MATHEMATICS (211)

Class 10

PRACTICAL FILE

Name: ______________________________

Enrollment No.: _____________________

Study Centre: ______________________

Session:

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ACTIVITY 1

Title:

Verification of the identity $(a+b)^2 = a^2 + 2ab + b^2$.

Expected Background Knowledge:

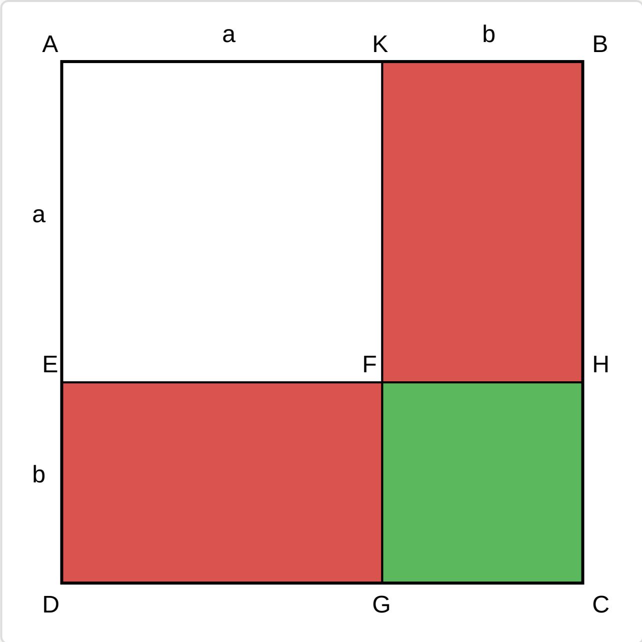
Area of a square and a rectangle.

Objectives:

After performing this activity the learner will be able to verify and demonstrate the identity $(a+b)^2 = a^2 + 2ab + b^2$

Materials Required:

- (i) Cardboard
- (ii) White chart paper
- (iii) Two glazed papers of different colours, say red and green
- (iv) Pair of scissors
- (v) Gum
- (vi) Pencil and geometrical instruments.



Geometric representation of $(a+b)^2$

Preparation For The Activity:

- (i) On a white chart paper, draw a square ABCD of side (a+b) units (say a= 7cm, b=4cm) Cut it out and paste it on the cardboard.
- (ii) Cut off two rectangles of dimensions a x b (7cmx4 cm) from red colour paper and a square of side b (4 cm) from green colour paper.
- (iii) Paste these cutouts on the square ABCD as shown in the figure and name them as rectangle EFGD, square FHCG and rectangle KBHF.

Demonstration And Use

In the figure, area of square ABCD = $(AB)^2 = (a+b)^2$ unit^2
Area of square AKFE = $(AK)^2 = a^2$ unit^2.
Area of rectangle KBHF = (KF x FH) = a x b = ab unit^2
Area of square FHCG = $(HC)^2 = b^2$ unit^2
Area of rectangle EFGD = ED x GD = a x b = ab unit^2
From the figure we may observe that:
Area of square ABCD = Area of square AKFE + area of rectangle KBHF + area of square FHCG + area of rectangle EFGD.
i.e. $(a+b)^2 = a^2 + ab + b^2 + ab$
$= a^2 + 2ab + b^2$

Conclusion:

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

ACTIVITY 2

Title:

Verification of the identity $(a-b)^2 = a^2 - 2ab + b^2$.

Expected Background Knowledge:

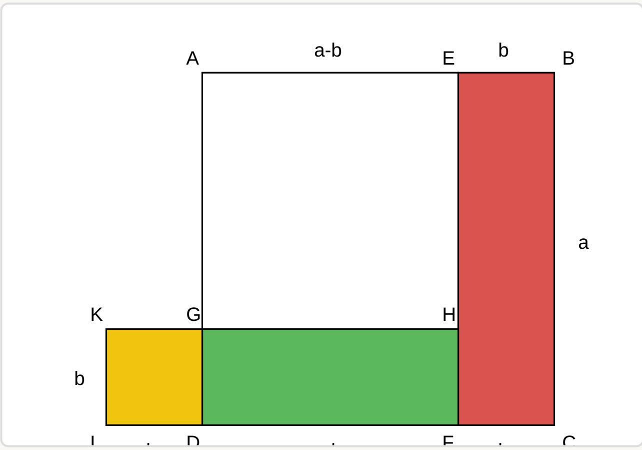
Area of a square and a rectangle.

Objectives:

After performing this activity, the learner will be able to verify and demonstrate the identity $(a-b)^2 = a^2 - 2ab + b^2$.

Materials Required:

- (i) Cardboard
- (ii) White chart paper
- (iii) Three glazed papers of different colours, say red green and yellow.
- (iv) Pair of scissors
- (v) Gum
- (vi) Coloured ball point pens
- (vii) Pencil and geometrical instruments.



Geometric representation of $(a-b)^2$

Preparation For The Activity:

- (i) On a white chart paper draw a square ABCD of side a [say a = 10cm], cut it out and paste it on the cardboard.
- (ii) Cut off a rectangle of dimensions a x b (say a =10cm, b=4cm) from red colour paper, a rectangle of dimensions (a-b) x b from green colour paper (Here a-b = 6cm and b=4cm) and a square of side b (b=4cm) from yellow colour paper.
- (iii) Paste these cut outs on the square ABCD as shown in the figure and name them as rectangle EBCF, rectangle GHFD and square KGDL.

Demonstration And Use

Area of square ABCD = $(BC)^2 = a^2$ unit^2
Area of square AEHG = $(AE)^2 = (a-b)^2$ unit^2
Area of rectangle EBCF = (BC x EB) = ab unit^2
Area of rectangle GHFD = (GH x HF) = (a - b)b unit^2
Area of square KGDL = $(KL)^2 = b^2$ unit^2
Area of rectangle KHFL = (KH x HF) = ab unit^2
From the figure we may observe that:
Area of square AEHG = Area of square ABCD + Area of square KGDL - Area of rectangle EBCF - Area of rectangle KHFL.
i.e. $(a-b)^2 = a^2 + b^2 - ab - ab$
$= a^2 - 2ab + b^2$

Conclusion:

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

ACTIVITY 3

Title:

To find the HCF of two given numbers by division method.

Expected Background Knowledge:

- (i) Factors of numbers
- (ii) Division of numbers

Objectives:

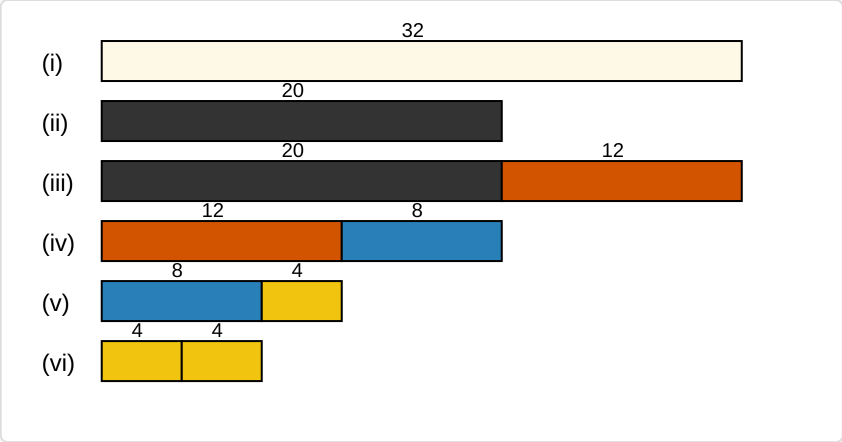
- (i) After completing this activity, the learner will be able to find the HCF of any two given numbers
- (ii) He will be able to find the largest number by which the two numbers can be divided.

Materials Required :

- (i) Cardboard
- (ii) Sketch Pens
- (iii) Pair of Scissors
- (iv) Fevicol
- (v) Scale

Preparation For The Activity:

Suppose we have to find the HCF of 20 and 32. Carry out the following steps:
(i) Cut 2 cm wide cardboard strips to get two pieces of length 32 cm each, two pieces of length 20 cm each, two pieces of length 12cm each, two pieces of length 8 cm each and three pieces of length 4 cm each.
(ii) Paste the cardboard strips as shown in figure below



Steps to find HCF by division method using strips

Demonstration And Use:

The first two strips represent numbers 32 and 20. Finding HCF means finding highest common factor of 32 and 20 i.e. finding that largest length of strip which measures the lengths 32cm and 20 cm exactly.

a) From the first two strips it is clear that this length can not be 20 cm as 20 cm does not divide 32.

b) If we keep the strip (ii) along (i), we see that the length of strip of length 12 cm is left out in (i).

c) From strip (iii) we see that the desired length can not be 12 cm, as it does not divide the 20cm strip exact number of times. From (iv) we see that a 12 cm strip covers a 20 cm strip once and then 8 cm strip is left over.

d) From strip (v) we see that desired length can not be 8, as it does not divide 12 cm strip exact number of times. We see that 8 cm strip covers 12 cm strip once and then 4 cm strip is left over.

e) The strip (vi) of 4 cm divides the 8 cm strip exactly.

Thus we see that the 4 cm long strip measures 32 cm and 20 cm strips exactly.

Thus, 4 is the HCF of 32 and 20.

Conclusion:

To find the HCF of two numbers, we have to find the largest number which can divide both given numbers.

ACTIVITY 4

Title:

Equivalent Fractions

Expected Background Knowledge:

Concept of fractions

Objectives:

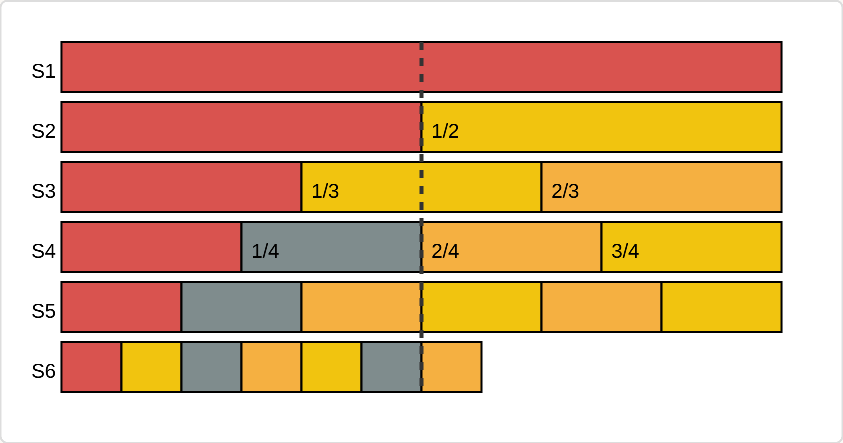
After performing this activity, the learner will understand the concept of equivalent fractions.

Materials Required:

- (i) Glazed paper (red)
- (ii) White square sheet
- (iii) String
- (iv) Sketch pens
- (v) Pencil, eraser and Fevicol.

Preparation For The Activity:

a) Mark 6 strips of same size on a square sheet marked S1, S2, S3, S4, S5 and S6, each strips starting from an initial point representing zero.
b) The first strip S1 has 12 squares and represents 1.
c) The second strip S2 has 2 equal parts of 6 squares each, each part representing 1/2 (half strip). Thus OA represents 1/2.
d) The third strip S3 has 3 equal parts, each of 4 squares. And each part represents 1/3 (one third of a strip). Thus OB represents 1/3 and OC represents 2/3.
e) The fourth strip S4 has 4 equal parts, each of 3 squares, each part representing 1/4 (one fourth of a strip). Thus OD, OE and OF on S4 represent 1/4, 2/4 and 3/4 respectively.
f) The fifth strip S5 has 6 equal parts, each of 2 squares, each part representing 1/6 (one sixth of a strip). Thus OG, OH, OI, OJ and OK represent 1/6, 2/6, 3/6, 4/6 and 5/6 respectively.
g) The sixth strip S6 has 12 equal parts, each of 1 square, each past representing 1/12 (One twelveth of a strip) Thus OL, OM, ON, OP, OQ, OR, OS, OT, OU, OV and OW represent 1/12, 2/12, 3/12, 4/12, 5/12, 6/12, 7/12, 8/12, 9/12, 10/12 and 11/12 respectively.



Grid showing equivalent fractions aligned vertically

Demonstration And Use:

Using a glazed paper and a thread, equivalent fractions can be shown in the same vertical line as shown in Fig. (i) and Fig.

Thus 1/2 = 2/4 = 3/6 = 6/12 and so on

Hence 1/2, 2/4, 3/6, 6/12 are equivalent fractions

Similarly 1/3, 2/6, 4/12 etc. are equivalent fractions

Similarly 2/3, 4/6, 8/12 are equivalent fractions.

ACTIVITY 5

Title:

To verify that a linear equation in two variables has infinite number of solutions.

Expected Background Knowledge:

Meaning of solution, plotting points on graph paper, reading the coordinates of the points lying on a line drawn on the graph paper.

Objectives:

After performing this activity, the learner will be able to demonstrate that a linear equation in two variables has infinite number of solutions.

Materials Required:

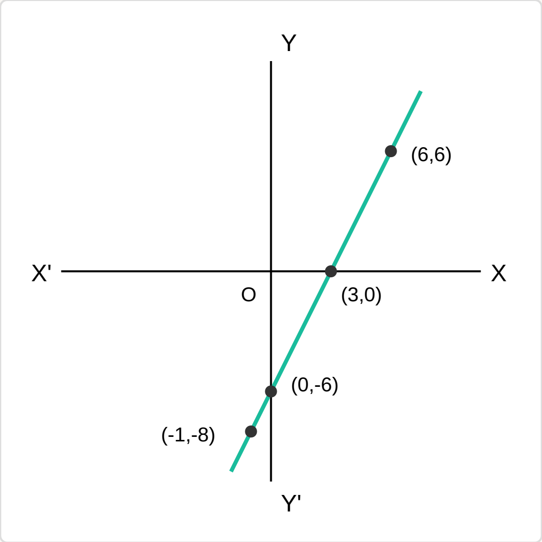
- (i) Glazed paper (red)
- (ii) Scale
- (iii) Pencil and geometrical instruments,
- (iv) Graph paper

Preparation For The Activity:-

Consider a linear equation in two variables of the form $ax + by = c$ e.g. $2x - y = 6$
Obtain a table of ordered pairs (x,y) which satisfy the given equation
e.g.

x	0	-1	3
y	-6	-8	0

Draw the graph of the given equation on a graph paper as shown in the figure given below.



Graph of linear equation 2x - y = 6

Demonstration And Use:

Take any other three points A (6,6) B (1,-4) and C (-4, -14) on the line drawn. Substitute the co-ordinates of these points in the given equation.

i.e. For A (6,6), 2x6 - 6 = 6 => 6 = 6

For B (1,-4), 2x1 - (-4) = 6 => 6 = 6

For C (-4, -14), 2x(-4) - (-14) = 6 => 6 = 6

Conclusion:

You may observe that for each of the three points A, B and C, the given equation is satisfied i.e. LHS of the equation becomes equal to R.H.S, therefore coordinates of each of the three points give solution of the given equation. The learner may further note that there are infinite number of such points on the graph of the equation. Hence, a linear equation in two variables has infinite number of solutions.

ACTIVITY 6

Title:

To verify that a given sequence is an A.P.

Expected Background Knowledge:

Knowledge of a sequence, definition of an A.P.

Objectives:

After performing this activity, learner will be able to identify an arithmetic progression out of the given sequences.

Materials Required:

- (i) Square papers with squares of size 1 cm x 1cm
- (ii) Pair of scissors
- (iii) Gum/fevicol
- (iv) Ruler, Pencil
- (v) Geometrical instruments.

Preparation For The Activity:

Consider the following sequences of positive numbers.
1, 4, 7, 10, 13, 16, ---
and 2, 3, 6, 10, 12, 15, 17, ---
For first sequence cut rectangular strips from coloured papers of different colours of width 1 cm and lengths 1 cm, 4cm, 7cm, 10 cm, --- Paste the coloured stripes in order on a squared paper as shown in the figure given below. [Fig.(i)]

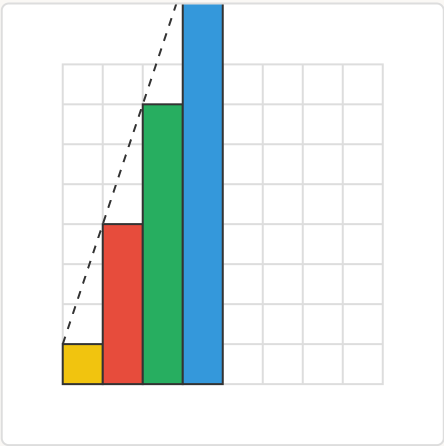


Fig. (i): Strips forming a straight line for A.P.

For the second sequence cut rectangular strips from coloured papers of different colours of width 1 cm and length 2cm, 3cm, 6cm, 10cm... Paste the coloured strips in order on a squared paper as shown in the figure given below. Fig. (ii)

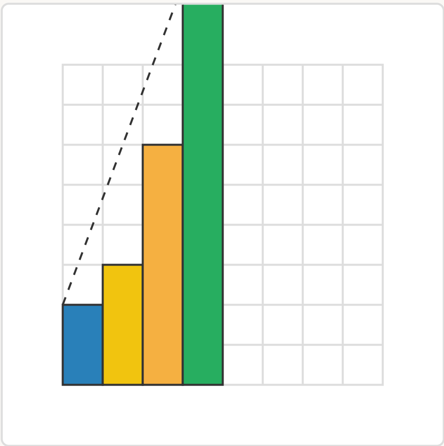


Fig. (ii): Strips not forming a straight line

Demonstration And Use

For the first sequence, the coloured strips form a ladder in which the difference between the heights of the adjoining strips is constant (Here it is 3cm). For the second sequence the coloured strips form a ladder in which the difference between the heights of the adjoining strips is not constant.

Conclusion:

For the first sequence which is an A.P. the difference between the heights of the adjoining strips of the ladder formed is constant and for the second sequence which is not an A.P, the difference between the heights of the adjoining strips of the ladder formed is not constant.

Hence, if the difference between the consecutive terms of a sequence is constant, then the given sequence is an A.P. otherwise it is not an A.P.

Note: In case of an A.P, the right hand top corners of the strips, when joined, form a straight line, which will not be the case, if the sequence is not an A.P.

ACTIVITY 7

Title:

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

Expected Background Knowledge:

- (i) Angles and Triangles
- (ii) Construction of angles and triangles

Objectives:

After performing this activity, the learner will be able to
(i) verify and demonstrate that the sum of the angles of a triangle is 180°.
(ii) find the measure of an angle of a triangle when the measure of other two angles are given.

Materials Required:

- (i) Coloured glazed papers
- (ii) Coloured Paper (card) board
- (iii) Scale
- (iv) Pencil
- (v) Eraser
- (vi) Fevicol
- (vii) Pair of scissors/cutter

Preparation For The Activity:-

(i) Take the orange coloured Cardboard
(ii) Draw a triangle ABC on a thick white paper. Cut out the triangular region and paste it on the cardboard. [Fig.(i)]

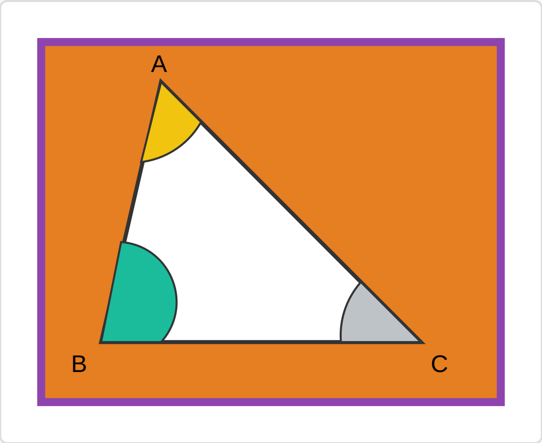


Fig. (i)

Demonstration And Use

(i) Cut off angles BAC, ACB and CBA from the triangular portion and colour them yellow, grey and green respectively
(ii) Paste these cut-out angles on a sheet of paper, as shown in Fig. (ii).
(iii) It can be seen that the three angles together form a straight angle, showing thereby that the sum of the angles of a triangle is 180°.

Conclusion:

The sum of the angles of any triangle is 180°

ACTIVITY 8

Title:

To verify that the angles opposite to equal sides of a triangle are equal.

Expected Background Knowledge:

- (i) Construction of triangles
- (ii) Congruency of triangles
- (iii) Paper folding and superposition

Objectives:

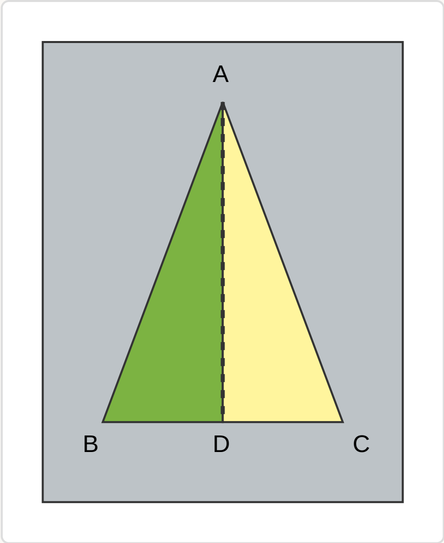
After completion of the activity, the learner will be able to demonstrate this concept and use it in proving the problems requiring this knowledge.

Materials Required:

- (i) Grey Card board sheet of size 25 cm x 30cm.
- (ii) Pencil
- (iii) Eraser
- (iv) Fevicol
- (v) Pair of compasses
- (vi) Scale
- (vii) Pair of scissors/cutter

Preparation For The Activity:

(i) On a bigger white board, paste a grey cardboard of size 25cm x 30cm
(ii) Draw a ABC, in which AB=AC, on the cardboard and make a copy of ABC on a white sheet
(iii) Of the ABC, made on white sheet, find the median AD using paper folding
(iv) Colour the two halves in different colours and paste the triangle on the triangle drawn on the board, as shown in the figure
(v) Keep the fold AD loose on the board



Isosceles Triangle Folded along Median

Demonstration And Use

(i) Fold the pasted triangle ABC along the median AD
(ii) See that point C falls on B and AC falls along AB. You can see that CD falls along BD, showing that $\angle ABC = \angle ACB$.

Conclusion:

Angles opposite to equal sides of a triangle are equal.

ACTIVITY 9

Title:

To find the area of a circle.

Expected Background Knowledge:-

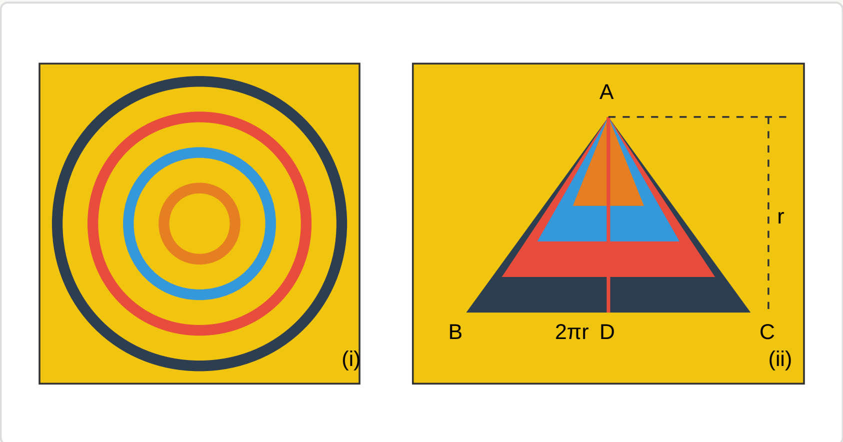
- (i) Concept of area
- (ii) Circle and its related terms

Objectives:-

After the start and finish of activity, the learner will be able to quote the area of a circle correctly and use it wherever needed.

Materials Required:

- (i) Threads of different colours
- (ii) Pair of compasses
- (iii) Pencil
- (iv) Pair of scissors.
- (v) Fevicol
- (vi) Yellow Thick cardboard



Concentric circles laid out as a triangle to find area

Preparation For The Activity: -

(i) Cut-off the yellow thick board of size 15cm x 15cm

(ii) Using pair of compasses, draw concentric circles as shown in fig. (i)

(iii) Arrange coloured Threads on the concentric circles as shown in (i).

(iv) Cut-off the circles from the innermost thread to the outermost thread and arrange them as shown in fig. (ii) as a triangle.

Demonstration And Use

Let r be the radius of outermost circle

Base BC of triangle ABC has length = $2\pi r$ units

Length of AD, the altitude of triangle ABC = r units

Area of circle = Area of triangle ABC = 1/2 BC x AD

= $1/2\ (2\pi r)\ (r)$ sq. units

= πr^2 sq. units

Observation:

(i) The cut-outs laid down in (ii) form an approximate triangle

(ii) With no wastage, area of circle = Area of cut out threads laid

Conclusion:

Area of a circle of radius r is πr^2.

ACTIVITY 10

Title:

To find the area of a trapezium

Expected Background Knowledge:

Recognition of a trapezium and knowledge of terms related to it.

Objective:-

After performing this activity the learner should be able state the formula and find the areas of different trapezia.

Materials Required:

- (i) Coloured papers
- (ii) Geometry box
- (iii) Fevicol
- (iv) Pair of scissor
- (v) Thermocol
- (vi) Hardboard

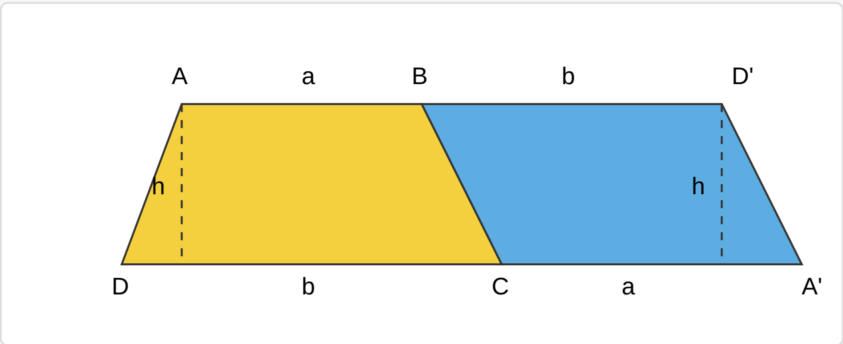


Fig. 1: Finding area of trapezium

Preparation For The Activity: -

(i) Take a piece of hardboard.
(ii) Cut two congruent trapezia of parallel sides a and b from yellow and blue papers.
(iii) Paste the two trapezia on the hardboard as shown in Fig. 1.

Demonstration And Use:

It can be easily seen that the two trapezia together form a parallelogram of base (a+b) and height h
Area of parallelogram AD'A'D = h (a+b)
Area of trapezium ABCD = 1/2 [(a+b) x h]

Conclusion:

The area of a trapezium is equal to 1/2 [(sum of its parallel sides) x (perpendicular distance between them)]