Activity 61

Objective

To verify Pythagoras Theorem using a grid paper

Material Required

Grid paper, cardboard, pen/pencil, sketch pens of different colours, adhesive, scissors, ruler.

Method of Construction

1. Take a cardboard of convenient size and paste a grid paper on it.
2. Draw a right triangle ABC of sides 3 cm, 4 cm and 5 cm as shown in Fig. 1.

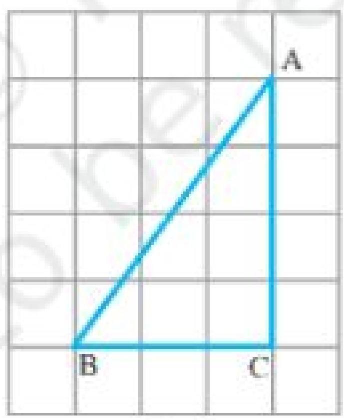


Fig. 1

3. Draw squares on sides AB, BC and CA. Colour square on AC with red and square on BC as blue.
4. Make a cut out of the square on side AC and take out its 16 unit squares in the form of strips each of 4 unit squares.
5. Make a cut out of the square on side BC.

Demonstration

1. Arrange 16 unit squares (red) along the side of the square on AC as shown in Fig. 2.

2. Place the cut out of square on BC (blue) on the remaining part of the square on side AB as shown in Fig. 2.

3. Square on AB is now completely covered with the 16 unit squares (red) and 9 unit squares (blue).

4. Area of square on AC + Area of square on BC = Area of square on AB.

   i.e., $AC^2 + BC^2 = AB^2$

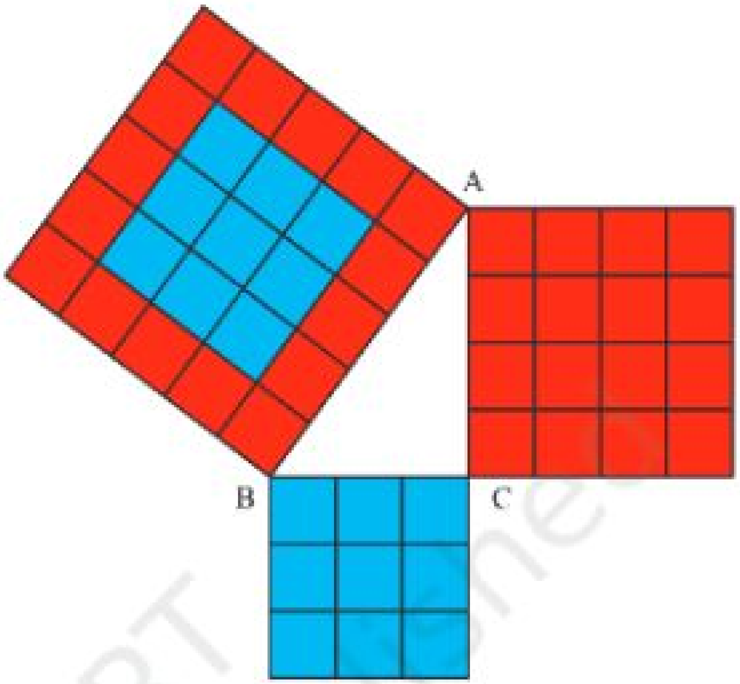


Fig. 2

Observation

Area of square on side AC = _____ square units.

Area of square on side BC = _____ square units.

Area of square on side AB = Area of square on side____ + Area of square on side____.

$AB^2 = AC^2 +$ ____.

Application

1. Whenever any two sides of a right triangle are given, the third side can be found out using this result.

2. Pythagoras theorem is helpful in studying problems related to right angled triangles such as ladder and window problems.

Activity 62

Objective

To verify Pythagoras Theorem for an isosceles right triangle

Material Required

Cardboard, plain sheets, adhesive, scissors, sketch pens, pencil, tracing paper, geometry box.

Method of Construction

1. Take a piece of cardboard of convenient size and paste a white paper on it.
2. Draw an isosceles right triangle of suitable size on a paper and cut it out. Paste this triangle on the cardboard and name it as ABC (Fig. 1).

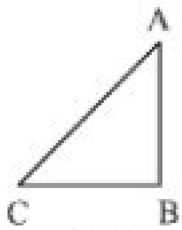


Fig. 1

3. Draw squares on sides AB, BC and AC (Fig. 1).
4. Make cutouts of these two squares on AB and BC using tracing paper in two different colours say purple and blue.
5. Cut each of these squares along one of the diagonals and obtain 4 right triangles.

Demonstration

1. Arrange the cut out triangles in the square on side AC of the triangle as shown in Fig. 2.
2. Four cut out triangles exactly cover the square on side AC of the triangle.

3. Square on side AC is made up of two isosceles purple triangles and two isosceles blue triangles.

4. Square on side AC = Square on side BC + Square on side AB

   or $AC^2 = BC^2 + AB^2$.

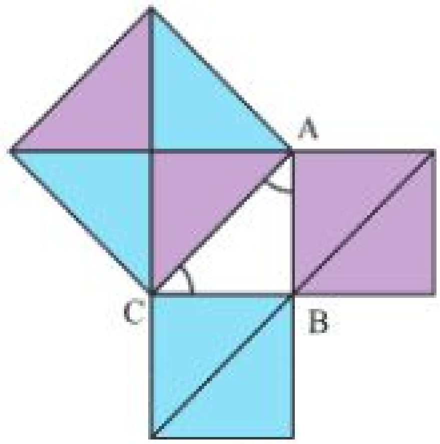


Fig. 2

Observation

On actual measurement (in centimetres)

1. AB = ____. BC = ____.

   CA = ____

   so, AB^2 = ____. BC^2 = ____.

   CA^2 = ____.

   $AB^2 + BC^2$ = ____.

Applications

1. Whenever two, out of three sides of a right triangle are given, the third side can be found out by using Pythagoras Theorem.

2. Pythagoras Theorem can be used to solve problems related to ladder and wall, heights and distances etc.

NOTE This Activity can also be performed by using 45° – 45° – 90° set squares.

Activity 63

Objective

To verify Pythagoras Theorem for a right triangle with one angle 30°

Material Required

Cardboard, plain sheets of paper, adhesive, scissors, sketch pens, pencil, tracing paper, geometry box.

Method of Construction

1. Take a piece of cardboard of convenient size and paste a white paper on it.
2. Draw a right triangle with one angle 30° of a suitable size on a paper and cut it out. Paste this triangle on the cardboard and name it as ABC.
3. Draw squares on sides AB, BC and AC of the triangle as shown in Fig.1.

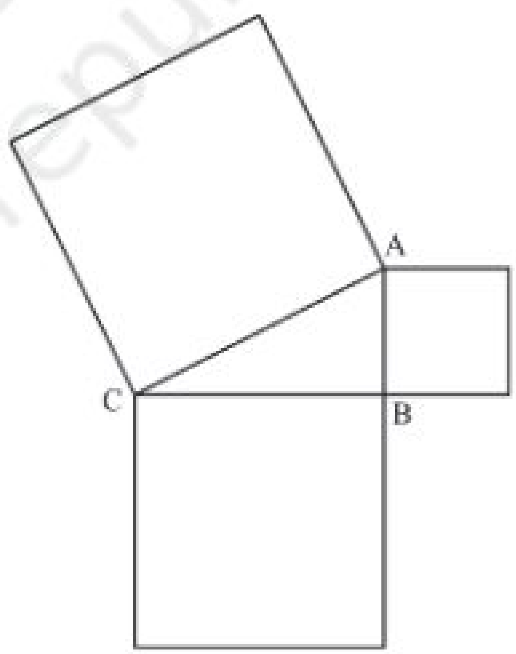


Fig. 1

4. Make cutouts of the squares on sides AB and BC. Divide the cut out of the square on BC into 4 identical right triangles by paper folding/ cutting as shown in Fig. 2.

Demonstration

1. Arrange these 4 triangles and the square on side AB in the square on side AC as shown in Fig. 2.
2. Four cut out triangles and the square on side AB exactly covers the square on side AC of triangle ABC.
3. Square on side AC is made up of four identical right triangles and the square on side AB.
4. Square on side AC = Square on side BC + Square on side AB.

or $AC^2 = BC^2 + AB^2$.

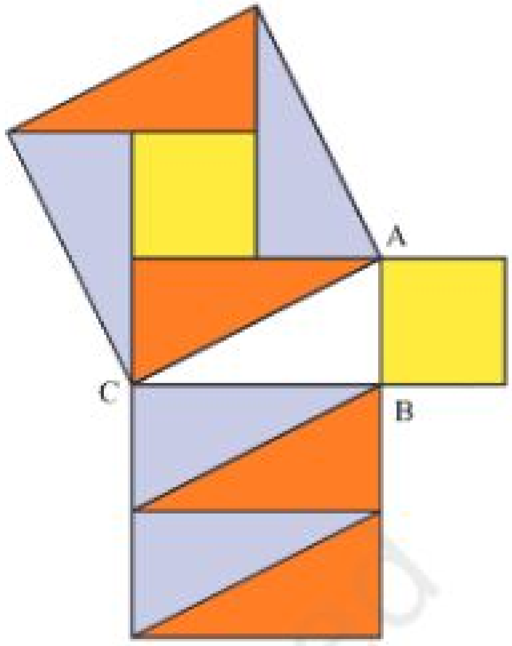


Fig. 2

Observation

1. On actual measurement (in centimetres)

   AB = ____, BC = ____, CA = ____.

2. AB^2 = ____, BC^2 = ____, CA^2 = ____.
3. $AB^2 + BC^2$ = ____, BC^2 = ____ + ____.
4. $AB^2 + BC^2$ = ___.

Application

1. Whenever two out of three sides of a right triangle are given, the third side can be found by using Pythagoras Theorem.
2. Pythagoras Theorem can be used to solve problems related to ladder and wall, heights and distances etc.

NOTE

This activity can also be performed by using 30° – 60° – 90° set squares and the square on the smallest side of the set square.

Activity 64

Objective

To verify that if two parallel lines are intersected by a transversal, then

(i) the pairs of corresponding angles are equal.

(ii) the pairs of alternate interior angles are equal.

(iii) the pairs of interior angles on the same side of the transversal are supplementary.

Material Required

Drawing board, drawing pins, wires/thread, broomsticks, pen, adhesive, chart paper/glaze paper.

Method of Construction

1. Take a drawing board paste a white chart paper on it.
2. With the help of a ruler draw two parallel lines AB and CD on the board as shown in Fig. 1.
3. Draw a transversal EF intersecting the two lines AB and CD.
4. Mark the angles so formed as ∠1, ∠2, ∠3, ∠4, ∠5, ∠6, ∠7 and ∠8. (see Fig. 2).
5. Make cutouts of these angles.

Fig. 1

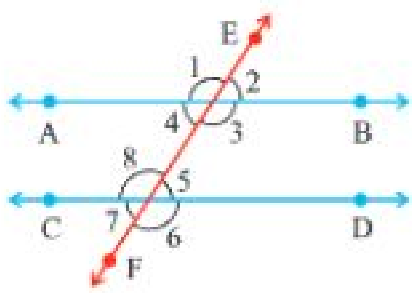


Fig. 2

Demonstration

1. Place the cut out of $\angle 1$ on $\angle 8$ and see whether $\angle 1 = \angle 8$. Now place cut out of $\angle 2$ on $\angle 5$ and see whether $\angle 2 = \angle 5$. Similarly, check the equality of $\angle 3$ and $\angle 6$, $\angle 4$ and $\angle 7$. These pairs of angles are corresponding angles.
2. Take the cut out of $\angle 4$ and place it on $\angle 5$ and see whether $\angle 4 = \angle 5$. Similarly, check that $\angle 3 = \angle 8$. These pairs are alternate interior angles.
3. Place the cut out of $\angle 3$ and $\angle 5$ adjacent to each other as shown in Fig. 3.
4. With the help of a ruler, check that their non common arms are in the same line and hence supplementary. Similarly, check for $\angle 4$ and $\angle 8$. These are pairs of interior angles on the same side of the transversal.

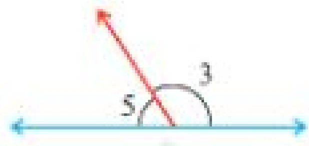


Fig. 3

Observations

S. No.	Angles	Type	Are they Equal/ supplementary	Inference
1.	$\angle 1$ and $\angle 8$	Corresponding	Equal	Corresponding
	$\angle 4$ and $\angle 7$	angles	—	angles are equal
	$\angle 2$ and $\angle 5$		—	
	$\angle 3$ and $\angle 6$		—	
2.	$\angle 4$ and $\angle 5$	—	—	
	$\angle 3$ and $\angle 8$	—	—	
3.	$\angle 4$ and $\angle 8$	—	—	
	$\angle 3$ and $\angle 5$	—	—	

Application

1. This activity may be used to verify that the pairs of vertically opposite angles are equal.
2. The results are useful in solving a number of geometrical problems.

Activity 65

Objective

To verify that the sum of three angles of a triangle is 180°

Material Required

Coloured paper/drawing sheet, colours, adhesive, scissors, cardboard.

Method of Construction

1. Take a cardboard of convenient size and paste a coloured paper/drawing sheet on it.

2. Cut out two identical triangles using paper.

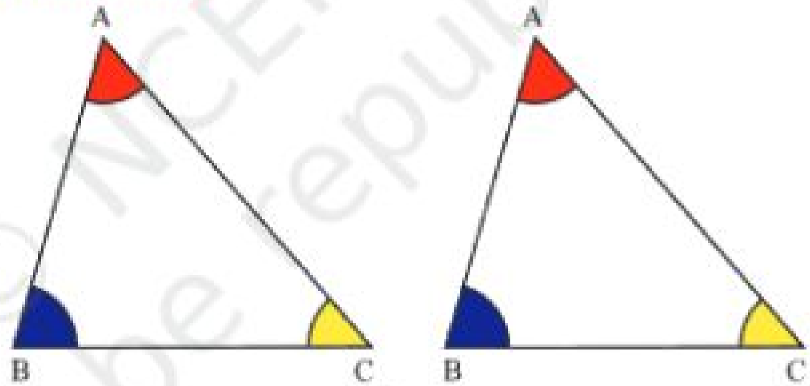


Fig. 1

3. Colour the angles as shown in Fig. 1.

4. Cut out the three angles of one triangle as shown (Fig. 2).

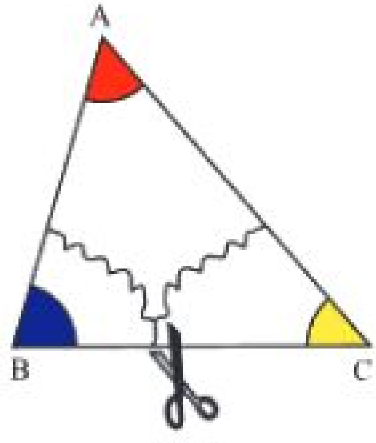


Fig. 2

5. Now paste the three cutouts adjacent to each other with their vertices at a common point P on the cardboard (Fig. 3).

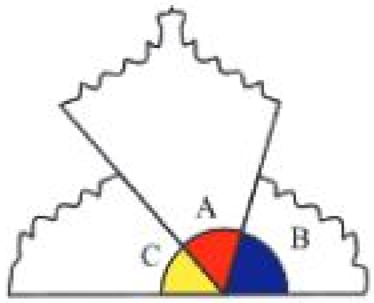


Fig. 3

Demonstration

The cutouts of the three angles A, B and C placed adjacent to each other at a point P have the arms of angles of $\angle A$ and $\angle C$ as opposite rays and hence form a straight angle.

Therefore, angles A, B and C form a straight angle.

Therefore $\angle A + \angle B + \angle C = 180^\circ$.

Observation

Measure of $\angle A$ = _______.

Measure of $\angle B$ = _______.

Measure of $\angle C$ = _______.

$\angle A + \angle B + \angle C$ = _______.

Thus, sum of three angles of a triangle is _______.

Application

This result is used in a number of geometrical problems such as to find the sum of angles of a polygon such as quadrilateral, pentagon etc.

Activity 66

Objective

To obtain formula for the area of a parallelogram

Material Required

Coloured paper, adhesive, scissors, drawing sheet, pen/pencil.

Method of Construction

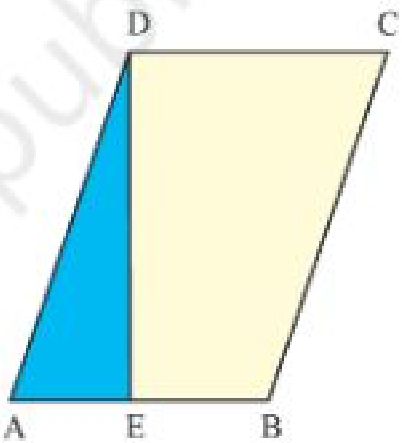


Fig. 1

1. Take a coloured paper and make a parallelogram through paper folding or draw a parallelogram on a paper.
2. Name the parallelogram as ABCD and cut it out. Paste it on a drawing sheet. Through D make DE ⊥ AB by paper folding (Fig. 1).
3. Cut out Δ ADE and paste it along the other side of the parallelogram such that DA is adjacent to CB as shown in Fig. 2.

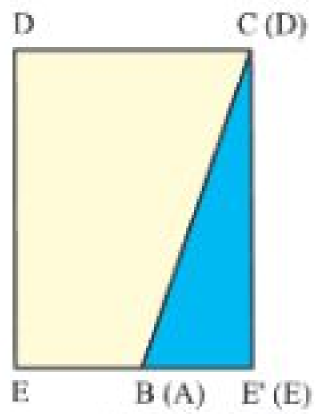


Fig. 2

Demonstration

1. The breadth of rectangle DEE′C is the height of parallelogram ABCD.
2. Length of rectangle DEE′C is the base of parallelogram ABCD.

3. Area of parallelogram ABCD = area of rectangle DEE′C

= Length × Breadth

= Base of parallelogram × Height of parallelogram

= $b \times h$.

OBSERVATION

On actual measurement.

Length of the rectangle = _______.

Breadth of the rectangle = _______.

Area of the rectangle = _______.

Area of parallelogram = Area of rectangle = ____ × ____.

APPLICATION

The result is used for explaining the formula for Area of a triangle.

Activity 67

Objective

To make a rhombus by paper folding and cutting

Material Required

Cardboard, pen/pencil, coloured paper, scissor and adhesive.

Method of Construction

1. Take a rectangular sheet of coloured paper and fold it such that one part exactly covers the other part as shown in Fig. 1.

Fig. 1

2. Fold it again as shown in Fig. 2.

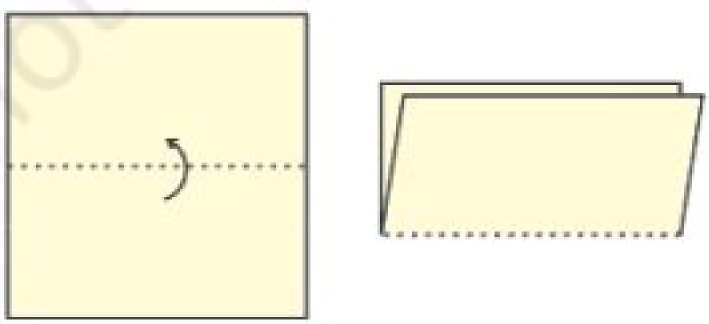


Fig. 2

3. Fold it again as shown in Fig. 3.

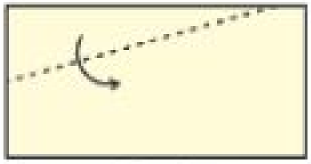


Fig. 3

4. Unfold the sheet and mark the crease with pencil as shown in Fig. 4.

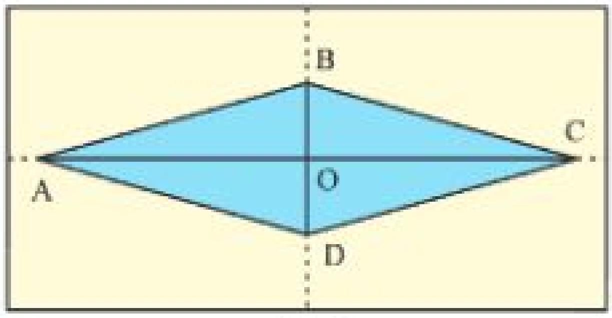


Fig. 4

5. Now cut out the figure ABCD and paste it on a cardboard.

Demonstration

1. AB = BC = CD = DA as they have been obtained by paper folding.

2. ∠AOD = ∠COD = 90°, so, AC ⊥ BD.

Thus figure ABCD is a rhombus.

Observation

On actual measurement:

OC	= _____.	OA	= _____.
OD	= _____.	OB	= _____.
∠DOC	= _____.	∠DOA	= _____.
∠BOC	= _____.	∠BOA	= _____.
AB	= _____.	BC	= _____.
CD	= _____.	DA	= _____.

AC and DB are __________ bisector of each other.

ABCD is a __________.

Application

This activity can be used in understanding the shape of a rhombus and also to explain its properties.

Activity 68

Objective

To make a rectangle by paper folding

Material Required

Cardboard, coloured paper, pencil/pen, adhesive.

Method of Construction

1. Take a sheet and fold it to get a crease. Name the crease as AB as shown in Fig. 1.

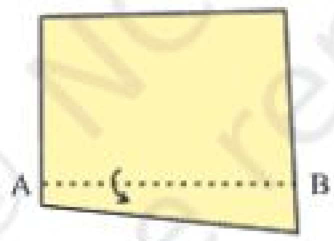


Fig. 1

2. Make CD perpendicular to AB by paper folding as shown in Fig. 2.

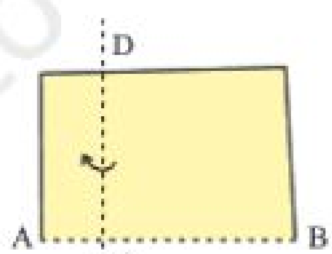


Fig. 2

3. Make EF ⊥ CD by paper folding (see Fig. 3).

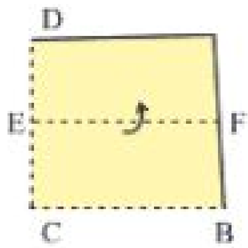


Fig. 3

4. Make GH ⊥ EF by paper folding (see Fig. 4).

5. Take the cut out of the shape ECHG and paste it on a cardboard.

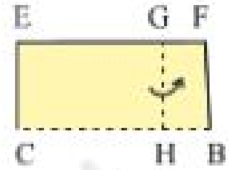


Fig. 4

DEMONSTRATION

1. CH ⊥ EC as AB ⊥ CD
2. EG ⊥ CE as EF ⊥ CD
3. GH ⊥ EG as GH ⊥ EF
4. So, ECHG is a rectangle.

OBSERVATION

On actual measurement:

EG = _____ ; CH = _____.

EC = _____ ; GH = _____.

∠ECH = _____ , ∠CHG = _____ , ∠HGE = _____ , ∠GEC = _____ .

So, ECHG is a _____.

APPLICATION

The activity may be used to understand the properties of a rectangle.

NOTE Similar activity can be done to make a square.

Activity 69

Objective

To make a square by paper folding

Material Required

Cardboard, thick paper/pen, pencil, adhesive.

Method of Construction

1. Take a sheet of thick paper. Fold it as shown in Fig. 1.

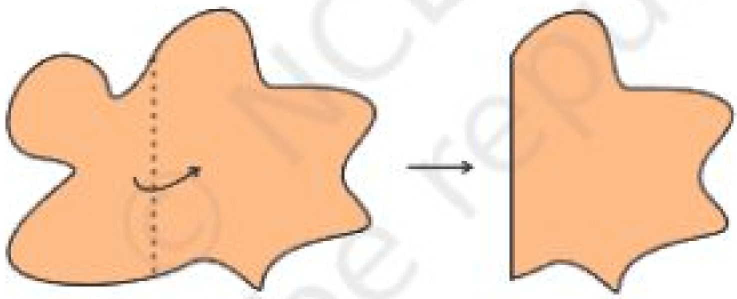


Fig. 1

2. Fold it again as shown in Fig. 2.

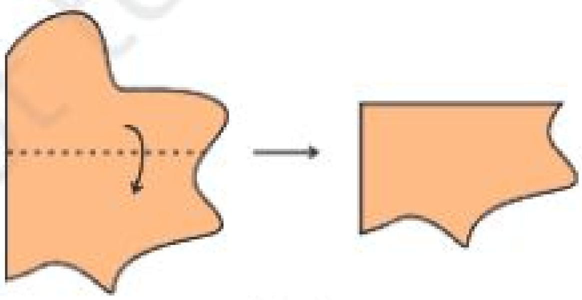


Fig. 2

3. Fold it again as in Fig. 3.

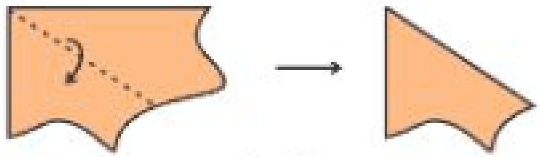


Fig. 3

4. Fold it again as in Fig. 4.

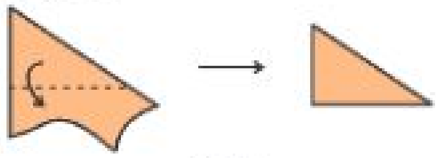


Fig. 4

5. Unfold and mark the crease as in Fig. 5.
6. Name the square as ABCD and point of intersection of diagonal AC and BD as O.
7. Cut out shape ABCD and paste it on a card board.

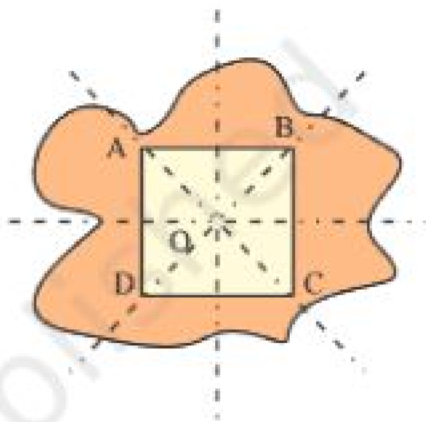


Fig. 5

DEMONSTRATION

1. From Fig. 5 DO = OB = OC = OA.
2. DB = AC.
3. AB = BC = CD = DA.
4. ABCD is a square.

OBSERVATION

On actual measurement

DB = _____ ; AC = _____.

AB = _____ ; BC = _____.

DC = _____ ; AD = _____.

ABCD is a _____.

APPLICATION

This activity may be used to understand the properties of a square.

Activity 70

Objective

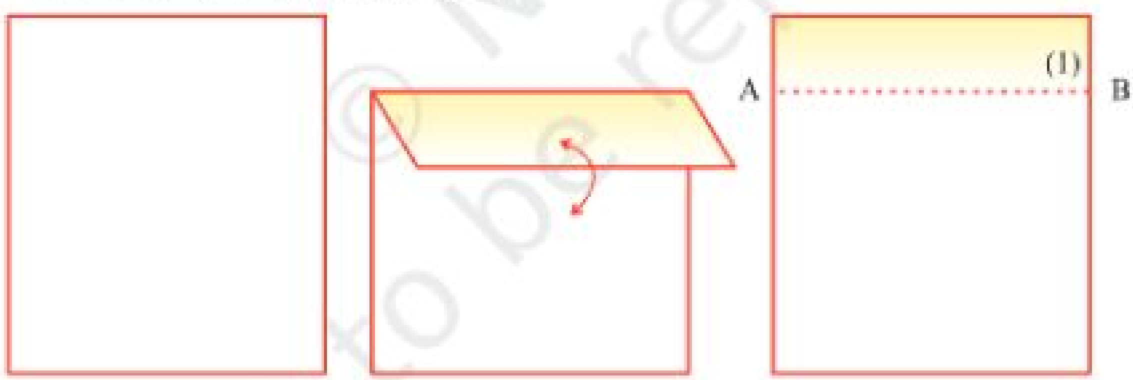
To obtain a parallelogram by paper folding

Material Required

Rectangular sheet of paper, coloured pen.

Method of Construction

1. Take a rectangular sheet of paper.
2. Fold it parallel to its breadth at a convenient distance and make a crease (1) as shown in Fig. 1.



(i) (ii) (iii)

Fig. 1

3. Obtain a crease perpendicular to crease (1) at any point on it to get a crease (2) as shown in Fig. 2. Call it as CD.

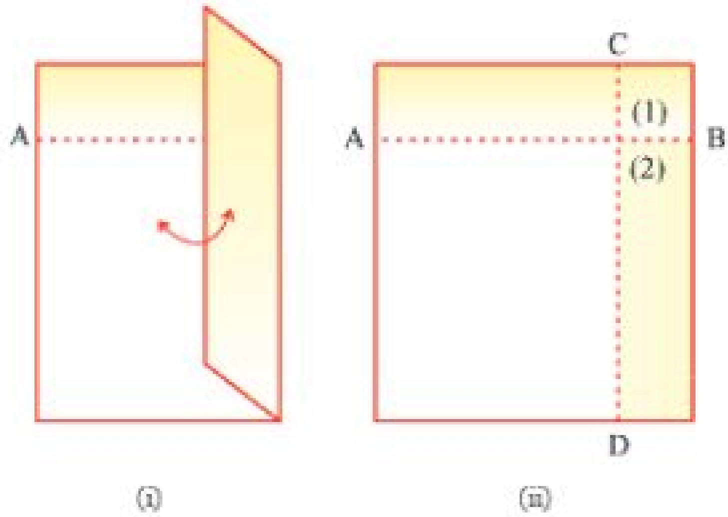


Fig. 2

4. Obtain a third crease perpendicular to crease (2) at any point on crease (2) and call it as crease (3) as shown in Fig. 3. Call it as EF.

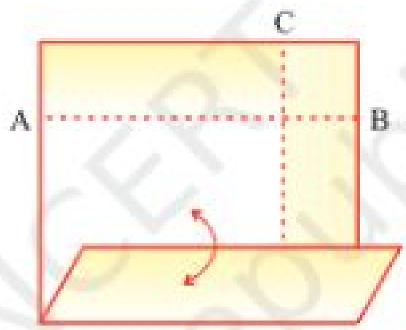


Fig. 3

5. Mark crease (1) and (3) with pen as shown in Fig. 4.

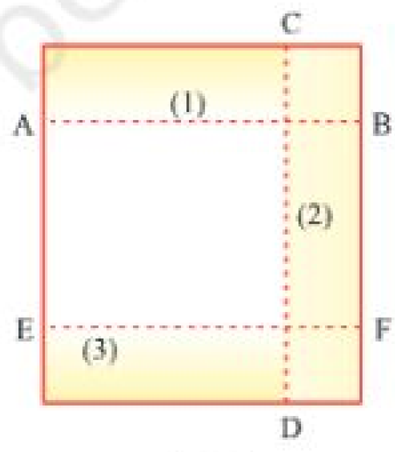


Fig. 4

6. Make a fold, cutting the creases (1) and (3) as shown in Fig. 5. Call it crease (4).

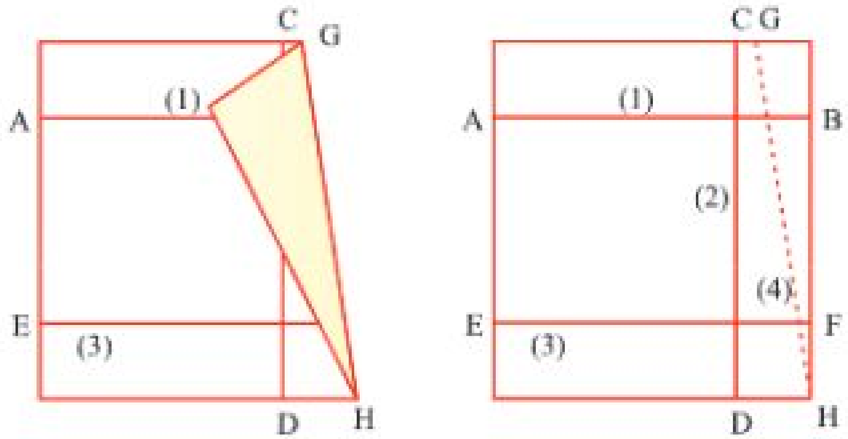


Fig. 5

7. Adopting the method used for getting a pair of parallel lines as explained in Steps 2 to 5, get a fold parallel to crease (4), call this as crease (5) as shown in Fig. 6.

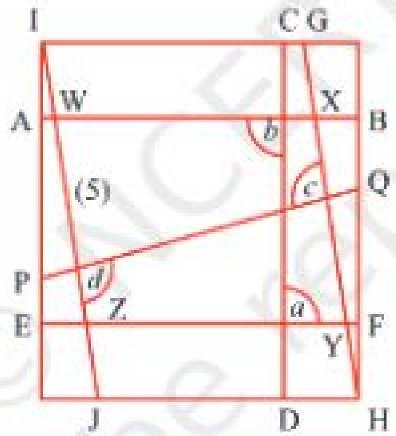


Fig. 6

Demonstration

In Fig 6, CD ⊥ AB

EF ⊥ CD

Therefore,

AB ∥ EF

PQ ⊥ GH

IJ ⊥ PQ

Therefore,

GH ∥ IJ

Thus, WXYZ is a parallelogram.

Observation

∠ a = ________

Therefore, CD ⊥ ________.

∠ b = ________

Therefore, EF ⊥ ________.

Thus,

AB ________ EF

∠ c = ________

Therefore, PQ ⊥ ________.

∠ d = ________

Therefore, IJ ⊥ ________.

Thus

GH ________ IJ

This shows that WXYZ is a ________.

Application

Construction of a rectangle can also be done using this activity.