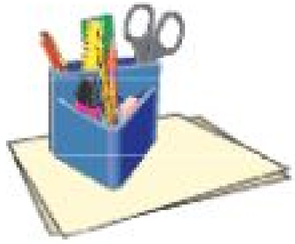
Activity 31



Objective

To explain the SSS criterion for congruency of two triangles

Material Required

Cardboard, cutter, white paper, geometry box, pencil, sketch pens, coloured glaze papers.

Method of Construction

1. Take a cardboard of convenient size and paste a white paper on it.
2. Make a pair of triangles ABC and DEF in which AB = DE, BC = EF and AC = DF on a glaze paper and make cutouts of Δ ABC and Δ DEF.
3. Paste Δ ABC on the cardboard.

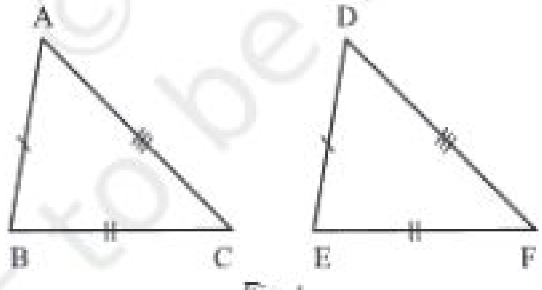


Fig. 1

Demonstration

Superpose the cut out of Δ DEF and see whether one triangle covers the other triangle or not by suitable arrangement. See that Δ DEF covers Δ ABC completely only under the correspondence A ↔ D, B ↔ E, C ↔ F.

So, Δ ABC ≅ Δ DEF.

This is SSS criterion for congruency of two triangles.

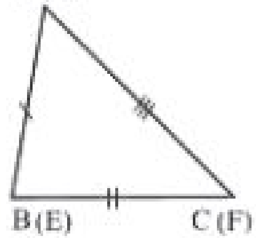


Fig. 2

Observation

On actual measurement in Δ ABC and Δ DEF:

$\angle A$ = ________. $\angle D$ = ________.

$\angle B$ = ________. $\angle E$ = ________.

$\angle C$ = ________. $\angle F$ = ________.

$\angle A = \angle D$

$\angle B = \angle$ ________.

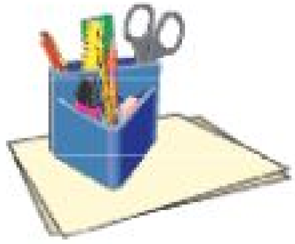
$\angle C = \angle$

So, Δ ABC $\cong$ ________.

Application

This activity is useful in solving various geometrical problems.

Activity 32



Objective

To explain ASA criterion for congruency of two triangles

Material Required

Cardboard, cutter, white paper, geometry box, pencil, sketch pens, coloured glaze papers.

Method of Construction

1. Take a cardboard of convenient size and paste a white paper on it.
2. Make a pair of triangles PQR and STU in which QR = TU, $\angle Q = \angle T$, $\angle R = \angle U$ on a glaze paper and make cutouts of Δ PQR and Δ STU.
3. Paste Δ PQR on the cardboard.

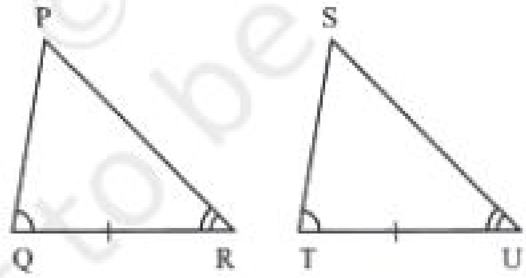


Fig. 1

Demonstration

Superpose the cut out of Δ STU on Δ PQR and see whether it covers the triangle or not by suitable arrangement. See that Δ STU covers Δ PQR completely only under the correspondence $P \leftrightarrow S$, $Q \leftrightarrow T$, $R \leftrightarrow U$. (Fig. 2).

So, $\Delta PQR \cong \Delta STU$.

This is ASA criterion for congruency of two triangles.

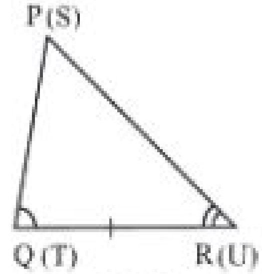


Fig. 2

Observation

On actual measurement, in Δ PQR and Δ STU:

$\angle P$ = ________. $\angle S$ = ________.

PQ = ________. ST = ________.

PR = ________. SU = ________.

$\angle P = \angle S$

PQ = ________.

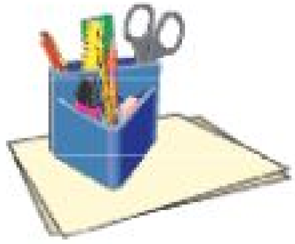
PR = ________.

So, Δ PQR $\cong$ ________.

Application

This activity is useful in solving of various geometrical problems.

Activity 33



Objective

To explain RHS criterion for congruency of two right triangles

Material Required

Cardboard, cutter, white paper, geometry box, pencil, sketch pens, coloured glaze papers.

Method of Construction

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

2. Make a pair of right triangles XYZ and LMN in which hypotenuse YZ = hypotenuse MN and side XZ = side LN on a glaze paper and make cut outs of Δ XYZ and Δ LMN.

3. Paste Δ XYZ on the cardboard.

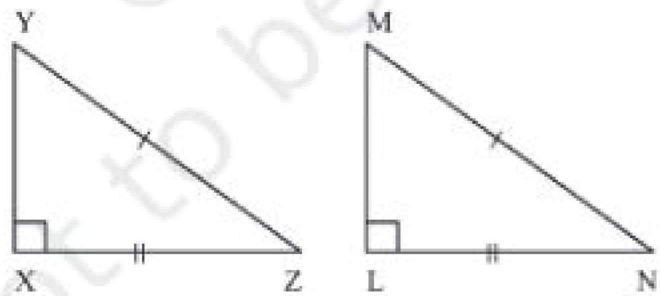


Fig. 1

Demonstration

Superpose the cut out of Δ LMN on Δ XYZ and see whether it covers the triangle or not by suitable arrangement. See that Δ LMN covers Δ XYZ completely only under the correspondence X ↔ L, Y ↔ M, Z ↔ N (Fig. 2).

So, Δ XYZ $\cong$ Δ LMN.

This is RHS criterion for congruency of two triangles.

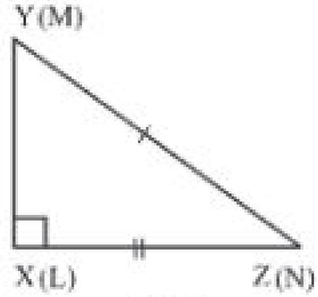


Fig. 2

Observation

On actual measurement, in Δ XYZ and Δ LMN:

$\angle$Y = ________. $\angle$M = ________.

$\angle$Z = ________. $\angle$N = ________.

XY = ________. LM = ________.

$\angle$Y = $\angle$M

$\angle$Z = $\angle$ ________.

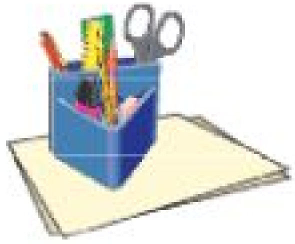
XY = ________.

So, Δ XYZ $\cong$ Δ ________.

Application

This activity is useful in solving various geometrical problems.

Activity 34



Objective

To verify that in an isosceles triangle, angles opposite equal sides are equal

Material Required

Cardboard, white sheet, drawing sheet, different colours, adhesive, scissors, tracing paper, pen/pencil, geometry box.

Method of Construction

1. Take a cardboard of convenient size and paste a white sheet on it.
2. Draw an isosceles triangle ABC (with AB = AC) on a drawing sheet and cut it out.
3. Colour the three angles of the triangle using different colours as shown in Fig. 1.

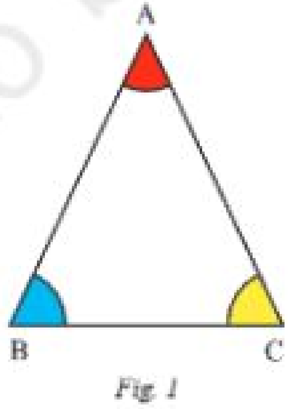


Fig. 1

4. Make a trace copy of the triangle and colour the angles of it exactly the same as the triangle on the board.

5. Make the cutouts of these three angles.

Demonstration

Try to place cutouts of each angle on the other angles of the triangle and see whether it covers the angle or not. Cut out of $\angle B$ should cover exactly $\angle C$ and vice versa.

So, $\angle B = \angle C$.

Observation

1. Cut out of $\angle B$ covers exactly cut out of $\angle$ ______.
2. Cut out of $\angle C$ covers exactly cut out $\angle$ ______.

   Cut out of $\angle B$ does not cover exactly cut out of $\angle$ ______.

   Cut out of $\angle C$ ______ exactly $\angle A$.

   Thus $\angle B = \angle$ ______.

   On actual measurement:

   $\angle B =$ ______.

   $\angle C =$ ______.

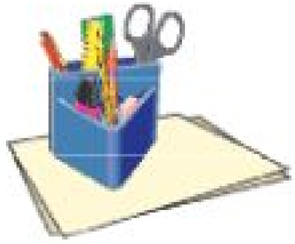
   $\angle A =$ ______.

   Thus, in a triangle angles opposite equal sides are ______.

Application

This result is used in solving many other geometrical problems.

Activity 35



Objective

To multiply two fractions (say, $\frac{3}{4}$ and $\frac{5}{6}$)

Material Required

Cardboard, white chart paper, ruler, pencil, eraser, adhesive, sketch pens of different colours (say Blue and Red).

Method of Construction

1. Take a cardboard of convenient size and paste a white paper on it.
2. Draw a rectangle ABCD of suitable dimensions (say 8 cm × 3 cm) as shown in Fig.1 on the cardboard.

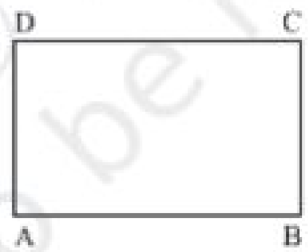


Fig. 1

3. Divide the rectangle ABCD into 4 equal parts (say along the length) and shade 3 parts in red colour using a sketch pen as shown in Fig. 2.

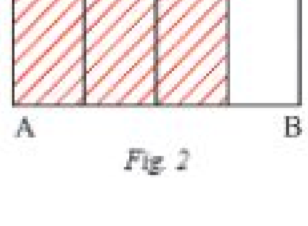


Fig. 2

4. Divide the rectangle ABCD along the breadth into 6 equal parts and shade 5 parts in blue colour as shown in Figure 3.

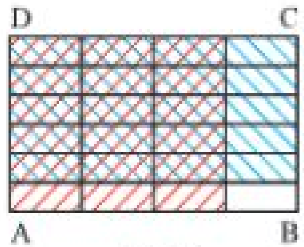


Fig. 3

Demonstration

1. In Fig. 2, portion shaded in red colour represents the fraction $\frac{3}{4}$.
2. In Fig. 3, portion shaded in blue colour represents the fraction $\frac{5}{6}$.
3. In Fig.3, portion shaded in both red and blue colour represents the fraction $\frac{15}{24}$. It also represents $\frac{5}{6}$ of $\frac{3}{4}$ or $\frac{5}{6} \times \frac{3}{4}$.

   Thus, $\frac{5}{6} \times \frac{3}{4} = \frac{15}{24}$.

   Repeat this activity for some other pairs of fractions.

Observation

1. In Fig. 2, the number of equal parts along the length = ________.

   In Fig. 2, the number of parts shaded in red = ________.

   Therefore, shaded part in Fig. 2 represents the fraction = ________.

   In Fig. 3, the number of equal parts along the breadth = ________.

   In Fig. 3, the number of parts shaded in blue = ________.

   Therefore, in Fig. 3, shaded part in blue (along the breadth) represents the fraction = ________.

   In Fig. 3, total number of equal parts = ________.
   (along the length and breadth)

In Fig. 3, the number of parts shaded in both blue and red = ________.

Therefore, in Fig. 3, shaded part (in both blue and red) represents the fraction = ________.

Hence $\frac{5}{6} \times \frac{3}{4} = \boxed{\quad}$

2. Let the rectangular area of the rectangle ABCD represent unit area.

   (i) Area of shaded region in red represents $\boxed{\quad}$ of area of rectangle ABCD.

   (ii) Area of shaded region in blue represents $\boxed{\quad}$ of area of the rectangle ABCD.

   (iii) The whole rectangular region in Fig. 3 is divided into $\boxed{\quad}$ equal parts and each equal part represents $\boxed{\quad}$

   (iv) The area of the double shaded region (in red and blue) represents $\boxed{\quad}$ of area of the rectangle ABCD.

The length and breadth of the double shaded rectangular region represents $\frac{3}{4}$ of the length and $\frac{5}{6}$ of breadth of the rectangle ABCD.

Hence $\frac{3}{4} \times \frac{5}{6} =$ ________.

Thus, the product of two fractions $= \dfrac{\text{Product of their numerators}}{\text{Product of their denominators}}$.

Application

This activity may be used in explaining product of a pair of proper fractions.

Activity 36

Objective

To divide a fraction by another fraction [say, $\frac{2}{3} \div \frac{1}{6}$]

Material Required

White paper sheet, colour pen/pencils, eraser etc.

Method of Construction

1. Draw a rectangle on a paper and divide it into three equal parts (Fig. 1).

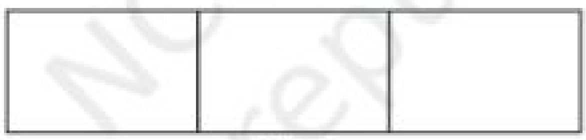


Fig. 1

2. Again divide each smaller rectangle (cell) into two equal parts and get six smaller equal parts (Fig. 2).

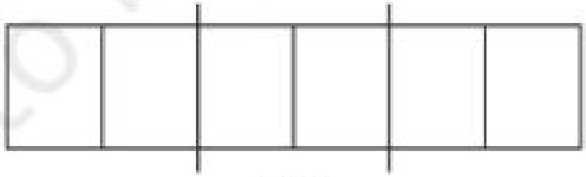


Fig. 2

Demonstration

1. Each part of the rectangle in Fig.1, represents the fraction $\frac{1}{3}$.

   So, fraction $\frac{2}{3}$ is represented by two equal parts (Fig. 3).

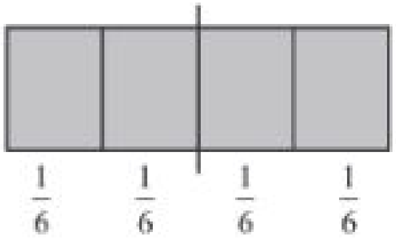


Fig. 3

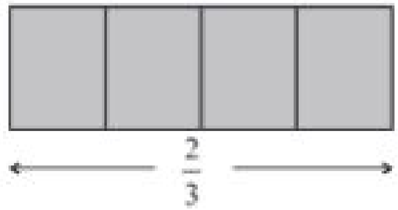


Fig. 4

2. Each part in Fig. 2, represents the fraction $\frac{1}{6}$.

3. Take two equal parts of Fig. 2, we get Fig. 3. $\frac{2}{3} \div \frac{1}{6}$ means, the number of $\frac{1}{6}$ that are contained in $\frac{2}{3}$.

4. There are four $\frac{1}{6}$ in $\frac{2}{3}$ (see Fig. 4).

   So, $\frac{2}{3} \div \frac{1}{6} = 4$

Observation

In Fig. 1, each part represents the fraction = ______.

In Fig. 1, two parts represents the fraction = ______.

In Fig. 2, each part represents the fraction = ______.

In Fig. 4, number of $\frac{1}{6}$ = ______.

So, ______ = ______.

Application

This activity is useful in explaining the division of two fractions.

Activity 37

Objective

To divide a fraction by a natural number. [say, $\frac{1}{3} \div 4$]

Material Required

White paper sheet, colour pens/pencils, eraser etc.

Method of Construction

1. Draw a rectangle on a paper and divide it into 3 equal parts (Fig. 1).

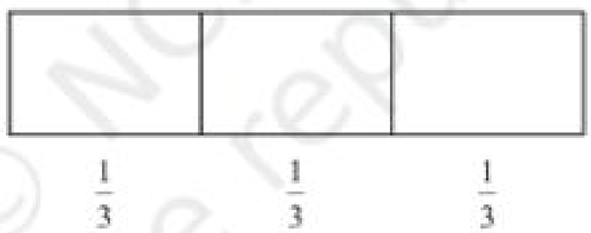


Fig. 1

2. Again divide each smaller rectangle (cell) into four equal parts and obtain 12 smaller equal parts (Fig. 2).

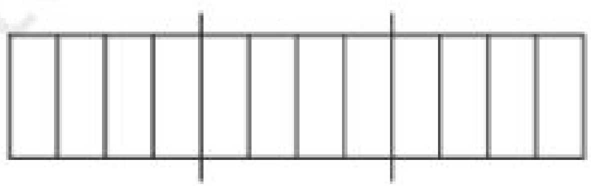


Fig. 2

Demonstration

1. Each part, in the rectangle in Fig.1, represents the fraction $\frac{1}{3}$.

2. Each part of Fig. 2, has been obtained on dividing $\frac{1}{3}$ into 4 equal parts.

   So, each part in Fig. 2 represents $\frac{1}{3} \div 4$.

3. Each part in Fig. 2 represents the fraction $\frac{1}{12}$.

   Thus, $\frac{1}{3} \div 4 = \frac{1}{12}$.

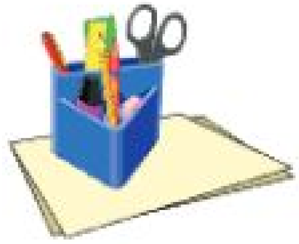
Observation

1. Each part of Fig. 1 represents the fraction = _______.
2. Each part of Fig. 2 represents the fraction = ______.
3. Each part of Fig. 2 is obtained on dividing ______ by ______.
4. So, $\frac{1}{3} \div 4$ = ______.

Application

This activity is useful in explaining division of a fraction by a natural number.

Activity 38



Objective

To multiply integers using unit squares of different colours

Material Required

Cardboard, white paper, red and blue grid papers, colour pens (Red and Blue), adhesive, ruler, scissors.

Method of Construction

1. Take a cardboard of a convenient size and paste a white paper on it.
2. Take a blue grid paper and cut out sufficient number of square pieces of unit squares. Each blue square represents an integer '+1' (Fig. 1).

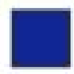


Fig. 1

3. Take a red grid paper and cut out sufficient number of square pieces of unit area. Let each red square represent an integer '–1' (Fig. 2).

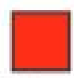


Fig. 2

4. Paste one blue unit square and one red unit square together so that one side of the square is blue and the other is red.

Demonstration

I. For two positive integers, say 2 × 3.

1. Draw 5 (= 2 + 3) blue edges of unit length on this cardboard as shown in Fig. 3.
2. Complete the rectangular shape using blue unit squares as shown in Fig. 4.

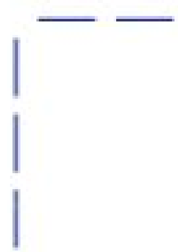


Fig. 3

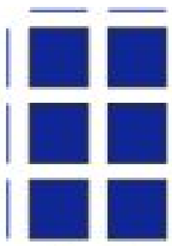


Fig. 4

3. Number of blue unit squares in the rectangle is 6. Thus, $2 \times 3 = 6$.

II. For one negative and one positive integer, say (–2) × 3.

4. Draw 3 blue edges and 2 red edges each of unit length using coloured pen as we have to multiply (–2) by (3) [Fig. 5].

Fig. 5

5. Complete the rectangle in Fig. 5 using blue unit squares [Fig. 6].

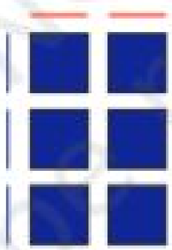


Fig. 6

6. Since one side of the rectangle has red edges, so invert each blue square of Fig. 6 once as shown in Fig. 7.

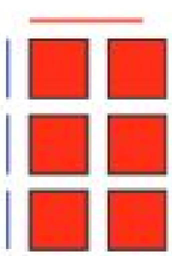


Fig. 7

7. In Fig.7, there are six red unit squares.

So, $(-2) \times 3 = -6$.

III. For two negative integers, say, $(-2) \times (-3)$.

8. Draw 5 red edges each of unit length as shown in Fig. 8 as we have to multiply (-2) by (-3).

Fig. 8

9. Complete the rectangle in Fig. 8 using blue unit squares [Fig. 9].

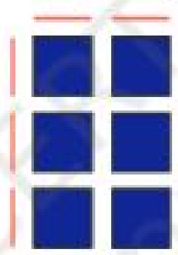


Fig. 9

10. Since two sides of the rectangle in Fig. 9 are having red edges, so invert the squares, two times as shown in Fig. 10 and 11.

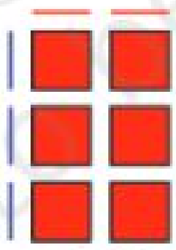


Fig. 10

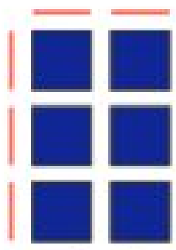


Fig. 11

11. There are now, 6 blue squares in the rectangle.

So, $(-2) \times (-3) = 6$

This activity may be performed for finding other products such as $(-4) \times 3$, 4×3, $(-3) \times (5)$ etc.

Observation

2×3 = __6__.

-2×3 = __–6__.

$(-2) \times (-3)$ = _____.

4×3 = _____.

-4×4 = _____.

$(-3) \times (-5)$ = _____.

$(-9) \times (-10)$ = _____.

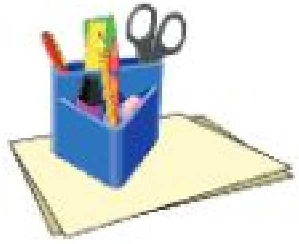
-7×4 = _____.

$-5 \times (-6)$ = _____.

Application

This activity is useful in explaining multiplications of two integers with same / different signs and to understand rules of multiplication of integers.

Activity 39



Objective

To divide a natural number by a fraction

Material Required

Chart paper, sketch pens, ruler, pencil, adhesive, cardboard.

Method of Construction

Let us find $2 \div \frac{1}{4}$.

1. Take a cardboard of a convenient size and paste a chart paper on it.
2. Cut out 2 rectangles of same size from the cardboard (Fig.1).

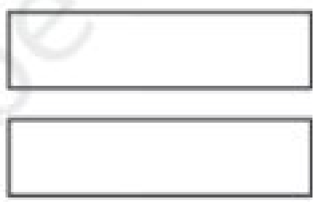


Fig. 1

3. Divide each rectangle to form equal parts as shown in Fig. 2.

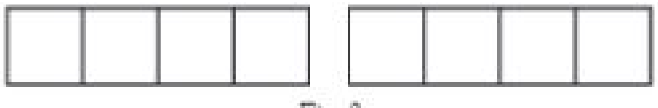


Fig. 2

Demonstration

1. There are two identical rectangles each representing natural number 1.

Thus the two rectangles together represent the natural number 2.

2. Each rectangle has been divided into 4 equal parts. So, each part in a rectangle represents the fraction $\frac{1}{4}$.

3. There are in all eight $\frac{1}{4}$'s in Fig. 2 i.e., Fig. 2 contains eight $\frac{1}{4}$.

   Thus $2 \div \frac{1}{4} = 8$ (or $2 \times \frac{4}{1}$).

This activity can be performed by taking different natural numbers and fractions, such as $3 \div \frac{1}{4}$, $4 \div \frac{1}{5}$, $6 \div \frac{1}{3}$.

Observation

1. In Fig. 1 each rectangle represents the number ________.
2. In Fig. 2, both rectangles together represent the number ________.
3. In Fig. 2 each part in a rectangle represents ________.
4. In Fig. 2, the number of parts representing $\frac{1}{4}$ is ________.
5. $2 \div \frac{1}{4} =$ ________.

Application

This activity is useful in explaining division of a natural number by a fraction.

Activity 40

Objective

To divide a mixed fraction by a proper fraction [say, $1\frac{3}{4} \div \frac{1}{4}$]

Material Required

Paper, colour pen, eraser, pencil, cardboard, adhesive.

Method of Construction

1. Draw two circles of equal radius on a paper and cut them out and paste on a cardboard.
2. Divide each circle into 4 equal parts as shown in Fig.1.

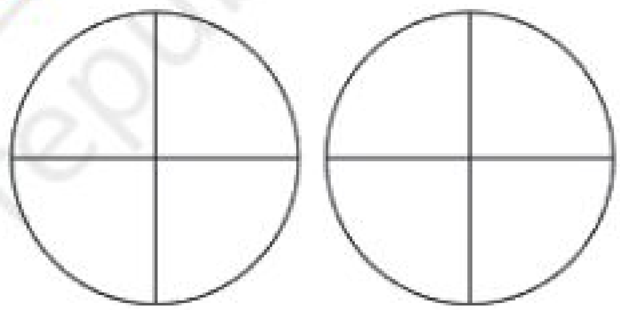


Fig. 1

3. Shade one circle completely and 3 equal parts in other circle (Fig. 2).

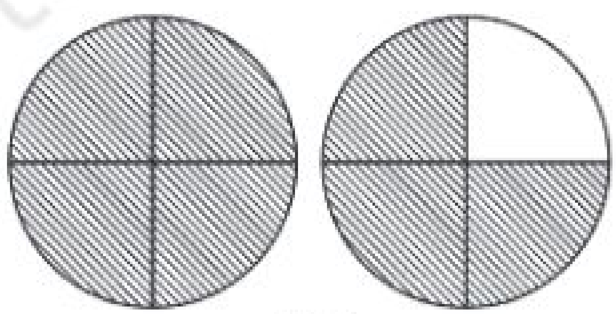


Fig. 2

Demonstration

1. Each part in Fig. 1 represents the fraction $\frac{1}{4}$.

2. Shaded portion in Fig. 2 represents mixed fraction $1\frac{3}{4}$.

3. There are seven $\frac{1}{4}$'s in the shaded part in Fig. 2.

   So. $1\frac{3}{4} \div \frac{1}{4} = 7$.

Observation

Each part in Fig. 1 represents the fraction = _____.

In Fig. 2 the shaded portion represents mixed fraction = _____.

There are _____ 's in the shaded portion in Fig. 2.

So, ____ ÷ ____ = ____.

Application

This activity is useful in explaining division of a mixed fraction by a proper fraction.