Activity 21

OBJECTIVE

To verify Pythagoras theorem by Bhaskara method.

MATERIAL REQUIRED

Chart papers of different colours, glazed papers, geometry box, scissors, adhesive.

METHOD OF CONSTRUCTION

1. Take a chart paper and draw a right angled triangle whose sides are *a, b* and *c* units, as shown in Fig. 1.
2. Make three replicas of the triangle from different coloured chart papers.
3. Paste all the four triangles to make a square as shown in Fig. 2.
4. Name the square as PQRS whose side is *c* units.

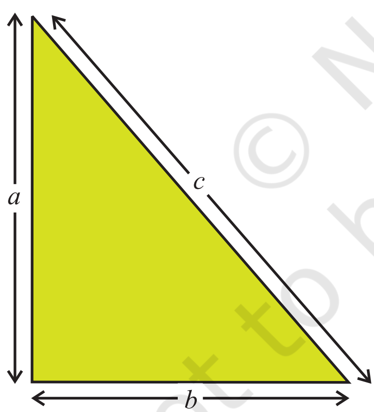

Fig. 1

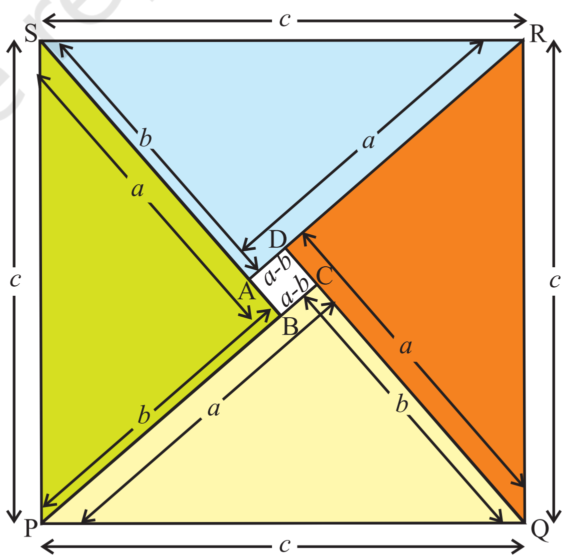

Fig. 2

5. A square ABCD of side $(a - b)$ units is formed inside the square PQRS.

The area of the square PQRS is equal to the area of square of side $(a - b)$ units added to the areas of four identical right angled triangles of sides a, b and c units.

DEMONSTRATION

1. Area of one right angled triangle = $\frac{1}{2}ab$ sq.units

   Area of four right angled triangles = $4 \times \frac{1}{2} ab$ sq.units $= 2ab$ sq. units.

   Area of the square of side $(a - b)$ units $= (a - b)^2$ sq. units $= (a^2 - 2ab + b^2)$ sq. units.

2. Area of the square PQRS of side c units = c^2 sq. units.

   Therefore, $c^2 = 2ab + a^2 - 2ab + b^2$

or $c^2 = a^2 + b^2$.

Hence, the verification of Pythagoras theorem.

OBSERVATION

By actual measurement:

Side a of the triangle =__________ units.

Side b of the triangle =__________ units.

Side c of the triangle =__________ units.

$a^2 + b^2$ =__________ sq. units. c^2 =__________ sq. units.

Thus, a^2 + _________ $= c^2$

APPLICATION

Whenever two, out of the three sides of a right triangle are given, the third side can be found out by using Pythagoras theorem.

Activity 22

OBJECTIVE

To verify experimentally that the tangent at any point to a circle is perpendicular to the radius through that point.

MATERIAL REQUIRED

Coloured chart paper, adhesive, scissors/cutter, geometry box, cardboard.

METHOD OF CONSTRUCTION

1. Take a coloured chart paper of a convenient size and draw a circle of a suitable radius on it. Cut out this circle and paste it on a cardboard.
2. Take points P, Q and R on the circle [see Fig. 1].
3. Through the points P, Q and R form a number of creases and select those which touch the circle. These creases will be tangents to the circle.

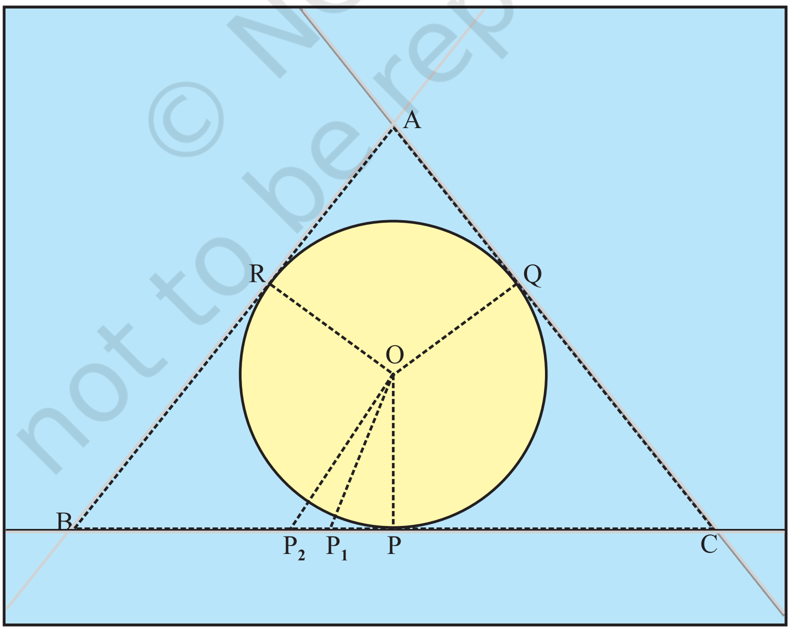

Fig. 1

4. Let the creases intersect at the points A, B and C forming a ΔABC (creases has been shown by dotted lines)
5. The circle now can be taken as incircle of ΔABC with O as its centre. Join OP, OQ and OR.
6. Take points P_1 and P_2 on the crease BC.

Demonstration

Take triangles POP_1 and POP_2

Clearly $OP_1 > OP$, $OP_2 > OP$.

In fact, OP is less than any other line segment joining O to any point on BC other than P, i.e., OP is the shortest of all these.

Therefore, OP ⊥ BC.

Hence, tangent to the circle at a point is perpendicular to the radius through that point.

Similarly, it can be shown that OQ ⊥ AC and OR ⊥ AB.

Observation

By actual measurement:

OP = ..., OQ =.............., OR = ...

OP_1 = ..., OP_2 =..............

OP < OP_1, OP .... OP_2

Therefore, OP ..... BC

Thus, the tangent is .... to the radius through the point of contact.

Application

This result can be used in proving various other results of geometry.

Activity 23

Objective

To find the number of tangents from a point to a circle.

Material Required

Cardboard, geometry box, cutter, different coloured sheets, adhesive.

Method of Construction

1. Take a cardboard of a suitable size and paste a coloured sheet on it.
2. Draw a circle of suitable radius on a coloured sheet and cut it out [see Fig. 1].

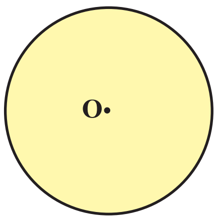

Fig. 1

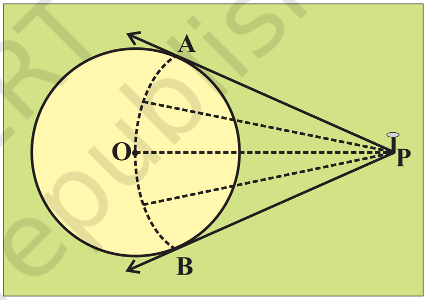

Fig. 2

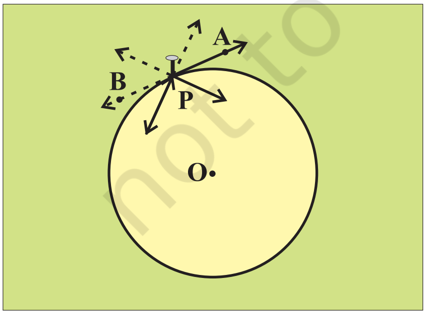

Fig. 3

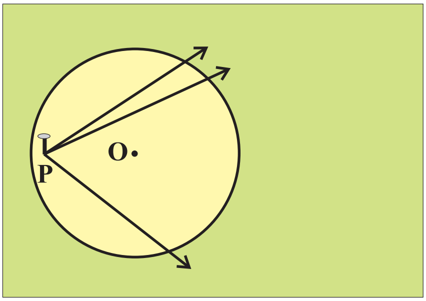

Fig. 4

3. Paste the cutout circle on the cardboard.
4. Take any point P outside (on or inside) the circle and fix a nail on it. [see Fig. 2, Fig. 3 and Fig. 4].
5. Take a string and tie one end of it at the point P and move the other end towards the centre of the circle. Also move it up and down from the centre such that it may touch the circle. [see Fig. 2, Fig. 3 and Fig. 4].

Demonstration

1. If the point P is outside the circle, there are two tangents PA and PB as shown in Fig. 2.
2. If the point P is on the circle, there is only one tangent at P [see Fig. 3].
3. If the point P is inside the circle, there is no tangent at P to the circle. [see Fig. 4].

Observation

1. In Fig. 2, number of tangents through P = -------------------.
2. In Fig. 3, number of tangents through P = ----------------.
3. In Fig. 4, number of tangents through P = ------------------.

Application

This activity is useful in verifying the property that the lengths of the two tangents drawn from an external point are equal.

Activity 24

OBJECTIVE

To verify that the lengths of tangents to a circle from some external point are equal.

MATERIAL REQUIRED

Glazed papers of different colours, geometry box, sketch pen, scissors, cutter and glue.

METHOD OF CONSTRUCTION

1. Draw a circle of any radius, say *a* units, with centre O on a coloured glazed paper of a convenient size [see Fig. 1].
2. Take any point P outside the circle.
3. Place a ruler touching the point P and the circle, lift the paper and fold it to create a crease passing through P [see Fig. 2].

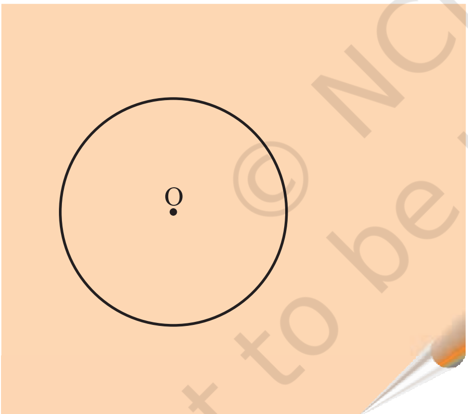

Fig. 1

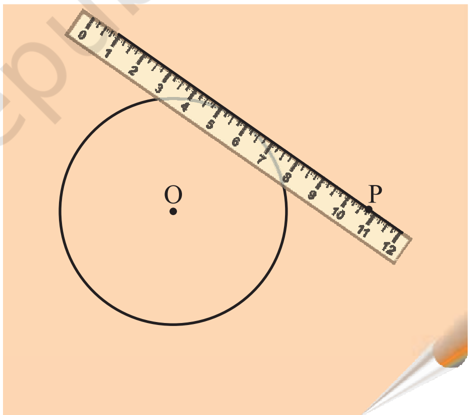

Fig. 2

4. Created crease is a tangent to the circle from the point P. Mark the point of contact of the tangent and the circle as Q. Join PQ [see Fig. 3].
5. Now place ruler touching the point P and the other side of the circle, and fold the paper to create a crease again [see Fig. 4].

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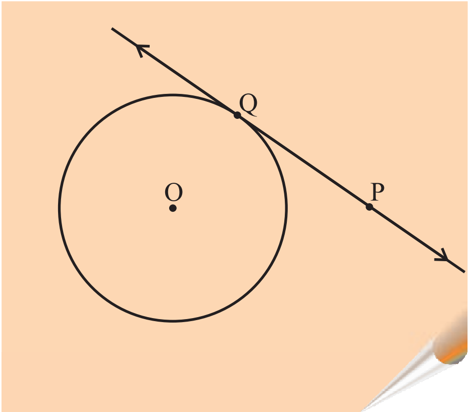

Fig. 3

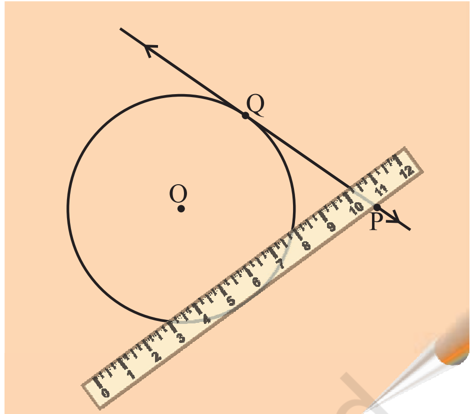

Fig. 4

6. This crease is the second tangent to the circle from the point P. Mark the point of contact of the tangent and the circle as R. Join PR [see Fig. 5].
7. Join the centre of the circle O to the point P [see Fig. 6].

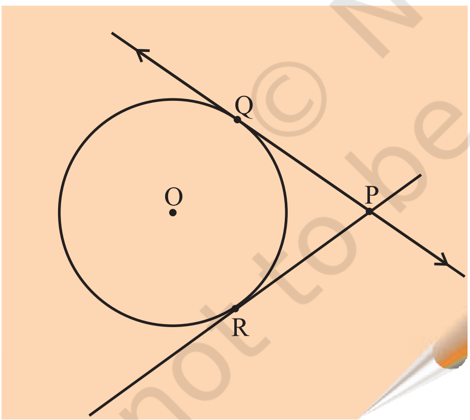

Fig. 5

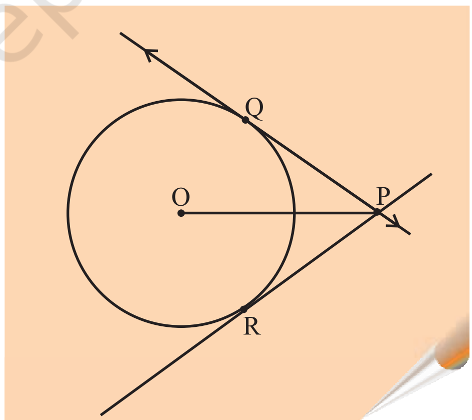

Fig. 6

DEMONSTRATION

1. Fold the circle along OP.

2. We observe that Q coincides with R. Therefore, QP = RP, i.e., length of the tangent QP = length of the tangent RP.

   This verifies the result.

Observation

On actual measurement:

1. Length of tangent QP = ...
2. Length of tangent RP = ...

   So, length of tangent QP = length of tangent ....

Application

This result is useful in solving problems in geometry and mensuration.

Activity 25

Objective

To find the height of a building using a clinometer.

Material Required

Clinometer (a stand fitted with a square plate which is fitted with a movable 0º–360º protractor and a straw), a measuring tape 50 m long, table or stool.

Method of Construction

1. Place a table on the ground of a school.
2. Place a clinometer (a stand fitted with 0º–360º protractor and a straw whose central line coincides with 0º–360º line) on the table.
3. Now face it towards the building of the school.
4. Peep out through the straw to the top of the school building and note the angle (θ) through which the protractor turns from 0º–360º line.

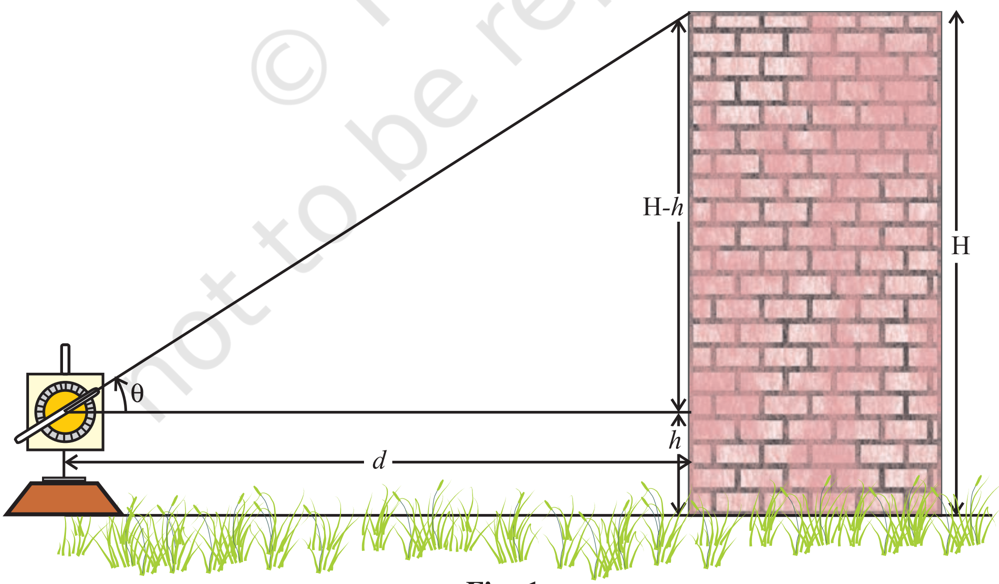

Fig. 1

5. Measure the height (h) of the centre of the protractor from the ground.

6. Measure the distance (d) of the building from the point lying on the vertical line of the stand (centre of the protractor) kept on table [see Fig. 1].

7. Repeat the above method keeping the clinometer at different positions and collect the values of q, h, d for different settings.

DEMONSTRATION

Using the knowledge of trigonometric ratios, we have :

$\tan\theta = \frac{H - h}{d}$, where H is the height of the building.

i.e., $H = h + d\tan\theta$

OBSERVATION

S.No.	Angle measured through protractor (Angle of elevation) θ	Height of the protractor from ground (h)	Distance (d) of the building from the centre of the protractor	tan θ	H = h + d tan θ
1.	----	---	---	---	---
2.	----	---	---	---	---
3.	----	---	---	---	---
...	----	---	---	---	---
...	----	---	---	---	---
...					

APPLICATION

1. A clinometer can be used in measuring an angle of elevation and an angle of depression.

2. It can be used in measuring the heights of distant (inaccessible) objects, where it is difficult to measure the height directly.

Activity 26

OBJECTIVE

To obtain formula for area of a circle experimentally.

MATERIAL REQUIRED

Threads of different colours, scissors, cardboard, thick sheet of paper, adhesive, ruler.

METHOD OF CONSTRUCTION

1. Draw a circle of radius say r units on a thick sheet of paper, cut it out and paste it on the cardboard.
2. Cut the coloured threads of different sizes in pairs.
3. Fill up the circle by pasting one set of coloured threads of different sizes in concentric pattern so that there is no gap left in between the threads as shown in Fig. 1.
4. Arrange the other set of coloured threads starting from smallest to the largest in the pattern shown in Fig. 2. Last thread will be of same colour and same length as that of the outermost thread of the circle as shown in Fig. 2.

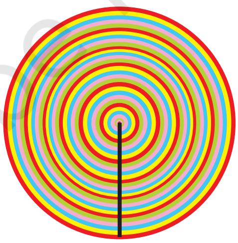

Fig. 1

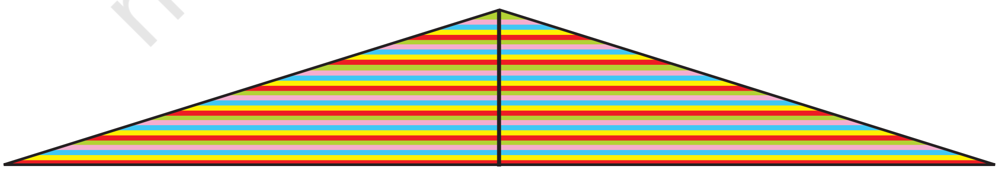

Fig. 2

Demonstration

1. Number and size of threads pasted on the circle and number and size of thread pasted in the form of triangle are the same.
2. Therefore, area covered by threads on the circle and area of triangular shaped figure formed by threads is the same.
3. Area of triangle $= \frac{1}{2}$ Base × Height
4. Base of triangle is equal to the circumference of the circle ($2\pi r$) and height of the triangle is equal to radius of circle, i.e., r.
5. Area of the circle = Area of triangle $= \frac{1}{2} \times 2\pi r \times r = \pi r^2$

Observation

On actual measurement:

1. Base of the triangle = ------- units.
2. Height of triangle = ------- units (i.e., radius of the circle).
3. Area of triangle = $\frac{1}{2}$ (Base × Height) sq. units.
4. Area of circle = Area of triangle = -------------------.

Application

This result can be used in finding areas of flower beds of circular and semi-circular shapes and also for making circular designs and in estimating the number of circular tiles required to cover a floor.

Note

Thinner the thread more is the accuracy. Fig. 2 is not drawn to scale.

Activity 27

Objective

To form a frustum of a cone.

Material Required

Geometry box, sketch pens, cellotape, acrylic sheet, cutter.

Method of Construction

1. Take an acrylic sheet of a convenient size and cut out a circle of suitable radius from it [see Fig.1].
2. Cut out a sector of, say 120° angle, from the circle [see Fig.2].
3. Make a cone from this sector by joining the two ends along the radii of the sector as shown in Fig. 3.

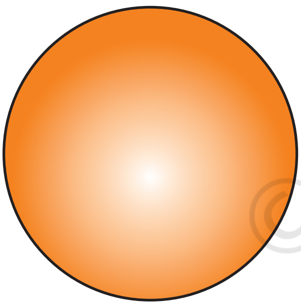

Fig. 1

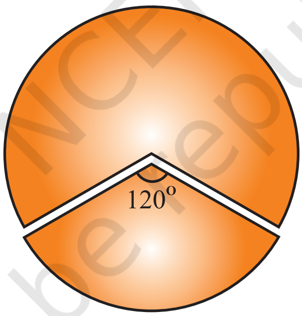

Fig. 2

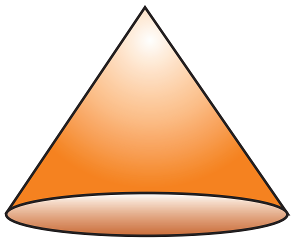

Fig. 3

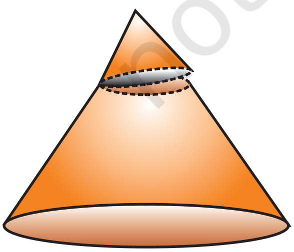

Fig. 4

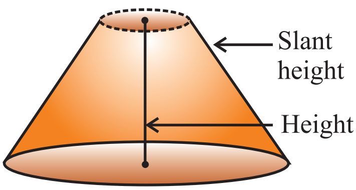

Fig. 5

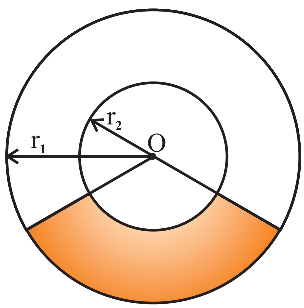

Fig. 6

4. Cut off a smaller cone from this cone such that the base of the smaller cone is parallel to that of the original cone [see Fig. 4].
5. The remaining solid is shown in Fig. 5.

Demonstration

The solid shown in Fig. 5 is called the frustum of a cone. Its base and top are two circles of different radii. The height of this frustum is the length of the line segment joining the centres of circles at the top and bottom. Slant height of the frustum is the difference of the slant height of the original cone and the slant height of the cut off cone.

Observation

On actual measurement:

Radius of the base of the frustum = ___________

Radius of the top of the frustum = ___________

Slant height of the original cone = ___________

Slant height of the cut off cone = ___________

Slant height of the frustum = ___________

Height of the original cone = ___________

Height of the cut off cone = ___________

Height of the frustum = ___________

Height of the frustum = Difference of the heights of two ___________.

Slant height of the frustum = Difference of the slant heights of two _______.

Application

1. This activity may be used to explain the concepts related to a frustum of a cone.
2. Frustum like shapes are very much in use in daily life such as buckets, tumblers, lamp shades, etc.

Note

An alternative method to form a frustum

Draw two concentric circles of radii r_1 and r_2 ($r_1 > r_2$) on a acrylic sheet. Mark a sector of the bigger circle and cut out the shaded region [see Fig. 6]. Now fold it and form a frustum of a cone.

Activity 28

Objective

To obtain formulae for the surface area and the volume of a frustum of a cone.

Material Required

Acrylic sheet, geometry box, sketch pens, cellotape.

Method of Construction

1. Make a frustum of a cone by cutting a smaller cone from a bigger cone using an acrylic sheet as explained in Activity 27 [see Fig. 1 and Fig. 2].
2. Name the radii of the bigger cone and smaller cone as r_1 and r_2, respectively, slant heights of the bigger cone and smaller cone as l_1 and l_2 , respectively and heights as h_1 and h_2, respectively.

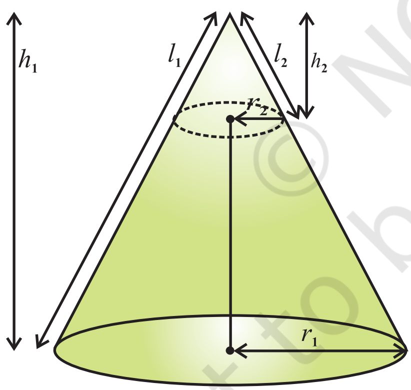

Fig. 1

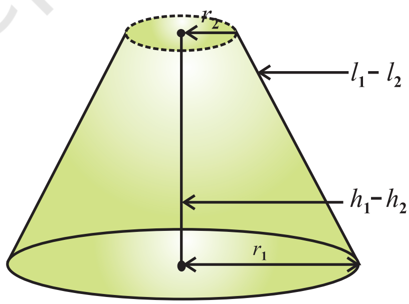

Fig. 2

Demonstration

Surface Area: (i) Curved surface area of the frustum

= Curved surface of the bigger cone – Curved surface of the cut off cone

$= \pi r_1 l_1 - \pi r_2 l_2$

(ii) Total surface area = $\pi r_1 l_1 - \pi r_2 l_2 +$ areas of the top and base

$$= \pi r_1 l_1 - \pi r_2 l_2 + \pi r_2^2 + \pi r_1^2$$

Volume : Volume of the frustum = Volume of the bigger cone – Volume of the cut off cone

$$= \frac{1}{3}\pi r_1^2 h_1 - \frac{1}{3}\pi r_2^2 h_2$$

OBSERVATION

On actual measurement:

r_1 = ___________, r_2 = _____________

h_1 = ___________, h_2 = _____________

l_1 = ___________, l_2 = _____________

Curved surface area of the frustum = ________________________.

Total surface area of the frustum = __________________________.

Volume of the frustum = __________________________.

APPLICATION

These results may be used in finding the material required in making containers/ objects in the shape of a frustum of a cone and also to find their capacities.

Activity 29

OBJECTIVE

To draw a cumulative frequency curve (or an ogive) of less than type.

MATERIAL REQUIRED

Coloured chart paper, ruler, squared paper, sketch pens, cellotape, cutter, glue.

METHOD OF CONSTRUCTION

1. Collect data on heights of the students of a school and make a frequency distribution table, containing, say, five classes as given below:

Height	*a-b*	*b-c*	*c-d*	*d-e*	*e-f*
Frequency	f_1	f_2	f_3	f_4	f_5

2. Form a cumulative frequency table of less than type of the above data as given below :

Height	less than *b*	less than *c*	less than *d*	less than *e*	less than *f*
Cumulative frequency	f_1	f_1+f_2 (say F_1)	$f_1+f_2+f_3$ (say F_2)	$f_1+f_2+f_3+f_4$ (say F_3)	$f_1+f_2+f_3+f_4+f_5$ (say F_4)

3. Take a squared paper of size 15 cm × 15 cm and paste it on a coloured chart paper.
4. Take two perpendicular lines OX and OY on the squared paper and graduate them with divisions as needed by the data in Step 2.
5. On the squared paper, plot the points A (b, f_1), B (c, F_1), C (d, F_2), D (e, F_3) and E (f, F_4).
6. Join the plotted points by a free hand curve using a sketch pen, as shown in Fig. 1.

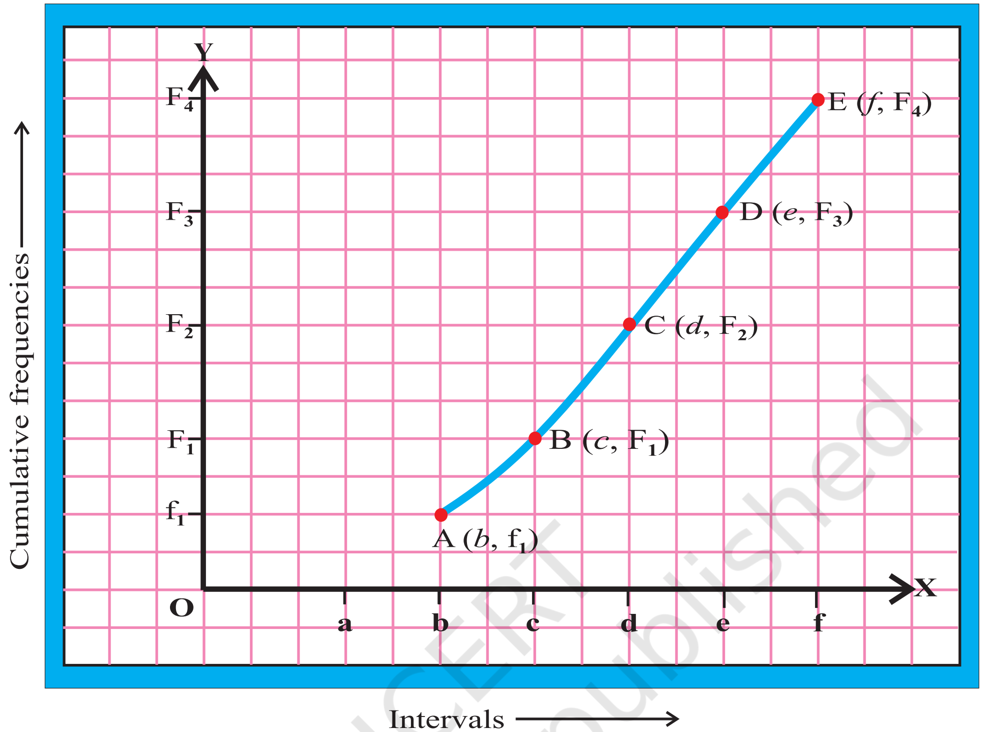

Fig. 1

Demonstration

The curve is an uprising curve, with cumulative frequencies rising from lower to higher. This is called "less than type ogive".

Observation

Intervals :

a-b = ________, b-c = ________, c-d = ________, d-e = ________, e-f = __________,

f_1 = __________, f_2 = __________, f_3 = __________, f_4 = __________, f_5 = __________,

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F_1 = __________, F_2 = __________,

F_3 = __________, F_4 = __________

Coordinates of A = ____________________

Coordinates of B = ____________________

Coordinates of C = ____________________

Coordinates of D = ____________________

Coordinates of E = ____________________

Free hand curve obtained by joining the points A, B, C, D and E is ____________ type _____________

APPLICATION

This ogive can be used to find median of the data.

Activity 30

OBJECTIVE

To draw a cumulative frequency curve (or an ogive) of more than type.

MATERIAL REQUIRED

Coloured chart paper, ruler, squared paper, sketch pens, cellotape, cutter, adhesive.

METHOD OF CONSTRUCTION

1. Collect data on heights of students of your school and make a frequency distribution table as given below :

Height	a-b	b-c	c-d	d-e	e-f
Frequency	f_1	f_2	f_3	f_4	f_5

2. Form a cumulative frequency table of more than type from the above data as given below:

Height	More than or equal to a	More than or equal to b	More than or equal to c	More than or equal to d	More than or equal to e
Cumulative frequency	$f_1+f_2+f_3+f_4+f_5$ (say F_4)	$f_1+f_2+f_3+f_4$ (say F_3)	$f_1+f_2+f_3$ (say F_2)	f_1+f_2 (say F_1)	f_1

3. Take a squared paper of size 15 cm × 15 cm and paste it on a coloured chart paper.

4. Take two perpendicular lines OX and OY on the squared paper and graduate them with divisions as needed by the data.

5. On the squared paper, plot the points A (a, F_4), B (b, F_3), C (c, F_2), D (d, F_1) and E (e, f_1).

6. Join the plotted points by a free hand curve using a sketch pen, as shown in Fig. 1.

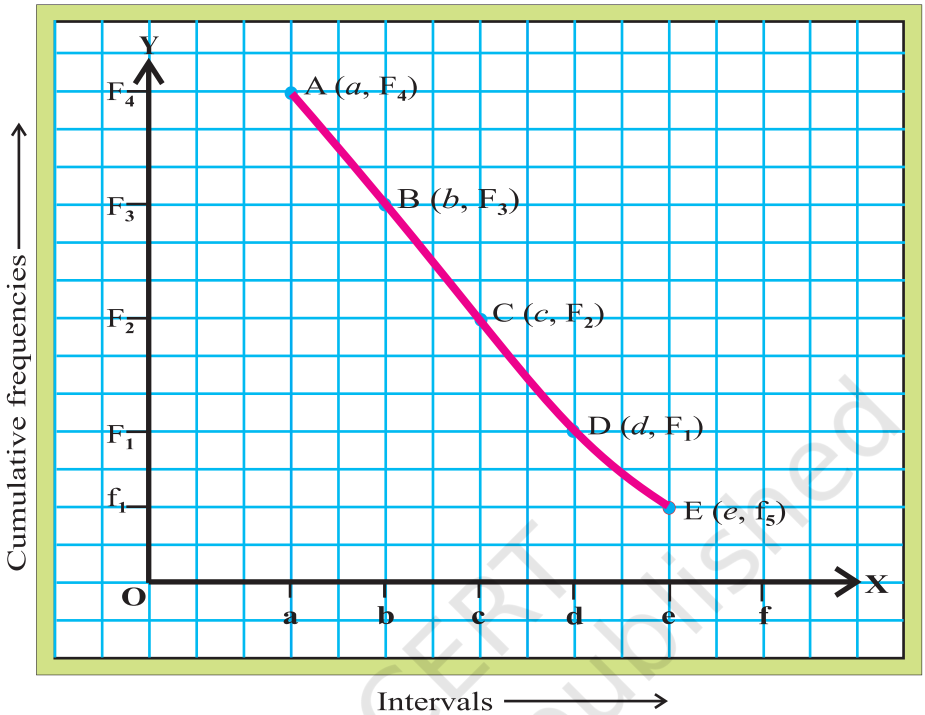

Fig. 1

DEMONSTRATION

The curve in Fig. 1 is falling curve with cumulative frequencies falling from higher to lower frequencies. This is called a cumulative frequency curve or an ogive of "more than type".

OBSERVATION

Class intervals are:

a-b = ___________, b-c = ___________, c-d = ___________,

d-e = ___________, e-f = ___________,

f_1 = ___________, f_2 = ___________, f_3 = ___________,

f_4 = ___________,

f_5 = ____________, F_1 = ____________, F_2 = ____________,

F_3 = ____________, F_4 = ____________

Coordinates of point A = ________________________

Coordinates of point B = ________________________

Coordinates of point C = ________________________

Coordinates of point D = ________________________

Coordinates of point E = ________________________

Free hand curve obtained by joining the points A, B, C, D and E is _________ type ________

APPLICATION

On the same squared paper, if for a given frequency distribution, "less than type ogive" and "more than type ogive" are drawn, then the *x*-coordinate of the point of intersection of these ogives will give the "median" of the data.

Activity 31

Objective

To determine experimental probability of 1, 2, 3, 4, 5 or 6 by throwing a die 500 times and compare them with their theoretical probabilities.

Material Required

A fair die, pen, sheets of white paper.

Method of Construction

1. Divide the students of the class into ten groups I, II, III, IV, V, VI, VII, VIII, IX and X of suitable size.
2. Each group will throw a die 50 times and will observe the occurrence of each 1, 2, 3, 4, 5 and 6.
3. Count the total number of times (frequency) 1 comes up in each group and denote it by a_1, a_2, a_3 ,...., a_{10}, respectively.
4. Calculate the experimental probability of 1 appearing in each group as

   $\frac{a_1}{50}, \frac{a_2}{50}, \frac{a_3}{50}, \ldots\ldots, \frac{a_{10}}{50}$

5. Calculate the experimental probability of 1 based on the data of 1st group, 1st two groups, ..., all ten groups as

   $\frac{a_1}{50}, \frac{a_1+a_2}{100}, \frac{a_1+a_2+a_3}{150}, \ldots, \frac{a_1+a_2+\ldots+a_{10}}{500}$, respectively.

6. Similarly, calculate the expermental probability of 2 based on the data of 1st group, 1st two groups, ..., all the ten groups as $\frac{b_1}{50}, \frac{b_1+b_2}{100}, \frac{b_1+b_2+b_3}{150}$, ..., $\frac{b_1+b_2+\ldots+b_{10}}{500}$, respectively.
7. Proceed in the same way for getting experimental probabilities for 3, 4, 5 and 6.

DEMONSTRATION

1. The probabilities $\frac{a_1}{50}$, $\frac{a_1+a_2}{100}$, $\frac{a_1+a_2+a_3}{150}$, ..., $\frac{a_1+a_2+........+a_{10}}{500}$ are coming closer to $\frac{1}{6}$ and the last probability $\frac{a_1+a_2+........+a_{10}}{500}$ is closest to $\frac{1}{6}$. Same will be the case for $\frac{b_1}{50}$, $\frac{b_1+b_2}{100}$, $\frac{b_1+b_2+b_3}{150}$, ..., $\frac{b_1+b_2+......+b_{10}}{500}$ and so on.

2. The theoretical probability P(E) of an event E (say 1) = P(1)

$$= \frac{\text{Number of outcomes favourable to E}}{\text{Number of all possible outcomes of the experiment}} = \frac{1}{6}$$

Similarly, P (2) = P (3) = P (4) = P (5) = P (6) = $\frac{1}{6}$.

From Steps (1) and (2), it can be seen that the experimental probability of each number 1, 2, 3, 4, 5 and 6 is very close to the theoretical probability $\frac{1}{6}$.

Group No.	Number of times a die is thrown in a group	Total number of times a number comes up					
		1	2	3	4	5	6
I	50	a_1 =	b_1 =	c_1 =	d_1 =	e_1 =	f_1 =
II	50	a_2 =	b_2=	----	---	----	----
III	50	----	----	----	---	----	----
-	-	----	----	----	---	----	----
-	-	----	----	----	---	----	----
-	-	----	----	----	---	----	----
-	-	----	----	----	---	----	----
-	-	----	----	----	---	----	----
-	-	----	----	----	---	----	----
X	50	----	----	----	---	----	----
	Total = 500	----	----	----	---	----	----

OBSERVATION

1. Each group will complete the following table :-

$$\frac{a_1}{50} = \_\_\_\_\_\_,\quad \frac{a_1 + a_2}{100} = \frac{\sum_{i=1}^{2} a_i}{100} = \_\_\_\_\_\_,\quad \frac{\sum_{i=1}^{3} a_i}{150} = \_\_\_\_\_\_,$$

$$\frac{\sum_{i=1}^{4} a_i}{200} = \_\_\_\_\_\_,\quad \frac{\sum_{i=1}^{5} a_i}{250} = \_\_\_\_\_\_,\quad \frac{\sum_{i=1}^{6} a_i}{300} = \_\_\_\_\_\_,\quad \frac{\sum_{i=1}^{7} a_i}{350} = \_\_\_\_\_\_,$$

$$\frac{\sum_{i=1}^{8} a_i}{400} = \_\_\_\_\_\_,\quad \frac{\sum_{i=1}^{9} a_i}{450} = \_\_\_\_\_\_,\quad \frac{\sum_{i=1}^{10} a_i}{500} = \_\_\_\_\_\_$$

and same for b_i's, c_i's , ... f_i's

2. Experimental probability of 1 = $\frac{---}{500}$

   Experimental probability of 2 = $\frac{---}{500}$,

   -

   Experimental probability of 6 = $\frac{---}{500}$

   Experimental probability of 1 is nearly equal to theoretical ________.
   Experimental probability of 2 is ________ to theoretical _________.
   Experimental probability of 6 is _____ to _______ probability.

APPLICATION

Probability is used extensively in the fields like physical sciences, commerce, biological sciences, medical sciences, weather forecasting, etc.

Activity 32

OBJECTIVE

To determine experimental probability of a head (or a tail) by tossing a coin 1000 times and compare it with its theoretical probability.

MATERIAL REQUIRED

A fair coin, pen, sheets of white paper.

METHOD OF CONSTRUCTION

1. Divide the students of the class in 10 groups I, II, III, ..., X.
2. Each group will toss a coin 100 times and will observe the occurrence of a head.
3. Count the total number of times (frequency) a head comes up in each group and denote these by $a_1, a_2, ..., a_{10}$, respectively.
4. Calculate the experimental probability of a head in each group as

   $$\frac{a_1}{100}, \frac{a_2}{100}, ..., \frac{a_{10}}{100}$$

5. Calculate the experimental probabilities of a head based on the data of 1st group, 1st two groups, ..., all ten groups as $\frac{a_1}{100}, \frac{a_1+a_2}{200}, \frac{a_1+a_2+a_3}{300}, ...,$

   $\frac{a_1+a_2+...+a_{10}}{1000}$, respectively.

DEMONSTRATION

1. The probabilities $\frac{a_1}{100}, \frac{a_1+a_2}{200}, \frac{a_1+a_2+a_3}{300}, ..., \frac{a_1+a_2+.......+a_{10}}{1000}$ are coming closer and closer to $\frac{1}{2}$.

2. The theoretical probability of an event E (a head) = P (H).

$$= \frac{\text{Number of outcomes favourable to E}}{\text{Number of all possible outcomes of the experiment}} = \frac{1}{2}.$$

From Steps 1 and 2, it can be seen that the experimental probability of a head is very close to the theoretical probability.

Observation

1. Each group will complete the following table :

Group	Number of times a coin is thrown in a group	Total number of times a head comes up
I.	100	a_1 = _______
II.	100	a_2 = _______
III.	100	a_3 = _______
IV.	100	a_4 = _______
.	.	
,	.	
,	.	
X	100	a_{10} = _______

2. $\frac{a_1}{100}$ = _______, $\frac{a_1 + a_2}{200}$ = $\frac{\sum_{i=1}^{2} a_i}{200}$ = _________, $\frac{\sum_{i=1}^{3} a_i}{300}$ = _________,

$\frac{\sum_{i=1}^{4} a_i}{400}$ = _______, $\frac{\sum_{i=1}^{5} a_i}{500}$ = _______, $\frac{\sum_{i=1}^{6} a_i}{600}$ = _________,

$\dfrac{\sum_{i=1}^{7} a_i}{700}$ = ________, $\dfrac{\sum_{i=1}^{8} a_i}{800}$ = _______,

$\dfrac{\sum_{i=1}^{9} a_i}{900}$ = _______, $\dfrac{\sum_{i=1}^{10} a_i}{1000}$ = _________

3. Experimental probability of a head = $\dfrac{---}{1000}$

4. Experimental probability of a head is nearly equal to theoretical ________

5. ________ probability of a head is nearly ______ to theoretical _________

NOTE

Similar activity can be performed for the occurrence of a tail.

APPLICATION

Probability is used extensively in the fields like physical sciences, commerce, biological sciences, medical sciences, weather forecasting, etc.