Activity 1

Objective

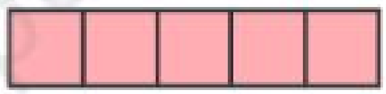
To verify that addition of whole numbers is commutative

Material Required

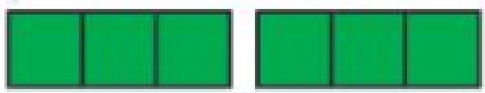
Cardboard, white paper, graph strips, scissors, glue.

Method of Construction

1. Take a cardboard of convenient size and paste a white paper on it.
2. Take a graph paper and make two strips containing 'a' squares, say, 5 squares each and colour them pink.



3. Similarly, make two strips each containing 'b' squares, say, 3 squares and colour them green.



4. Draw two straight lines on the cardboard as shown in Fig. 1.

Fig. 1

Demonstration

1. Now paste the pink and green strips side by side on lines l_1 and l_2 as shown in Fig. 2.

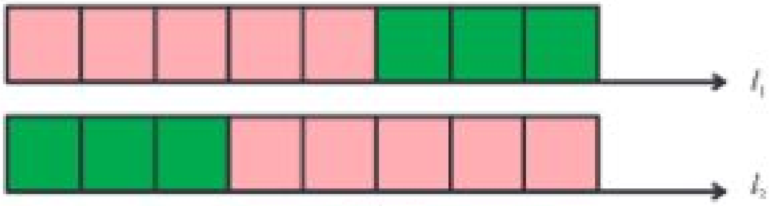


Fig. 2

Observation

From Fig. 2,

The length of the combined strips on line l_1 = 5 + 3.

The length of the combined strips on line l_2 = 3 + 5.

From Fig. 2, one can see that the length of combined strips on l_1 is the same as the length of combined strips on l_2.

So, 5 + 3 = 3 + 5.

That is, addition of 5 and 3 is commutative.

Repeat this activity by taking different pairs of numbers like 4, 5; 7, 2; 6, 7 and strips corresponding to these pairs.

Addition of whole numbers is ______.

Application

This activity can also be used to verify associative property for addition of whole numbers.

Activity 2

Objective

To verify that multiplication of whole numbers is commutative

Material Required

Cardboard, white sheet, graph paper/grid paper, colours, glue, scissors.

Method of Construction

1. Take a cardboard of a convenient size and cover it neatly with white sheet and graph paper.
2. To show 4 × 3 on a graph paper/grid paper, colour four columns of 3 squares each, with pink colour as shown in Fig. 1.

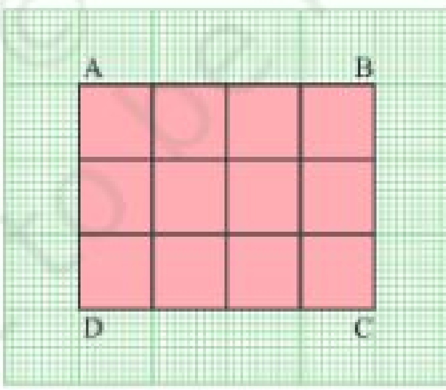


Fig. 1

3. To show 3 × 4 on a graph paper, colour 3 columns of 4 squares each with blue colour as shown in Fig. 2.

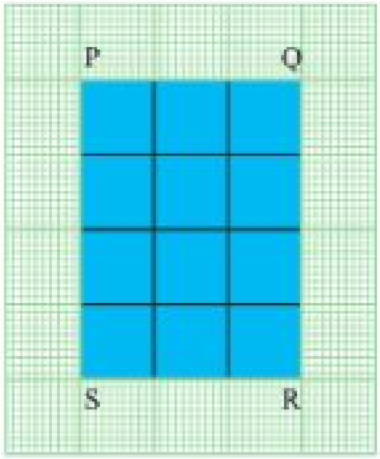


Fig. 2

4. Cut the coloured portion from both the graph papers and paste one coloured (say, pink) graph sheet on the cardboard.

Demonstration

1. Try to place the other coloured sheet over the pasted one in such a way that it exactly covers the pasted sheet.
2. PQ or SR of blue colour sheet covers exactly AD or BC of pink colour sheet.
3. PS or QR of blue colour covers exactly AB or CD of pink colour sheet.

Observation

On actual counting:

1. Number of squares of pink colour = ______ = 3 × ____.
2. Number of squares of blue colour = ______ = ____ × 3

   So, 3 × ____ = 4 × ____.

   Thus multiplication of 3 and 4 is commutative.

   Repeat this activity by taking some more pairs of strips.

   Multiplication of whole numbers is commutative.

Application

This activity can be used to explain the commutativity of multiplication of any two whole numbers. It can also be used to find the area of a rectangle.

Activity 3

Objective

To verify distributive property of whole numbers

Material Required

Chart paper, pencil, geometry box, eraser, sketch pens of blue and red colours.

Method of Construction

1. Draw three different line-segments of lengths $a = 5$ cm, $b = 2$ cm and $c = 1$ cm, respectively as shown in Fig. 1.

Fig. 1

2. Construct a rectangle ABCD with sides 'a' and $(b + c)$ (Fig. 2).

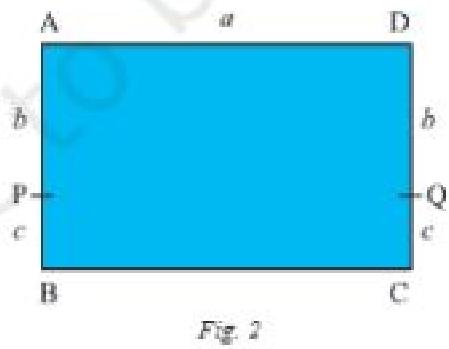


Fig. 2

3. Mark points P and Q on sides BA and CD respectively such that BP = CQ = c. Join PQ (Fig. 3).

4. Shade the part APQD with blue colour and the part BCQP with red colour.

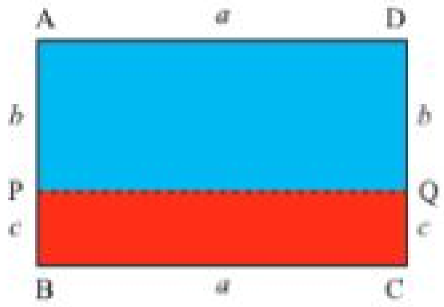


Fig. 3

Demonstration

1. From Fig. 2, area of the rectangle ABCD = $a \times (b + c)$.
2. From Fig. 3, area of the rectangle APQD = $a \times b$.
3. From Fig. 3, area of the rectangle PBCQ = $a \times c$.

   Also area of rectangle ABCD = area of APQD + area of PBCQ.

   So, $a \times (b + c) = a \times b + a \times c$.

Observation

Repeat the activity by taking different values of a, b and c.

On actual measurement:

a = ______.

b = ______.

c = ______.

Area of rectangle ABCD = ______.

Area of rectangle APQD = ______.

Area of rectangle PBCQ = ______.

Area of rectangle ABCD = Area of rectangle _____ + Area of rectangle _____.

So, $a \times (b + c) = (a \times$ ____) + ($a \times$ ___).

Application

1. This activity can be useful in explaining distributive property of whole numbers. This property is also useful in simplifying different expressions.

2. The above activity may be extended to explain the identity

   $(a + b)\,(c + d) = ac + ad + bc + bd$

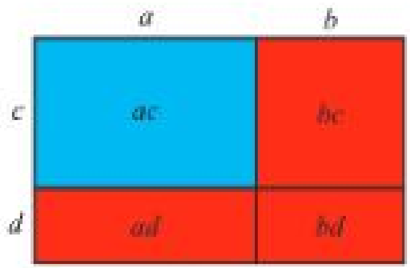


Fig. 4

Activity 4

Objective

To verify distributive property of multiplication over addition of whole numbers

Material Required

Cardboard, white sheet, grids of different dimensions, colours, scissors, glue, pen/pencil.

Method of Construction

1. Take a cardboard of a convenient size and cover it with a white sheet.
2. On a grid, colour 10 columns of 5 squares each with the same colour (say red) as in Fig. 1.

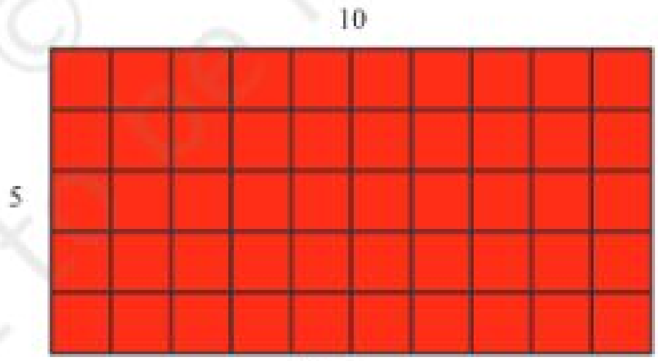


Fig. 1

3. Paste it neatly on the cardboard.
4. Now take three sets of grid papers and colour them as indicated below (Fig. 2). Make their cutouts also.

Set A :	5 columns of 5 squares	Pink colour
	5 columns of 5 squares	Pink colour
Set B :	3 columns of 5 squares	Blue colour
	7 columns of 5 squares	Blue colour
Set C :	4 columns of 5 squares	Yellow colour
	6 columns of 5 squares	Yellow colour

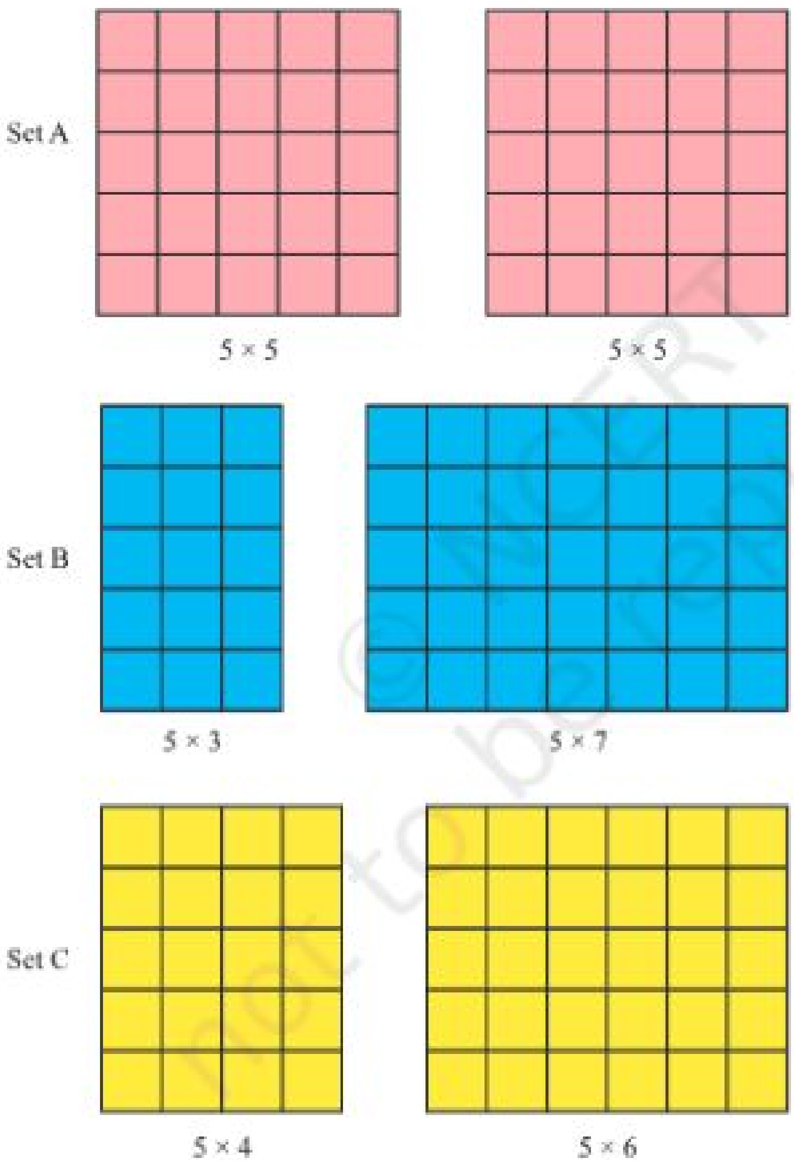


Fig. 2

Demonstration

1. Place the sets one above the other on the coloured grid in Fig. 1.
2. Both the sheets of set A when arranged side by side leaving no space between them will cover the pasted sheet exactly.

   So, $5 \times 10 = 5 \times 5 + 5 \times 5$.

   i.e. $5 \times (5 + 5) = 5 \times 5 + 5 \times 5$.
3. Both the sheets of set B when arranged side by side leaving no space between them will cover the pasted sheet exactly.

   So, $5 \times 10 = 5 \times 3 + 5 \times 7$.

   i.e., $5 \times (3 + 7) = 5 \times 3 + 5 \times 7$.
4. Both the sheets of set C when arranged side by side leaving no space between them will cover the pasted sheet exactly.

   So, $5 \times 10 = 5 \times 4 + 5 \times 6$.

   or, $5 \times (4 + 6) = 5 \times 4 + 5 \times 6$.

Observation

On actual counting of the squares:

$5 \times 10 =$ ______, $5 \times 5 =$ ______, $5 \times 5 =$ ______.

$5 \times 3 =$ ______, $5 \times 7 =$ ______.

$5 \times 4 =$ ______, $5 \times 6 =$ ______.

$5 \times 10 = 5 \times 5 + 5 \times$ ______.

$5 \times 10 = 5 \times 3 + 5 \times$ ______.

$5 \times 10 = 5 \times$ ___ $+ 5 \times 6$.

Repeat this activity for different such sets.

In general, $a \times (b + c) = a \times b + a \times c$.

Application

1. This activity may be used to explain distributive property of multiplication over addition of whole numbers which can be further used to simplify different expressions.
2. The activity can also be used to verify the distributive property of multiplication over subtraction of whole numbers.

Activity 5

Objective

To find HCF of two numbers

Material Required

Coloured strips, scissors, glue, ruler, pen/pencil.

Method of Construction

1. Take a cut out of one strip of length 'a' (say 16 cm) and another strip of length 'b' (say 6 cm) (Fig. 1).

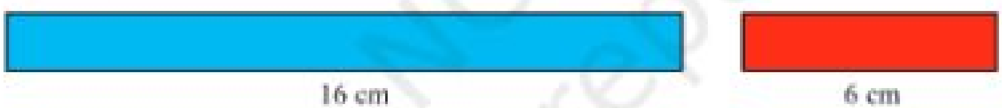


Fig. 1

2. Place strip 'b' over strip 'a' as many times as possible (Fig. 2).

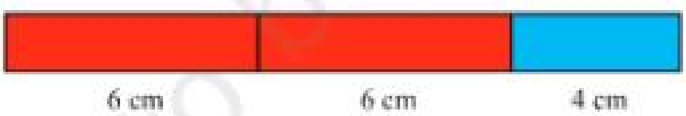


Fig. 2

3. Cut the part of strip 'a' left out in the above step.

4. Place this cut out part of strip 'a' as obtained from Step 3 on strip 'b' as shown in Fig. 3.

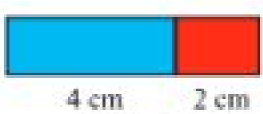


Fig. 3

5. Again cut the left out part of strip '*b*' as obtained in the above step.

6. Place the cutout part of above strip as many times as possible on the other part of strip '*b*' obtained in Step 4 as shown in Fig. 4.

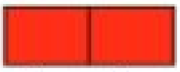


Fig. 4

Demonstration

Since the left out part of strip *b* in Step 5 covers the other part of strip '*b*' at Step 6 completely, HCF of 16 and 6 is 2 (length of the last cut out part).

It can be seen that a strip of length 2 cm can cover both the strips of length 16 cm and 6 cm complete number of times.

Similarly, HCF of other two numbers may be found out by taking strips of suitable lengths.

Observation

a	*b*	HCF
16	6	2
18	12	-
20	8	-
21	5	-

Application

The activity may be used for explaining the meaning of HCF of two or more numbers, which is useful in simplifying rational expressions.

Activity 6

Objective

To find L.C.M. of two numbers

Material Required

White drawing sheet, colours, glue, scissors, cardboard, pen/pencil.

Method of Construction

1. Make three grids each of size 10 cm × 10 cm and write numbers 1 to 100 on one grid (Fig. 1).

2. Stick this grid on a cardboard base of a suitable size.

3. Cut out the multiples of one of the numbers a (say 4) from one grid (Fig. 2).

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	38	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Fig. 1

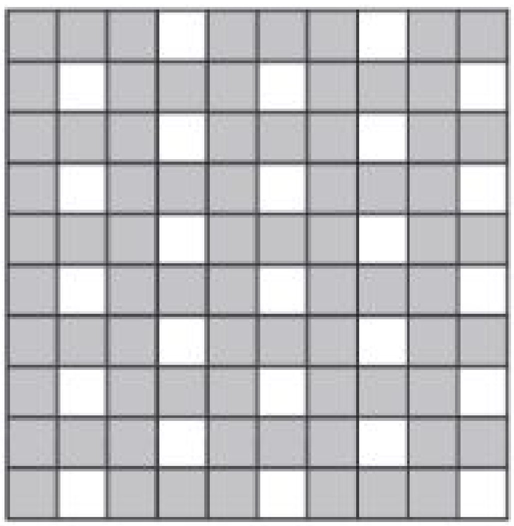


Fig. 2

4. Cut out the multiples of another number b (say 6) from another grid (Fig. 3).

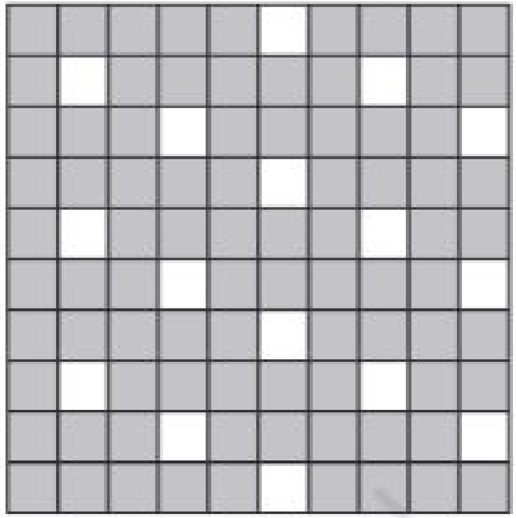


Fig. 3

Demonstration

1. Place both the cut out grids one above the other over the base grid (Fig. 4).
2. Common multiples of 4 and 6 visible through the holes are 12, 24, 36, 48, 60, 72, 84, 96.
3. The smallest of these common multiples is the L.C.M of 4 and 6.

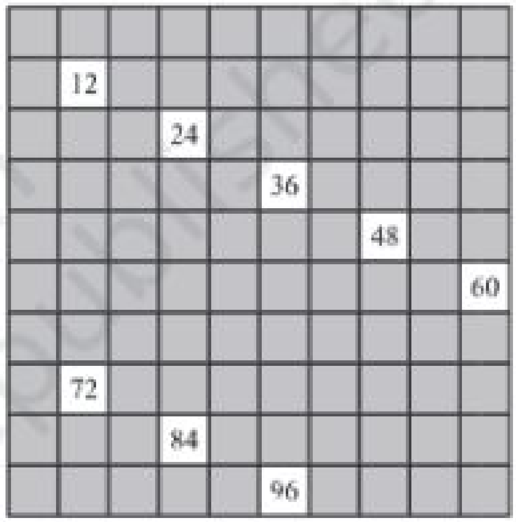


Fig. 4

Observation

1. The smallest visible common multiple of 4 and 6 is _______.
2. LCM of 4 and 6 is _______.

   Now complete the table by making different grids:

Number a	Number b	L.C.M
4	6	12
5	10	–
6	9	–
3	7	–

Application

This activity can be used to find:

1. Common multiples of given numbers.
2. Least common multiple of given numbers.

Activity 7

Objective

To find fractions equivalent to a given fraction

Material Required

White chart paper, soft cardboard, glue, ruler, pencil, sketch pens, scissors.

Method of Construction

Let us find fractions equivalent to $\frac{1}{2}$.

1. Draw four rectangles of dimensions 16 cm × 2 cm on the white chart paper and cut these out with the help of scissors.
2. Fold all the strips into two equal parts.
3. Unfold one of them, colour one part and paste the strip on the cardboard as shown in Fig.1.

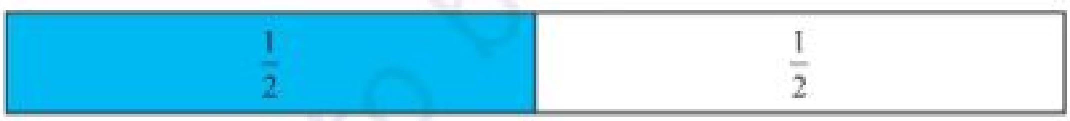


Fig. 1

4. Take another strip, fold it again, unfold it and colour its two equal parts as shown in Fig. 2.

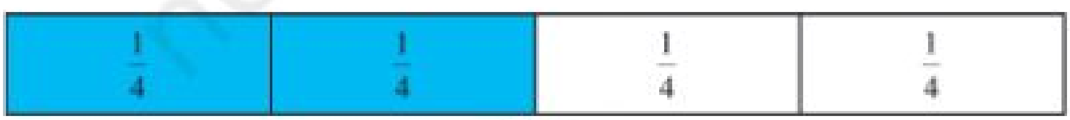


Fig. 2

5. Paste it on the cardboard below the first strip as shown in Fig. 2.

6. Take the third strip. Fold it twice. Unfold it and colour its 4 equal parts as shown in Fig. 3.

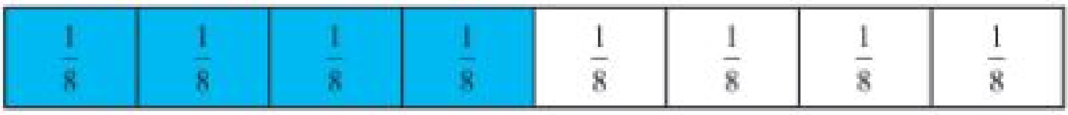


Fig. 3

7. Paste it on the cardboard just below the second strip as shown in Fig. 3.

8. Continue the process for the fourth strip and paste it on the cardboard as shown in Fig. 4.

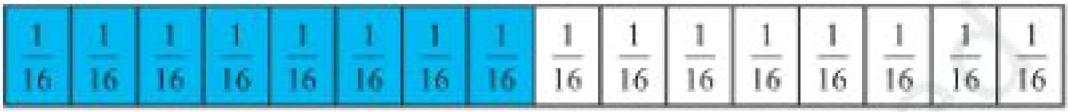


Fig. 4

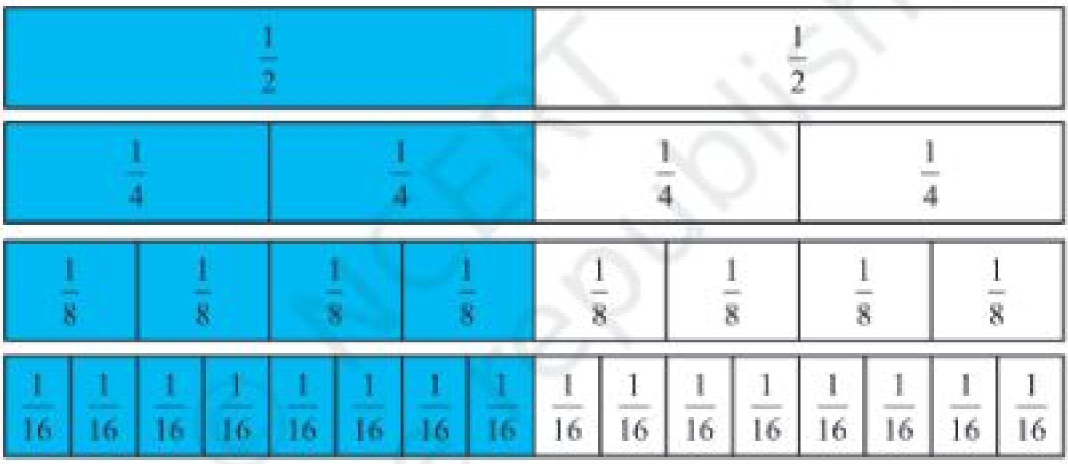


Fig. 5

Demonstration

1. In all the figures, coloured portion in each strip is equal (Fig. 5).
2. Note down the fractions represented in Fig. 1, Fig. 2, Fig. 3 and Fig. 4.

Observation

1. In Fig. 1, coloured portion represents the fraction $\frac{1}{2}$.

In Fig. 2, coloured portion represents the fraction $\frac{2}{4}$.

In Fig. 3, coloured portion represents the fraction ______.

In Fig. 4, coloured portion represents the fraction ______.

Since, coloured portions of all strips are equal, so,

$\frac{1}{2}$ = ___ = ___ = $\frac{8}{16}$.

Thus, $\frac{2}{4}, \frac{4}{8}, \frac{8}{16}$ are fractions equivalent to the fraction $\frac{1}{2}$.

In a similar way the activity can be performed for finding equivalent fractions of $\frac{1}{3}, \frac{2}{3}, \frac{3}{4}$ etc.

Application

This activity can be used to explain the meaning of equivalent fraction.

Activity 8

Objective

To find the sum of fractions with same denominators [say, $\frac{1}{5}+\frac{3}{5}$]

Material Required

Square sheet, sketch pens of different colours.

Method of Construction

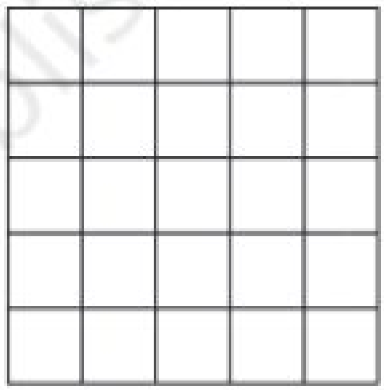


Fig. 1

1. First fold the square sheet along any side four times to make five equal parts.
2. Again fold the square sheet four times along another side to make five equal parts to get a 5×5 grid having 25 small squares (Fig. 1).
3. Mark each small square of any row, say first row, by '+' sign with red sketch pen (Fig. 2).
4. Mark each small square of first three columns by '+' with blue sketch pens (Fig. 3).

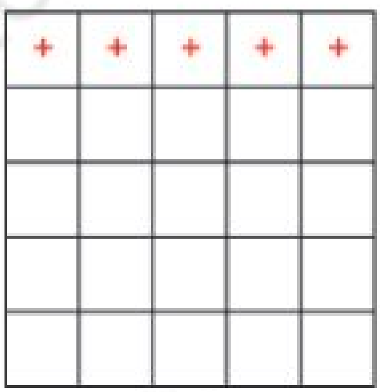


Fig. 2

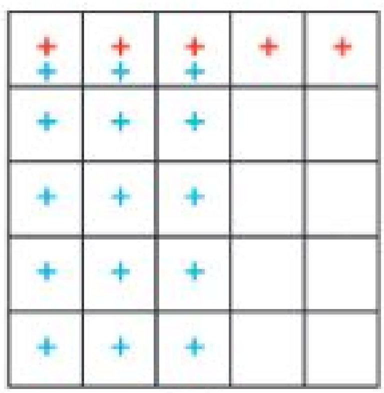


Fig. 3

5. We obtain 20 coloured '+' signs in the box of 25 small squares.

Demonstration

1. Count the total number of '+' signs in Fig. 3. There are 20 '+' signs in all.
2. Fraction represented by 20, '+' signs = $\frac{20}{25} = \frac{4}{5}$.
3. In Fig. 3, there are 25 small squares in all.
4. Five red '+' signs represent the fraction $\frac{5}{25} = \frac{1}{5}$.
5. Fifteen blue '+' signs represent the fraction $\frac{15}{25} = \frac{3}{5}$.
6. Fraction of the portion covered by '+' signs = $\frac{5}{25} + \frac{15}{25}$.
7. So, $\frac{5}{25} + \frac{15}{25} = \frac{20}{25}$ or $\frac{1}{5} + \frac{3}{5} = \frac{4}{5}$.

NOTE

This activity can also be performed by directly taking any row to represent $\frac{1}{5}$ and any other three rows to represent $\frac{3}{5}$.

Observation

1. Red '+' signs represent the fraction $\frac{\_\_\_}{25} = \frac{\_\_\_}{5}$
2. Blue '+' signs represent the fraction $\frac{\_\_\_}{25} = \frac{\_\_\_}{5}$
3. Total number of '+' signs represents the fraction $\frac{\_\_\_}{25} = \frac{\_\_\_}{5}$

   So, $\frac{1}{5} + \frac{3}{5} =$ ________

Application

This activity may be used to explain the addition of two (or more) fractions with the same denominator.

Activity 9

Objective

To find the sum of fractions with different denominators say, $\frac{1}{4}+\frac{2}{3}$

Material Required

Rectangular sheet, sketch pens of different colours.

Method of Construction

1. First fold a rectangular sheet along the length three times to make four equal parts.
2. Again fold the rectangular sheet along the breadth two times to make three equal parts to get a 4 × 3 grid in which there are 12 squares (Fig. 1).

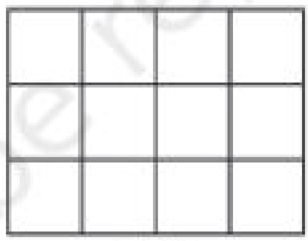


Fig. 1

3. Mark each square of any column, say, first column by '+' sign with red sketch pen (Fig. 2).

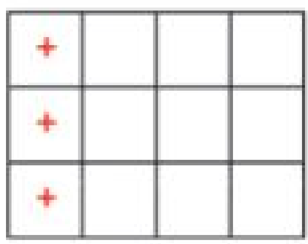


Fig. 2

4. Now mark any two rows, say first two rows, by '+' signs with blue sketch pen (Fig. 3).

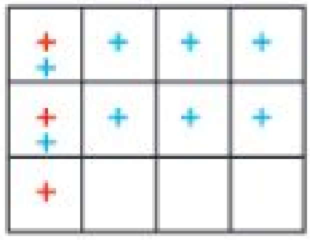


Fig. 3

Demonstration

1. Count the total number of '+' signs in Fig. 3. There are 11 '+' signs in all.
2. In Fig. 3, there are in all 12 squares.
3. Three red '+' signs represent the fraction $\frac{3}{12} = \frac{1}{4}$.
4. Eight blue '+' signs represent the fraction $\frac{8}{12} = \frac{2}{3}$.
5. Fraction represented by 11 '+' signs = $\frac{11}{12}$.

   So, $\frac{1}{4} + \frac{2}{3} = \frac{11}{12}$.

Observation

1. Red '+' signs represent the fraction = $\frac{\_\_\_}{12} = \frac{\_\_\_}{4}$.
2. Blue '+' signs represent the fraction = $\frac{\_\_\_}{12} = \frac{\_\_\_}{3}$.
3. Total number of '+' signs represent the fraction = $\frac{\_\_\_}{12}$.

   So, $\frac{1}{4} + \frac{2}{3} =$ ______.

Application

This activity may be used to explain addition of two fractions with different denominators.

Activity 10

Objective

To subtract a smaller fraction from a greater fraction with the same denominator [say, $\frac{4}{7}-\frac{2}{7}$]

Material Required

Square sheet, sketch pens of different colours.

Method of Construction

1. First fold a square sheet six times along any side to make seven equal parts.
2. Again fold the square sheet six times along the other side to make seven equal parts to get a 7×7 grid in which there are 49 squares (Fig. 1).
3. Mark each square of any four rows by '+' sign with red sketch pen (Fig. 2).

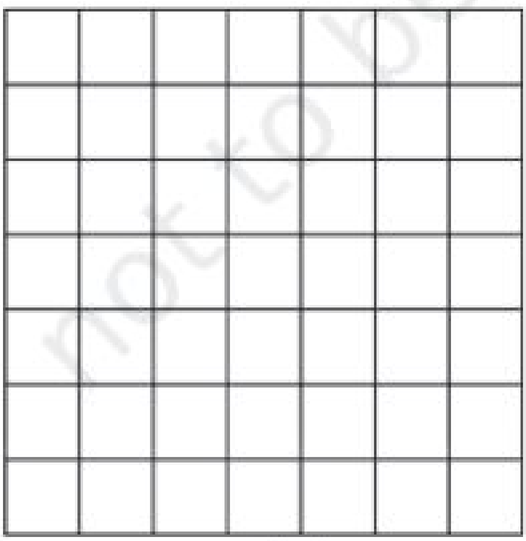


Fig. 1

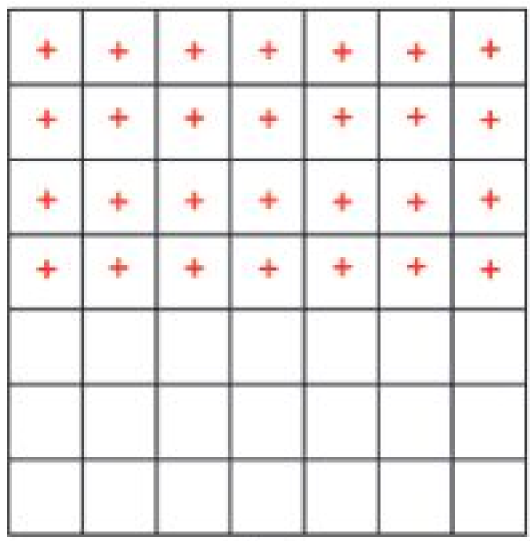


Fig. 2

4. Mark each square of any two columns by '–' sign with blue sketch pen (Fig. 3).

Demonstration

1. Count the total number of '+' signs in Fig. 3. There are 28, '+' signs.
2. Fraction represented by '+' signs = $\frac{28}{49} = \frac{4}{7}$.
3. Count the total number of '–' signs in Fig. 3. There are 14, '–' signs.
4. Fraction represented by '–' signs = $\frac{14}{49} = \frac{2}{7}$.
5. Enclose one '+' sign with one '–' sign (Fig. 4).
6. Count the number of enclosed signs in Fig. 4.

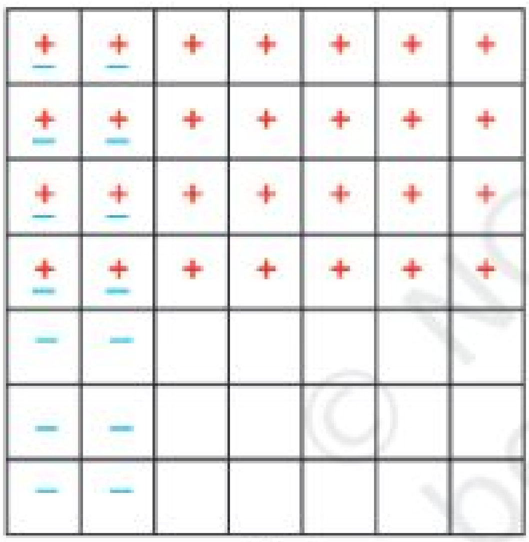


Fig. 3

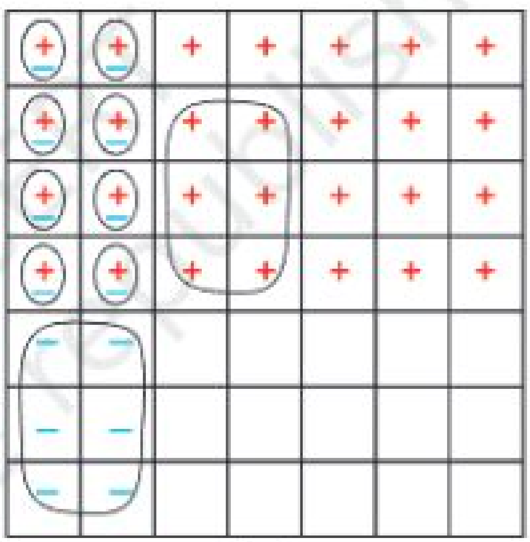


Fig. 4

They are 14 in all.

7. Fraction represented by unenclosed signs = $\frac{14}{49} = \frac{2}{7}$.

So, $\frac{4}{7} - \frac{2}{7} = \frac{2}{7}$.

Observation

1. Red '+' signs represent the fraction = $\frac{\_\_\_}{49}$ = $\frac{\_\_\_}{7}$.

2. Blue '+' signs represent the fraction = $\frac{\_\_\_}{49}$ = $\frac{\_\_\_}{7}$.

3. Total number of unenclosed signs represents the fraction = $\frac{\_\_\_}{49}$ = $\frac{\_\_\_}{7}$.

   So, $\frac{4}{7} - \frac{2}{7} =$ ____.

Application

This activity may be used to explain subtraction of two fractions with the same denominator.