angles of a quadrilateral forms a complete angle and hence is equal to 360°.

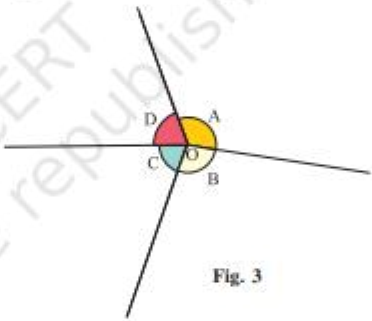

Fig. 3

Observation

Measure of ∠A = ---------.

Measure of ∠B = ----------. Measure of ∠C = ---------.

Measure of ∠D = ----------. Sum [∠A+ ∠B+ ∠C+ ∠D] = ------------.

Application

This property can be used in solving problems relating to special types of quadrilaterals, such as trapeziums, parallelograms, rhombuses, etc.

Activity 18

OBJECTIVE

To verify experimentally that in a triangle, the longer side has the greater angle opposite to it.

MATERIAL REQUIRED

Coloured paper, scissors, tracing paper, geometry box, cardboard sheet, sketch pens.

METHOD OF CONSTRUCTION

1. Take a piece of cardboard of a convenient size and paste a white paper on it.
2. Cut out a ΔABC from a coloured paper and paste it on the cardboard [see Fig. 1].
3. Measure the lengths of the sides of ΔABC.
4. Colour all the angles of the triangle ABC as shown in Fig. 2.
5. Make the cut-out of the angle opposite to the longest side using a tracing paper [see Fig. 3].

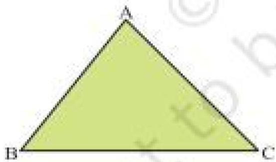

Fig. 1

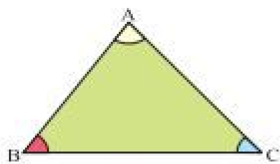

Fig. 2

Fig. 3

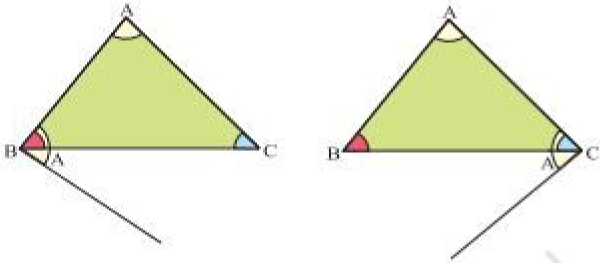

Fig. 4

Demonstration

Take the cut-out angle and compare it with other two angles as shown in Fig. 4.

$\angle A$ is greater than both $\angle B$ and $\angle C$.

i.e., the angle opposite the longer side is greater than the angle opposite the other side.

Observation

Length of side AB = ...

Length of side BC = ...

Length of side CA = ...

Measure of the angle opposite to longest side = ...

Measure of the other two angles = ... and ....

The angle opposite the .... side is .... than either of the other two angles.

Application

The result may be used in solving different geometrical problems.

Activity 20

Objective

To verify that the triangles on the same base and between the same parallels are equal in area.

Material Required

A piece of plywood, graph paper, pair of wooden strips, colour box , scissors, cutter, adhesive, geometry box.

Method of Construction

1. Cut a rectangular plywood of a convenient size.
2. Paste a graph paper on it.
3. Fix any two horizontal wooden strips on it which are parallel to each other.
4. Fix two points A and B on the paper along the first strip (base strip).
5. Fix a pin at a point, say at C, on the second strip.
6. Join C to A and B as shown in Fig. 1.

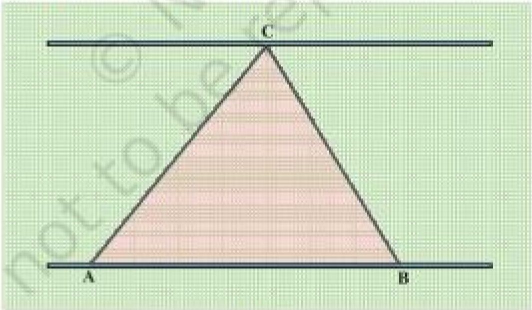

Fig. 1

7. Take any other two points on the second strip say C′ and C″ [see Fig. 2].
8. Join C′A, C′B, C″A and C″B to form two more triangles.

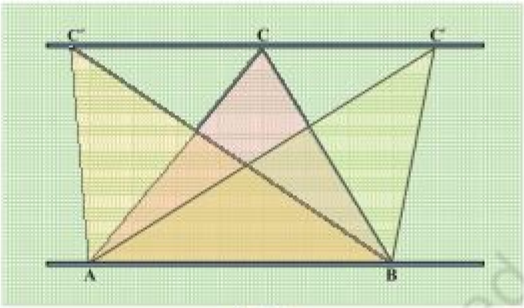

Fig. 2

Demonstration

1. Count the number of squares contained in each of the above triangles, taking half square as $\frac{1}{2}$ and more than half as 1 square, leaving those squares which contain less than $\frac{1}{2}$ squares.
2. See that the area of all these triangles is the same. This shows that triangles on the same base and between the same parallels are equal in area.

Observation

1. The number of squares in triangle ABC =.........., Area of ΔABC = ... units
2. The number of squares in triangle ABC$'$ =......., Area of D ABC$'$ = ... units
3. The number of squares in triangle ABC$''$ =....... , Area of D ABC$''$ = ... units

   Therefore, area (ΔABC) = ar(ABC$'$) = ar(ABC$''$).

Application

This result helps in solving various geometric problems. It also helps in finding the formula for area of a triangle.

Activity 21

Objective

To verify that the ratio of the areas of a parallelogram and a triangle on the same base and between the same parallels is 2:1.

Material Required

Plywood sheet of convenient size, graph paper, colour box, a pair of wooden strips, scissors, cutter, adhesive, geometry box.

Method of Construction

1. Take a rectangular plywood sheet.
2. Paste a graph paper on it.
3. Take any pair of wooden strips or wooden scale and fix these two horizontally so that they are parallel.
4. Fix any two points A and B on the base strip (say Strip I) and take any two points C and D on the second strip (say Strip II) such that AB = CD.
5. Take any point P on the second strip and join it to A and B [see Fig. 1].

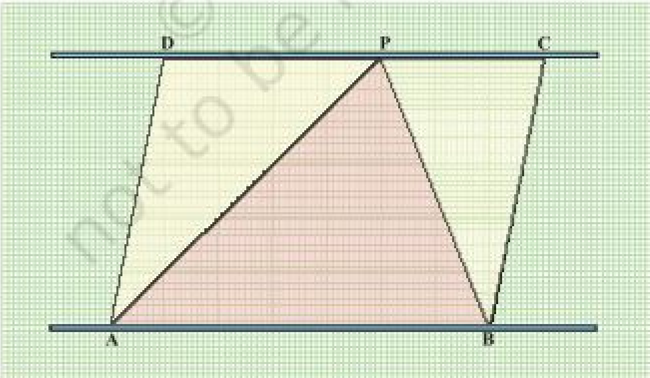

Fig. 1

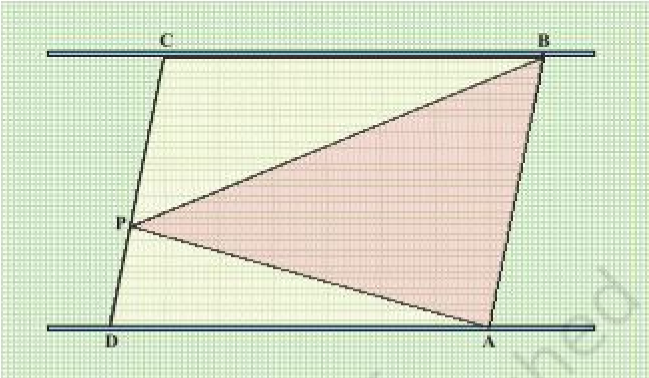

Fig. 2

Demonstration

1. AB is parallel to CD and P is any point on CD.
2. Triangle PAB and parallelogram ABCD are on the same base AB and between the same parallels.
3. Count the number of squares contained in each of the above triangle and parallelograms, keeping half square as $\frac{1}{2}$ and more than half as 1 square, leaving those squares which contain less than half square.
4. See that area of the triangle PAB is half of the area of parallelograms ABCD.

Observation

1. The number of squares in triangle PAB =..............
2. The number of squares in parallelogram ABCD =.............. .

   So, the area of parallelogram ABCD = 2 [Area of triangle PAB]

   Thus, area of parallelogram ABCD : area of DPAB = ... : ....

Activity 23

Objective

To verify that the angles in the same segment of a circle are equal.

Material Required

Geometry box, coloured glazed papers, scissors, cardboard, white paper and adhesive.

Method of Construction

1. Take a cardboard of suitable size and paste a white paper on it.
2. Take a sheet of glazed paper and draw a circle of radius a units on it [see Fig. 1].
3. Make a cut-out of the circle and paste it on the cardboard.
4. Take two points A and B on the circle and join them to form chord AB [see Fig. 2].
5. Now take two points C and D on the circle in the same segment and join AC, BC, AD and BD [see Fig. 3].
6. Take replicas of the angles ∠ACB and ∠ADB.

Fig. 1

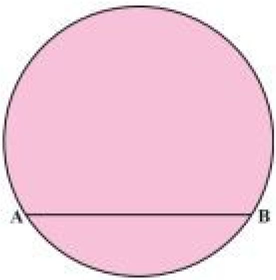

Fig. 2

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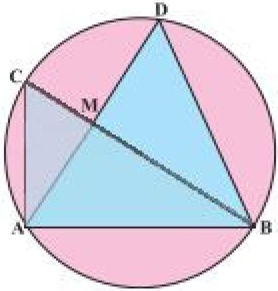

Fig. 3

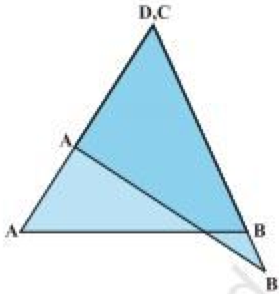

Fig. 4

Demonstration

Put the cut-outs of ∠ACB and ∠ADB on each other such that vertex C falls on vertex D [see Fig. 4]. In Fig. 4, ∠ACB covers ∠ADB completely. So, ∠ACB = ∠ADB.

Observation

On actual measurement:

∠ACB = --------------, ∠ADB = --------------

So, ∠ACB = ∠ADB. Thus, angles in the same segment are ---------.

Application

This result may be used in proving other theorems/riders of geometry related to circles.

Activity 30

Objective

To find a formula for the curved surface area of a right circular cylinder, experimentally.

Material Required

Coloured chart paper, cellotape, ruler.

Method of Construction

1. Take a rectangular chart paper of length l units and breadth b units [see Fig. 1].
2. Fold this paper along its breadth and join the two ends by using cellotape and obtain a cylinder as shown in Fig. 2.

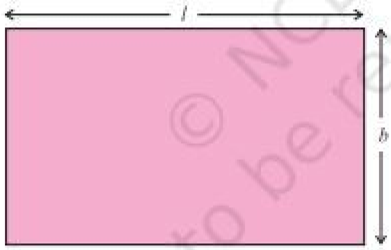

Fig. 1

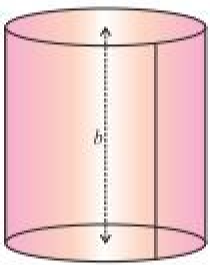

Fig. 2

Demonstration

1. Length of the rectangular paper = l = circumference of the base of the cylinder = $2\pi r$, where r is the radius of the cylinder.
2. Breadth of the rectangular paper = b = height (h) of the cylinder.
3. The curved surface area of the cylinder is equal to the area of the rectangle $= l \times b = 2\pi r \times h = 2\pi rh$ square units.

Observation

On actual measurement :

$l =$ ...., $b =$ ....,

$2\pi r = l =$ ...., $h = b =$ ....,

Area of the rectangular paper $= l \times b =$ ....

Therefore, curved surface area of the cylinder $= 2\pi rh$.

Application

This result can be used in finding the material used in making cylindrical containers, i.e., powder tins, drums, oil tanks used in industrial units, overhead water tanks, etc.