Activity 11

Objective

To subtract a smaller fraction from a greater fraction with different denominators [say, $\frac{5}{7} - \frac{2}{3}$]

Material Required

Rectangular sheet, sketch pens of different colours.

Method of Construction

1. First fold a rectangular sheet along its length six times to make seven equal parts.
2. Again fold the sheet along its breadth two times to make three equal parts to get a 7×3 grid in which there are 21 squares (Fig. 1).

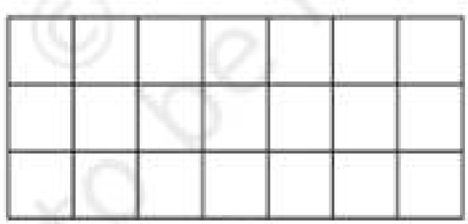


Fig. 1

3. Mark each square of any 5 columns by '+' sign with red sketch pen (Fig. 2).

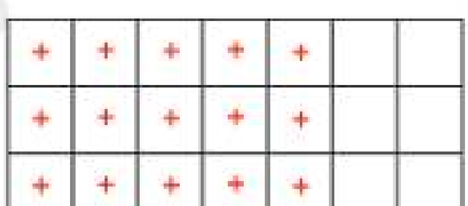


Fig. 2

4. Mark each square of any two rows with '–' sign using a blue sketch pen (Fig. 3).

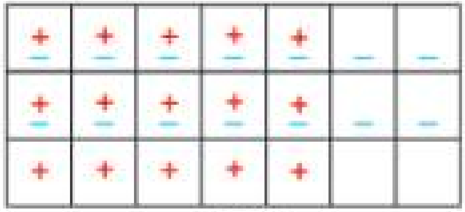


Fig. 3

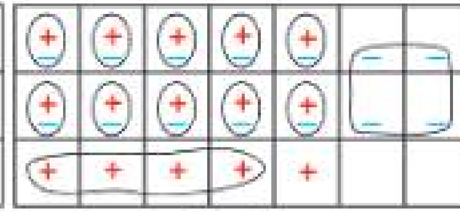


Fig. 4

Demonstration

1. Count the total number of '+' signs in Fig. 3. There are 15 '+' signs.
2. Fraction represented by '+' signs = $\frac{15}{21} = \frac{5}{7}$.
3. Count the total number of '–' signs in Fig. 3. There are 14.
4. Fraction represented by '–' signs = $\frac{14}{21} = \frac{2}{3}$.
5. Enclose one '+' sign with one '–' sign as shown in Fig. 4.
6. Count the number of unenclosed signs in Fig. 4. There is only 1 unenclosed sign.
7. Fraction represented by unenclosed sign = $\frac{1}{21}$.

   So, $\frac{5}{7} - \frac{2}{3} = \frac{1}{21}$.

Observation

1. Red '+' signs represent the fraction = _______ = _______.
2. Blue '±' signs represent the fraction = _______ = _______.
3. Total number of unenclosed signs represent the fraction = _______.

   So, = _______.

Application

This activity may be used to explain subtraction of two fractions having different denominators.

Activity 12

Objective

To add integers

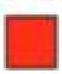
Material Required

Coloured square paper, scissors, adhesive, ruler, pen/pencil.

Method of Construction

Make some squares of two different colours, say red and blue.

Demonstration

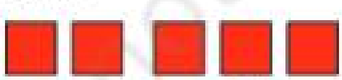
 represents +1

 represents −1

To add:

(a) Two positive integers say, 2 and 3.

Place 2 red squares and 3 red squares in the same row as shown below:



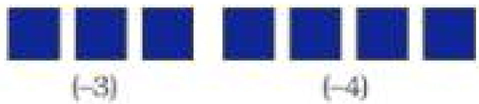
Count the total number of squares and note down their colour.

There are 5 squares of red colour.

So, $2 + 3 = 5$.

(b) Two negative integers say –3 and –4.

Place 3 blue squares and 4 blue squares and place them in a row as shown below:



Count the total number of squares and note down their colour.

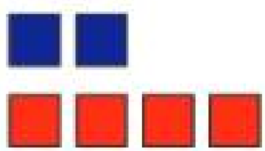
There are 7 squares of blue colour.

So, (–3) + (–4) = –7.

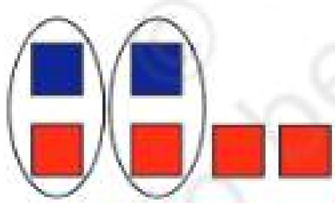
(c) One negative and one positive integer.

(i) (–2) + (4)

Place two squares of blue colour and 4 squares of red colour in two rows as shown below:



Encircle one blue and one red square as shown below. Note down the number of coloured squares left.

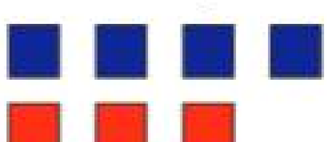


Two squares of red colour are left.

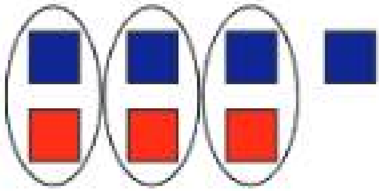
So, (–2) + (4) = 2.

(ii) (–4) + 3

Place 4 blue squares and 3 red squares in two rows as shown below:



Encircle one blue and one red square as shown below.



Note down the number of squares left alongwith its colour.

There is one blue square left.

So, (–4) + 3) = –1

From (a) and (b):

If the integers are of the same sign, then to find their sum, add the two integers ignoring their signs and put the sign of the two integers with the sum.

From (c):

If the integers are of different signs, then to find their sum, subtract the smaller number from the bigger number (ignoring their signs) and put the sign of the bigger number with the sum.

Observation

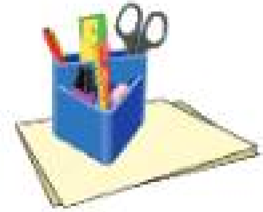
Complete the table:

Integers			
a	*b*	*a* + *b*	*Sum* =
2	3	2 + 3	5
–2	–3	–2 + (–3)	–5
–2	4	–2 + 4	.....
–4	3	–4 + 3	.....
–7	+5	.....	.....
3	–10	.....	.....
–10	5	.....	.....

Application

This activity is useful in understanding the process of addition of two or more integers.

Activity 13



Objective

To subtract integers

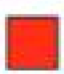
Material Required

Coloured square paper, adhesive, white sheet, ruler, pen/pencil.

Method of Construction

Make different squares of two different colours, say red and blue.

Demonstration

 represents +1

 represents –1

1. To find: 2 – 3

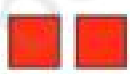


Fig. 1

(i) To subtract 3 from 2, take 2 red squares (Fig.1). Try to cross 3 red squares from it. But there are only 2 red squares, so to cross three, we add one red and one blue as shown in Fig. 2.

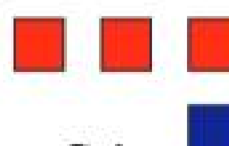


Fig. 2

(ii) Now cross three red squares. Count the number and colour of squares left (Fig. 3).

Fig. 3

One blue square is left.

So, 2 – 3 = –1. [It is same as doing 2 + (–3)].

2. To find: $-2 - (-4)$

(i) To subtract -4 from -2, take 2 blue squares (Fig. 4) and try to cross 4 blue squares from it. But there are only two blue squares, so add two blue and two red squares as shown in Fig. 5

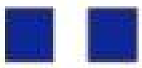


Fig. 4

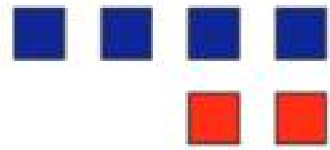


Fig. 5

(ii) Cross blue squares from them and count the number of squares left along with their colour (Fig.6).

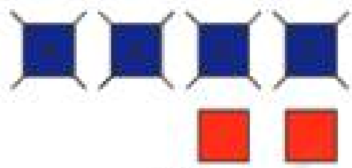


Fig. 6

There are two red squares left.

So, $-2 - (-4) = +2$. [It is same as doing $-2 + (4)$].

3. To find: $3 - (-7)$

(i) To subtract -7 from 3 take 3 red squares and add 7 blue and 7 red squares as shown below (Fig. 7).

(ii) Cross seven blue squares.

Count the number of squares left alongwith their colour.

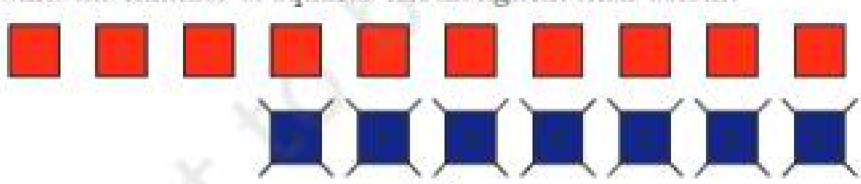


Fig. 7

There are 10 red squares left.

So, $3 - (-7) = 10$. [It is same as doing $3 + 7$].

4. To find: $-2 - (5)$

(i) To subtract 5 from -2, take 2 blue squares and add 5 blue squares and 5 red squares (Fig. 8). Cross five red squares.

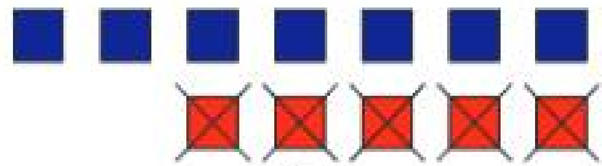


Fig. 8

(ii) Now count the number of squares left alongwith their colour. There are 7 blue squares left.

So, $-2 - (5) = -7$. [It is same as doing $-2 + (-5)$].

Thus, to subtract integer b from an integer a, add additive inverse of b to a. That is, $a - b = a + (-b)$.

Observation

Complete the table.

Integers			
a	b	$a - b$	$a - b =$
2	–3	2 – 3	–1
–2	–4	–2 – (–4)	+2
3	–7	3 – (–7)	10
2	–5	......	......
–3	5	......	......
–2	–7	......	......

Application

This activity can be used to demonstrate subtraction of integers.

Activity 14

[GAME]

OBJECTIVE

Addition of decimals

MATERIAL REQUIRED

Thick sheet of paper, waste card, sketch pen, scissor.

METHOD OF CONSTRUCTION

1. Take a thick sheet of paper.
2. Cut them into sufficient number of small square pieces or rectangular pieces (say 40).
3. Write different decimal numbers on the cards using a sketch pen as shown below.

0.1	0.5	0.9	0.8	0.2	0.6	0.4	0.50
0.85	0.35	0.55	0.25	0.45	0.65	0.15	0.75

Fig. 1

LET US PLAY

1. Teacher may divide the class into groups of say 4.
2. Mix all the cards and place them face down. Now one child will pick any two cards at a time and add the decimal number written on them. If the sum is 1, the child will keep the cards with him/her and if the sum is not 1, then he/she will put the cards back face down.

3. Now the second child will pick two cards and repeat the above steps. The game will continue till all the cards are picked up.

4. The child with maximum number of cards is the winner in that group. Then the winners of all the groups will play the game again and the winner of the whole class will be declared.

Observation

S. No.	Number on first Card	Number on second Card	Sum
1.	0.2	0.8	1
2.	0.45	0.55	1
3.	–	–	–
4.	–	–	–
5.	–	–	–

NOTE

Teacher may appoint one of the students as a referee to see whether the calculations done are correct or not. Penalty points may be decided if a student commits a mistake while adding.

Application

1. This game is useful in understanding addition of decimals. In this game, the sum of two decimals may also be taken different from 1.

2. The game can be extended for subtraction and multiplication of decimals also.

Activity 15

Objective

To construct a 4 × 4 Magic Square of Magic Constant 34

Material Required

Chart paper, coloured paper, sketch pen, scissors, ruler.

Method of Construction

1. Take 2 square sheets of size 12 cm × 12 cm.
2. Make two 4 × 4 squares on the chart papers.
3. Write numbers 1 to 16 in an order in the squares and enclose numbers with identical shapes as shown in (Fig.1) on one sheet.
4. Interchange the numbers in identical shapes as in Fig. 2.

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Fig.1

16	2	3	13
5	11	10	8
9	7	6	12
4	14	15	1

Fig. 2

Demonstration

1. The sum of numbers taken along any row, column or diagonal in Fig. 2 is 34 (magic constant).
2. Thus Fig. 2 gives the required 4×4 magic square.

Observation

Sum of numbers in first row = _______ = Magic constant.

Sum of numbers in second row = _______. =_______.

Sum of numbers in third row = _______.

Sum of numbers in fourth row = ______.

Sum of numbers in first column = _______.

Sum of numbers in second column = _______.

Sum of numbers in third column = _______.

Sum of numbers in fourth column = ________.

Sum of numbers in each diagonal = _______.

So, Fig. 2 gives a 4×4 magic square of magic constant = ______.

Application

This method can also be used to construct a 4×4 magic square of some other magic constants such as 38, 42, 46 and so on, using 16 consecutive natural numbers.

Activity 16

Objective

To form various polygons by paper folding and to identify convex and concave polygons

Material Required

White paper, ruler, sketch pens of different colours, pencil.

Method of Construction

1. Take a white sheet of paper and fold it again and again at least 10 to 12 times. Each time the paper is folded, it should be first unfolded before the next fold.
2. Draw various polygons of different number of sides by drawing lines on the creases so formed.

Demonstration

1. Take any two points X and Y in the interior of the polygon PQRST.
2. If the line segment joining X and Y lies wholly inside the polygon for all such points X and Y, then the polygon is said to be convex [see polygon PQRST in Fig. 1].
3. If the line segment joining X and Y is such that a part of it lies outside the polygon for some points X and Y, then the polygon is said to be concave [see polygon ABCDE in Fig. 1].
4. Check convexity and non convexity of some more polygons formed in Fig. 1 using the process stated in Steps 2 and 3.

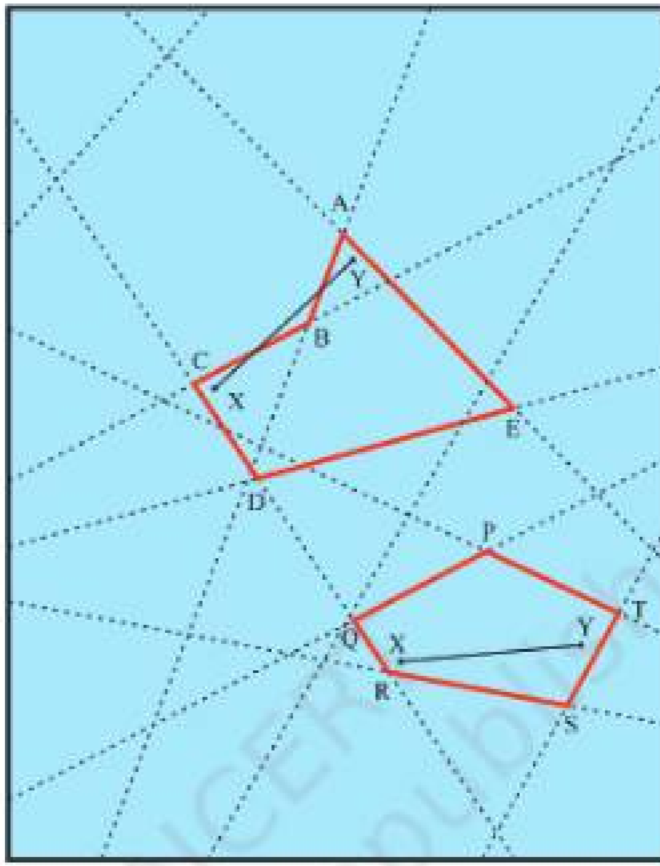


Fig. 1

Observation

1. In polygon PQRST the line segment XY lies in the interior of the polygon.

   So, PQRST is a ________ polygon.

2. In polygon ABCDE, the line segment XY does not completely lie in the interior of the polygon.

   So, it is a ________ polygon.

Application

This activity is useful in identifying a convex or concave polygon.

Activity 17

Objective

To obtain areas of different geometric figures using a Geoboard and verify the results using known formulas

Material Required

Cardboard, grid paper, adhesive, nails, rubber bands, hammer, pen/pencil.

Method of Construction

1. Take a cardboard of convenient size and paste a grid paper on it. Put the nails on the vertices of small squares as shown in Fig. 1.
2. Make different geometric figures using rubber bands as shown in Fig.1.

Demonstration

1. To find the area of any shape, count the number of complete squares, more than half squares and half squares ignoring less than half squares.

   Area of the figure = Number of complete squares + Number of more than half squares + $\frac{1}{2}$ (Number of half squares)

   For example, area of shape 1 = $9 + 2 + \frac{1}{2}(2) = 12$ sq. units.

   This shape is a parallelogram.

   Its area = base × altitude = $4 \times 3 = 12$ sq. units.

   Both the areas are same.

   This activity may be repeated for other geometric shapes.

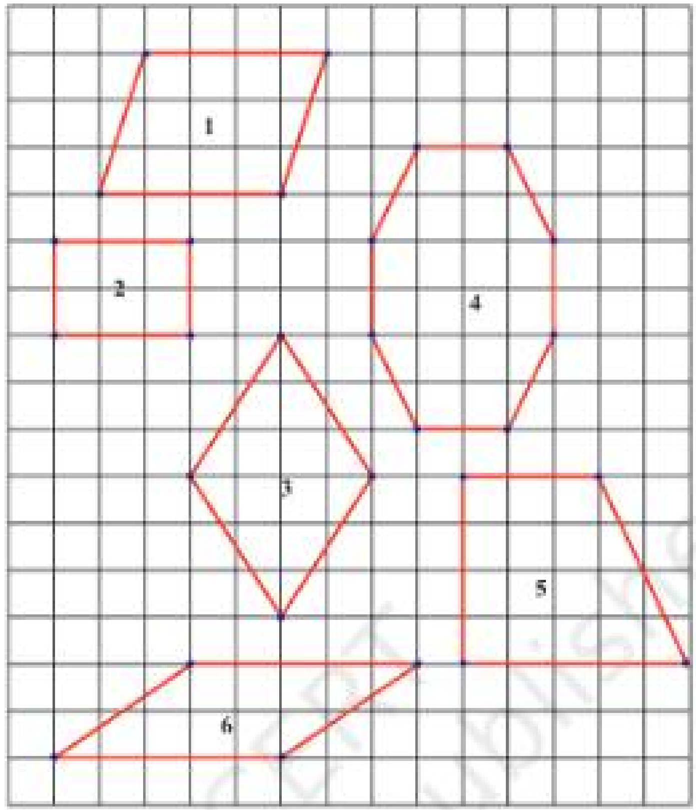


Fig. 1

OBSERVATION

1. Complete the following tables:

Shape	Number of complete squares	Number of more than half squares	Number of half squares	Area (Squares)
1	9	2	2	12
2	6	0	0	6
3	—	—	—	–
4	—	—	—	—
5	—	—	—	—
6	—	—	—	—

Actual area of the shapes:

Shape	Shapes	Formula (Area)	Calculation
1	Parallelogram	base × height	$4 \times 3 = 12$
2	Rectangle	$l \times b$	—
3	Rhombus	$\frac{1}{2} d_1 \times d_2$	—
4	—	—	—
5	—	—	—
6	—	—	—

2.

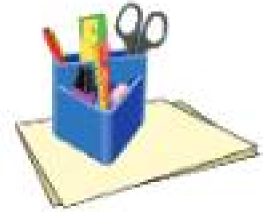
Shape	Actual area	Area obtained using Geoboard
1	12	12
2	6	6
3	—	—
4	—	—
5	—	—
6	—	—

So, the area of each geometric figure obtained using a Geoboard is approximately the same as obtained by using the formula.

Application

This activity may be used to explain the concept of area of various geometrical shapes.

Activity 18



OBJECTIVE

To establish the fact that triangle is the most rigid figure

MATERIAL REQUIRED

Cycle spokes/wooden sticks/tooth picks etc., valve tube pieces, nut bolts, thick thread, cutter.

METHOD OF CONSTRUCTION

1. Take a sufficient number of wooden sticks about 10 cm in length.
2. Cut valve tube into several pieces each of length, say, 3 cm.
3. Join the sticks with the help of valve tube pieces to make different shapes such as a triangle, quadrilateral, pentagon and hexagon [Fig.1].

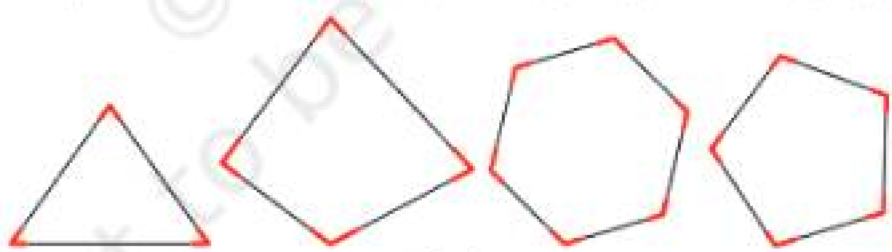


Fig. 1

DEMONSTRATION

1. Press any vertex or any side of the hexagon made of sticks.

   Does it change its shape? Yes (Fig. 2).

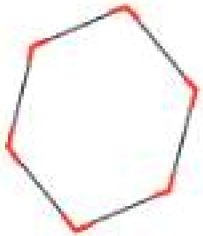


Fig. 2

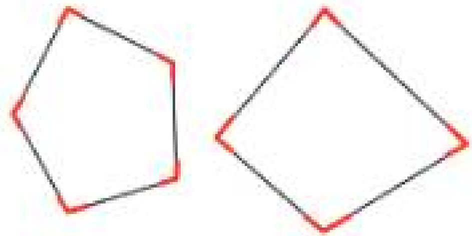


Fig. 3

2. Press any vertex or any side of the pentagon and the quadrilateral.

   Do these change their shape? Yes [Fig. 3].

3. Press any vertex of a triangle. Does it change its shape? It does not change its shape [Fig. 4].

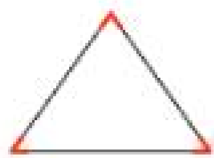


Fig. 4

So, triangle is the most rigid figure.

Observation

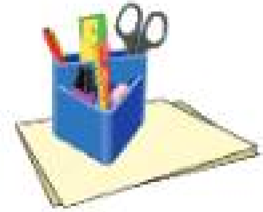
Complete the following table:

Number of sticks used	Shape formed	Change shape after pushing at a vertex
3	Triangle	No
4	Quadrilateral	—
5	Pentagon	—
6	Hexagon	—
7	Septagon	—
8	Octagon	—

Application

This property of rigidity of triangles is used in day to day life in the construction of bridges, ropes, ladders, furniture etc.

Activity 19



Objective

To represent a decimal number using a grid paper

Material Required

3 cardboards, 3 white chart papers, ruler, pencil, eraser, adhesive, three sketch pens of different colours (say Blue, Green and Red).

Method of Construction

1. Take 3 cardboards of convenient size and paste a white paper on each one of them.
2. Make three 10 × 10 grids on them and label the corners of the grids as A, B, C and D as shown in Fig. 1.
3. Take one of the grids and shade 6 horizontal strips out of 10 strips by using red sketch pen starting from the bottom as shown in Fig. 2.

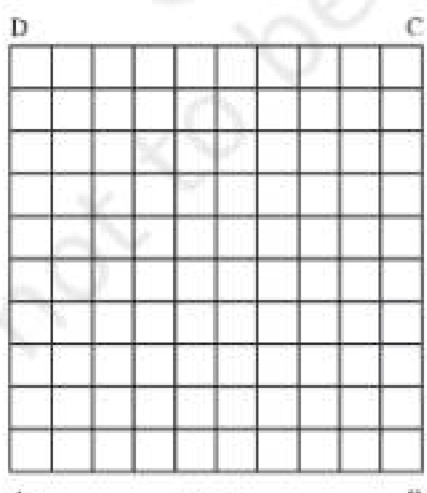


Fig. 1

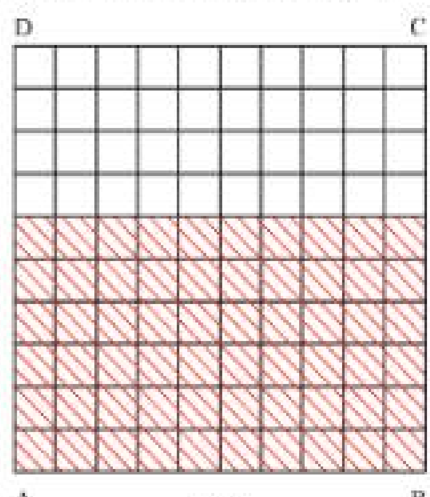


Fig. 2

4. Take another grid and shade 60 small squares using a blue sketch pen as shown in Fig. 3.

5. Take the third grid and shade 52 small squares using green sketch pen as shown in Fig. 4.

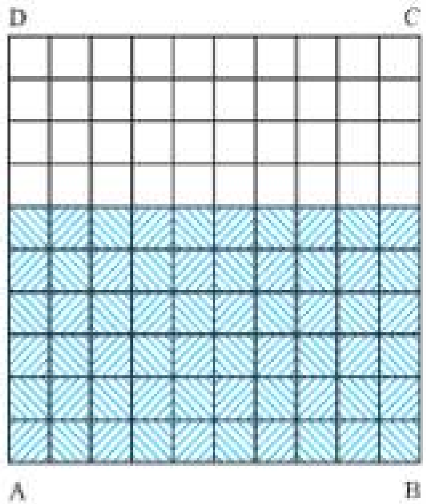


Fig. 3

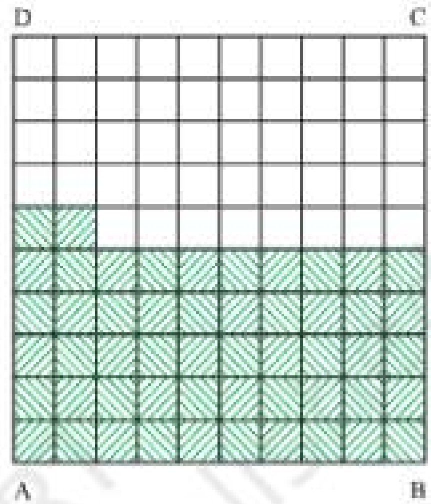


Fig. 4

Demonstration

In Fig. 2, portion shaded in red colour represents $\frac{6}{10}$ or 0.6.

In Fig. 3, portion shaded in blue colour represents $\frac{60}{100}$ or 0.60 or 0.6.

In Fig. 4, portion shaded in green colour represents $\frac{52}{100}$ or 0.52.

Also portions shaded in Fig. 2 and Fig. 3 are the same.

So, 0.60 = 0.6.

Observation

In Fig. 2:

Total number of horizontal strips = ________.

Number of horizontal strips shaded in red = ________.

Decimal represented by the shaded horizontal strips = ________.

In Fig. 3:

Total number of small squares = ________.

Number of squares shaded in blue = ________.

Decimal represented by the shaded region = ________.

In Fig. 4:

Total number of small squares = ________.

Number of squares shaded in green = ________.

Decimal represented by the shaded region = ________.

Fig. 2 and Fig. 3 represent _______ portion shaded in Red and Blue respectively.

This shows, 0.6 = _______.

APPLICATION

This activity can be used to explain the representation of decimal numbers graphically.

Activity 20

Objective

To make a 'protractor' by paper folding

Material Required

Thick paper, pencil/pen, compasses, cardboard, adhesive, scissor.

Method of Construction

1. Draw a circle of a convenient radius on a sheet of paper. Cut out the circle (Fig. 1).

Fig. 1

2. Fold the circle to get two equal halves and cut it through the crease to get a semicircle.

3. Fold the semi circular sheet as shown in Fig. 2.

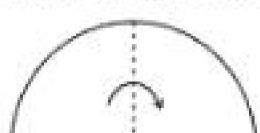


Fig. 2

4. Again fold the sheet as shown in Fig. 3.

Fig. 3

5. Fold it once again as shown in Fig. 4.

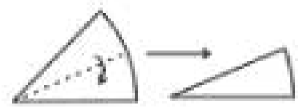


Fig. 4

6. Unfold and mark the creases as OB, OC,.... etc., as shown in Fig. 5.

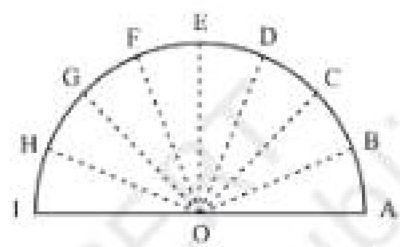


Fig. 5

Demonstration

1. In Fig. 5, $\angle AOB = \angle BOC = \angle COD = \angle DOE = \angle EOF = \angle FOG = \angle GOH = \angle HOI$ as all these angles cover each other exactly as they have been obtained by paper folding.

2. $\angle AOI$ (being straight angle) is 180°. Therefore, the degree marks corresponding to all these angles are as shown in Fig. 6.

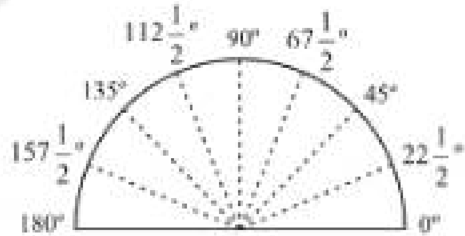


Fig. 6

Fig. 6, gives us a 'protractor'. This may be pasted on a cardboard and then cut out.

Observation

Measure of $\angle AOI$ = ________.

$$\angle AOE = \frac{1}{2}\ \angle AOI = \_\_\_\_\_\_\_\_.$$

$$\angle AOC = \frac{1}{2}\ \angle AOE = \_\_\_\_\_\_\_\_.$$

$$\angle AOB = \frac{1}{2}\ \angle AOC = \_\_\_\_\_\_\_\_.$$

$\angle AOD = 45° + \angle COD$ = ________.

$\angle AOG = \angle AOE + \angle EOG$ = ________.

$\angle AOH = 90° + \angle$ ________ = ________.

Application

1. This activity can be used to measure and construct some specific angles.
2. Similar activity can be used to make a 'protractor' of 360°.