Grade : 7

Mathematics Laboratory in Primary & Upper Primary schools

ACTIVITY 1

To represent the products of decimal numbers such as **(i) 0.7 x 0.3 (ii) 0.5 x 0.5** *on a square sheet.*

Learning Objective : To understand the multiplication of decimal numbers.

Pre-requisits : Knowledge of fractions.

Materials Required : Sketch pens, square paper, pencil and a ruler.

Procedure :

Step 1. Take a square sheet of paper.

Step 2. Divide this square into10 equal parts by drawing horizontal lines as shown in Fig. 1(a). Each part represents 1/10 = 0.1

Step 3. Shade 7 parts out of 10 so as to represent 0.7 as in fig.1(b)

Step 4. Now draw, 9 vertical lines on the same paper at equal distances such that each vertical part represents 1/10 or 0.1 as in Fig.1(c).

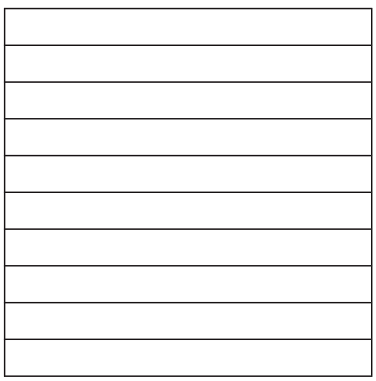


Fig 1(a)

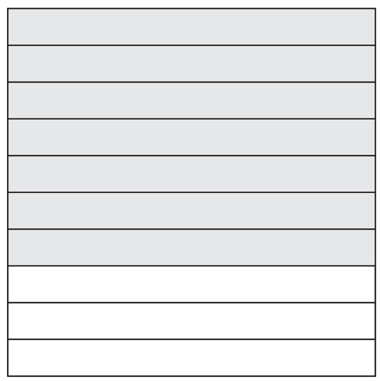


Fig 2(b)

Step 5. Shade 3 vertical parts so as to represent 0.3 as shown in Fig.1(d).

Step 6. The double shaded portion represents the product 0.3 x 0.7.

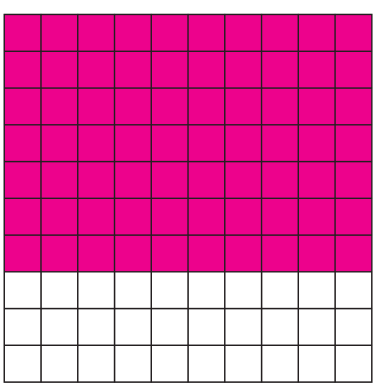


Fig 1(c)

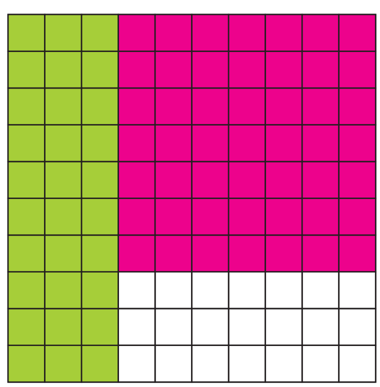


Fig 1(d)

Step 7. Follow the above Steps to represent the product 0.5 x 0.5. using another square sheet.

Observations :

(i) The square sheet has been divided into .... equal parts.

(ii) The number of equal parts in the double shaded portion is ....

(iii) The double shaded portion represents the product 0.3 x ....which is equal to ....

(iv) The product 0.5 x 0.5 = ...

ACTIVITY 2

To compare the marks obtained in all the subjects by a student in the first and second term examination, by drawing a bar graph using paper cutting and pasting.

Learning Objective : To draw and read the double bar graph and draw conclusions.

Pre-requisite : Knowledge of a bar graph and double bar graph and skill to draw a bar graph.

Materials Required : A pencil, paper sheet, sketch pens or coloured papers, a pair of scissors, glue and a ruler.

Procedure :

Step 1. Collect the data of your marks (say, out of 50) in all the subjects (English, Maths, Science, Social Science, Hindi) both in I term and II term examinations and write them in the form of a table as shown below :

	English	Maths	Hindi	Science	Social Science
I Term	35	33	22	30	26
II Term	32	38	25	34	30

Step 2. Keeping in view the minimum and maximum marks (22 and 38, in this case) choose an appropriate scale [0-40 in this case]

Step 3. Cut out strips of coloured papers of different lengths according to marks obtained in different subjects as per appropriate scale chosen already. Paste these strips as shown in the figure [Fig. 2(a)]. Make strips of one colour, say red for term I and of other colour, say green, for term II.

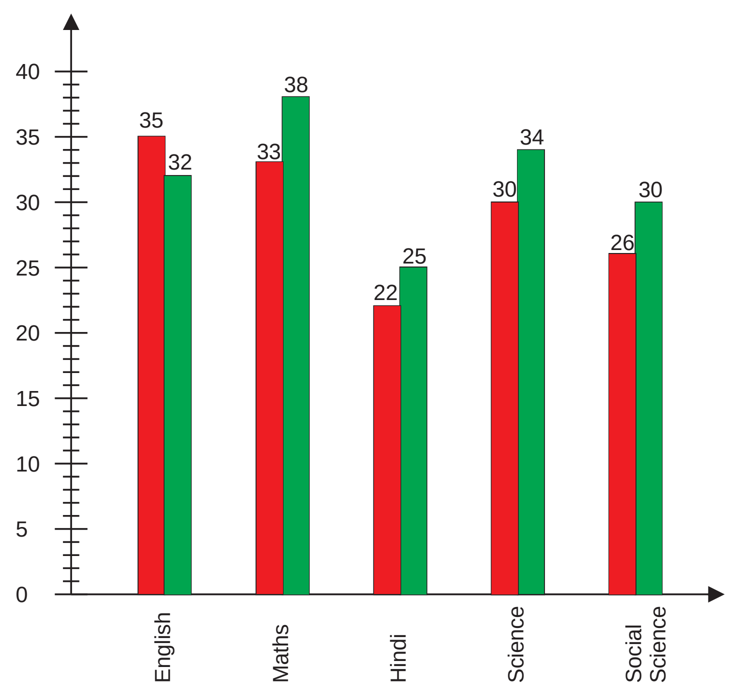


Fig 2(a)

Make a double bar graph as shown in fig.(1) taking marks on vertical axis and subjects on horizontal axis.

Observations :

(i) In which subjects there has been a downfall from I term to II term exam? ....

(ii) What do you observe from the bar graph about the Marks of II term examination?..................

(iii) In which subject (in terms of marks) is the improvement from I term to II term

(a) maximum? ....

(b) minimum? ....

(iv) In which two subjects, the increase in marks in II term is the same?

Extension : Let the students collect the data regarding monthly income and expenditure of their families. Ask them to represent the data using a double bar graph taking data of 5 families at a time.

ACTIVITY 3

To verify, by paper cutting and pasting, that if two parallel lines are intersected by a transversal, then -

(i) each pair of corresponding angles are equal

(ii) each pair of alternate interior angles are equal

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

Learning Objective : To establish the properties relating to different pairs of angles formed by a transversal with two parallel lines.

Pre-requisite : Knowledge and identification of pairs of corresponding angles, pairs of alternate interiors angles and pairs of interior angles on the same side of the transversal.

Materials Required : Sheets of white and coloured papers, a pair of scissors, glue, a geometry box, carbon paper and a pencil/pen.

Procedure :

Step 1. Draw two lines l_1 and l_2 parallel to each other and a transversal l_3 intersecting them. Label the angles thus obtained by numbers 1 to 8 [Fig. 3(a)].

Step 2. Make a cut out of $\angle 1$ on a coloured paper placing it below the figure and marking impressions by using carbon paper or tracing paper.

Step 3. Place the cutout of the angle on $\angle 5$ and check whether the two angles cover each other or not.

Note that these angles make a pair of corresponding angles.

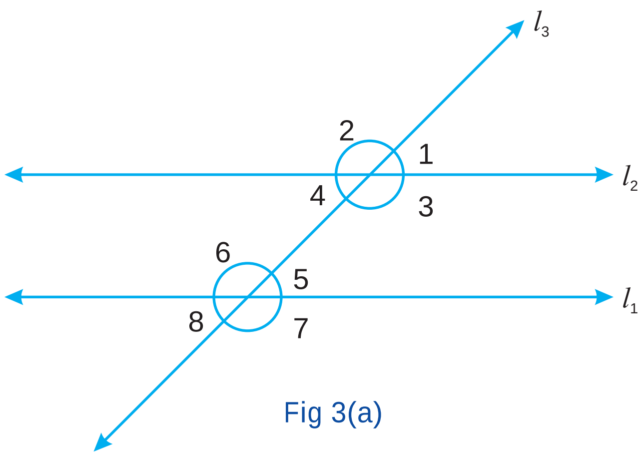


Fig 3(a)

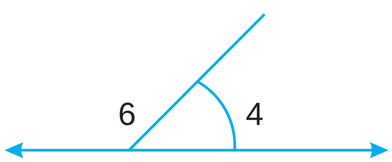


Fig 3(b)

Step 4. Identify the other pairs of corresponding angles and repeat Steps 2 and 3 to check whether the two angles cover each other or not.

Step 5. Observe the pair $\angle 4$ and $\angle 5$. They make a pair of alternate interior angles. Copy, cutout and place $\angle 4$ on $\angle 5$ as in Steps 2 and 3 above.

Step 6. There is one more pair of alternate interior angles. Identify it and check whether the two angles cover each other by repeating the Step 2 and 3.

Step 7. Observe the pair of angles 4 and 6. They make a pair of interior angles on the same side of the transversal. Copy, cutout and place them adjacent to each other with one arm of each coinciding. [Fig. 3(b)]. The other two arms will form a straight line. Similarly, repeat this for another pair of interior angles 3 and 5.

Observations :

(i) In Step 3, $\angle 1$ and $\angle 5$ are .... angles and they are ....

(ii) $\angle 4$ and $\angle 6$ are .... angles and they are ....

(iii) $\angle 3$ and $\angle 7$ are .... angles and they are ....

(iv) $\angle 4$ and $\angle 8$ are .... angles and they are ....

(v) If two parallel lines are intersected by a transversal, then the corresponding angles are ....

(vi) $\angle 4$ and $\angle 5$ are .... angles and they are ....

(v) $\angle 3$ and $\angle 6$ are .... angles and they are ....

(viii) If two parallel lines are intersected by a transversal, then alternate interior angles are ....

(ix) $\angle 3$ and $\angle 5$ are .... angles on the same side of the transversal. $\angle 3 + \angle 5 =$ ....

(x) $\angle 4$ and $\angle 6$ are .... angles on the same .... of the transversal. Their sum is ....

(xi) If two parallel lines are intersected by a transversal, their interior angles on the same side of the transversal are ....

ACTIVITY 4

(a) To get a median of a given triangle from any vertex by paper folding and to verify that in a triangle, medians pass through a single point.

(b) To get an altitude of a given triangle from any vertex by paper folding and to verify that in a triangle altitudes pass through a single point.

Learning Objective : To understand the concept of a median and an altitude of a triangle.

Pre-requisite : Familiarity with elements of triangles (vertices, sides and angles), types of triangles. Knowledge of median and altitude of a trangle, skill of paper folding.

Materials Required : Thick papers, a pair of scissors, coloured pencil, a ruler.

Procedure : (a)

Step 1. Cut out a triangular shape from a thick paper and name it as ABC [Fig. 4(a)].

Step 2. Fold the side AC on itself so that vertex C falls on vertex A. Mark the point of intersection of the line of fold with AC as P [Fig. 4(b)]. P is the mid point of AC.

Step 3. Similarly, find mid points of sides AB and BC and mark them as Q and R respectively [Fig. 4(b)].

Step 4. Now fold the triangular cut out to create a crease along BP. The crease thus obtained is the median from vertex B on the side AC. [Fig. 4(d)].

Step 5 Similarly, get medians from vertex A and C as AR and CQ. [Fig. 4(d)].

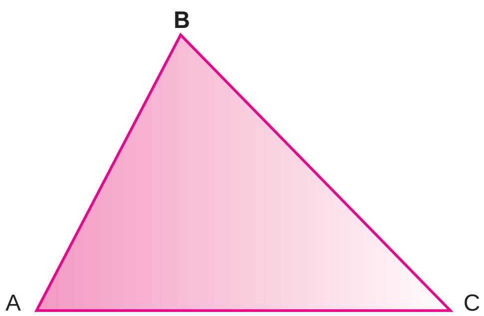


Fig 4(a)

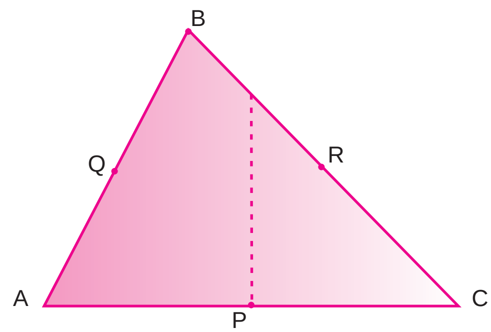


Fig 4(b)

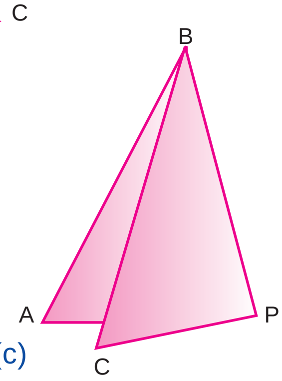


Fig 4(c)

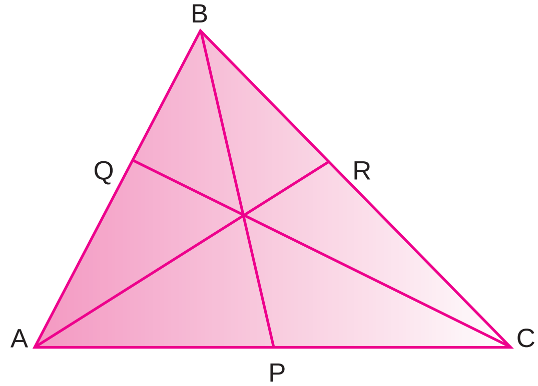


Fig 4(D)

Observations :

1. The medians of a triangle ABC are ....
2. The medians pass through a .... point.
3. Are all the medians of same length? .... (Yes/No)

Procedure : (b)

Step 1. Cut out a triangular shape from a thick paper and name it as MNO. [Fig. 4(e)].

Step 2. Fold this cut out through the vertex M in such a way, that side ON falls along it self. Mark the crease as MP [Fig. 4(f)]. MP is an altitude.

Step 3. Fold this triangular cut out again through the point N such that the side OM falls along itself and obtain the crease as NQ [Fig. 4(g)]

Similarly, obtain the third crease OR [Fig. 4(g)].

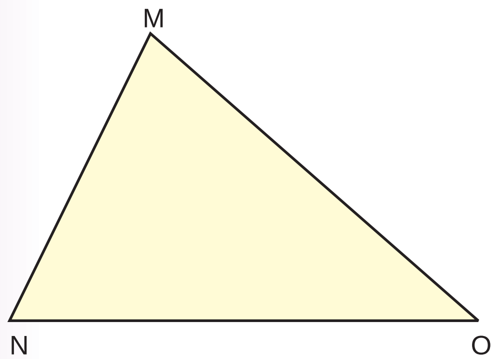


Fig 4(e)

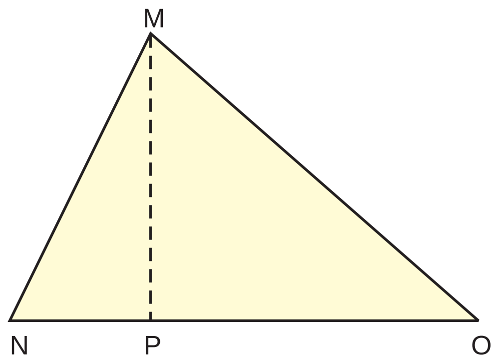


Fig 4(f)

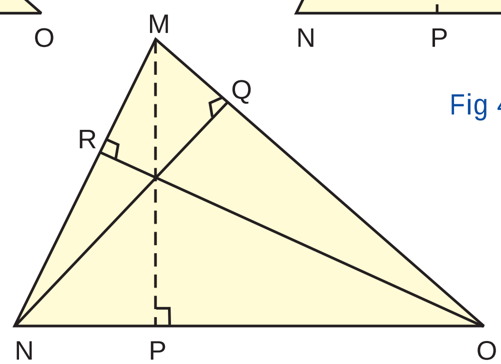


Fig 4(g)

Observations :

1. The attitudes of the triangle MNO are ....
2. The altitudes pass through a .... point.
3. Are all the altitudes of same length? .... (Yes/No)

Extension :

1. Medians of all types of triangles can be obtained by repeating the procedure (a).

   Explore which triangle has all the three medians equal.
2. Altitudes of all types of triangles can be obtained by repeating the procedure (b).

   Explore which triangle has all the three altitudes equal.

ACTIVITY 5

(a) To verify by paper cutting and pasting that sum of angles of a triangle is 180°.

(b) To verify by paper cutting and pasting that an exterior angle of a triangle is equal to the sum of two interior opposite angles.

Learning Objective : To understand the angle sum property and the exterior angle property of a triangle.

Pre-requisite : Knowledge of straight angle, exterior angle and interior angle of a triangle.

Materials Required : Coloured sheets of paper, plane sheets of paper, a pencil, adhesive, a pair of scissors, a ruler.

Procedure :

Step 1. Draw a triangle on a coloured sheet and name the angles as 1, 2 and 3. [Fig. 5(a)].

Step 2. Make the cut out of the angles 1, 2 and 3 using a tracing paper. Now paste these cut outs on a sheet of paper having common vertex so that there is no gap between them as shown in Fig. 5(b).

Step 3 Draw a triangle ABC on a plain sheet and produce BC to a point D as shown in Fig.5(c).

Step 4 Make the cut outs of $\angle BAC$, $\angle BCA$ from different coloured papers. Place these two cutouts on the exterior angle ABD to cover such that there is no gap between the two cutouts as shown in Fig. 5(d).

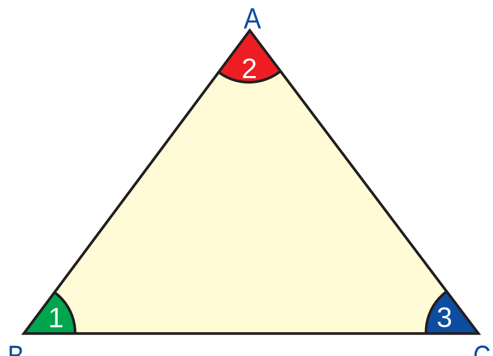


Fig 5(a)

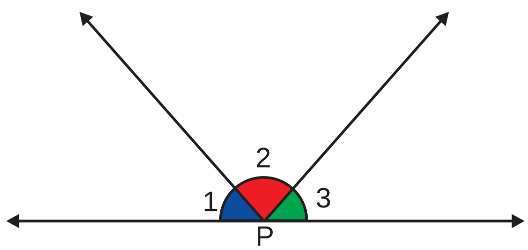


Fig 5(b)

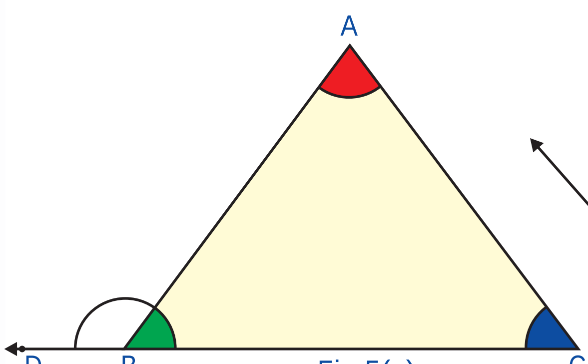


Fig 5(c)

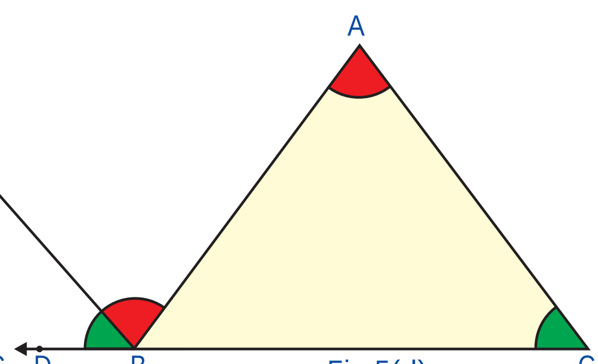


Fig 5(d)

Observations :

(i) Three angles 1, 2 and 3 in Fig. 5(b), form a an .... angle (acute / right / obtuse / straight)

(ii) The sum of the angles of a triangle is .... 180° (less than / equal to / more than).

(iii) In Fig. 5(c) ∠ABD is an .... angle and ∠BAC and ∠BCA are two .... angles.

(iv) .... ∠ABD = Sum of two interior .... angles ∠BAC and ∠...............

(v) ∠ABD = ∠BAC + ∠ ....

7

Grade : 7 - Mathmatics Laboratory in Primary & Upper Primary schools

ACTIVITY 6

To verify, using broom sticks, that a triangle can be drawn only if the sum of lengths of any two sides is greater than the third side.

Learning Objective : To understand triangle inequality property.

Pre-requisite : Knowledge of a triangle and its elements / parts.

Materials Required : Sets of broom sticks following lengths, a scale, glue, paper sheet

Set 1. 5 cm, 7 cm, 11 cm

Set 2. 5 cm, 7 cm, 14 cm

Set 3. 5 cm, 7 cm, 12 cm

Procedure :

Step 1. Take broom sticks of lengths 5 cm, 7 cm & 11 cm. (Set 1) Fig. 6(a)

Step 2. Try to make a triangle using these broom sticks [Fig 6(b)].

Do you get a triangle?

Step 3. Now, take the other set of broom sticks and repeat Steps (1 to 2). [See Fig. 6 (c and d)]

Do you get a triangle?

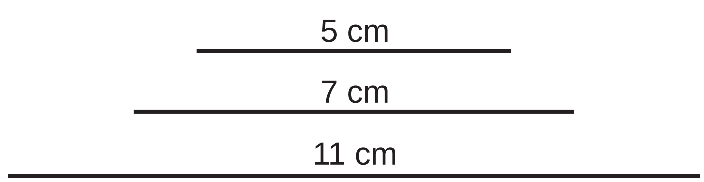


Fig 6 (a)

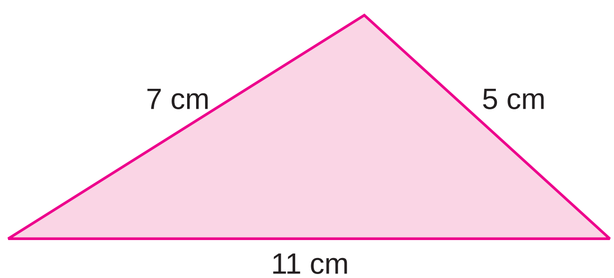


Fig 6 (b)

Fig 6 (c)

Fig 6 (d)

Observations :

For Set 1: [See Fig. 6(b)]

5 + 7 > 11 ....

5 + 11 > ....

7 + 11 > ....

Triangle can .... (be formed / not be formed)

For Set 2: [See Fig. 6(c)]

7 + 14 > 5

5 + 14 > ....

5 + 7 14

Triangle can .... (be formed / not be formed)

For Set 3: [See Fig. 6 (d)]

7 + 12 > 5 ....

5 + 12 > ....

7 + 5 12

Triangle can .... (be formed / not be formed)

Thus, a triangle can only be formed when sum of the length of its two side is .... than the third side.

ACTIVITY 7

To verify Pythagoras theorem.

Learning Objective : To understand property of a right triangle.

Pre-requisite : Knowledge of area .

Materials Required : Squared papers, sketch pens of different colours, paper and pencil.

Procedure :

Step 1. Draw a right angled triangle ABC of sides say 3, 4 and 5 units on a squared paper. [Fig. 7(a)]

Step 2. Make a square on side BC (3 units) and a square on the side AB (4 Units) as shown in [Fig. 7(b)].

Step 3. Also make a square of side 5 units on a squared paper of the same type and cut it out.

Step 4. Paste this cut out square along the side AC of the triangle as shown in the Fig. 7 (c).

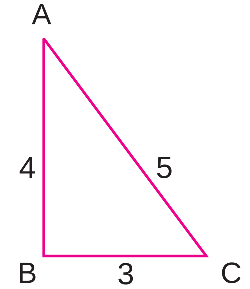


Fig 7(a)

Step 5. Count the number of unit squares in each of these three squares on AB, BC and AC.

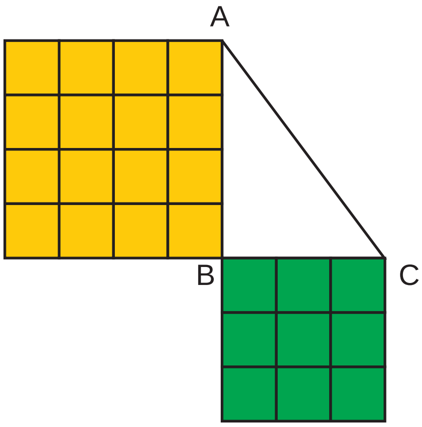


Fig 7(b)

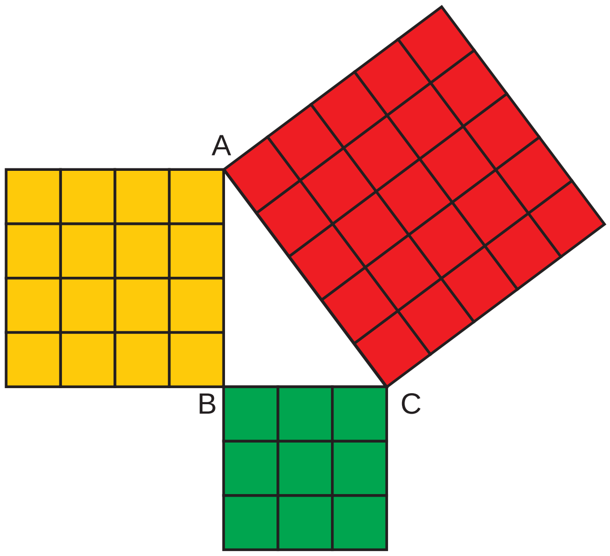


Fig 7(c)

Observations :

(i) Number of unit squares in the square on side AB = ...

(ii) Number of unit squares in the square on side BC = ...

(iii) Number of unit squares in the square on side AC = ...

(iv) Sum of unit squares in the squares on sides AB and BC = ...

Number of units squares on side AC = Sum of number of unit squares on sides .... and ....

(v) Square on the hypotenuse of a right triangle = Sum of the squares on the other .... sides of the triangle.

Extension :

(i) Draw a triangle of dimensions 4 units, 5 units and 6 units. Is $4^2 + 5^2 = 6^2$? (Yes/No)

Is the angle opposite to side 6cm a right angle? (Yes/No)

(ii) The above activity can also be performed by pasting the square of side 4 units on the square of side 5 units, at one of the corners. Then fill the remaining space by cutting and pasting the unit squares of side 3 units.

ACTIVITY 8

(a) To verify by paper cutting and superimposing that diagonal of a parallelogram divides it into two congruent triangles.

(b) To verify using a squared paper that all congruent triangles are equal in area but the triangles equal in area may not be congruent.

Learning Objective : (1) To understand that diagonal of a parallelogram divides it into two congruent triangles.

(2) To understand that all congruent triangles are equal in area but the triangles equal in area may not be congruent.

Pre-requisite : Knowledge of a parallelogram and its a diagonals. Idea of congruent triangles.

Materials Required : Squared papers, a ruler, sketch pens and a pair of scissors.

Procedure : (a)

Step 1. Take a squared paper.

Step 2. Draw a parallelogram ABCD on it. [Fig 8(a)]

Step 3. Join diagonal AC. [Fig. 8(b)]

Step 4. Cut out the parallelogram ABCD.

Step 5. Cut the parallelogram along the diagonal AC. [Fig. 8(c)]

Step 6. Place the triangle Δ ADC on Δ ABC such that AD coincides with CB and CD coincides with AD.

Does triangle ADC completely cover ΔABC?

Step 7. Repeat the activity by cutting across the other diagonal BD of the parallelogram ABCD and superpose one triangle on the other.

Observations :

(i) When cut along AC, the two triangles ABC and ADC cover each other completely..(Yes/No)

(ii) Are the triangles ABC and ADC congruent? .... (Yes/No).

(iii) When cut along BD, are the triangles thus obtained congruent?.............. (Yes/No)

(iv) The diagonal of a parallelogram divides it into two .... triangles.

Procedure : (b)

Step 1. Count the number of squares of triangles ABC and ADC which you have shown congruent in the Procedure (a).

Observations :

(i) Number of unit squares in ΔABC = ...

(ii) Number of unit squares in ΔADC= ....

(iii) Are the areas of two triangle equal ? .... (Yes/No)

(iv) Are the areas of triangle BCD and BAD also equal ? ....(Yes/No).

(v) Congruent triangles are .... in area.

Step 2. Consider two triangles EFG and KLM. [Fig 8(d)].

Step 3. Count the number of squares in each triangle and find their areas.

Step 4. Cut any one of these triangles and try to superpose it on the other. Do they completely cover each other?

Observations :

(i) Number of unit squares in ΔEFG = ...

(ii) Number of unit squares in ΔKLM = ...

(iii) Are the areas of the two triangles i.e. EFG and KLM equal?............. (Yes/No).

(iv) Do they superpose each other?................(Yes/No).

(v) Are these two triangles congruent? (Yes/No).

(vi) Triangles equal may not be ....

(vii) Congruent triangles have .... area but triangles with equal areas may not be ....

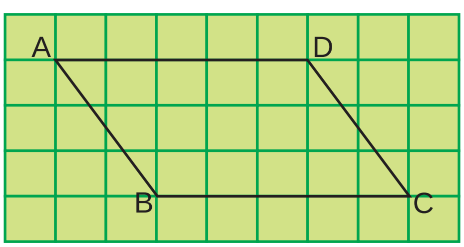


Fig. 8(a)

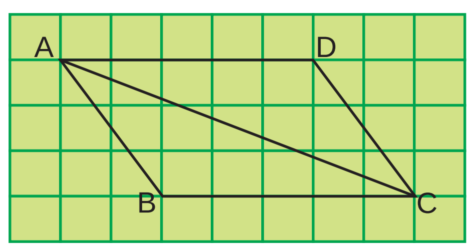


Fig. 8(b)

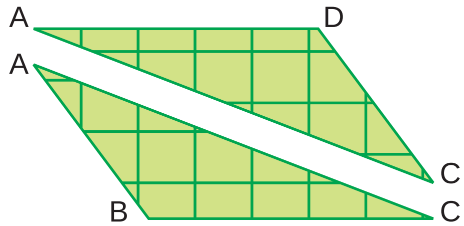


Fig. 8(c)

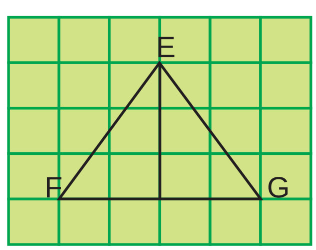


Fig. 8(d)

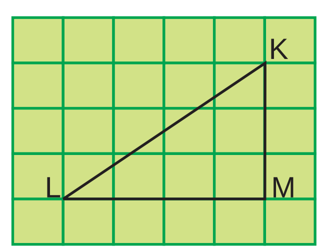


Fig. 8(e)

ACTIVITY 9

To find the ratio of circumference of a circle to its diameter.

Learning Objective : To understand that the ratio of circumference of a circle to its diameter is constant.

Pre-requisite : Concept of a circle, circumference, diameter and ratio.

Materials Required : A ruler, thick paper like drawing sheet, three different sized bottle cans having circular base/three bangles of different sizes, a pair of scissors, a sketch pen.

Procedure :

Step 1. Draw three circles using three different sized bottle cans or bangles on a thick paper [Fig. 9(a)]. Mark them as circle, 1, 2 and 3

Step 2. Cut out all the three circular discs with the help of pair of scissors.

Step 3 Mark the diameter of each circle by folding each circle in two halves. [Fig. 9(b)]. Name these diameters as AB, CD and EF respectively.

Step 4. Draw a ray on a paper and mark its initial point as G. [Fig. 9(c)]

Step 5. Hold one of the cirles, say, circle 3 in upright position on a paper such that the point E on the circle coincides with the point G on the ray [Fig. 9(d)]

Step 6. Rotate the circle along the ray and keep on rotating until the point E again touches the ray. Mark that point on line as H [Fig. 9 (e and f)]

Step 7. Measure the distance GH with the help of a ruler.

Step 8. Measure the diameter EF with the help of a ruler.

Record these measurements on a paper.

Step 9. Repeat the above Steps for circles 2 and 1.

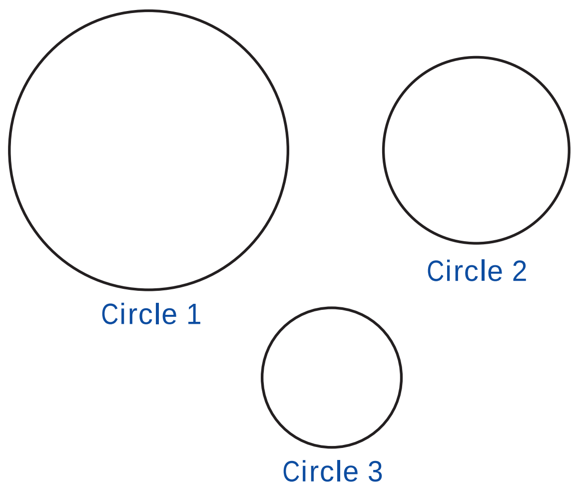


Fig 9(a)

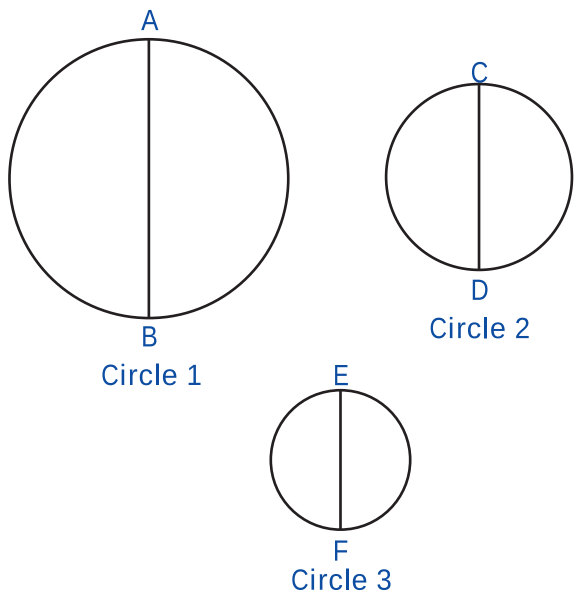


Fig 9(b)

Fig 9(c)

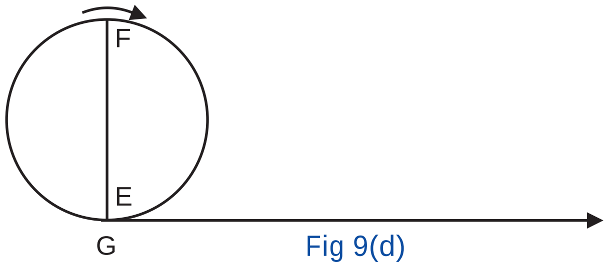


Fig 9(d)

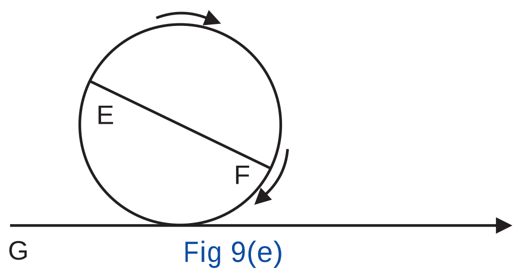


Fig 9(e)

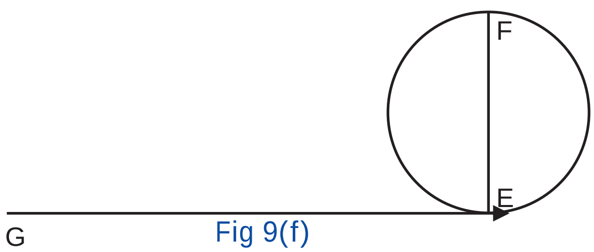


Fig 9(f)

Observations : Record the data in the following table.

	Circumference (cm) (C)	Diameter (cm) (D)	Ratio = Circumference/Diameter (=C/D)
Circle 1			
Circle 2			
Circle 3			

Value of C/D is approximately equal to .... [The ratio C/D is denoted by π and its value is approx. equal to 3.1416].

ACTIVITY 10 A

To draw a cube with given edge (say 5 cm long) on an isometric dot paper and to draw its oblique sketch on the squared paper.

Learning Objective : To develop skill of drawing three dimensional shapes on two dimensional sheet.

Pre-requisite : Familiarity with isometric dot paper. Knowledge of horizontal, vertical and standing lines.

Materials Required : Isometric dot paper, a ruler, a sketch pen and a squared dot paper pencil.

Procedure :

Step 1. Take an isometric dot paper and mark a point A on it [Fig. 10 A(a).

Step 2. Draw a horizontal line through A.

Step 3. Identify 3 dots nearest to the point A which are above the horizontal line and mark them, X ; Y and Z with pencil. [Fig. 10 A(b)]

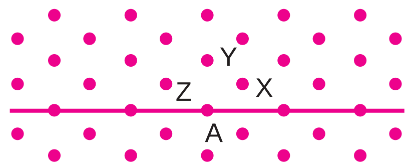


Fig 10A(a)

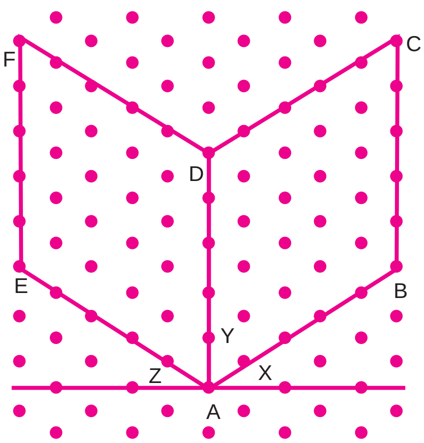


Fig 10A(b)

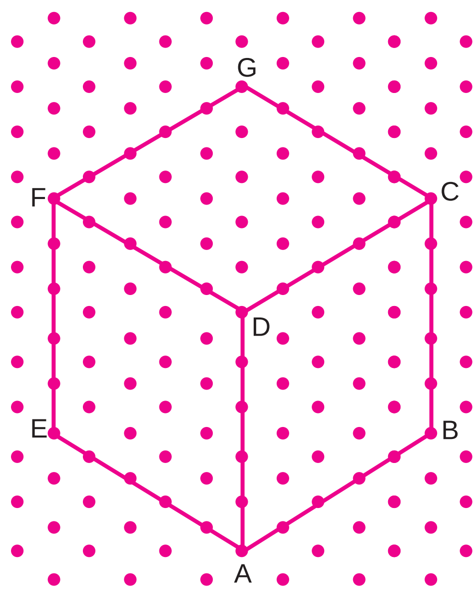


Fig 10A(c)

Step 4. Starting from point A, move 5 dots along AX and mark fifth dot as B. [Fig. 10 A(b)]

Step 5. Starting from the point B, move 5 dots upward and mark the fifth dot as C. [Fig. 10 A(b)]

Step 6. Starting from the point A, move 5 dots along AY and mark the fifth dot as D. [Fig. 10 A(b)]

Step 7. Starting from the point A, move 5 dots along AZ and mark the 5th dot as E. [Fig. 10 A(b)]

Step 8. Starting from the point E move 5 dots in the upward direction and mark the fifth dot as F. [Fig. 10 A(b)]

Step 9. Join F, D and C, D [Fig. 10 A(b)].

Step 10. Starting from point C move 5 dots in the directors parallel to DF. Mark the fifth dot as G [Fig. 10 A(c)]

Step 11. Join FG, CG, BC, AB, AE, EF and AD.

ABCDEFG is the required isometric sketch of the cube of side 5 units.

Oblique Sketch of the Cube

Step 1. Take a squared dot paper and mark a point A on it [Fig. 10 A(d)].

Step 2. Starting from A, move five dots to the right and mark the fifth dot as B.

Step 3. Again, starting from A, move five dots vertically upwards from the point B and mark the fifth dot as C. Similarly, starting from A, move 5 dots vertically upward and mark the fifth dot as D. [Fig. 10 A(c)]

Step 4. Join AB, BC, CD and AD to get the square ABCD of side 5 units.

Step 5. Now take one more point say E on the squared dot paper and draw the square EFGH of side 5 units by following Steps 2,3 and 4. [Fig. 10 A(e)]

Step 6. Join AE, BF, CG and DH as shown in Fig. 10 A(f).

ABCDEFG is the required oblique sketch of the cube.

Note: Show hidden edges by dotted line [Fig. 10 A(g)].

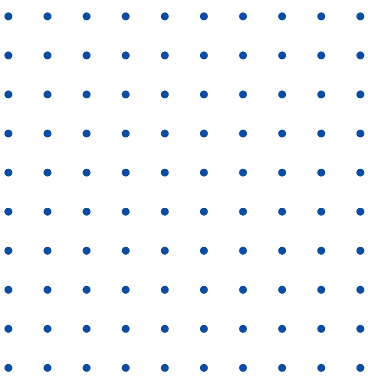


Fig 10A(d)

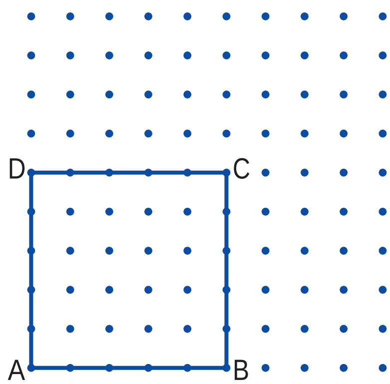


Fig 10A(e)

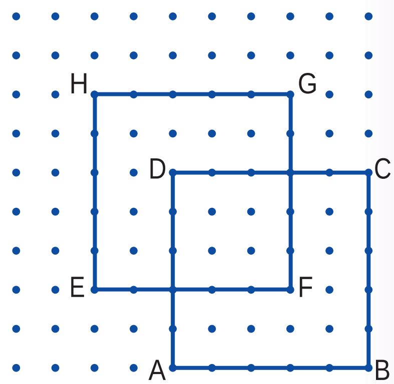


Fig 10A(f)

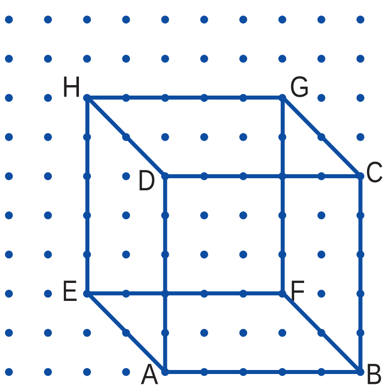


Fig 10A(g)

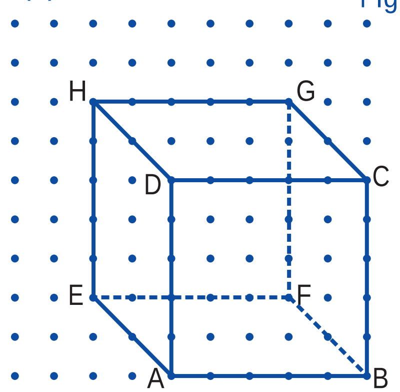


Fig 10A(h)

7

ACTIVITY 10 B

To draw a cuboid of given dimensions (say 7 units, 4 units and 2 units) on an isometric dot paper and to draw its oblique sketch on the squared paper.

Learning Objective : To develop skill to draw 3-D shapes on a two dimensional sheet.

Pre-requisite : Familiarity with isometric dot paper. Knowledge of horizontal, vertical and slanting lines.

Materials Required : isometric dot paper, a ruler, sketch pen, pencil, and a squared dot paper.

Procedure :

Step 1. Take an isometric dot paper and mark a point A on it [Fig. 10B(a)].

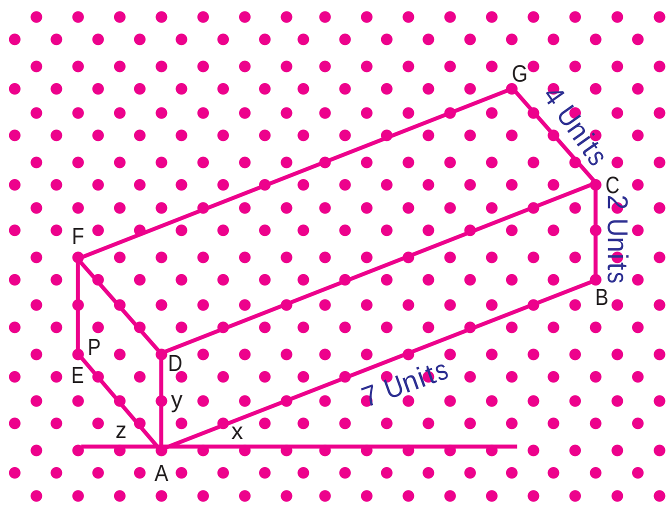


Fig 10B(a)

Step 2. Starting from the point A, move 7 dots upwards towards right and mark the seventh dot as B. Starting from A, move 4 dots upwards towards left and mark the 4th dot as E.

Again starting point A, move 2 dots vertically upward and mark the second dot as D [Fig. 10B(a)]

Step 3. Mark the points C, F and G following similar steps.

Step 4. Join AB, BC, CD, CG, FG, FD, EF, AD and EA to get required isometric sketch of the cuboid ABCDEFG of given dimensions.

For oblique Sketch of Cuboid

Follow the same procedure given in Activity 10(A) and draw the oblique sketch of the cuboid on the squared dot paper.

Observations : Activity 10 (A) and 10 (B)

(i) Side AB of cube ABCDEFG in Fig. 10 A(c) = ... units

(ii) Side BC of the cube = ... units

(iii) Side DF of the cube = ... units

(iv) Side AB of the cuboid ABCDEFG in Fig. 10B(a) = ... units

(v) Side AD of the cuboid = ... units

(vi) Side CG of the cuboid = ... units.

ACTIVITY 11

To make the following 7 shapes using unit cubes.

Learning Objective : To visualise solid shapes and to understand the concepts of surface area and volume.

Pre-requisite : Knowledge of unit cube.

Materials Required : Unit Cubes, cellotape, glue.

Procedure :

Step 1 Look at the Fig. 11(a) and make all the 7 shapes by joining unit cubes using cellotape or glue.

Observations :

S.No.	Shape	Volume	Surface Area
1.	Shape 1	………	………
2.	Shape 2	………	………
3.	………	………	………
4.	………	………	………
5.	………	………	………
6.	………	………	………
7.	………	………	………

Extension :

(i) Try to make sofa as shown in Fig. 11(b) and find its volume and surface area.

(ii) Try to make a bed as shown in Fig. 11(c) using all seven shapes given in Fig. 11(a).

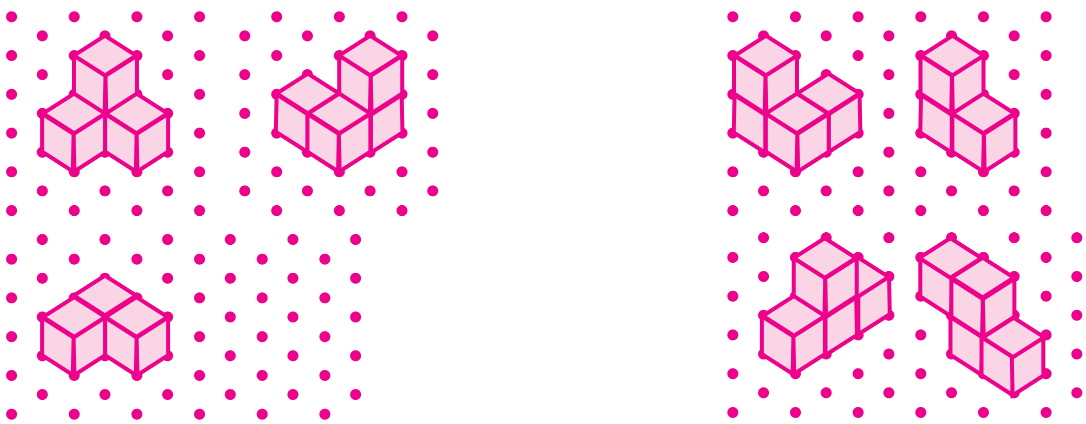


Fig. 11(a)

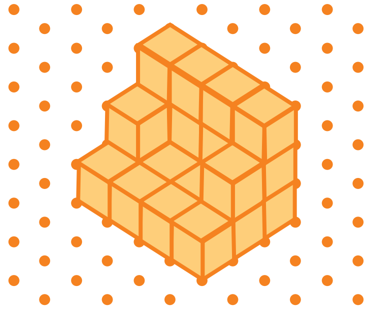


Fig. 11(b)

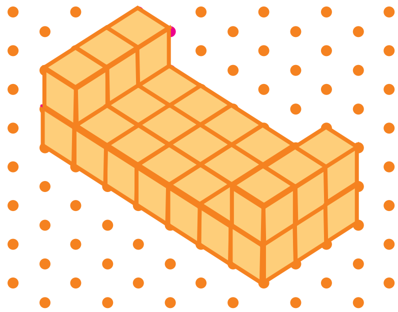


Fig. 11(c)

Grade : 8

Mathematics Laboratory in Primary & Upper Primary schools

ACTIVITY 1

To fold a paper 8 times in any way. Unfold and locate various convex and concave polygons.

Learning Objective : To identify concave and convex polygons.

Pre-requisite : Knowledge of concave and convex polygons.

Materials Required : Paper sheets, a pencil and a ruler.

Procedure :

Step 1. Take a rectangular sheet of paper as shown in Fig. 1(a).

Step 2. Fold it in any way as shown in Fig. 1(b) and then unfold it. Draw a line on the crease using a ruler and pencil.

Step 3. Repeat this process 7 more times. Every time draw a line on the crease.

Step 4. Make the points of intersections as A, B, C, D, ... [Fig. 1(c)]

Step 5. Identify polygons having move than 3 sides in Fig. 1(c) and examine whether they are convex or concave.

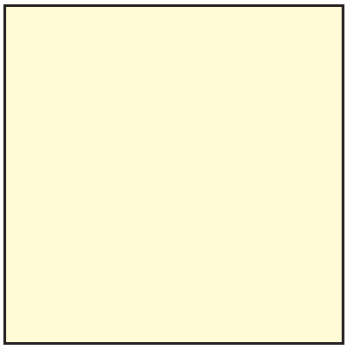


Fig. 1(a)

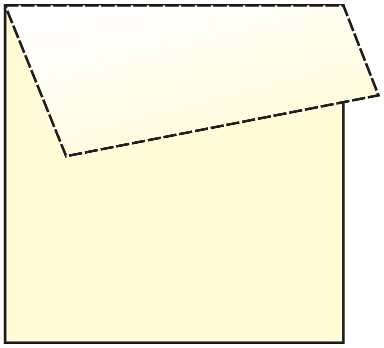


Fig. 1(b)

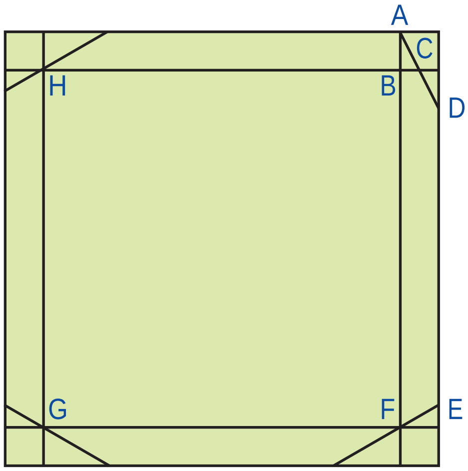


Fig. 1(c)

Observations :

Complete the following table :

Polygon	Number of sides	Convex	Concave
	4	Yes	No
	5	No	Yes

Extension : Identify a triangle, quadrilateral, a pentagon, a hexagon, if any, and determine whether it is convex or concave.

ACTIVITY 2

To verify, by paper cutting and pasting, that the sum of interior angles of a quadrilateral is 360°.

Learning Objective : To understand the angle sum property of a quadrilateral.

Pre-requisite : Knowledge of a quadrilateral and its interior angles. Idea of a complete angle.

Materials Required : A coloured sheet of paper, a plain sheet of paper, glue, a pair of scissors, a ruler and a pencil/pen.

Procedure :

Step 1. On a coloured sheet of paper, draw a quadrilateral ABCD. Name its angles as1, 2, 3, 4. [Fig. 2(a)]

Step 2. Make the cutouts of all the four angles using a tracing paper, carbon paper and a plane sheet.

Step 3. Paste these cutouts on a sheet of paper at a point P so that there is no gap between them as shown in Fig. 2(b).

Observations :

1. All angles together forms a ....angle.(straight / obtuse / complete / reflex)
2. The sum of four angles of a quadrilateral is..............

Extension : Verify angle sum property for a concave quadrilateral.

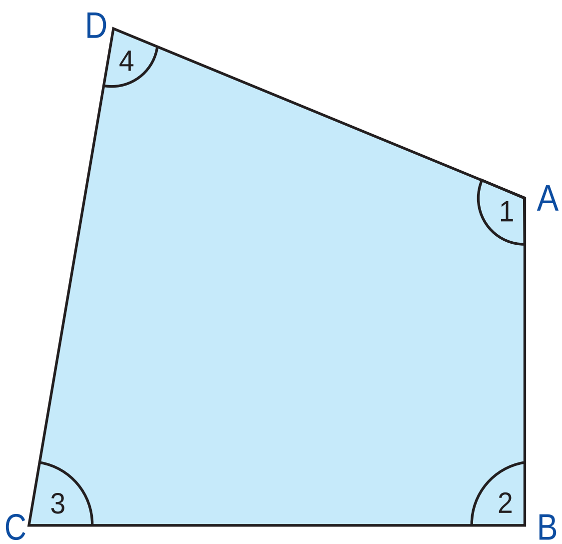


Fig. 2(a)

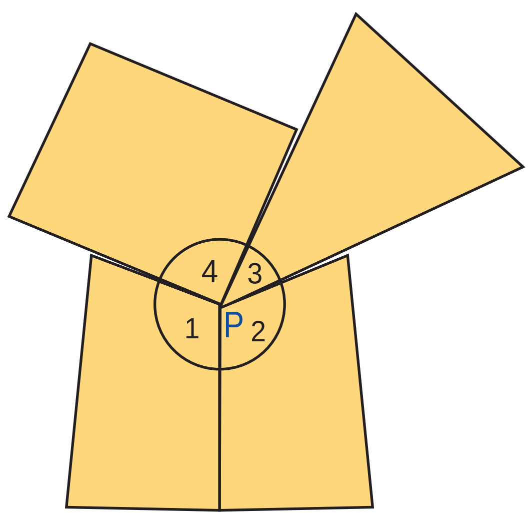


Fig. 2(b)

ACTIVITY 3

To verify by paper cutting and pasting, that the sum of the exterior angles drawn in order, of any polygon is 360°.

Learning Objective : To understand the exterior angles property of a polygon.

Pre-requisite : Familiarity with exterior angles of a polygon and a complete angle.

Materials Required : Coloured and white sheets of paper, a ruler, a pencil, a pair of scissors and a pair of compasses.

Procedure : (a) For triangle

Step 1. Draw a triangle on a coloured sheet and name it ABC. Make exterior angles in an order at each vertex of this triangle and name them as X, Y and Z. Fig. 3(a).

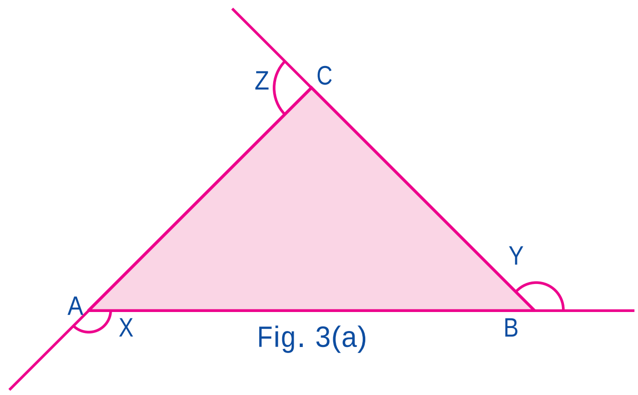


Fig. 3(a)

Step 2. Cut out all the three exterior angles. Paste them on a white sheet of paper at a point P so that there is no gap between them as shown in Fig. 3(b).

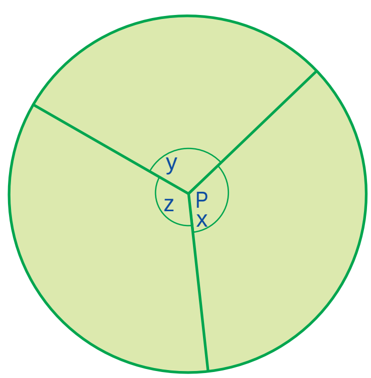


Fig. 3(b)

Observations.

1. All angles together form a .... angle (straight, reflex, complete)
2. The sum of exterior angles of a triangle taken in order is...............

Procedure : (b) For polygons

Step 4. Draw a quadrilateral, a pentagon and a hexagon on a coloured sheet of paper. Mark their exterior angles taken in order at each vertex.

Step 5. Repeat Step 2 for each of these polygons. [See Fig. 3(f), Fig. 3(g) and Fig. 3(h)]

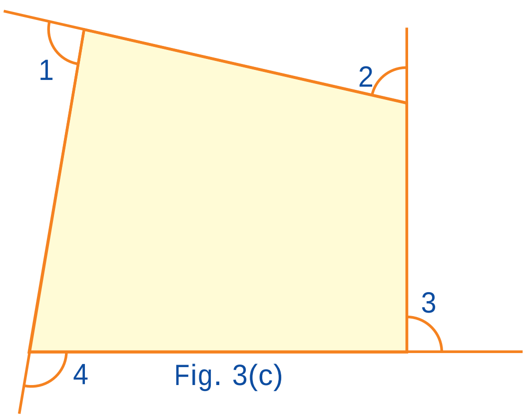


Fig. 3(c)

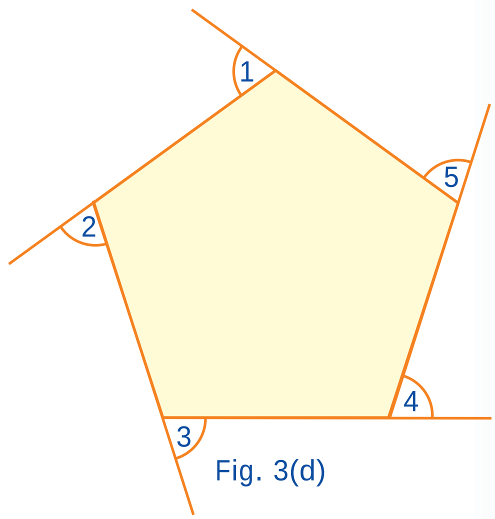


Fig. 3(d)

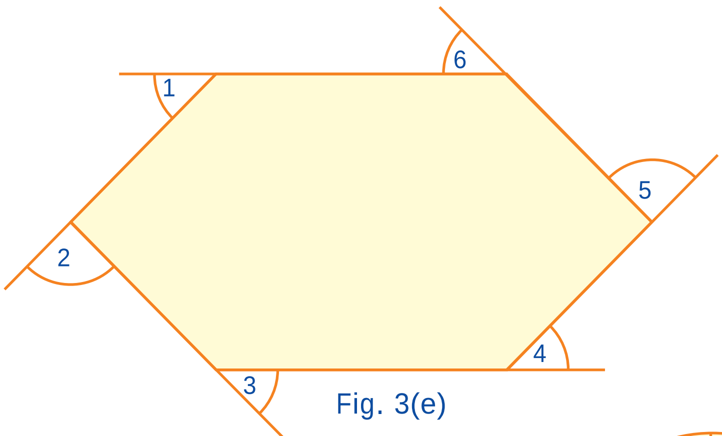


Fig. 3(e)

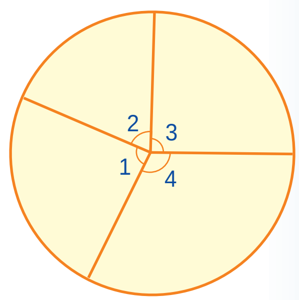


Fig. 3(f)

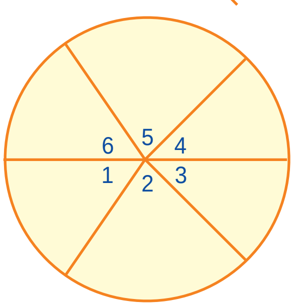


Fig. 3(h)

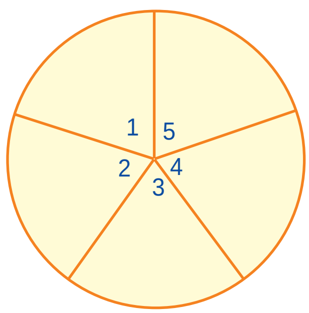


Fig. 3(g)

Observations :

1. The sum of exterior angles of a quadrilateral taken in an order is ....
2. The sum of exterior angles of a pentagon taken in an order is ....
3. The sum of exterior angles of a hexagon taken in an order is ....
4. The sum of exterior angles in each polygon taken in an order is ....

ACTIVITY 4

To make the following shapes by paper folding and cutting.

(a) A kite

(b) A rhombus

Learning Objective : To understand the shape of a kite and that of a rhombus.

Pre-requisite : Familiarity with a quadrilateral and its parts.

Materials Required : Sheets of paper, a pair of scissors, a ruler and a pencil/pen.

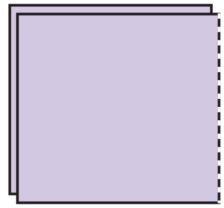


Fig. 4(b)

Procedure : (a)

Step 1. Take a rectangular sheet of paper. [Fig. 4(a)].

Fig. 4(a)

Step 2. Fold it in such a way that one pair of opposite edges coincide with each other. [Fig. 4(b)]

Step 3. Fold it again so that the other pair of opposite edges overlap each other. Mark the creases [Fig. 4(c)].

Fig. 4(c)

Step 4. Unfold the fold of Step 3. [Fig. 4(d)].

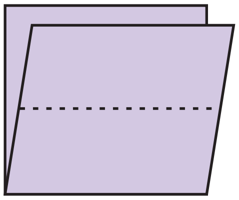


Fig. 4(d)

Step 5. Name the vertices of the folded sheet as A, B, C and D. Point P is the mid point of side AD. [Fig. 4(e)]

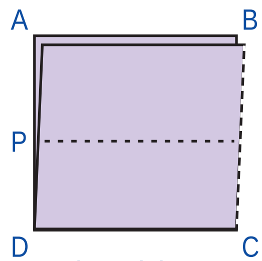


Fig. 4(e)

Step 6. Mark a point Q on the side AD other than its mid point. Join QB and QC with the help of a ruler. [Fig. 4(f)].

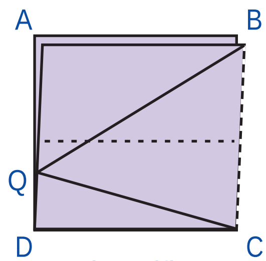


Fig. 4(f)

Step 7. Cut along the sides QB and QC and unfold the cut out. Shape in Fig. 4(g) shape thus obtained is a kite BQCR.

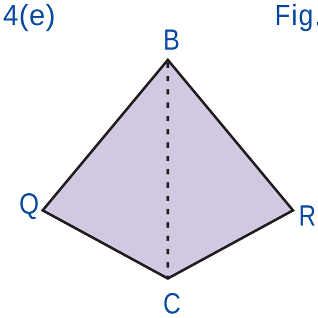


Fig. 4(g)

Procedure : (b) Repeat Steps 1 to 5 as above.

Step 8. Jon PB and PC with the help of ruler [Fig. 4(h)].

Step 9. Cut along the sides PB ad PC and unfold the cut out. Shape thus obtained is a rhombus. PBCR [Fig. 4(i)].

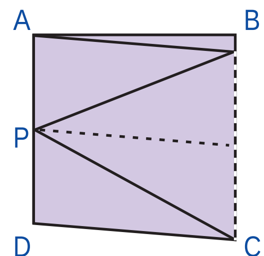


Fig. 4(h)

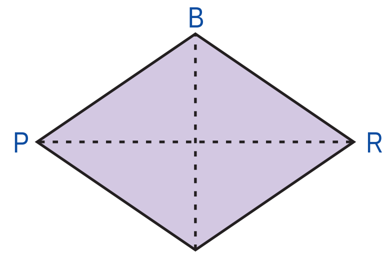


Fig. 4(i)

Observations :

(i) Are all the sides of the kite obtained in Fig. 4(g) equal? .... (Yes / No)

(ii) Are pairs of opposite sides equal? .... (Yes / No)

(iii) Which pairs of adjacent sides are equal? ....

(iv) Are all the sides of the rhombus equal? .... (Yes / No)

(v) How a kite is different from a rhombus? ....

8

ACTIVITY 5

To verify that

(a) the diagonals of a rectangle are equal.

(b) the diagonals of a square are equal.

(c) the diagonals of a rhombus or a parallelogram are not equal.

Learning Objective : To understand the properties of the diagonals of a square, a rectangle, a parallelogram and a rhombus.

Pre-requisite : Knowledge of diagonals of a quadrilateral.

Materials Required : A thick piece of thread, a sheet of paper, a ruler, a pencil, and a sketch pen.

Procedure (a) :

Step 1. Draw a rectangle on a sheet of paper and name its vertices as A, B, C and D. Join diagonals AC and BD. [Fig. 5(a)].

Step 2. Take a thread, place it on point A. Stretch the thread along AC. Mark both the points A and C on the thread with a sketch pen. [Fig. 5(b)].

Step 3. Now stretch the marked portion of the thread placing it along BD and check whether AC and BD are equal or not.

Step 4. Draw a square on a sheet of paper and repeat Steps, 2 and 3. [Fig. 5(d). 5(e), 5(f)]. Check whether AC and BD are equal or not.

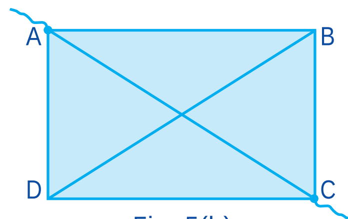


Fig. 5(b)

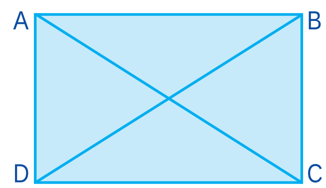


Fig. 5(a)

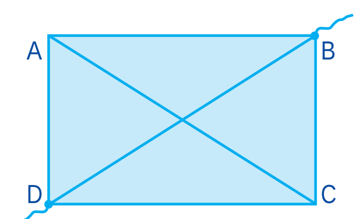


Fig. 5(c)

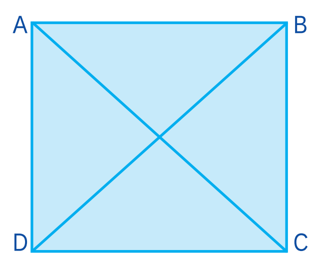


Fig. 5(d)

Procedure : (c)

Step 5. Draw a rhombus or a parallelogram. Repeat Step 1, 2 and 3. [Fig.5(g), Fig 6(h)]. Check whether AC and BD are equal or not.

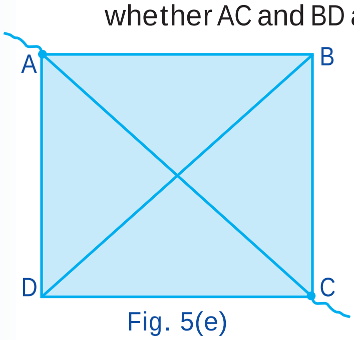


Fig. 5(e)

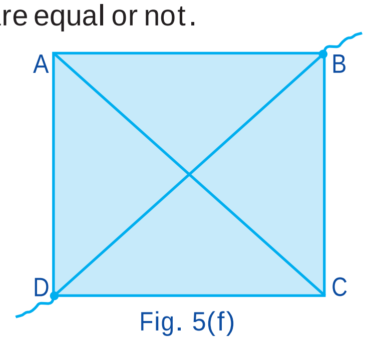


Fig. 5(f)

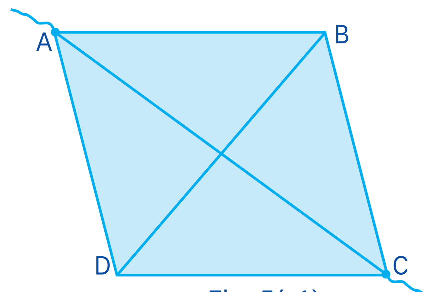


Fig. 5(g1)

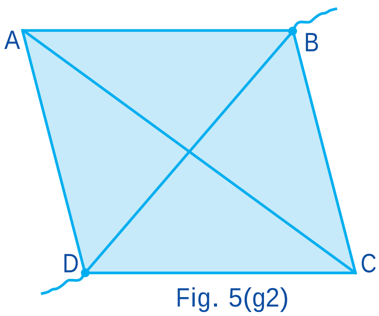


Fig. 5(g2)

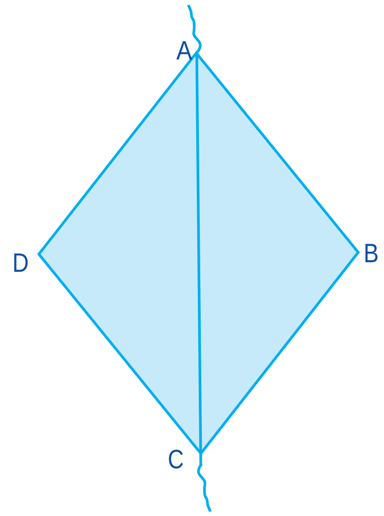


Fig. $5(h_1)$

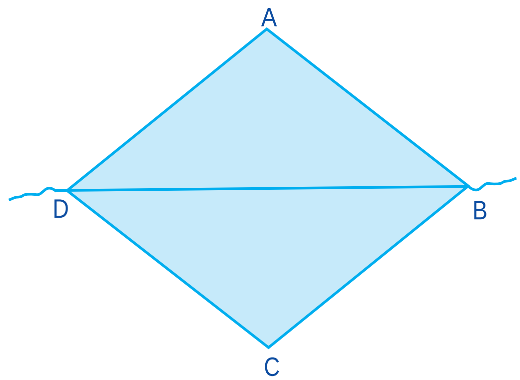


Fig. $5(h_2)$

Observations : Write the correct options –

1. Diagonals of a rectangle are .... (equal / unequal).
2. Diagonals of a square are ....(equal / unequal).
3. Diagonals of a parallelogram are ....(equal / unequal).
4. Diagonals of a rhombus are ....(equal / unequal).

ACTIVITY 6

To make a paper die using a paper net of a cube and to observe the occurrence of different outcomes 1, 2, 3, 4, 5, 6 appearing on its top face when it is thrown 100 times.

Learning Objective : To understand the occurrence of a number on a die and to get a feel of probability of an outcomes.

Pre-requisite : Knowledge of making a cube from its net and knowledge of a die.

Materials Required : A thick paper, a pair of scissors, a cellotapes, and pen and a pencil.

Procedure :

Step 1. Draw a net of a cube on a thick paper sheet and cut it out. [Fig. 6(a)]

Step 2. Make a cube with this net and write the numbers 1, 2, 3, 4, 5, 6 on its faces in such a way that the sum of the numbers on the opposite faces is 7. [Fig. 6(b)].

Step 3. Throw this die 100 times and note down the number appearing on its top face after each throw. Record the data in the following table using tally marks.

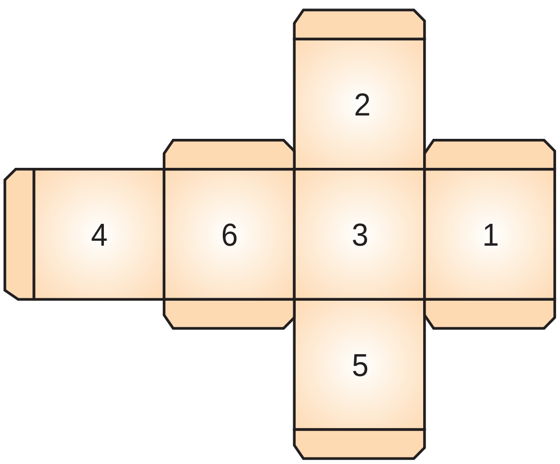


Fig 6(a)

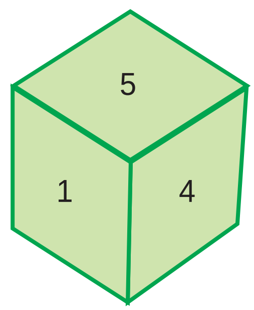


Fig 6(b)

Number on the top face of the die	Number of times it has occurred
1	
2	
3	
4	
5	
6	
Total	**100**

Observations :

(i) Number of faces of the die = ...

(ii) Sum of numbers on the opposite faces of a die is ....

(iii) Number of times the outcome '1' has occurred = ...

(iv) Number of times the outcome '2' has occurred = ...

(v) Number of times the outcome '3' has occurred = ...

(vi) Number of times the outcome '4' has occurred = ...

(vii) Number of times the outcome '5', '6' occured respectively ....

(viii) The outcome which is most likely to occur on the basis of this experiment is ....

(ix) The outcomes which is least likely to occur on the basis of this experiment is ....

Extension : Activity can be used to explain the idea of probability.

8

ACTIVITY 7

To observe some given number patterns and write their next three steps / rows.

Learning Objective : To understand number patterns and to generalise them.

Pre-requisite : Knowledge of number patterns.

Materials Required : Some patterns involving numbers.

Procedure :

Step 1. Observe carefully the following number patterns:

(a)		(b)
	$1^2 = 1$	$1 + 3 = 4 = 2^2$
	$11^2 = 121$	$1 + 3 + 5 = 9 = 3^2$
	$111^2 = 12321$	$1 + 3 + 5 + 7 = 16 = 4^2$

Step 2. Identify the rule involved in each pattern.

Step 3. Complete next three rows of each pattern on the basis of the identified rule in Step 2.

Observations :

I. 4th row in pattern (a) is : $1111^2 = 1234321$

5th row is : 11111^2 =........................

6th row is : .... = 123456 ....

II. 4th row in pattern (b) is : 1+3+5+7+9 = 25 = (................)^2

5th row is : 1+3+5+7+9+11=........................ = (................)^2

6th row is : 1+3+5+7+.............= 49 = (................)^2

Extension : Collect some more number patterns and write their next 3 steps.

ACTIVITY 8

To verify the following algebraic identity by paper cutting and pastings.

$(a+b)^2 = a^2 + b^2 + 2ab$

Learning Objective : To understand algebraic identity.

Pre-requisite : Knowledge of algebraic operations on algebraic expressions and knowledge of areas of rectangles and squares.

Materials Required : **Thick** paper sheet, a pair of scissors, a ruler, glue and a pencil/pen.

Procedure : **(a)**

Step 1 On a thick paper sheet, draw

a. a square of side a units [Fig. 8(a)]

b. a square of side b units [Fig. 8(b)]

c. a square of side (a+b) units [Fig. 8(c)]

d. Two rectangles each of length a and breadth b units [Fig. 8(d)]

Step 2. Cut out all the above figures.

Step 3. Take the square of side (a+b) units and arrange and paste on it squares of side a units and side b units and rectangles of length a units and breadth b units as shown in Fig. 8(a), 8(b), 8(c), 8(d) and 8(e).

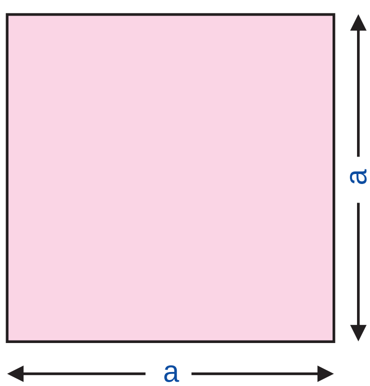


Fig 8(a)

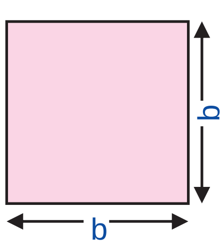


Fig 8(b)

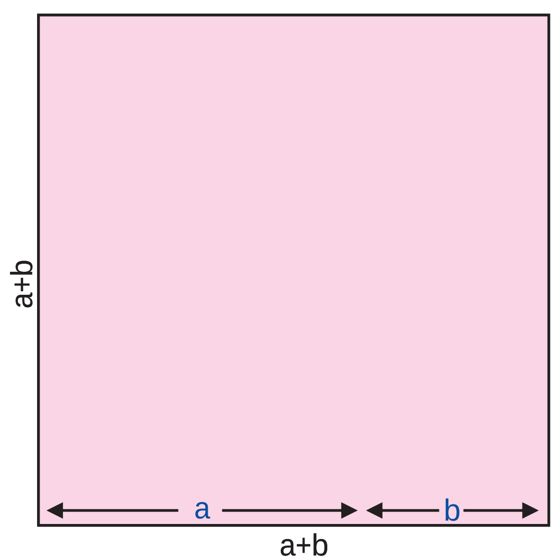


Fig 8(c)

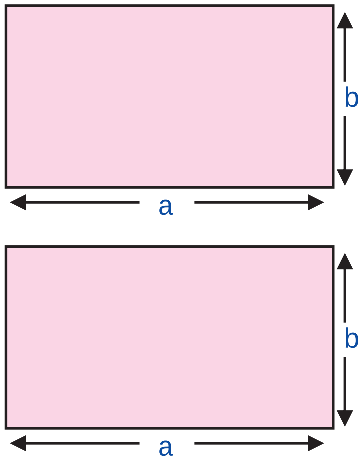


Fig 8(d)

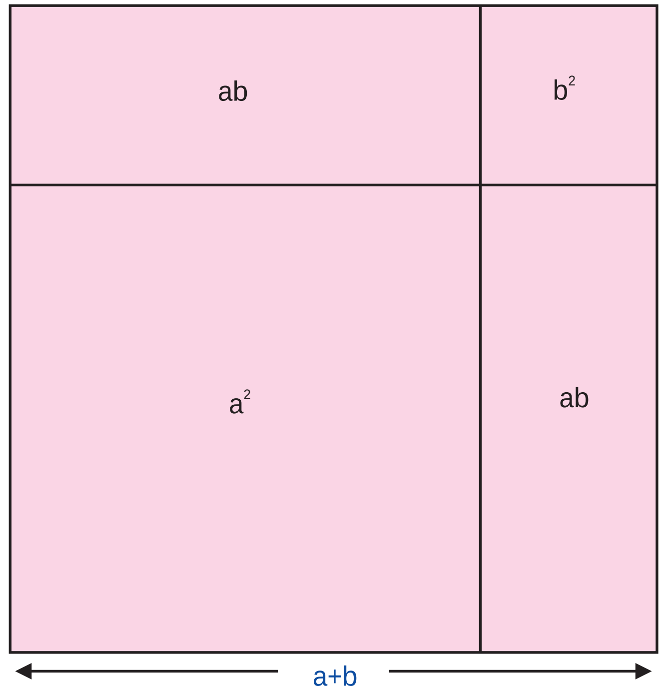


Fig 8(e)

Observation :

Square of side a units, square of side b units and the two rectangles each of length a units and breth b units cover completely the square of side .... units.

So, $(a+b)^2 = a^2 + \ldots\ldots\ldots\ldots + \ldots\ldots\ldots\ldots\ldots\ldots = \ldots\ldots\ldots\ldots\ldots\ldots$ Thus $(a+b)^2 = a^2+b^2+2ab$.

Extension : Verify the following identities

(a) $(a - b)^2 = a^2 - 2ab + b^2$

(b) $a^2 - b^2 = (a + b)(a - b)$

by taking suitable rectangles and squares and arranging them appropriately.

ACTIVITY 9

To draw front view, top view and side view of three dimensional shapes made by combining unit cubes.

Learning Objective : To draw shapes as viewed from different positions of some three dimensional shapes.

Pre-requisite : Knowledge of making solid shapes using unit cubes.

Materials Required : Unit cubes, cellotapes

Procedure :

Step 1. Take some unit cubes and make the shape shown in Fig. 9(a).

Step 2. Now, draw shapes when viewed from front, side and top.

Step 3. Repeat the activity by making other shapes. [Fig. 9(b) to 9(d)]

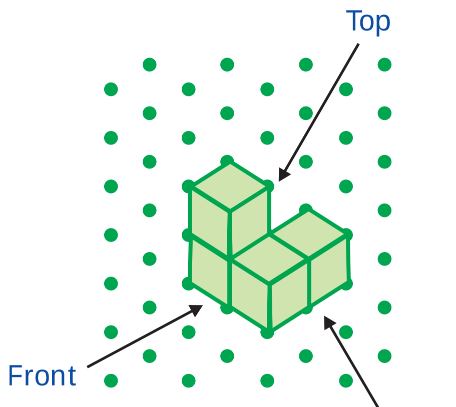


Fig 9(a)

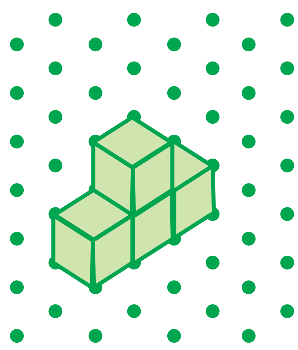


Fig 9(b)

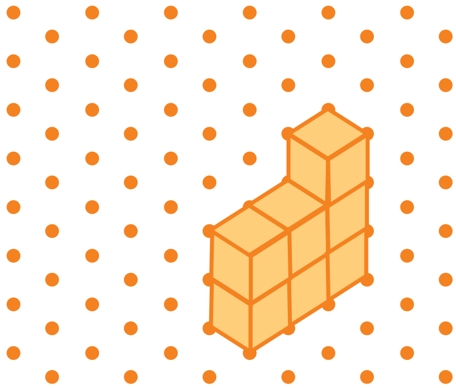


Fig. 9(c)

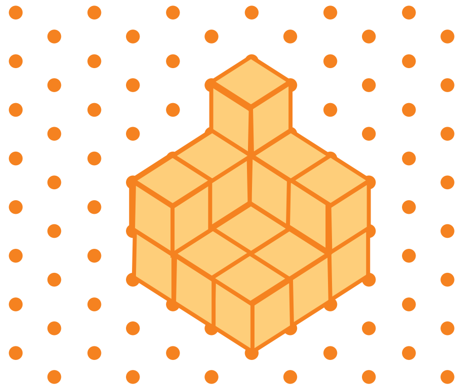


Fig. 9(d)

Observation :

(i) For Fig. 9(a) : Front View is

side view is

top view is

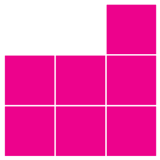
(ii) For Fig. 9(b) : Front view is

side view is

top view is

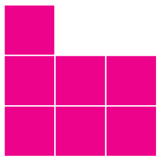
(iii) For Fig. 9(c) : Front view is

side view is

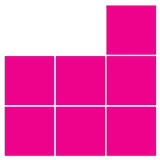


top view is

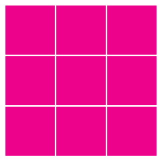
(iv) For Fig. 9(d) : Front view is



side view is



top view is



Extension : You may extend this activity for drawing different views of some more 3D objects from real life.

ACTIVITY 10

To derive the formula for total surface area of a cuboid.

Learning Objective : To find the total surface area of any cuboidal object.

Pre-requisite : Knowledge of area of a rectangle.

Materials Required : A cuboidal box, a pair of scissors and glue.

Procedure :

Step 1. Take an empty cuboidal box and label its length, breadth and height as 'l', 'b' and 'h' respectively. Fig. 10(a)

Step 2. Colour each pair of opposite faces with different colours say (red, blue and green).

Step 3. Cut out the 6 faces using a pair scissors.

Step 4. Paste the 6 faces on a sheet of paper [Fig. 10(b)].

Step 5. Find the area of each face.

Step 6. Add the areas of all faces. This will give the total surface area of the cuboidal box.

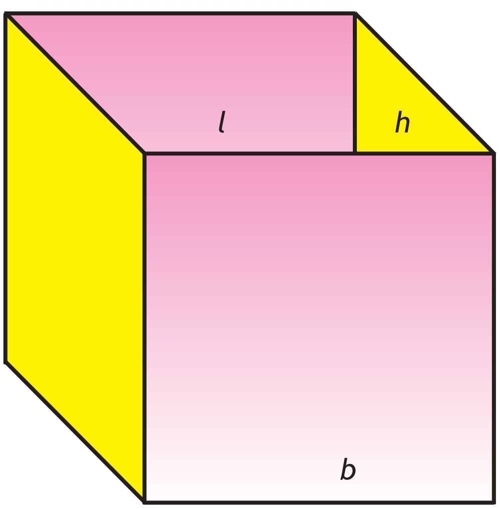


Fig 10A(a)

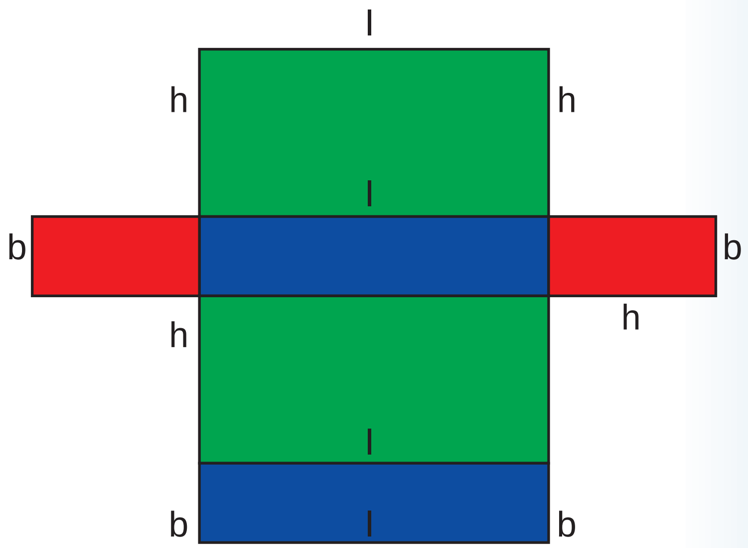


Fig 10(b)

Observations :

Area of each red face = ... sq. units

Area of each blue face = ... sq. units

Area of each green face = ... sq. units

Total Surface Area = 2 (Area of each red face+Area of each blue face+Area of each green face)

= 2(............... + ... + ...)

Extension : You may extend this activity to derive the formula of total surface areas of other 3 dimensional shapes such as a cube and a right circular cylinder.

ACTIVITY 11

To compare the surfaces areas of two unit cubes and the cuboid formed by joining these unit cubes.

Learning Objective : To understand the concept that surface area decrease on joining two 3D objects.

Pre-requisite : Knowledge of area of a square.

Materials Required : Unit cubes.

Procedure :

Step 1. Take 2 unit cubes and place them adjacent to each other without leaving any gap between their two faces as shown in Fig. 11(a).

Step 2. Find the surface area of the solid shape so formed.

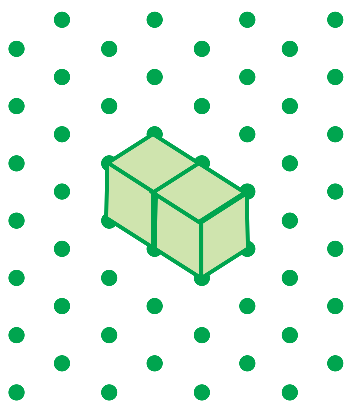


Fig 11(a)

Observations :

(i) Surface area of one unit cube = ... sq. units.

(ii) Surface area of two unit cubes = ... sq. units.

(iii) Solid formed by joining the two unit cubes is ....

(iv) Surface area of the new solid formed by joining two unit cubes = ... sq. units.

(v) Surface area of the new solid is .... than the surface area of two unit cubes.

(vi) Surface area of the new solid is .... square units ....than the surface area of two unit cubes.

Extension : This activity may be extended by taking three or more unit cubes and making different 3 dimensional shapes and finding their surface areas.

ACTIVITY 12

To make cuboids and cubes of given dimensions (4 x 3 x 2, 3 x 3 x 3) *using unit cubes and to calculate the volume of each.*

Learning Objective : To establish formulae for finding volumes of a cuboid and a cube.

Pre-requisite : Knowledge of volume.

Materials Required : Unit cubes.

Procedure : For cuboid (4 x 3 x 2)

Step 1. Take four unit cubes and join them to make a row. [Fig. 12(a)]

Step 2. Make three such rows as in Step 1 and join them as shown in. Fig. 12(b)

Step 3. Make one more solid of the type as given in Fig. 12(b) using unit cubes and place it over the solid formed in Fig. 12(b). [See Fig. 12(c)].

Find the volume of the cuboid in Fig. 12(c) by counting the number of unit cubes.

Step 4. Repeat the activity by

(i) Taking 3 cubes in a row.

(ii) Taking 3 rows of 3 cubes in each layer.

(iii) Taking 3 layers to get a cube of dimensions 3 x 3 x 3 [Fig. 12(d)].

Find the volume of the cube by counting the number of unit cubes.

4 Cubes

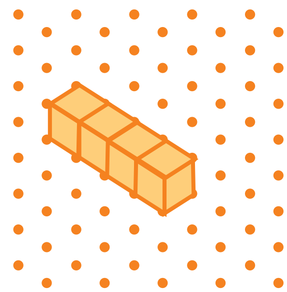


Fig. 12(a)

4x3 = 12 Cubes

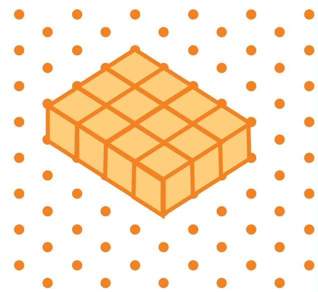


Fig. 12(b)

4x3x2 = 24 Cubes

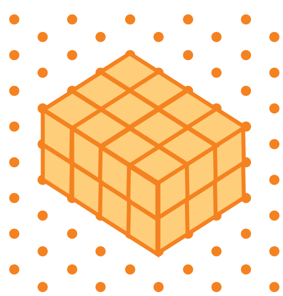


Fig. 12(c)

3x3x3 = 27 Cubes

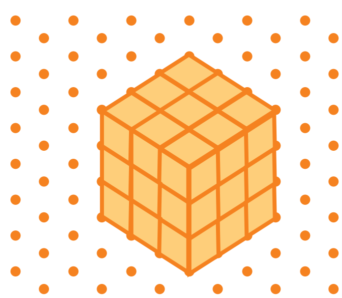


Fig. 12(d)

Observation :

(i) Number of unit cubes used in the solid (cuboid) in Fig 12(c) = ...
Its volume = ...cubic units.

(ii) Dimensions of this cuboid are 4 x 3 x ....

(iii) (Length x breath x height) of the cuboid = ... of the cuboid.

(iv) Number of unit cubes used in the solid (cube) in Fig. 12(d) = ...,
Its volume = ... cubic units.

(v) Dimensions of this cube are 3 x .... x 3.

(vi) Length x breath x height = length x length x length of the cube in Fig. 12(d) = ... of the cube.

ACTIVITY 13

To explore the relationship between -

(a) Length (in cm) and perimeter (in cm)

(b) Length (in cm) and area (in cm^2)

of 5 squares of different dimensions drawn on a squared paper.

Learning Objective : To understand the relationships between

(i) Length and perimeter

(ii) Length and area of a square.

Pre-requisite : Knowledge of perimeter and area of a square.

Materials Required : Five squares of different sides drawn on a squared paper, a pen / pencil.

Procedure :

Step 1. Take a squared paper on which five squares of different sides have been drawn [Fig. 13(a)].

Step 2. Find perimeter of each square. (i.e., sum of lengths of its all sides).

Step 3. Find area of each square by counting the number of squares in it and taking area of each unit as 1 unit square.

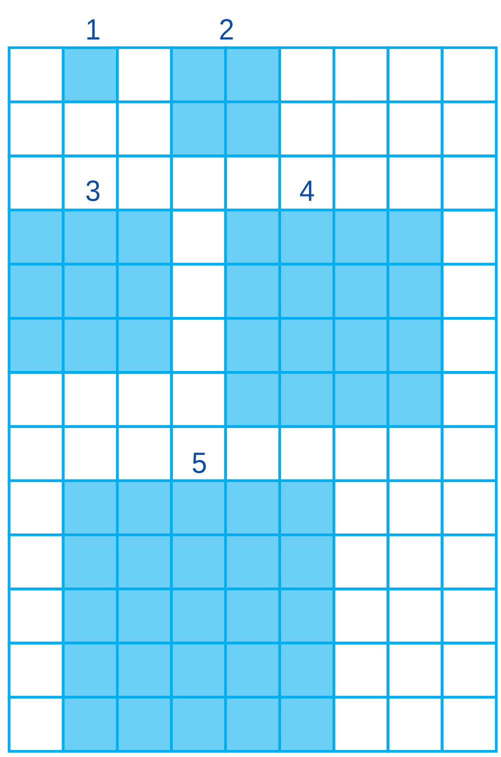


Fig 13(a)

Step 4. Record your observations in the following table and complete it.

Figure	Length of side	Perimeter	Area	$\frac{P}{L}$	$\frac{A}{L}$
	L	P	A		
Square 1	1				
Square 2	2				
Square 3	3				
Square 4	4				
Square 5	5				

Observation :

(i) Perimeter / length for each square is ....

(ii) Area/Length for each square is .... of the square.

(iii) Perimeter of a square = ... x length

(iv) Area of a square = ... x ....