Activity 1

Objective

To find the HCF of two numbers experimentally based on Euclid Division Lemma.

Material Required

Cardboard sheets, glazed papers of different colours, scissors, ruler, sketch pen, glue etc.

Method of Construction

1. Cut out one strip of length a units, one strip of length b units ($b < a$), two strips each of length c units ($c < b$), one strip of length d units ($d < c$) and two strips each of length e units ($e < d$) from the cardboard.
2. Cover these strips in different colours using glazed papers as shown in Fig. 1 to Fig. 5:

Fig. 1

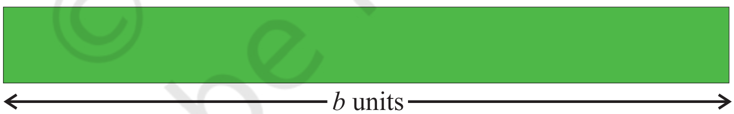


Fig. 2

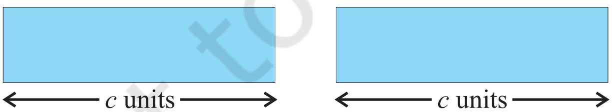


Fig. 3

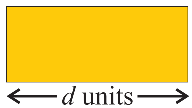


Fig. 4

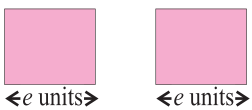


Fig. 5

3. Stick these strips on the other cardboard sheet as shown in Fig. 6 to Fig. 9.

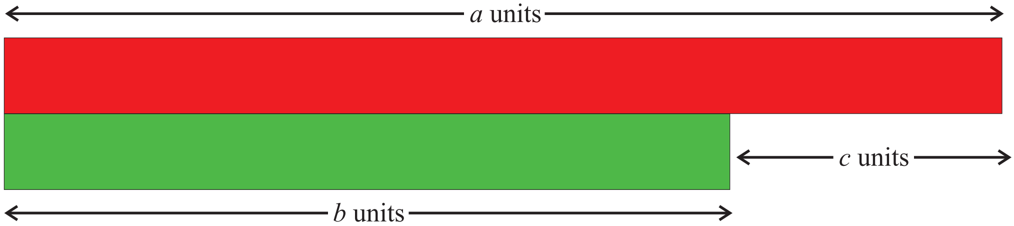


Fig. 6

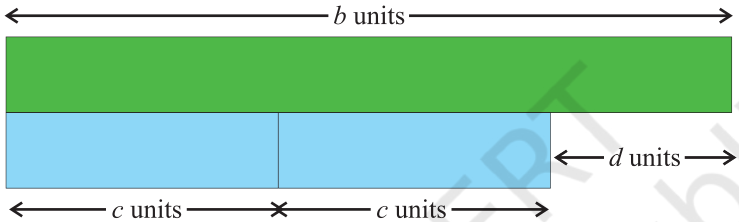


Fig. 7

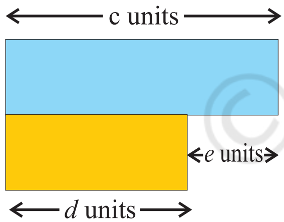


Fig. 8

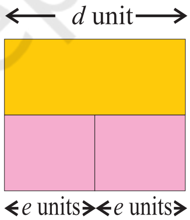


Fig. 9

Demonstration

As per Euclid Division Lemma,

Fig. 6 depicts $a = b \times 1 + c$ $(q = 1, r = c)$ (1)

Fig. 7 depicts $b = c \times 2 + d$ $(q = 2, r = d)$ (2)

Fig.8 depicts $c = d \times 1 + e$ $(q = 1, r = e)$ (3)

and Fig. 9 depicts $d = e \times 2 + 0$ $(q = 2, r = 0)$ (4)

As per assumptions in Euclid Division Algorithm,

HCF of a and b = HCF of b and c

= HCF of c and d = HCF of d and e

The HCF of d and e is equal to e, from (4) above.

So, HCF of a and b = e.

Observation

On actual measurement (in mm)

a =......... , b = ... , c = ... , d = ... , e = ...

So, HCF of __________ and __________ = ...

Application

The process depicted can be used for finding the HCF of two or more numbers, which is known as finding HCF of numbers by Division Method.

Activity 2

Objective

To draw the graph of a quadratic polynomial and observe:

(i) The shape of the curve when the coefficient of x^2 is positive.

(ii) The shape of the curve when the coefficient of x^2 is negative.

(iii) Its number of zeroes.

Material Required

Cardboard, graph paper, ruler, pencil, eraser, pen, adhesive.

Method of Construction

1. Take cardboard of a convenient size and paste a graph paper on it.
2. Consider a quadratic polynomial $f(x) = ax^2 + bx + c$
3. Two cases arise:

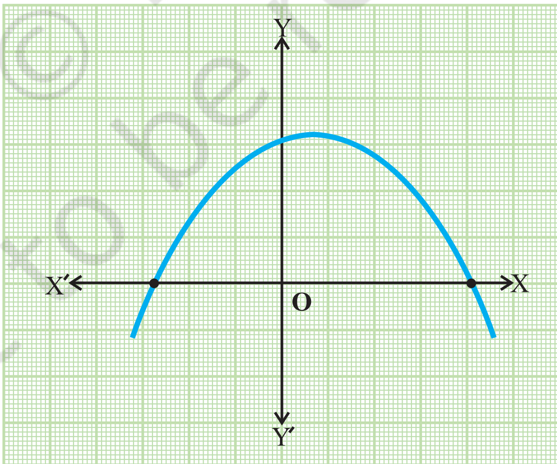


Fig. 1

(i) $a > 0$ (ii) $a < 0$

4. Find the ordered pairs $(x, f(x))$ for different values of x.
5. Plot these ordered pairs in the cartesian plane.

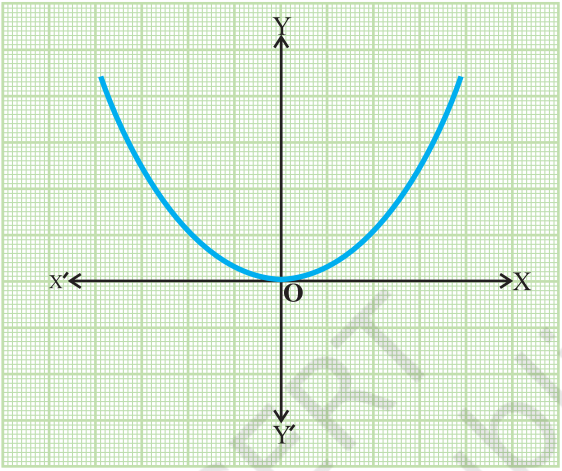


Fig. 2

6. Join the plotted points by a free hand curve [Fig. 1, Fig. 2 and Fig. 3].

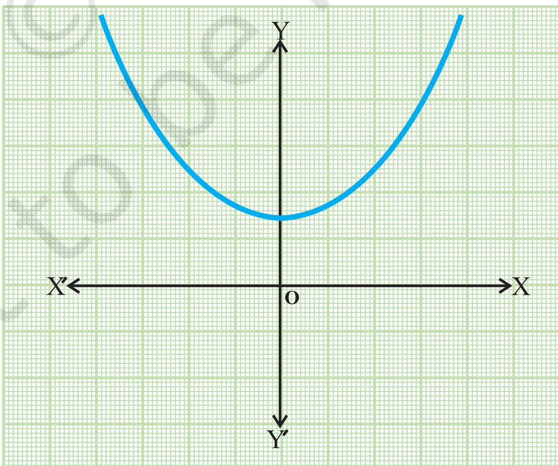


Fig. 3

Demonstration

1. The shape of the curve obtained in each case is a parabola.
2. Parabola opens upward when coefficient of x^2 is positive [see Fig. 2 and Fig. 3].
3. It opens downward when coefficient of x^2 is negative [see Fig. 1].
4. Maximum number of zeroes which a quadratic polynomial can have is 2.

Observation

1. Parabola in Fig. 1 opens ______
2. Parabola in Fig. 2 opens _______
3. In Fig. 1, parabola intersects x-axis at ______ point(s).
4. Number of zeroes of the given polynomial is ________.
5. Parabola in Fig. 2 intersects x-axis at ______ point(s).
6. Number of zeroes of the given polynomial is ______.
7. Parabola in Fig.3 intersects x-axis at ______ point(s).
8. Number of zeroes of the given polynomial is _______.
9. Maximum number of zeroes which a quadratic polynomial can have is ___________.

Application

This activity helps in

1. understanding the geometrical representation of a quadratic polynomial
2. finding the number of zeroes of a quadratic polynomial.

Note

Points on the graph paper should be joined by a free hand curve only.

Activity 3

Objective

To verify the conditions of consistency/ inconsistency for a pair of linear equations in two variables by graphical method.

Material Required

Graph papers, pencil, eraser, cardboard, glue.

Method of Construction

1. Take a pair of linear equations in two variables of the form

   $a_1x + b_1y + c_1 = 0$ (1)

   $a_2x + b_2y + c_2 = 0,$ (2)

   where a_1, b_1, a_2, b_2, c_1 and c_2 are all real numbers; a_1, b_1, a_2 and b_2 are not simultaneously zero.

There may be three cases :

Case I : $\dfrac{a_1}{a_2} \neq \dfrac{b_1}{b_2}$

Case II: $\dfrac{a_1}{a_2} = \dfrac{b_1}{b_2} = \dfrac{c_1}{c_2}$

Case III: $\dfrac{a_1}{a_2} = \dfrac{b_1}{b_2} \neq \dfrac{c_1}{c_2}$

2. Obtain the ordered pairs satisfying the pair of linear equations (1) and (2) for each of the above cases.

3. Take a cardboard of a convenient size and paste a graph paper on it. Draw two perpendicular lines X′OX and YOY′ on the graph paper (see Fig. 1). Plot the points obtained in Step 2 on different cartesian planes to obtain different graphs [see Fig. 1, Fig. 2 and Fig.3].

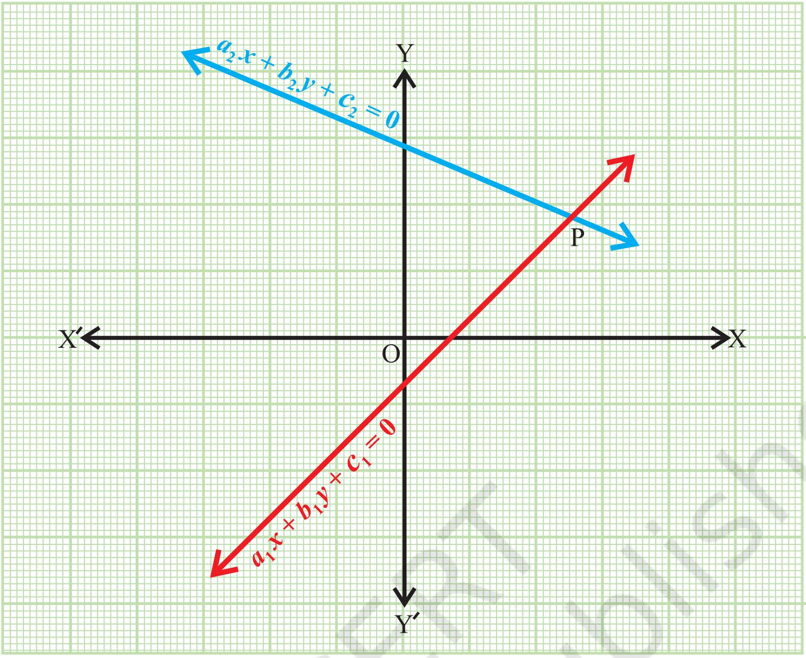


Fig. 1

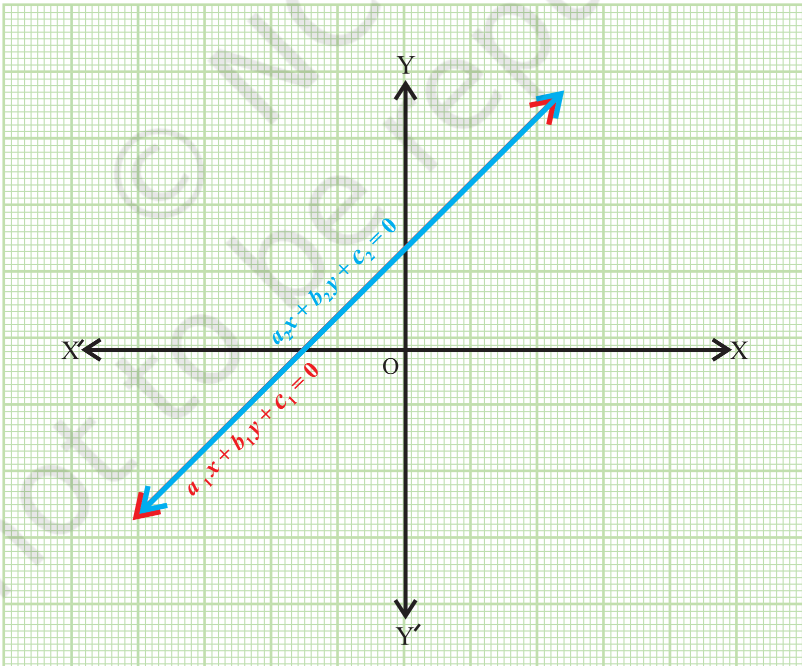


Fig. 2

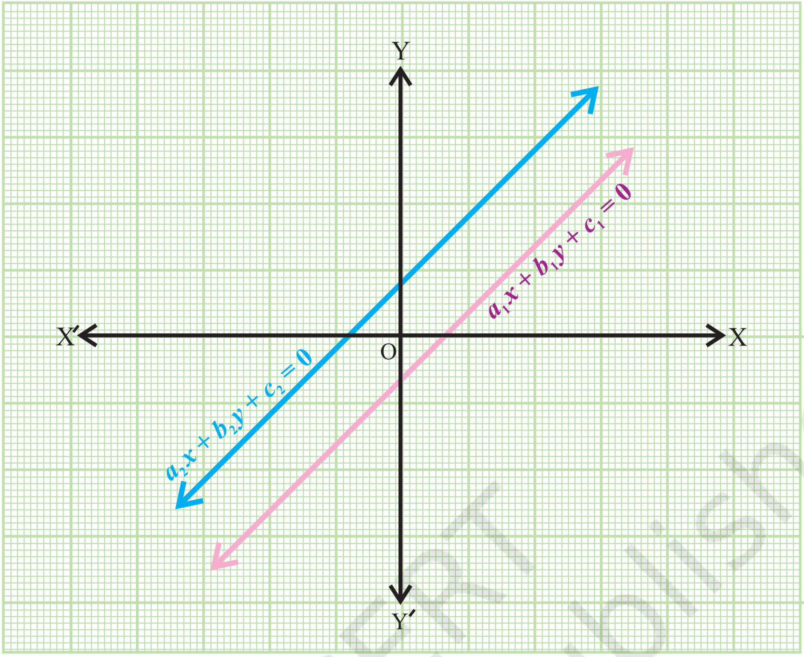


Fig. 3

Demonstration

Case I: We obtain the graph as shown in Fig. 1. The two lines are intersecting at one point P. Co-ordinates of the point P (x,y) give the unique solution for the pair of linear equations (1) and (2).

Therefore, the pair of linear equations with $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ is consistent and has the unique solution.

Case II: We obtain the graph as shown in Fig. 2. The two lines are coincident. Thus, the pair of linear equations has infinitely many solutions.

Therefore, the pair of linear equations with $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ is also consistent as well as dependent.

Case III: We obtain the graph as shown in Fig. 3. The two lines are parallel to each other.

This pair of equations has no solution, i.e., the pair of equations with $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ is inconsistent.

Observation

1. a_1 = ___________, a_2 = ___________,

   b_1 = ___________, b_2 = ___________,

   c_1 = ___________, c_2 = ___________,

So, $\frac{a_1}{a_2}$ = ..., $\frac{b_1}{b_2}$ = ..., $\frac{c_1}{c_2}$ = ...

$\frac{a_1}{a_2}$	$\frac{b_1}{b_2}$	$\frac{c_1}{c_2}$	Case I, II or III	Type of lines	Number of solution	Conclusion Consistent/ inconsistent/ dependent

Application

Conditions of consistency help to check whether a pair of linear equations have solution (s) or not.

In case, solutions/solution exist/exists, to find whether the solution is unique or the solutions are infinitely many.

Activity 4

Objective

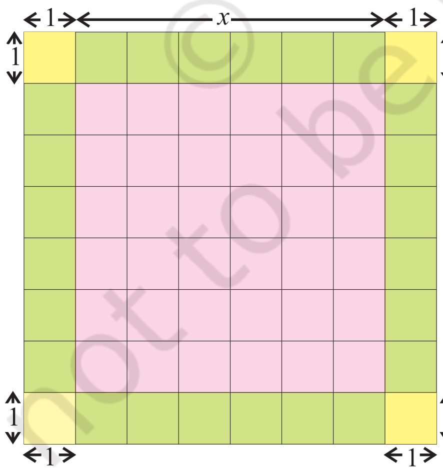
To obtain the solution of a quadratic equation ($x^2 + 4x = 60$) by completing the square geometrically.

Material Required

Hardboard, glazed papers, adhesive, scissors, marker, white chart paper.

Method of Construction

1. Take a hardboard of a convenient size and paste a white chart paper on it.
2. Draw a square of side of length x units , on a pink glazed paper and paste it on the hardboard [see Fig. 1] . Divide it into 36 unit squares with a marker.
3. Alongwith each side of the square (outside) paste rectangles of green glazed paper of dimensions $x \times 1$, i.e., 6×1 and divide each of them into unit squares with the help of a marker [see Fig. 1].
4. Draw 4 squares each of side 1 unit on a yellow glazed paper, cut them out and paste each unit square on each corner as shown in Fig. 1.



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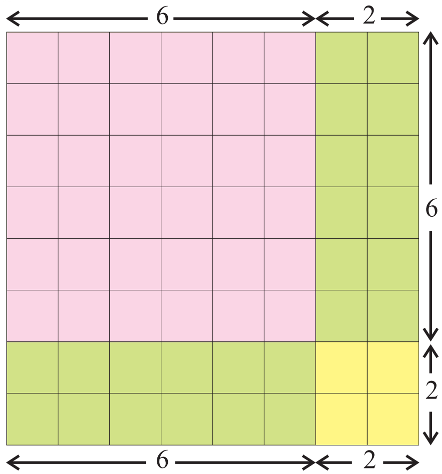

$x^2 + 4x + 4 \quad = \quad 64$

Fig. 1 **Fig. 2**

5. Draw another square of dimensions 8×8 and arrange the above 64 unit squares as shown in Fig. 2.

DEMONSTRATION

1. The first square represents total area $x^2 + 4x + 4$.
2. The second square represents a total of 64 (60 + 4) unit squares.

   Thus, $x^2 + 4x + 4 = 64$

   or $(x + 2)^2 = (8)^2$ or $(x + 2) = \pm 8$

   i.e., $x = 6$ or $x = -10$

   Since x represents the length of the square, we cannot take $x = -10$ in this case, though it is also a solution.

OBSERVATION

Take various quadratic equations and make the squares as described above, solve them and obtain the solution(s).

APPLICATION

Quadratic equations are useful in understanding parabolic paths of projectiles projected in the space in any direction.

Activity 5

Objective

To identify Arithmetic Progressions in some given lists of numbers (patterns).

Material Required

Cardboard, white paper, pen/pencil, scissors, squared paper, glue.

Method of Construction

1. Take a cardboard of a convenient size and paste a white paper on it.
2. Take two squared papers (graph paper) of suitable size and paste them on the cardboard.

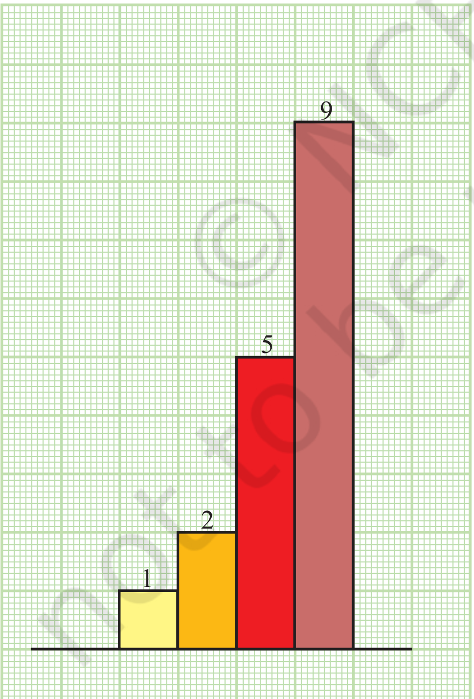

Fig. 1

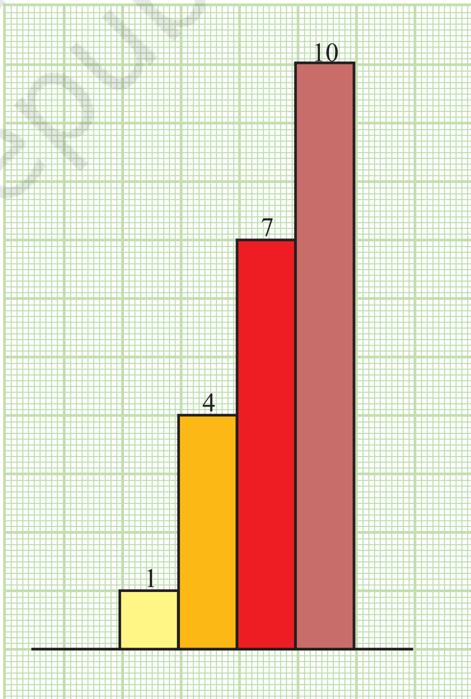

Fig. 2

3. Let the lists of numbers be

   (i) 1, 2, 5, 9, ... (ii) 1, 4, 7, 10, ...

4. Make strips of lengths 1, 2, 5, 9 units and strips of lengths 1, 4, 7, 10 units and breadth of each strip one unit.

5. Paste the strips of lengths 1, 2, 5, 9 units as shown in Fig. 1 and paste the strips of lengths 1, 4, 7, 10 units as shown in Fig. 2.

Demonstration

1. In Fig. 1, the difference of heights (lengths) of two consecutive strips is not same (uniform). So, it is not an AP.

2. In Fig. 2, the difference of heights of two consecutive strips is the same (uniform) throughout. So, it is an AP.

Observation

In Fig. 1, the difference of heights of first two strips = ______________

the difference of heights of second and third strips = ______________

the difference of heights of third and fourth strips = ______________

Difference is ______________ (uniform/not uniform)

So, the list of numbers 1, 2, 5, 9 ______________ form an AP. (does/does not)

Write the similar observations for strips of Fig.2.

Difference is ______________ (uniform/not uniform)

So, the list of the numbers 1, 4, 7, 10 __________ form an AP. (does/does not)

Application

This activity helps in understanding the concept of arithmetic progression.

Note

Observe that if the left top corners of the strips are joined, they will be in a straight line in case of an AP.