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

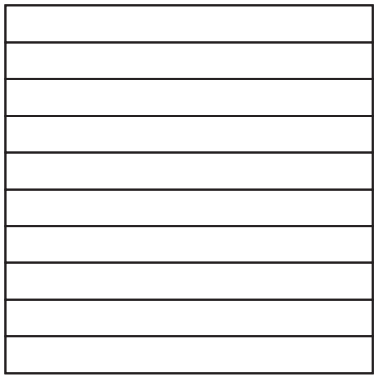

Fig 1(a)

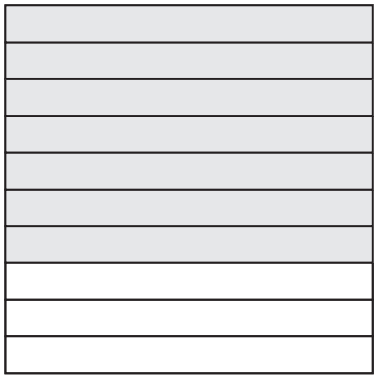

Fig 2(b)

part represents 1/10 or 0.1 as in Fig.1(c).

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.

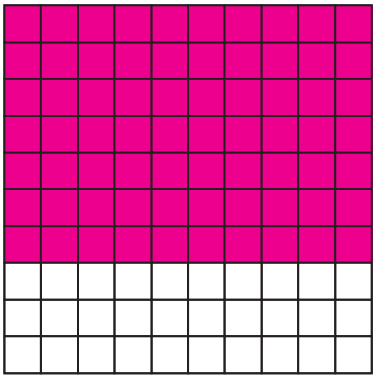

Fig 1(c)

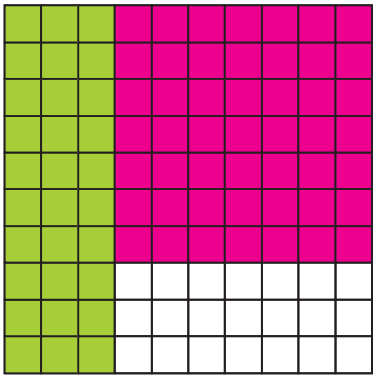

Fig 1(d)

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.

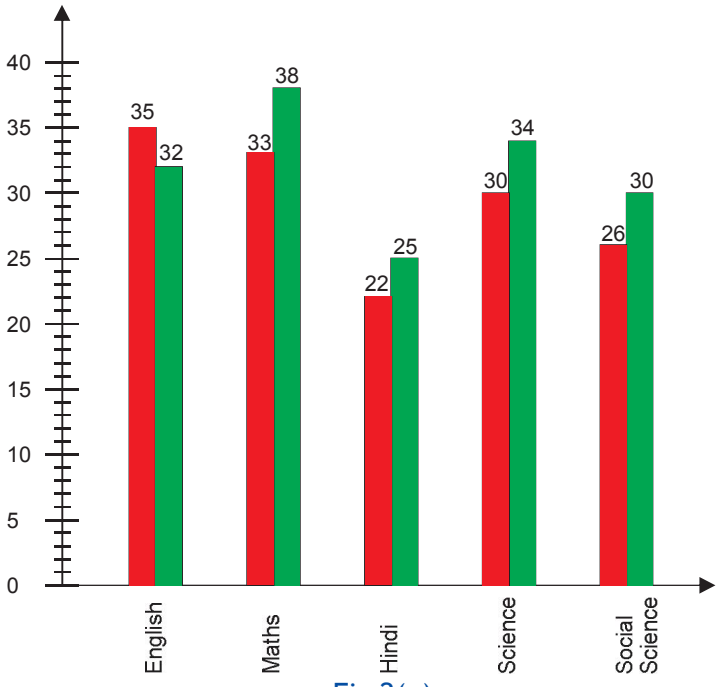

Fig 2(a)

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.

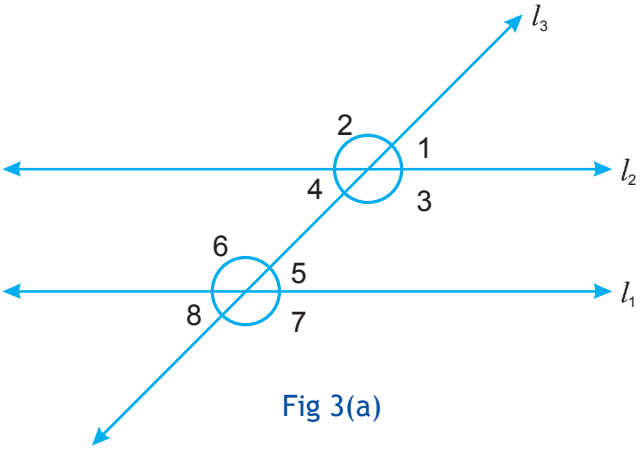

Fig 3(a)

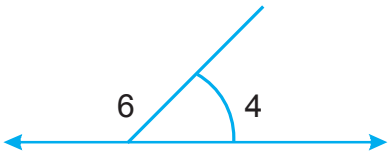

Fig 3(b)

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)].

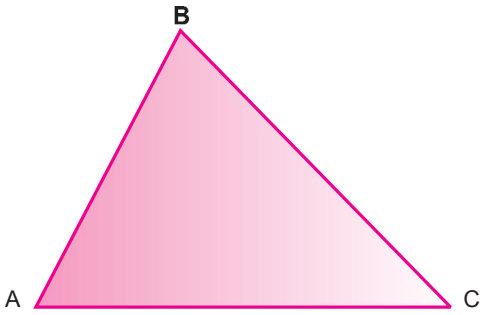

Fig 4(a)

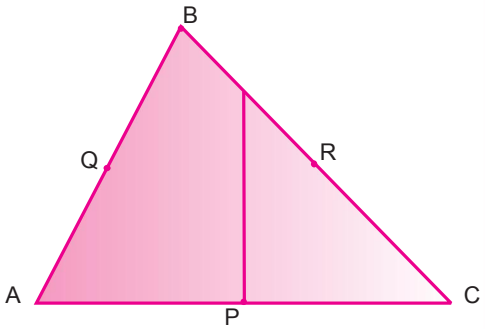

Fig 4(b)

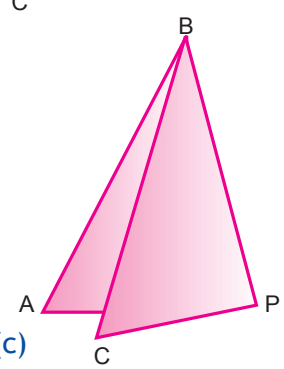

Fig 4(c)

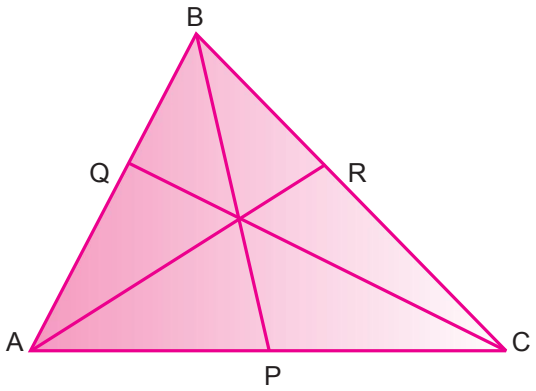

Fig 4(D)

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)].

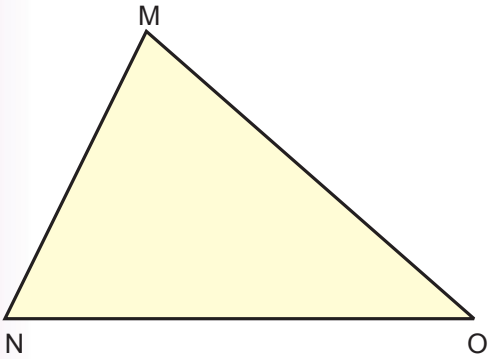

Fig 4(e)

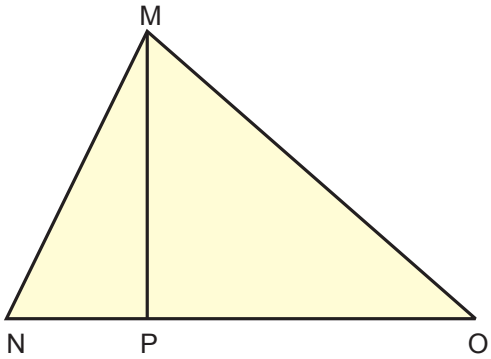

Fig 4(f)

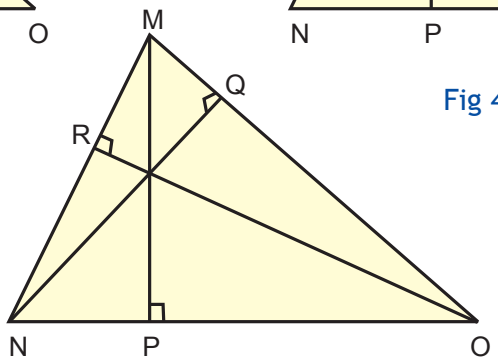

Fig 4(g)

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 ∠BAC, ∠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).

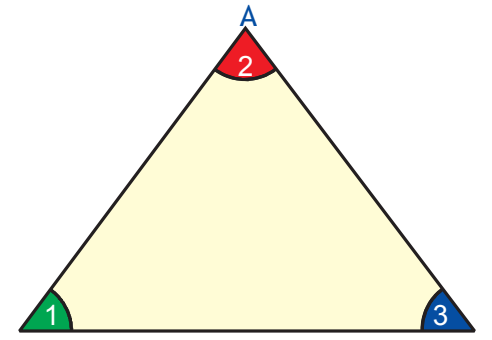

Fig 5(a)

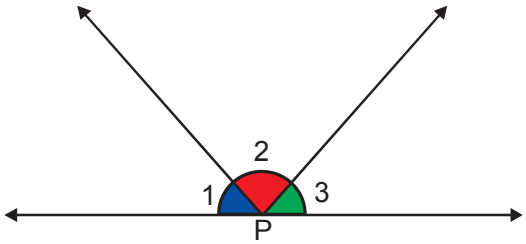

Fig 5(b)

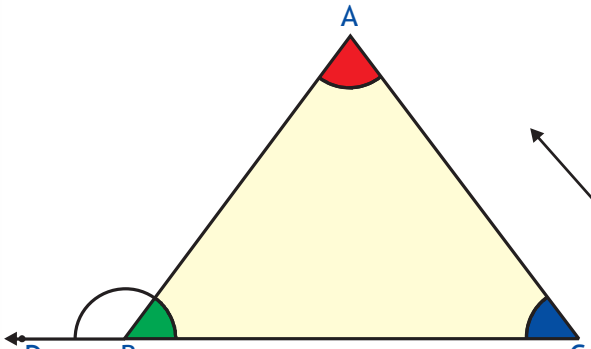

Fig 5(c)

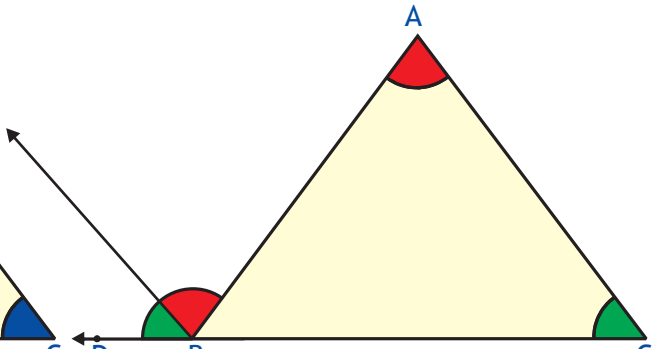

Fig 5(d)

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 + ∠ .....

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?

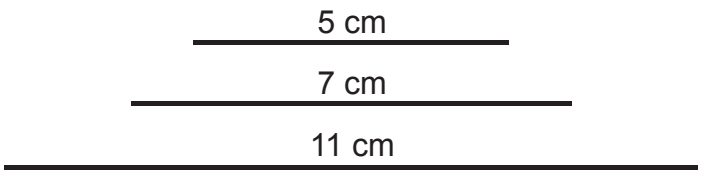

Fig 6 (a)

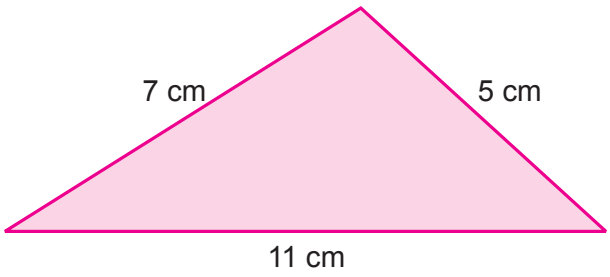

Fig 6 (b)

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).

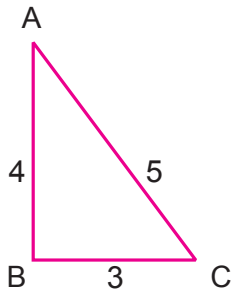

Fig 7(a)

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

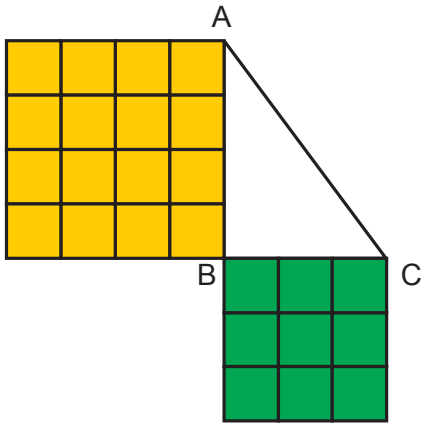

Fig 7(b)

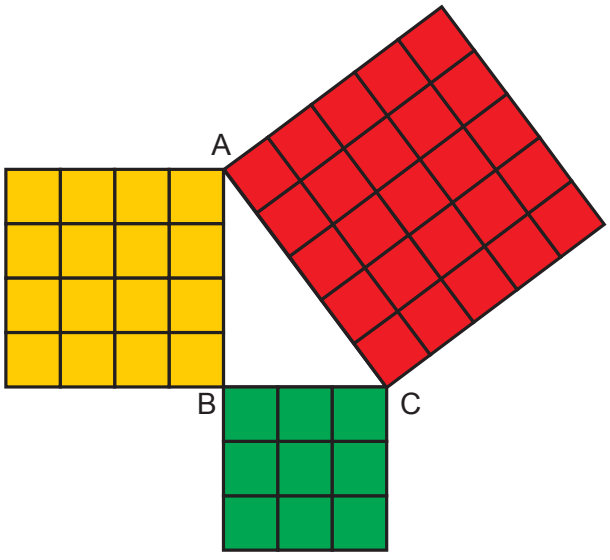

Fig 7(c)

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 .....

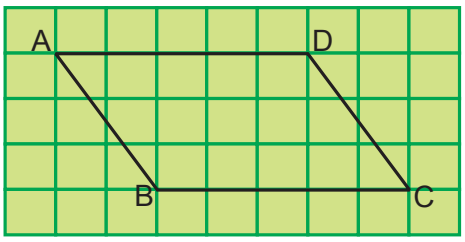

Fig. 8(a)

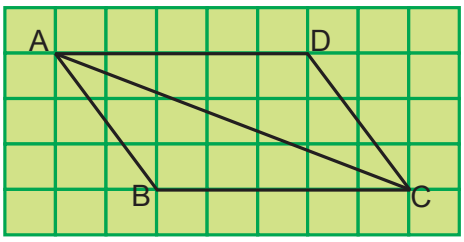

Fig. 8(b)

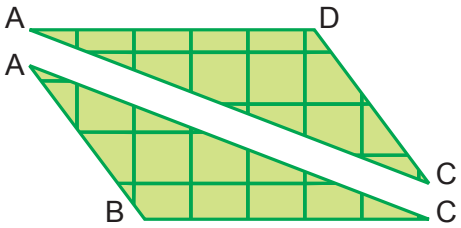

Fig. 8(c)

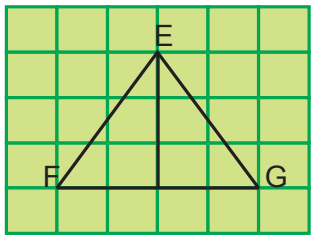

Fig. 8(d)

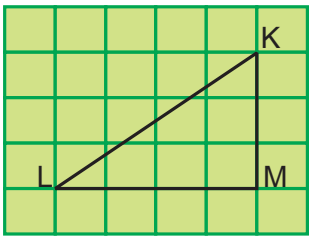

Fig. 8(e)

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.

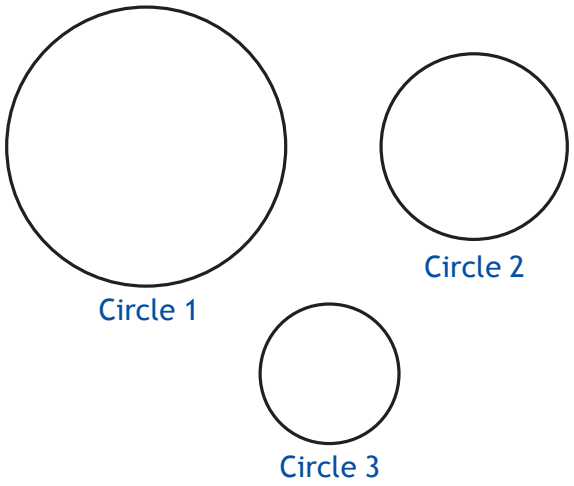

Fig 9(a)

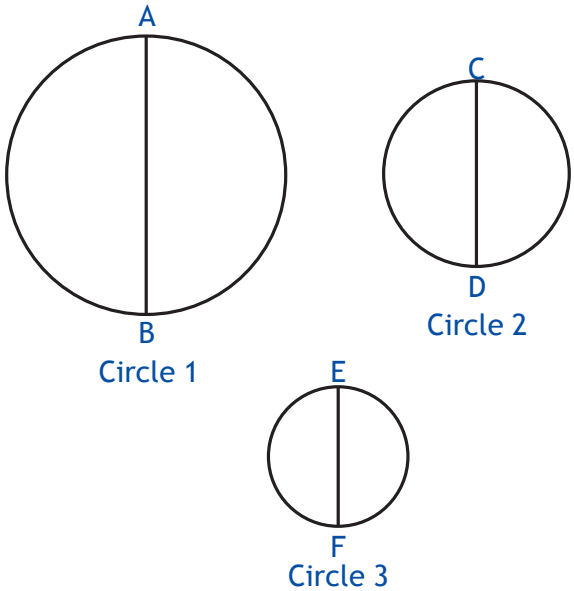

Fig 9(b)

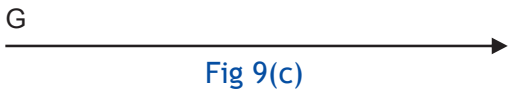

Fig 9(c)

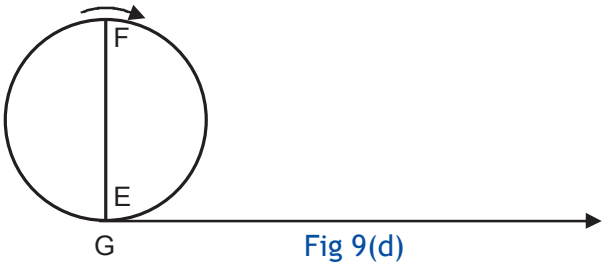

Fig 9(d)

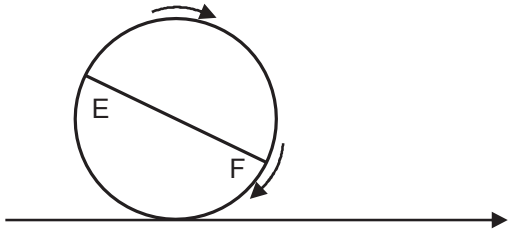

Fig 9(e)

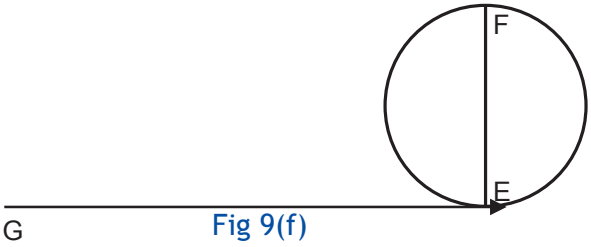

Fig 9(f)

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. 10A(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. 10A(b)]

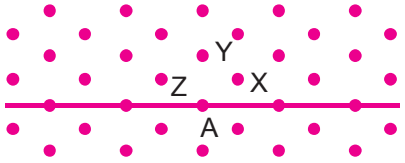

Fig 10A(a)

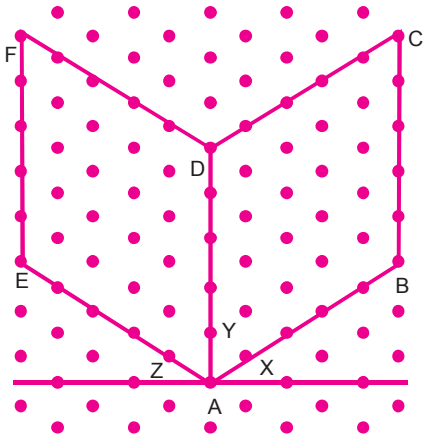

Fig 10A(b)

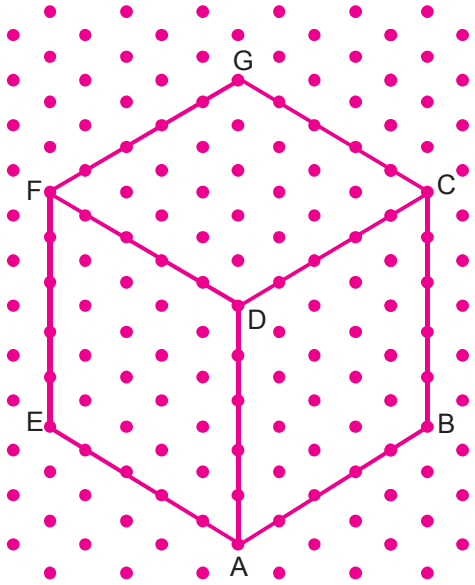

Fig 10A(c)

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

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

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

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

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

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

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

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

ABCDEFG is the required oblique sketch of the cube.

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

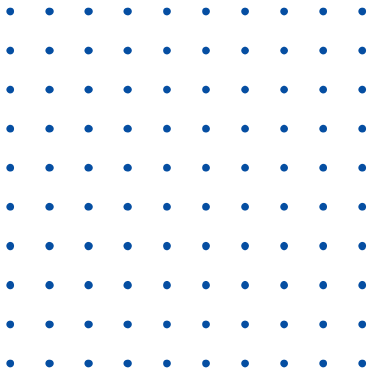

Fig 10A(d)

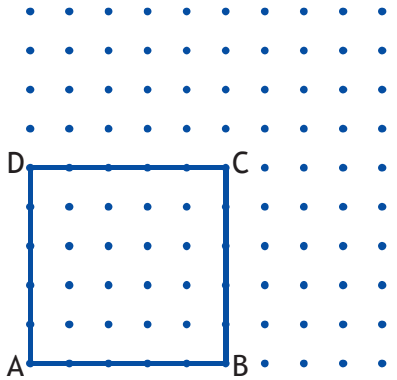

Fig 10A(e)

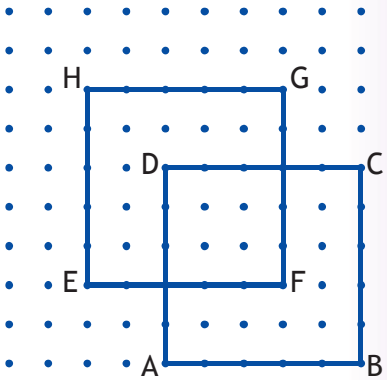

Fig 10A(f)

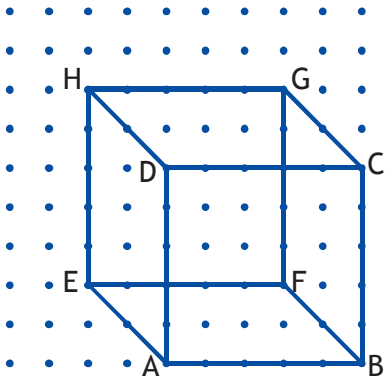

Fig 10A(g)

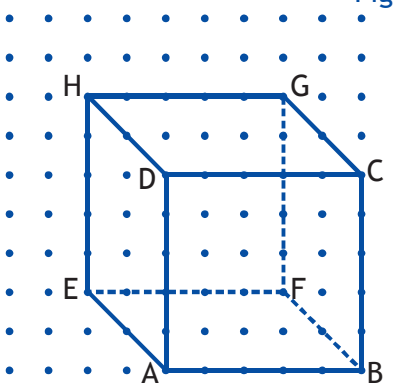

Fig 10A(h)

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)].

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.

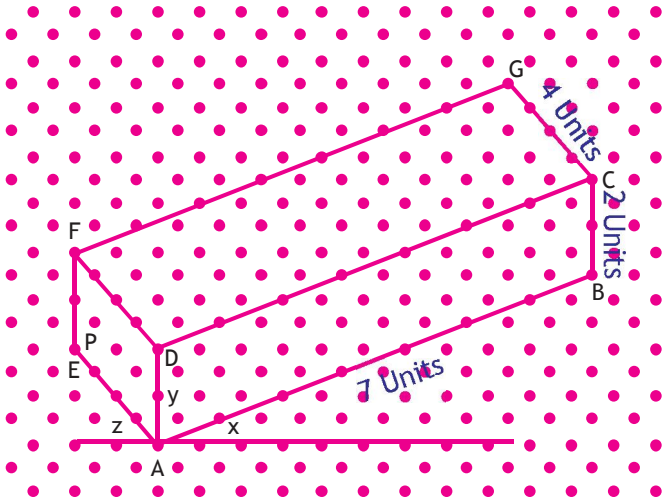

Fig 10B(a)

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).

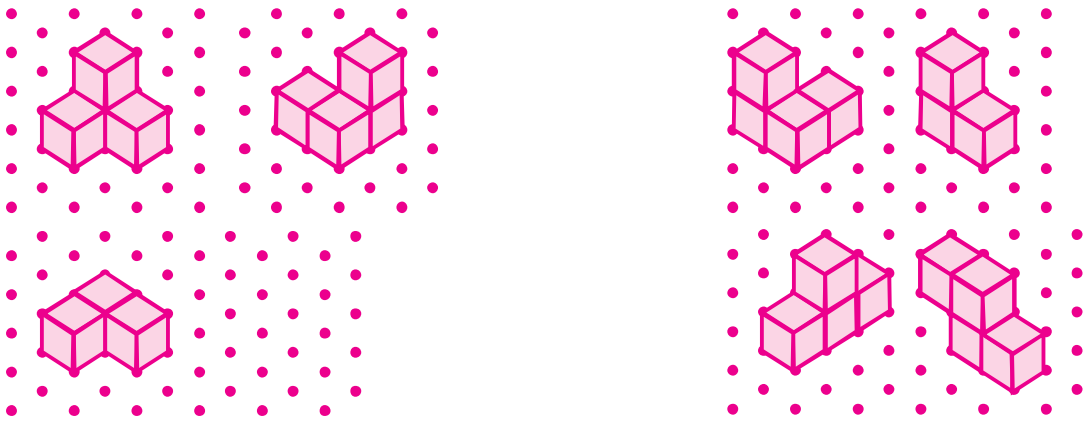

Fig. 11(a)

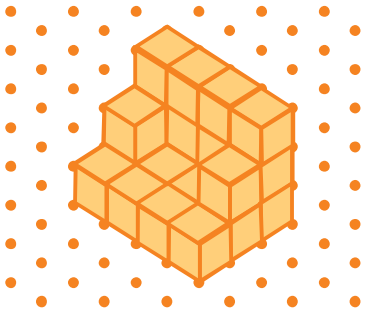

Fig. 11(b)

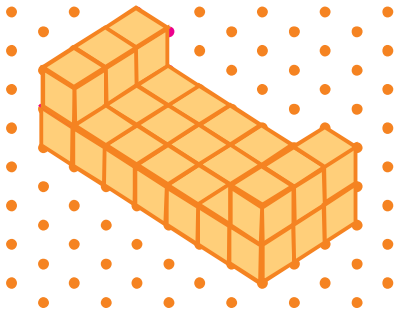

Fig. 11(c)