Activity 52

Objective

To obtain a formula for the area of a circle

Material Required

Cardboard, white drawing sheet, compasses, pencil, colours, adhesive, scissors.

Method of Construction

1. Take a cardboard of convenient size and paste a white sheet on it.
2. Draw two identical circles of radius 'a' (say 6 cm) (Fig. 1).
3. Make cutouts of these two circles.
4. Fold the circles as shown in Fig. 2.

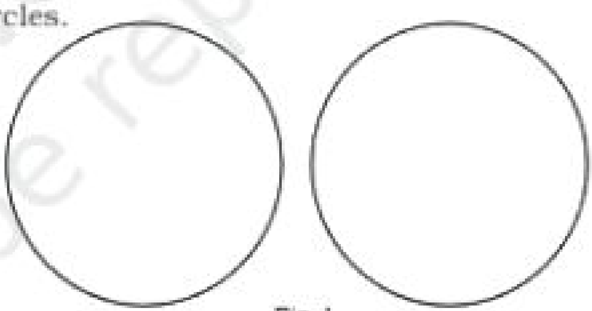


Fig. 1

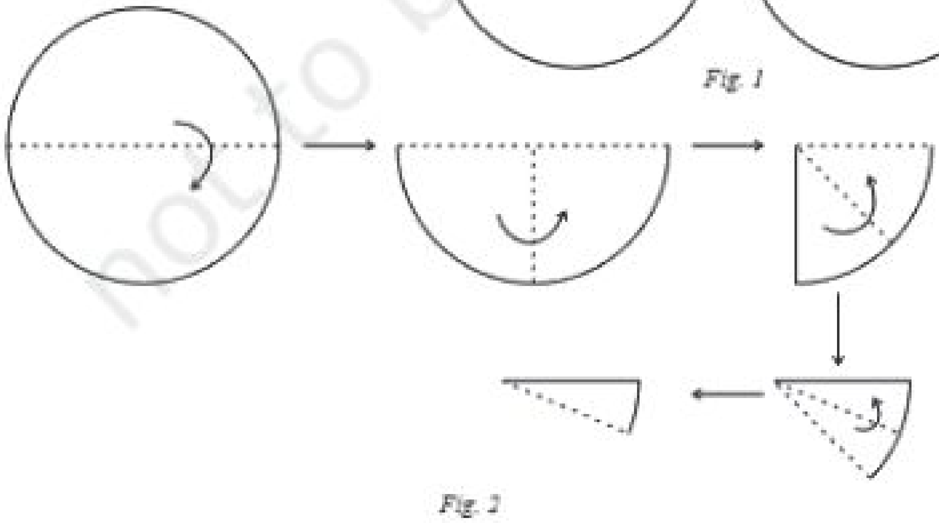


Fig. 2

5. Unfold both the circles and colour the sixteen parts so obtained as shown in Fig. 3.

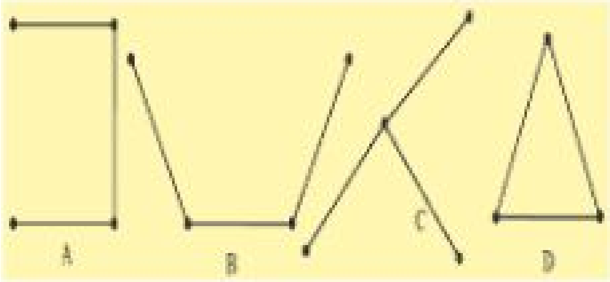


Fig. 3

6. Paste one of the circles on the cardboard sheet (Fig. 4).

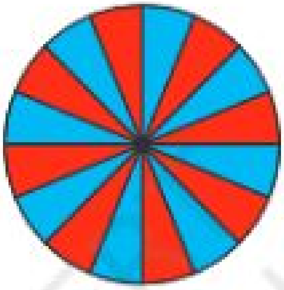


Fig. 4

7. Cut out neatly all sixteen parts from the other circle.

8. Arrange and paste them neatly as shown in Fig. 5.

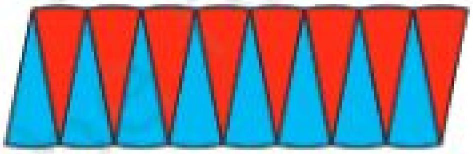


Fig. 5

Demonstration

1. The given figure looks like a rectangle.

2. Length of the rectangle $= \frac{1}{2}$ of circumference of the circle

$$= \frac{1}{2} \times (2\pi r)$$

$$= \pi r.$$

3. Breadth of the rectangle = radius of the circle = r

Therefore, area of the circle = Area of the rectangle

$$= l \times b$$

$$= \pi r \times r$$

$$= \pi r^2.$$

Observation

On actual measurement:

Radius of the circle = _____.

So, circumference of the circle = _____.

Length of rectangle in Fig. 5 = _____.

Breadth of rectangle in Fig. 4 = _____.

Area of rectangle in Fig. 5 = _____.

Area of circle in Fig. 3 = _____.

Application

This result is useful in finding area of any circular object.

Activity 53

Objective

To verify that vertically opposite angles are equal

Material Required

Cardboard, two straws, 360° protractor thumb pin, white paper.

Method of Construction

1. Take a cardboard of convenient size and paste a white paper on it.

2. Take two straws and a 360° protractor and fix them on the cardboard using a thumb pin at the centre of the protractor as shown in Fig.1.

3. Mark the end points of the straws as A, B, C and D either using paper chit's or using marker (see Fig.1).

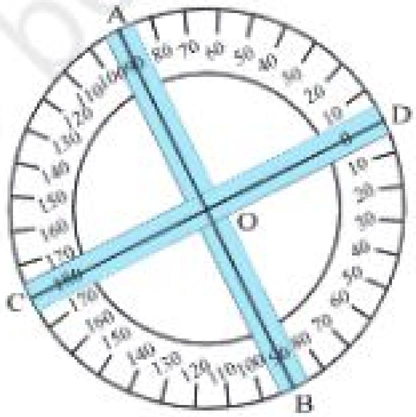


Fig. 1

DEMONSTRATION

1. Rotate the straws and note the measures of the angles AOC, BOC, BOD and AOD in different positions with the help of the protractor fixed.

2. From the measurements, $\angle AOD = \angle COB$ and $\angle AOC = \angle DOB$.

   Thus, vertically opposite angles are equal.

OBSERVATION

Complete the following table:

Position	∠AOC	∠BOC	∠BOD	∠AOD	
1	____	____	____	____	∠AOC = ..., ∠BOC = ...
2	____	____	____	____	.... = ∠BOD, ... = ∠AOD
3	____	____	____	____	∠..... = ∠..... =, ∠..... = ∠ .....
:					

Thus, vertically opposite angles are ______.

APPLICATION

This result can be used to explain

1. Property of a linear pair.
2. Meaning of vertically opposite angles.

Activity 54

Objective

To add two algebraic expressions (polynomials) using different strips of cardboard.

Material Required

Cardboard, coloured papers (green, blue and red), geometry box, cutter, eraser, adhesive, sketch pen.

Method of Construction

1. Take three pieces of cardboards and paste coloured papers on them. Green on one, blue on the second and red on the last one.

2. Make sufficiently large number of squares (strips) of side x units on green paper and cut them out [Fig. 1].

3. Similarly, draw rectangle of dimensions $x \times 1$ on blue coloured paper and square of dimensions 1×1 unit on red coloured paper and cut them out [Fig. 2 and Fig. 3].

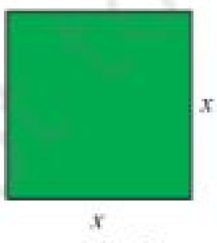


Fig. 1

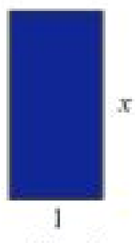


Fig. 2

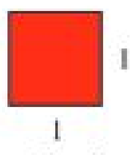


Fig. 3

DEMONSTRATION

1. To represent the algebraic expression $3x^2 + 2x + 5$, arrange the strips as shown in (Fig. 4).

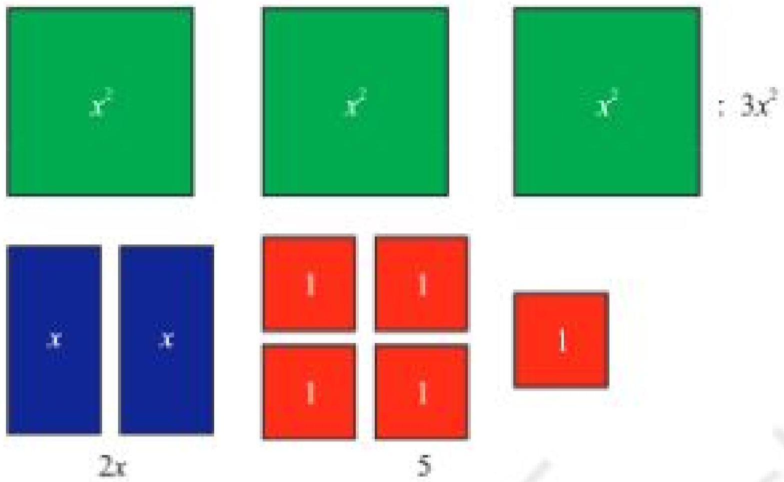


Fig. 4

2. Similarly, as in step 1, represent the algebraic expression $2x^2 + 4x + 2$ as follows (Fig. 5).

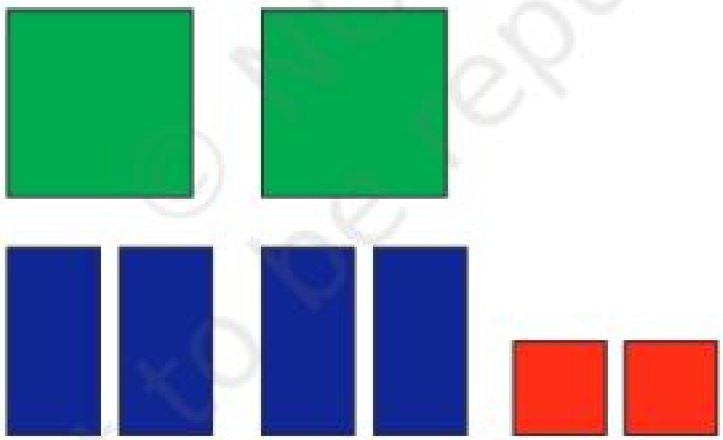


Fig. 5

3. To add the above two expressions, combine the strips in Fig. 4 and Fig. 5 as shown below (Fig. 6).

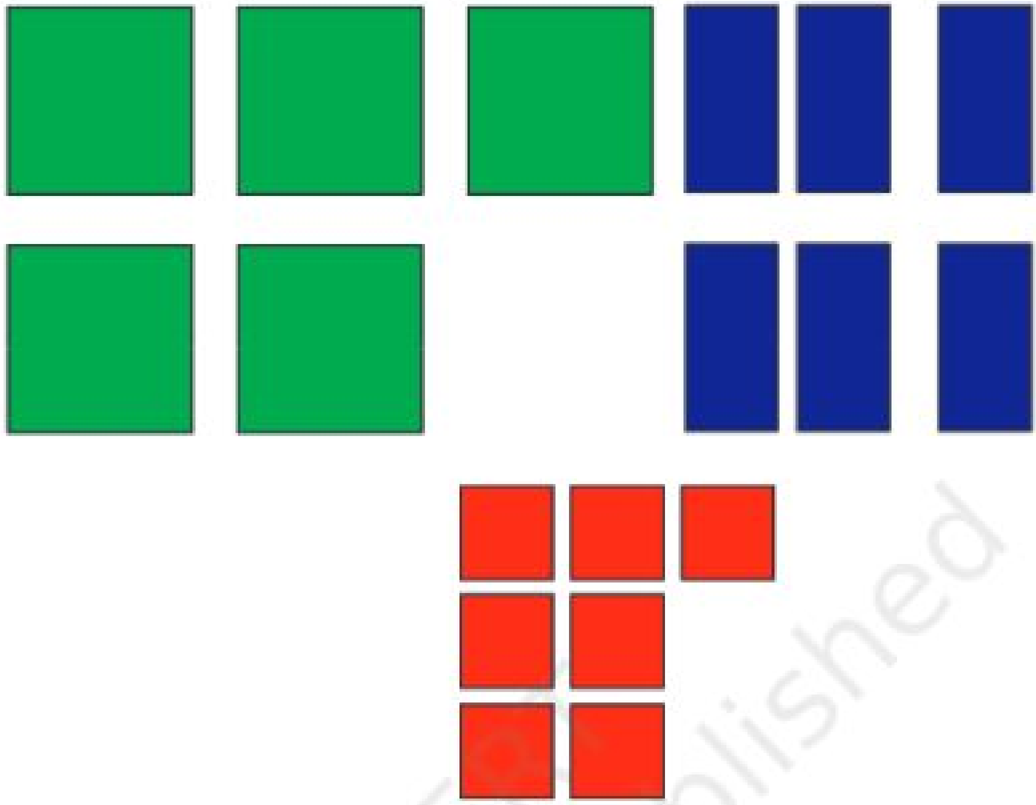


Fig. 6

4. Count the strips of each colour in Fig. 6. We find that it consists of 5 green strips, 6 blue strips and 7 red strips. This represents the sum of two algebraic expressions as mentioned above as $5x^2 + 6x + 7$

Similarly, find the sum of some other two algebraic expressions.

Observation

1. In Fig. 4

   (a) Number of green strips = ________.

   (b) Number of blue strips = ________.

   (c) Number of red strips = ________.

   (d) Algebraic expression represented = ________.

2. In Fig. 5

   (a) Number of green strips = ________.

(b) Number of blue strips = _______.

(c) Number of red strips = _______.

(d) Algebraic expression represented = _______.

3. In Fig. 6

(a) Number of green strips = _______.

(b) Number of blue strips = _______.

(c) Number of red strips = _______.

(d) Algebraic expression represented = _______.

Thus $(3x^2 + 2x + 5) + (2x^2 + 4x + 2)$ = ______ + ______ + ______.

Application

The activity is useful in explaining the concept of addition of two algebraic expressions as well as like and unlike terms.

Activity 55

Objective

To subtract a polynomial from another polynomial [for example, $(2x^2 + 5x - 3) - (x^2 - 2x + 4)$]

Material Required

Blue and red colours, scissors, ruler, eraser, white chart paper.

Method of Construction

1. Make sufficient number of cutouts of dimensions 3 cm × 3 cm, 3 cm × 1 cm and 1 cm × 1 cm as shown in Fig. 1.

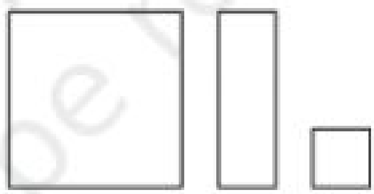


Fig. 1

2. Colour one side of each shape by red colour, and the other by blue colour.

3. Let blue coloured cut out of size 3 cm × 3 cm represent x^2, cut out of size 3 cm × 1 cm represent x and cut out of size 1 cm × 1 cm represent +1.

4. Similarly, let corresponding red coloured cutouts represent $-x^2$, $-x$ and -1, respectively.

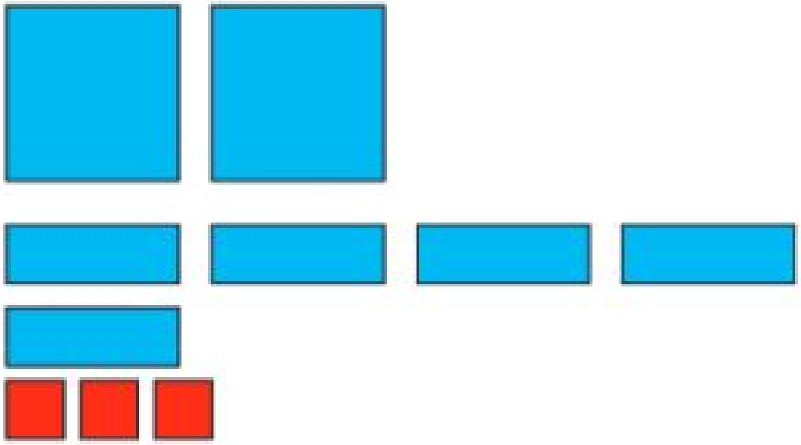


Fig. 2

DEMONSTRATION

1. The polynomial $2x^2 + 5x - 3$ is represented in Fig. 2.
2. The polynomial $(x^2 - 2x + 4)$ is represented in Fig. 3.

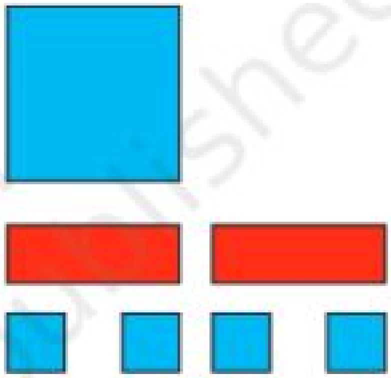


Fig. 3

To subtract the polynomial $x^2 - 2x + 4$ from $2x^2 + 5x - 3$, we have to remove 2nd set of algebraic pieces (Fig. 3). Invert each cut out of Fig. 3 and place it along the cutouts of Fig. 2 as shown in Fig. 4.

4. Cancel one blue cut out with one red cut out of same size, if any, as shown in Fig. 4.

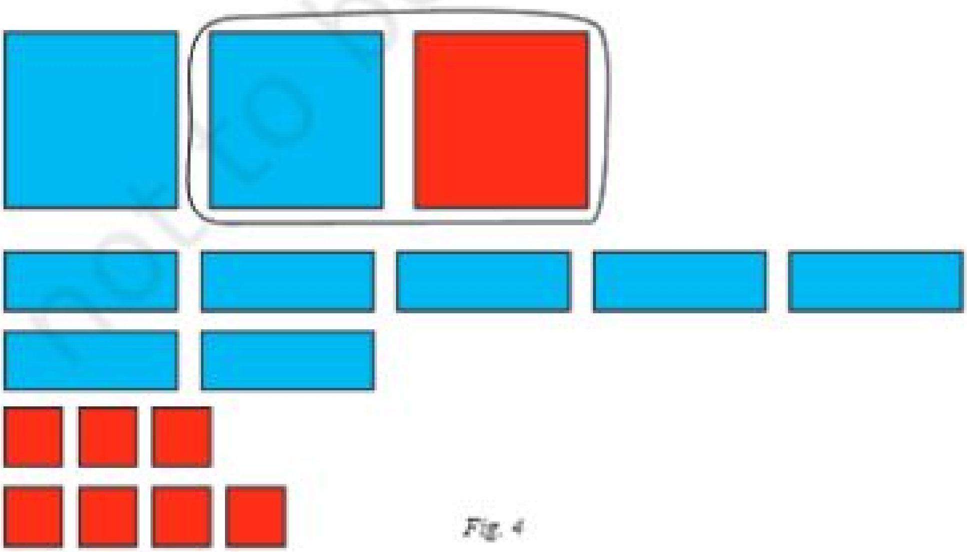


Fig. 4

5. Remaining cut outs represent the polynomial

   $x^2 + 7x - 7$

6. So, $(2x^2 + 5x - 3) - (x^2 - 2x + 4) = x^2 + 7x - 7$

   This result may be checked by finding

   (i) $(x^2 + 7x - 7) + (x^2 - 2x + 4) \quad = 2x^2 + 5x - 3$

   (ii) $(2x^2 + 5x - 3) - (x^2 + 7x - 7) \quad = x^2 - 2x + 4$

   through suitable activities.

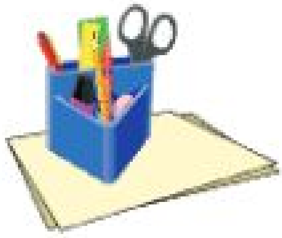
Observation

1. In Fig. 2, the polynomial represented is ________.
2. In Fig. 3, the polynomial represented is ________.
3. In Fig. 4, the polynomial represented is ________.
4. So, $(2x^2 + 5x - 3) - (x^2 - 2x - 1) =$ ___ + ___ $- 7$.

Application

This activity is useful in explaining subtraction of polynomials, and also the concept of like and unlike terms.

Activity 56



Objective

To collect data and represent this through a bar graph

Material Required

An English textbook, pen/pencil, graph paper/grid paper, different colours, ruler.

Method of Construction

1. Divide the class into groups of 4 or 5 students.
2. Let a student of one group open a page of English textbook randomly and record the number of times different vowels *a*, *e*, *i*, *o*, *u* occur on that page.
3. The other group members will help her in counting vowels. Each group may record the data in the table below.

Vowel	Tally marks	Number of times a vowel occurs on that page
a		
e		
i		
o		
u		
		Total

4. Take a cardboard and paste a grid paper on it.

5. Draw two perpendicular lines on it, through a point say O.

6. Write 'vowels' along the horizontal line and 'number of times a vowel occurs' (frequency) along the vertical axis.

7. Draw bars for each vowel acceding to its frequency.

8. Colour the bars differently.

Demonstration

1. The above table represents the frequency distribution of vowels.

2. The graph obtained after drawing bars in step 6 will be a bar graph representing occurrence of vowels on a page.

This activity will be performed by all the groups and separate bar graphs may be drawn by each group.

Data collected by each student may be combined together and a bar graph may be prepared for the data so obtained.

Observation

The vowel which occurs maximum number of times is __________.

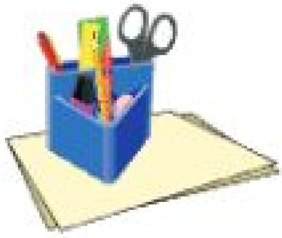
The vowel which occurs minimum number of times is __________.

Mode of the data is __________.

Application

This activity may be used in understanding the meaning of data, frequency distribution, bar graph and mode of the data.

Activity 57



OBJECTIVE

To verify that a minimum of three sides are required to construct a polygon

MATERIAL REQUIRED

Cardboard, sticks, adhesive, coloured paper.

METHOD OF CONSTRUCTION

1. Take a cardboard of convenient size and cover it with a coloured paper.
2. Take two sticks and place them end-to-end in different positions. Some positions are shown in Fig. 1.

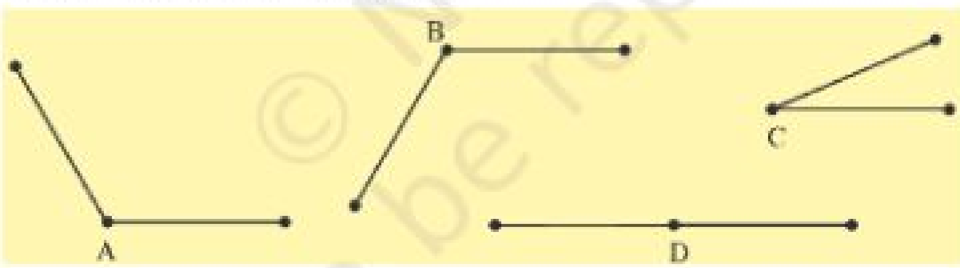


Fig. 1

3. Take three sticks and place them in different positions. Some positions are shown in Fig. 2.

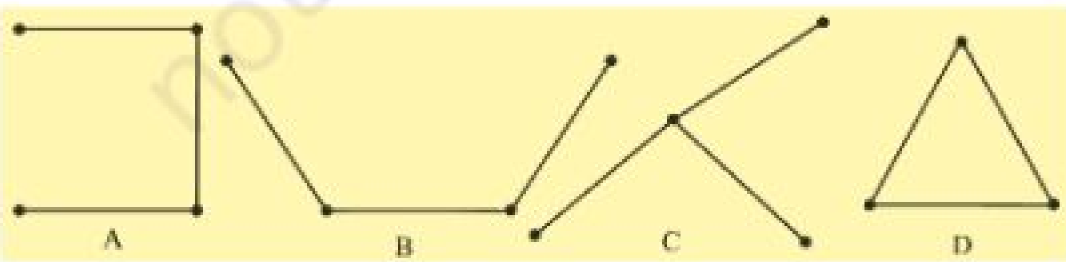


Fig. 2

4. Take four sticks and try to place them in different positions. Some of them are shown in Fig. 3.

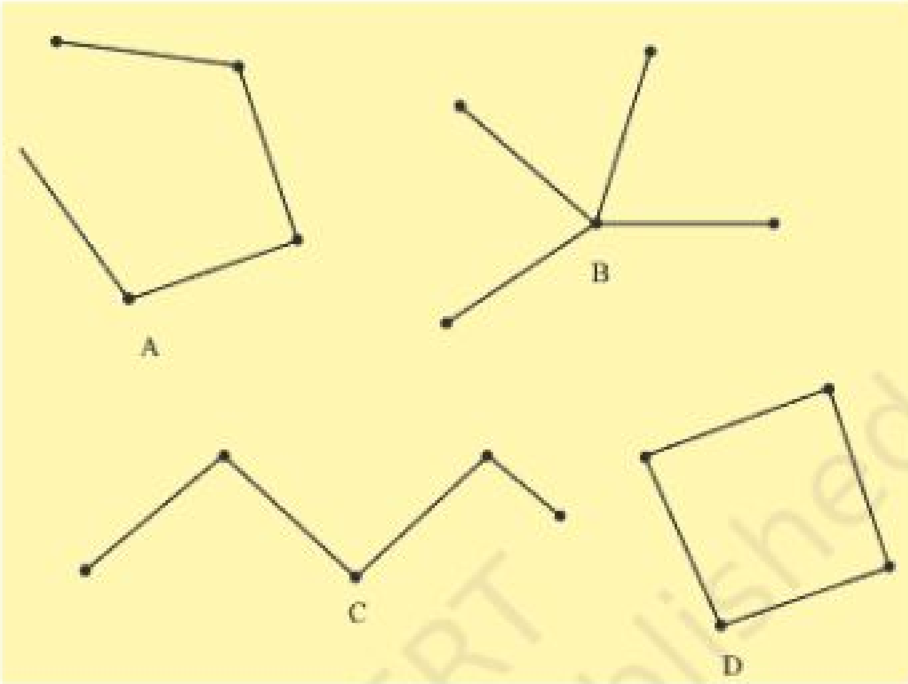


Fig. 3

5. Repeat the activity with more number of sticks.

Demonstration

1. No closed figure is formed with two sticks.
2. Closed figure is formed with three sticks.
3. Closed figure is formed with four sticks.
4. Closed figure is formed with five sticks and so on.

Observation

1. The closed figure formed with these sticks (line segments) is a polygon, called ________.
2. The closed figure formed with four line segments is a polygon, called ________.

3. The closed figure formed with five line segments is a polygon called _________.

4. No polygon is formed with _________ sticks (line segments) thus, a minimum of _________ line segments are needed to form a figure made up of line _________ , i.e. a _________.

Application

This activity may be useful in understanding the construction of a polygon.

Activity 58

Objective

To make medians of a triangle by paper folding

Material Required

Coloured paper, pencil, cardboard, scissors, adhesive, ruler.

Method of Construction

1. Make a triangle ABC by paper folding or draw a triangle ABC. Cut it out (Fig.1).

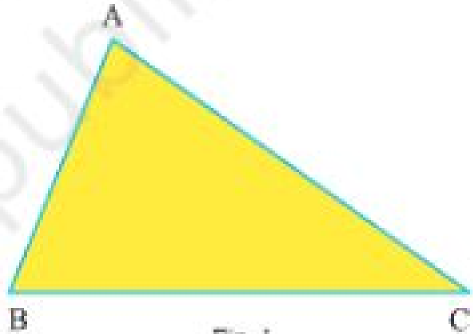


Fig. 1

2. Get the mid point of side BC by folding the paper such that B falls on C. Name this point D as shown in Fig. 2.

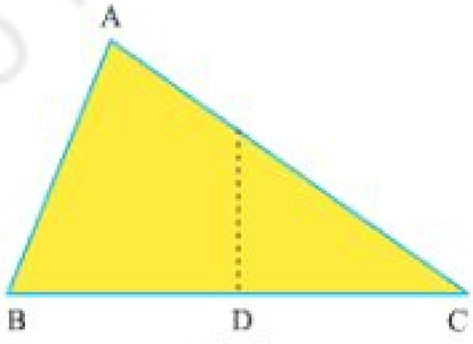


Fig. 2

3. Fold the triangle such that fold passes through A and D. Unfold and mark the crease with pencil as in Fig. 3.

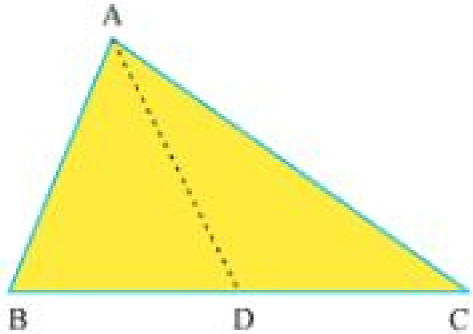


Fig. 3

4. Similarly, get the mid point E and F of sides AB and AC, respectively by paper folding. Join CE and BF by paper folding (Fig. 4).

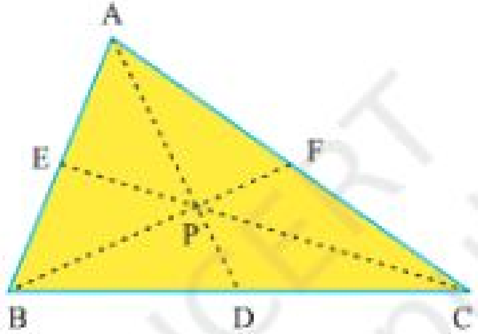


Fig. 4

Demonstration

1. AD, BF and CE are the medians of Δ ABC.
2. They meet at a point P.

Observation

1. On actual measurement (in centimetres)

   BD = __________, CD = ____________.

   BE = __________, AE = ____________.

   CF = __________, AF = ____________.

AD = __________, PD = ____________.

CP = __________, PE = ____________.

BP = __________, PF = ____________.

BD = __________, CD = ____________.

$\frac{AP}{AD} = \frac{BP}{PF} = \frac{CP}{PE} =$ ____________.

2. All the three medians pass through the same point.

3. This point lies in the interior of the triangle.

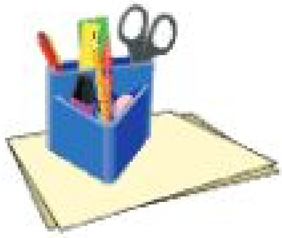
Application

The activity is useful in understanding the meaning of the medians of a triangle. Also in understanding an important result that all the medians meet at a point and this point divides each of these in the ratio 2 : 1.

NOTE

1. Do this activity for all types of triangles namely right angled triangle and obtuse angled triangle and see that in each case the three medians meet in the interior of the triangle.

Activity 59



Objective

To obtain a formula for area of a rhombus

Material Required

Coloured paper, adhesive, scissors, cardboard, pen, pencil.

Method of Construction

1. Take a coloured paper and make a rhombus through paper folding or draw a rhombus on a paper.

2. Cut it out and paste it on a cardboard and name it as ABCD (Fig. 1).

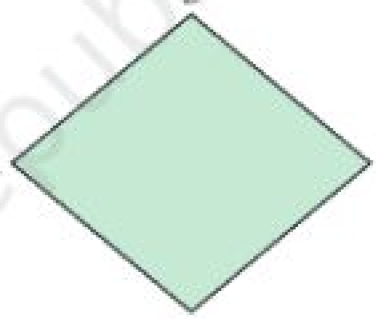


Fig. 1

3. Make a trace copy of this figure.

4. Obtain diagonals AC and DB of the trace copy by paper folding and then cut it through AC and DB to get four triangles as shown in Fig. 2.

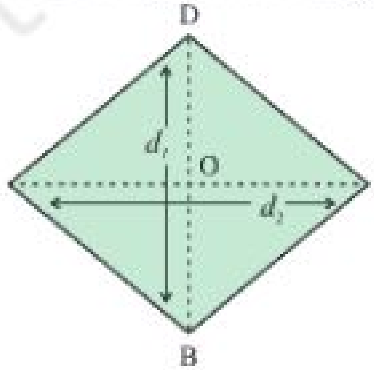


Fig. 2

5. Make replicas of ΔDOC, ΔDOA, ΔAOB and ΔBOC

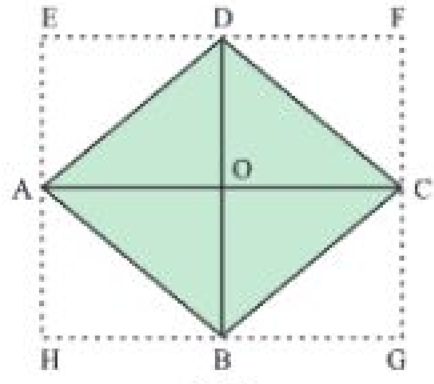


Fig. 3

Demonstration

1. Arrange the replicas of triangles as shown in Fig. 3.
2. EFGH is a rectangle.
3. Diagonal AC is equal to the length of the rectangle EFGH.
4. Diagonal DB is equal to the breadth of the rectangle EFGH.
5. Area of rhombus $= \frac{1}{2} \times$ area of rectangle

$= \frac{1}{2} \times$ length $\times$ breadth

$= \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{2} \times$ product of diagonals.

Observation

On actual measurement:

$d_1 =$ ______, $d_2 =$ ______.

So, $d_1 \times d_2 =$ ______, $\frac{d_1 \times d_2}{2} =$ ______.

Area of rectangle EFGH = ______.

Area of rhombus ABCD $= \frac{1}{2}$ area of rectangle ______.

$= \frac{1}{2} d_1 \times$ ______.

Application

This activity can be used in explaining formula for area of a rhombus.

Activity 60

Objective

To verify Pythagoras Theorem for any right triangle

Material Required

Cardboard, coloured papers, adhesive, scissors, geometry box, sketch pens, tracing paper.

Method of Construction

1. Take a piece of cardboard of convenient size and paste a white paper on it.
2. Make cut outs of eight identical right triangles of which four are of one colour (blue) and four are of another colour (red) of convenient size each having sides a, b and c (say 3 cm, 4 cm and 5 cm, respectively) (see Fig. 1).
3. Make two identical squares each of side $a + b$ (Fig. 2).

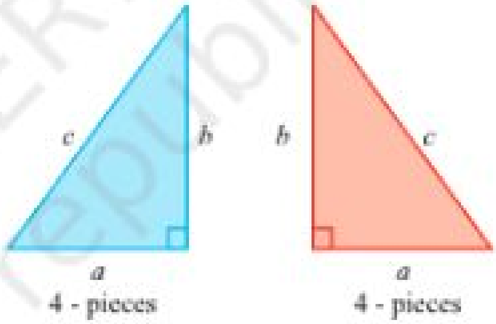


Fig. 1

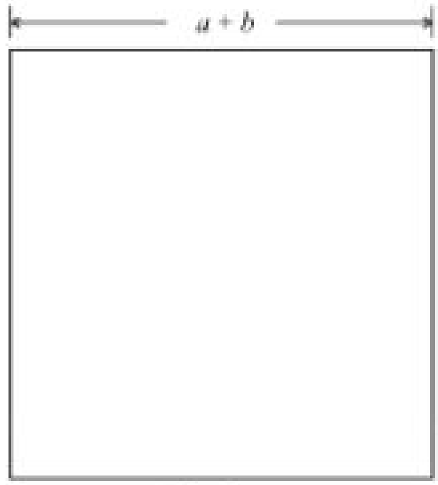


Fig. 2

Demonstration

1. Arrange four right triangles of blue colour in one of the squares as shown in Fig. 3.

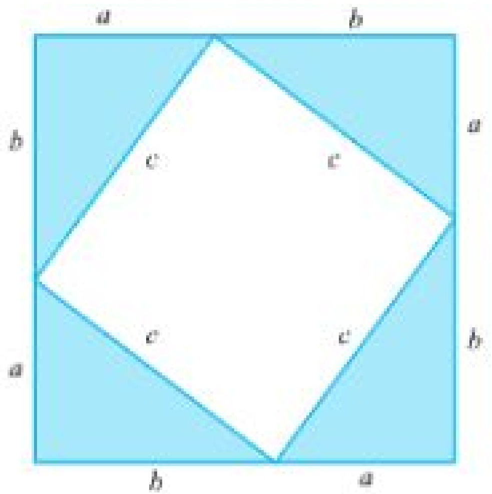


Fig. 3

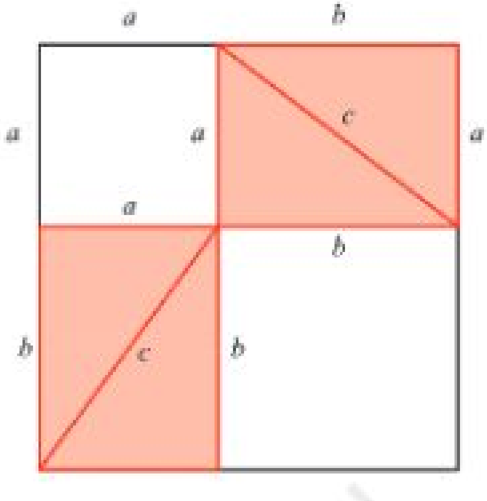


Fig. 4

2. Arrange the other four right triangles (red colour) in the other square as shown in Fig. 4.

3. In Fig. 3, after arranging four right triangles, the part of square of side $a + b$ left is a square of side c.

4. In Fig. 4, after arranging four right triangles, the part of square of side $a + b$ left is made up of two squares one of side a and the other of side b.

5. This shows that $c^2 = a^2 + b^2$.

Observation

On actual measurement (in centimetres)

1. a = ____, b = ____, c = ____.

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

3. $a^2 + b^2$ = ____.

Application

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

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