REFERENCES


References


APPENDICES
## Appendix A.1

Details of the Participants for the Experiment

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## Appendix A2

Details of the participants for the Pilot study

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Specimen copy of each set is attached in next pages with description.

SET A.

The set includes rather simple problems. The correct answer figure can be selected from the four alternatives and the selected are will well fit into the pattern giving it a definite shape. A specimen from set A is given below

SET A

A1
SET Ab

Problem in the set Ab includes simple problem. The set also consisted of four alternative and the selected one will well fit into the pattern giving, it a definite shape. A specimen from the Set Ab is given below.
SET B

The problem in the Set B is also very easy to understand. The answer figure to these problem are some what identical to the element given in the pattern in some problem the answer given (figure), can also be derived as the mirror image of the element which is printed at the top position.

A specimen figure from set B is given below.

SET B

B1
Appendix C

MATHEMATICAL CREATIVITY PRE-TEST (DRAFT)

Standard: 5, 6, 7                        Time: 60 minutes

Instructions for all the questions you can give as many responses as you can. Also try to name or describe the use of the item in your own words. Please ensure your response for each question. Your responses will be used for research purpose only.

1. Construct different meaningful figures using the cut pieces formed by cutting the figure with only two straight lines. Also name them.

   (7 minutes)

   Eg. Setty

2. Restructure the pieces of the following figure to form different objects. Also name them.

   (5 minutes)

   Eg: Boat

3. Using different geometrical shapes draw a vehicle of your choice and mark the geometrical shapes included in it. (Try to include different types of geometrical shapes).

   (7 minutes)

   Eg: Autorikshaw
4. Using maximum six points draw various patterns and name it with the familiar shapes.

   (5 minutes)

   Eg: Star

5. Arrange four squares to design objects. Also write the names of the constructed figures.

   (5 minutes)

   Eg. Window

6. You are given with a box of geometrical shapes. Design a public place of your choice and name it. There is no restriction in the numbers that you can use a shape.

   (8 minutes)

   Eg:

7. Using lines and parts of circle draw patterns (Passing through a single point.) There is no restriction in number that you can use.

   (5 minutes)

   Eg. Wheel
8. Design various things using the following shapes (not necessarily all of them) and name them.

\[ \triangle \quad \square \quad \underline{\text{rectangle}} \quad \underline{\text{ellipse}} \quad \bigcirc \quad \bigcirc \quad \underline{\text{line}} \]

Eg: House (5 minutes)

9. Using match sticks form meaningful patterns. Draw as many figures involving triangles and name them.

\[ \text{Pyramid} \]

Eg. Pyramid (5 minutes)

10. Using the figures given below, design faces. Also name them.

\[ \triangle \quad \bigcirc \quad \underline{\text{line}} \quad \text{Cat face} \]

Eg. Cat face (8 minutes)
MATHEMATICAL CREATIVITY POST-TEST (DRAFT)

Standard: 5, 6, 7  Time: 60 minutes

Instructions for all the questions you can give as many responses as you can. Also try to name or describe the use of the item in your own words. Please ensure your response for each question. Your responses will be used for research purpose only.

1. You are given with nine sticks of varying length. Design as many patterns as possible. Also name them. (7 minutes)

   Eg: Shape of a hut

2. Form as many meaningful shapes using triangles of any size. Also name them. (7 minutes)

   Eg: Pookkalam

3. Using geometrical shapes draw animal pictures of your choice and mark the geometrical shapes included in it. (Try to include different types of geometrical shapes). (5 minutes)

   Eg: Bear
4. Demolish the given house and using the shapes availed reconstruct an entirely new entity. (5 minutes)

5. Using squares of any size design as many furniture you can

   Eg: Table. (6 minutes)

6. Expand the given incomplete figure into a meaningful entity.

   Eg: Gate. (7 minutes)

7. Using a semi-circle and rhombus as compulsory components, design various objects and name them.

   Eg: Table lamb. (5 minutes)

8. Using three dimensional figures like cube, cuboid, sphere etc. form as many objects as possible. Name and describe their uses. (5 minutes)

   Eg: Setty
9. Using different geometrical shapes draw as many household articles as possible. (7 minutes)

   Eg: Clock

10. Using circles and parts of circle design as many objects as possible. (6 minutes)

   Eg. Jug
MATHEMATICAL CREATIVITY PRE-TEST (FINAL)

Standard: 5, 6, 7                      Time: 40 minutes

Instructions for all the questions you can give as many responses as you can. Also try to name or describe the use of the item in your own words. Please ensure your response for each question. Your responses will be used for research purpose only.

1. Construct different meaningful figures using the cut pieces formed by cutting the figure with only two straight lines. Also name them. (7 minutes)

   ![Figure 1]

   Eg: Setty

2. Using different geometrical shapes draw a vehicle of your choice and mark the geometrical shapes included in it. (Try to include different types of geometrical shapes). (7 minutes)

   ![Figure 2]

   Eg: Autorikshaw

3. You are given with a box of geometrical shapes. Design a public place of your choice and name it. There is no restriction in the numbers that you can use a shape. (8 minutes)

   ![Figure 3]

   Eg:
4. Using lines and parts of circle draw as many patterns (passing through a single point.) There is no restriction in number that you can use.

(5 minutes)

Eg. Wheel

5. Using match sticks form meaningful patterns. Draw as many figures involving triangles and name them.

(5 minutes)

Eg. Pyramid

6. Using the figures given below, design faces. Also name them.

(8 minutes)

Eg. Cat face
Appendix F

MATHEMATICAL CREATIVITY POST-TEST (FINAL)

Standard: 5, 6, 7  Time: 40 minutes

Instructions for all the questions you can give as many responses as you can. Also try to name or describe the use of the item in your own words. Please ensure your response for each question. Your responses will be used for research purpose only.

1. You are given with nine sticks of varying length. Design as many patterns as possible. Also name them.

   Eg: Shape of a hut  (7 minutes)

2. Form as many meaningful shapes using triangles of any size. Also name them.

   Eg: Pookkalam  (7 minutes)

3. Using squares of any size design as many furniture you can.

   Eg: Table  (6 minutes)
4. Expand the given incomplete figure into a meaningful entity. (7 minutes)

\[ \text{Eg. Gate} \]

5. Using different geometrical shapes draw as many household articles as possible. (7 minutes)

\[ \text{Eg: Clock} \]

6. Using circles and parts of circle design as many objects as possible. (6 minutes)

\[ \text{Eg. Jug} \]
Scoring of Mathematical Creativity

There are four components fluency, flexibility, originality and elaboration in each of the ten items. Aggregate score for a single item is the sum total of the scores for the above four components. Total score of the learner in the pre test on mathematical creativity (pilot study) is the sum total of scores in all the ten items.

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<thead>
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Appendix G

MODULE-I

BASIC GEOMETRIC CONCEPTS

<table>
<thead>
<tr>
<th>Submodule-1</th>
<th>Point, Line and Plane</th>
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<tr>
<td>Submodule-2</td>
<td>Line, Ray and Line Segment</td>
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<tr>
<td>Submodule-3</td>
<td>Plane and Curved Surfaces</td>
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</table>

SUBMODULE-1

POINT, LINE AND PLANE

OBJECTIVES

1. To make the learner know about point, line and plane.
2. To enable the learner understand the relation of point with line and plane.
3. To enable the learner apply the knowledge of points, line and plane in solving puzzles.
4. To analyze situations where the concepts of points, line and plane are involved.
5. To judge the appropriateness of using points, lines and planes at particular situations.
6. To develop creative responses for activities involving points, lines and planes.
CONTENT

POINT

A point is the basic unit of Geometry. A point is that which has no parts. It shows an exact location. It is almost invisible tiny point.

LINE

A line is length without breadth. A line is a collection of points going endlessly in both directions along a straight path. A Line is endless. For practical purpose we limit the length and denote it as

←-------------

and name it X←-------------→Y, Line XY.

PLANE

Infinite number of lines constitutes the plane. Plane has length and breadth, but no thickness.

CONCLUSION

Thus a plane is the union of infinite number of lines and a line is the union of infinite -number of points.

PRESENTATION DESCRIPTION

Visual

Power point presentation on a point and its illustration is shown.
**Auditory**

A point! It is the basic unit of geometry. It has no parts, breadth or length. It determines the exact location in space. We represent a point using a capital letter. Here ‘A’ is a point.

**Visual**

Picture of a point formed by a compass is shown.

![Example for a point](image)

**Auditory**

When we draw a circle using a compass, the centre made by it is an example for point.

**Visual**

Picture of scattered points is shown.

![Scattered Points](image)

**Auditory**

Scattered points! Here the points are scattered in the plane.

**Visual**

Picture of a line is shown.
A line is a collection of points going endlessly in both directions along a straight path.

Representation of a line XY

**Auditory**

Line is a length without breadth. It has no beginning and no end, hence no end-points. A line is a collection of points going endlessly in both directions along a straight path. Representation of a line is given.

**Visual**

Animation of points in a straight path to form a line is shown

---

**Auditory**

Now, many points join together in a straight path to form a line. Line is endless; that is a length without breadth. It extends indefinitely in both directions.

**Visual**

Picture of representing a line is shown.

LINE

X  Y
**Auditory**

A line is expressed as shown and is read as line XY.

**Visual**

Picture of a plane is shown

![Plane](image)

- Collection of lines endlessly in both directions.

**Auditory**

A collection of lines endlessly in both directions form a line.

**Visual**

Animation of forming a plane with lines is shown.

![Plane Animation](image)

**Auditory**

Infinite number of lines constitutes a plane. Plane has length and breadth, but no thickness. A plane is a flat surface. It cannot be drawn on a piece of paper since it has no boundary. What we draw on a paper is only a part of a plane but not the plane itself.

**Visual**

Pictures Illustrating planes are shown.
Examples

Auditory

Some examples for part of the plane are table top, the side of a wall, roof of the room etc.

Visual

Conclusion of the sub-module is given.

Auditory

Thus, we can conclude that a plane is the collection of lines which is a collection of points along a straight path.
**ACTIVITY**

Each student is given with a card with marked points arranged in rows and columns at a distance 1 cm each. Students are asked to join the given points for making various figures and name them each.

Eg:

![House](image)

**PUZZLE**

Connect all the nine dots using only four straight lines at a stretch (without taking pen from the paper).

![Nine Dots](image)

**HOME ASSIGNMENT**

Using a maximum of ten points, draw various patterns. Identify them with objects around you. Explain.

Eg: Star

![Star](image)
SUBMODULE-2
LINE, RAY AND LINE SEGMENT

OBJECTIVE

1. To enable the learner know about line-segment, ray and line.

2. To enable the learner understand the relation of line-segment, ray and line.

3. To enable the learner apply the knowledge of line-segment, ray and line in solving puzzles.

4. To analyze situations where the concepts of line-segment, ray and line can be used.

5. To judge the appropriateness of using line-segment, ray and line at particular situations.

6. To develop creative responses for activities involving line-segment, ray and line.

CONTENT

RAY

A ray is a part of a line, which has one end point. It extends endlessly in one direction.

\[
\text{A} \quad \text{Ray} \quad \text{B}
\]

LINE SEGMENT

\[
\text{A} \quad \text{Line Segment} \quad \text{B}
\]
Line segment is a part of a line, which has two end points

**PRESENTATION DESCRIPTION**

**Visual**

Picture of a line is shown.

![Line Image]

A line is a collection of points going endlessly in both directions along a straight path.

**Auditory**

A line is a collection of points going endlessly in both directions along a straight path. Here AB is a line.

**Visual**

Picture of a ray is shown.

![Ray Image]

A ray is a part of a line. It extends endlessly in one direction only. Hence it has one end point. Representation of a ray: CD

**Auditory**

A ray is a part of a line. It extends endlessly in one direction only. Hence it has one end point. Representation of a ray is given. Here CD is a ray.
**Visual**

Picture of a line-segment is shown.

![LINE-SEGMENT](image)

A segment or line-segment is a part of a line having two end points.

Representation of a line-segment: $\text{EF}$

---

**Auditory**

A segment or line-segment is a part of a line having two end points. Representation of a line-segment is given. Here EF is the line-segment.

**Visual**

Animation of a line becoming a ray is shown.

![Animation](image)

**Auditory**

Part of a line is cut apart and becomes a ray. That is, ray a portion of a line. It starts from a point and goes endlessly in one direction. Part of a ray is cut apart and becoming a line-segment. That is, a line-segment is also a part of a line which has two end points.

**ACTIVITY**

In this activity, line-segments are made without using scale. The items needed for this activity are a paper and colour pen. Fold the given paper to form line-segments and mark them us colour pen. Make as many such line-segments as possible.
**PUZZLE**

Draw the following figure using line-segments without taking pen from the paper. But the line-segments should not cross each other or over ride anywhere.

![Puzzle Diagram]

**HOME ASSIGNMENT**

Make as many curve-like patterns using straight lines.

Eg:

![Home Assignment Example]
SUBMODULE-3

PLANE AND CURVED SURFACES

OBJECTIVES

1. To make the learner know about plane and curved surfaces.
2. To understand the features of plane and curved surfaces.
3. To enable the learner apply the concepts of plane and curved surfaces in solving puzzles.
4. To analyze situations where the concepts of plane and curved surfaces are involved.
5. To judge the appropriateness of using plane and curved surfaces at particular situations.
6. To develop creative responses for activities related to plane and curved surfaces.

CONTENT

SURFACES

In geometry we term the faces of any object as surfaces. There are two kinds of surfaces.

1. PLANE SURFACE

Plane or flat face of an object is called a plane surface. The surface of paper, top of a table or box etc. are examples for plane surfaces.
2. CURVED SURFACE

Spherical or unplained surface of an object is called a curved surface. The surface of a football, cricket ball, round bottle, orange, grapes, mango etc. are examples for curved surfaces.

PRESENTATION DESCRIPTION

Direct experience on plane and curved surfaces.

The teacher demonstrates plane and curved surfaces by showing examples from surroundings. Each of the students is given with plane and curved surfaces. They are asked to draw curves and straight lines on the surface. They are asked to explain the observed difference between two types of surfaces (given to them).

Visual

Types of surfaces are explained.

Auditory

In geometry the faces of any object are called surfaces. There are two kinds of surfaces viz., plane surface and curved surface.

Visual

Plane surfaces are explained.

Auditory

Plane or flat face of an object is called a plane surface.

Visual

Plane surfaces are illustrated with pictures.
Examples for Plane Surfaces

Auditory

Some examples for plane surfaces are black board, table-top, laptop and tennis court.

Visual

Curved surfaces are explained.

CURVED SURFACE

- Spherical or unplained surface of an object is called a curved surface.

Auditory

Spherical or unplained surface of an object is called a curved surface.

Visual

Curved surfaces are illustrated with pictures.
Auditory

Some examples for curved surfaces are football, vessels, apple and balloons.

ACTIVITY

Identify the surfaces where straight lines and curves can be drawn and surfaces where only curves can be drawn. The teacher shows some objects two at a time and asks the students to differentiate them (with their properties)

a. a foot ball and a piece of card board
b. a sea shell and a slate
c. a pot and a writing pad
d. an egg shell and a note book

PUZZLE

Without taking pen from the paper draw a circle and a point at its centre.

HOME ASSIGNMENT

Make a list of plane and curved surfaces from your surroundings.
MODULE TEST-I

1. Draw as many patterns as you can with the theme, 'From a point as centre' and name the figures you have drawn.

![Pattern](image)

Every fourth point

2. Find examples from your surroundings for point, line, line-segment, ray etc.

Point: bindi

Line: railway line

Line-segment: edge of a scale

Ray: beam of a torch light

3. Draw a theme based figure and mark all the shapes you know with special emphasis on plane and curved surface.

Eg:

![Cylinder](image)
### MODULE II

**ANGLES**

<table>
<thead>
<tr>
<th>Submodule-1</th>
<th>The concept of angles and its measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submodule-2</td>
<td>A pair of straight lines and angles between them</td>
</tr>
</tbody>
</table>

**SUBMODULE – 1**

**THE CONCEPT OF ANGLES AND ITS MEASUREMENT**

**OBJECTIVES**

1. To make the learner know about angles, their measurements and types of angles.
2. To enable the learner understand various characteristics of angles, their measurements and types of angles.
3. To analyze the situations where the concept of angles are involved.
4. To judge the appropriateness of using various types of angles.
5. To develop creative responses for activities related to angles and their measurements.

**CONTENT**

**ANGLE**

An angle is a collection of points that is the union of two rays having same end point.
For example, hands of a clock, two arms of a divider, and two sharp edges of a scissors are all hinged at a point and thus are inclined to each other. This inclination between two arms is known as angle.

ARMS OF AN ANGLE

Arms are the sides of an angle that is the rays by which an angle is formed.

VERTEX OF AN ANGLE

Vertex of an angle is the common point where the two rays meet.

MEASUREMENT OF ANGLES

The measurement of angles is performed using a protractor.

TYPES OF ANGLES

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<tr>
<td></td>
<td>An angle whose measure is 90°</td>
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<tr>
<td>2</td>
<td>Acute Angle</td>
</tr>
<tr>
<td></td>
<td>An angle whose measure is less than 90°</td>
</tr>
<tr>
<td>3</td>
<td>Obtuse Angle</td>
</tr>
<tr>
<td></td>
<td>An angle whose measure is greater than 90°</td>
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<td></td>
<td>but less than 180°</td>
</tr>
<tr>
<td>4</td>
<td>Straight Angle</td>
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<td>An angle whose measure is 180°</td>
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<tr>
<td>5</td>
<td>Reflex Angle</td>
</tr>
<tr>
<td></td>
<td>An angle whose measure is more than 180°</td>
</tr>
<tr>
<td></td>
<td>but less than 360°</td>
</tr>
</tbody>
</table>

PRESENTATION DESCRIPTION

Visual

Animation of rays forming an angle between them is shown.
**Auditory**

Ray 1, ..................Ray 2, .................. They form an angle. That is, an angle is formed at the corner where two rays intersect.

**Visual**

A picture showing parts of an angle such as vertex and arms of the angle.

![Image of a pen and its shadow illustrating an angle]

**Auditory**

Otherwise, rays can be named like AB, AC etc. Here two rays AB and AC have a common end point A. So they form an angle BAC. The common end point is called the Vertex, here A is the vertex and rays AB and AC are the arms of the angle.

**Visual**

Picture of a pen and its shadow is shown for illustrating formation of an angle.
**Auditory**

In this picture the pen and its shadow forms an angle.

**Visual**

The measurement of angles using a protractor is demonstrated.

**Auditory**

Now, let us measure the angles using a protractor. Place the center of the protractor at the vertex of the angle; say X. Align one side of the angle with the base of the protractor so that the other side of the angle intersects the curved edge of the protractor. Now, use the scale starting at O and read the measure of the angle where the other side of the angle intersects the curved edge of the protractor.

**Visual**

Animation of measuring an angle, using the picture of a six petal flower is shown.
**Auditory**

Here we have a flower with six petals! Shall we measure the angles of petals?
The angle measure of first petal is 60°, the second is 120°, the third is 180°, fourth is 240°, fifth is 300° and when we complete with the last petal one circle is completed and the angle measures 360°.

**Visual**

Animation of measuring the angles inside a circle is shown.

**Auditory**

Here we demonstrate the angular measurement of a circle. The circle is divided into four equal parts and each quadrant measures 90°. The angle measure of a half circle is 180°, three fourth of the circle measures 270° and a full circle measures 360°.

**Visual**

Types of angles are explained here.
**Auditory**

Now, let us see some types of angles which are categorized according to their angular measures.

**Visual**

Power point presentation of right angle is shown.

![Right Angle](image)

**Auditory**

An angle whose measure is 90° is called right angle.

**Visual**

Power point presentation of acute angle is shown.

![Acute Angle](image)

**Auditory**

An angle whose measure is less than 90° is called an acute angle.
**Visual**

Power point presentation of obtuse angle is shown.

**Auditory**

An angle whose measure is greater than 90° but less than 180° is called an obtuse angle.

**Visual**

Power point presentation of straight angle is shown.

**Auditory**

An angle whose measure is 180° is called a straight angle.
**Visual**

Power point presentation of reflex angle is shown.

![Reflex Angle Image]

**Auditory**

An angle whose measure is more than $180^\circ$ but less than $360^\circ$ is called a reflex angle.

**ACTIVITY**

Draw a star on the space below and mark all the possible angles with a colour pencil. Also measure each of them using a protractor.

![Star Diagram]

Eg.

**PUZZLE**

In the following figure 24 sticks form 9 squares. Remove eight sticks and form exactly four equal squares.

![Grid Diagram]
**HOME ASSIGNMENT**

Using four straight lines, how many angles can be formed? Demonstrate as many types of arrangements as possible.

Eg: Four angles

---

**SUBMODULE-2**

**PAIR OF STRAIGHT LINES AND ANGLES**

**OBJECTIVES**

1. To make the learner know about pair of straight lines and angles between them.

2. To enable the learner understand various angles formed between pair of straight lines.

3. To analyze the situations where the concept of pair of straight lines and angles between them concepts can be used.

4. To judge the appropriateness of using angles formed between pair of straight lines at particular situations.

5. To develop creative responses for activities related to the concept of pair of straight lines and angles between them.
CONTENT

The two lines can be

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Coincident</td>
<td>If a line lies exactly on the other, we say the lines are coincident</td>
</tr>
<tr>
<td>2.</td>
<td>Parallel</td>
<td>Two lines are said to be parallel if they do not intersect each other at any point even if extended to infinity</td>
</tr>
<tr>
<td>3.</td>
<td>Intersecting</td>
<td>If two lines meet at any point, we say they are intersecting</td>
</tr>
<tr>
<td>4.</td>
<td>Perpendicular</td>
<td>Two lines are said to be perpendicular to each other if one of the angles formed by them is a right angle</td>
</tr>
</tbody>
</table>
PAIR OF ANGLES

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Supplementary Angles</td>
<td>Two angles whose sum is $180^\circ$ are called supplementary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>angles and one is called the supplement of the other.</td>
</tr>
<tr>
<td>2</td>
<td>Linear Pair</td>
<td>Two adjacent angles are said to form a linear pair if their</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sum is $180^\circ$.</td>
</tr>
<tr>
<td>3</td>
<td>Complementary Angles</td>
<td>Two angles whose sum is $90^\circ$ are called complementary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>angles and one is called the complement of the other.</td>
</tr>
<tr>
<td>4</td>
<td>Vertically Opposite</td>
<td>When two lines intersect, four angles are formed. Each opposite</td>
</tr>
<tr>
<td></td>
<td>Angles</td>
<td>pair is called vertical angles and is always congruent.</td>
</tr>
<tr>
<td>5</td>
<td>Adjacent Angles</td>
<td>Two angles having a common vertex and a common side are called</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adjacent angles.</td>
</tr>
<tr>
<td>6</td>
<td>Corresponding Angles</td>
<td>Two angles which occupy the same relative position at each</td>
</tr>
<tr>
<td></td>
<td></td>
<td>intersection where a straight line crosses two others. If the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>two lines are parallel, the corresponding angles are equal.</td>
</tr>
<tr>
<td>7</td>
<td>Co-Interior Angles</td>
<td>Two lines are co-interior if they are interior angles lying</td>
</tr>
<tr>
<td></td>
<td></td>
<td>on the same side of the transversal. If the lines are parallel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the co-interior angles are supplementary.</td>
</tr>
<tr>
<td>8</td>
<td>Co-exterior Angles</td>
<td>Two lines are co-exterior if they are exterior angles lying on</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the same side of the transversal. If the lines are parallel the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>co-exterior angles are supplementary.</td>
</tr>
<tr>
<td>9</td>
<td>Alternate-Interior</td>
<td>Pair of angles on opposite sides of the transversal but inside</td>
</tr>
<tr>
<td></td>
<td>Angles</td>
<td>the two lines are called Alternate Interior Angles.</td>
</tr>
</tbody>
</table>
**PRESENTATION DESCRIPTION**

**Visual**

The relationship between two lines is explained.

- RELATIONSHIP BETWEEN TWO LINES
  - Coincidental
  - Parallel
  - Intersecting
  - perpendicular

**Auditory**

The relationship between two lines can be coincident, parallel, intersecting or perpendicular.

**Visual**

Picture of a pair of coincidental lines are shown.

A picture of two parallel lines is shown.

**Auditory**

If a line lies exactly on the other, we say the lines are coincident.

**Visual**

Picture of a pair of parallel lines are shown.
**Auditory**

Two lines are said to be parallel if they do not intersect each other at any point even if extended to infinity.

**Visual**

The picture of a railway track is shown for illustrating parallel lines.

![Railway Track](image1.png)

**Auditory**

Opposite tracks of a railway are said to be parallel.

**Visual**

The picture of a boat and rows is shown for illustrating parallel lines.

![Boat and Rows](image2.png)

**Auditory**

Here in this picture, the roars are placed parallel.

**Visual**

Picture of a pair of intersecting lines are shown.

![Intersecting Lines](image3.png)
**Auditory**

If two lines meet at any point, we can say that they are intersecting.

**Visual**

The picture of a gate is shown for illustrating intersecting lines.

![Gate Image](image1.png)

**Auditory**

Here, the gate or fence having an intersecting lines pattern.

**Visual**

Picture of a pair of perpendicular lines are shown.

![Perpendicular Lines Image](image2.png)

Two lines are said to be perpendicular to each other if one of the angles formed by them is a right angle.

**Visual**

The picture of a holy cross and a book are shown for illustrating perpendicular lines.
Adjacent edges of a holy cross, adjacent edges of a book etc. are examples for perpendicular lines.

**Visual**

Picture is shown for illustrating complementary angles.

**Auditory**

Two angles whose sum is 90° are called complementary angles and one is called the complement of the other. Here, angle 1 and angle 2 sums up to 90°. Hence one is the complement of the other.

**Visual**

Picture is shown for illustrating non-complementary angles.
**Auditory**

Sum of angles 3 and 4 is more than 60°. So they are not complementary angles.

**Visual**

Picture is shown for illustrating supplementary angles.

---

**Auditory**

Two angles whose sum is 180° are called supplementary angles and one is called the supplement of the other. Here, angle 1 and angle 2 sums up to 180°. Hence they are supplement to each other.

**Visual**

Picture is shown for illustrating non-supplementary angles.

---

**Auditory**

Angles 1 and 2 are placed along a line one after the other in such a way that they have a common ray. They fit exactly on a line hence together making an angle 180°. Then they are called a linear pair.

**Visual**
Two parallel lines and a transversal are shown.

**Auditory**

Here two parallel lines are cut by a transversal and the angles formed are angle 1, angle 2, angle 3, angle 4, angle 5, angle 6, angle 7 and angle 8.

**Visual**

Animation is shown by highlighting angles 1 and 7 to demonstrate ‘vertically opposite angles’.

**Auditory**

Each opposite pair of angles is called vertically opposite angles and they are always equal. Here angle 1 and angle 7 are equal.

**Visual**

Animation is shown by highlighting angles 1 and 2 to demonstrate ‘adjacent angles’.
**Auditory**

Two angles having a common vertex and a common side are called adjacent angles and are always supplementary. Here angle 1 and angle 2 is a pair of adjacent angles.

**Visual**

Animation is shown by highlighting angles 1 and 3 to demonstrate ‘corresponding angles’.

![Corresponding Angles](image1.png)

**Auditory**

Two angles which occupy the same relative position at each intersection where a straight line crosses them are called corresponding angles and they are always equal. The corresponding angles are equal. Here angle 1 and angle 3 is a pair of corresponding angles.

**Visual**

Animation is shown by highlighting angles 2 and 3 to demonstrate ‘co-interior angles’.

![Co-interior Angles](image2.png)
**Auditory**

Two lines are co-interior if they are interior angles lying on the same side of the transversal. Since the lines are parallel, the co-interior angles are supplementary. Here angle 2 and angle 3 is a pair of co-interior angles.

**Visual**

Animation is shown by highlighting angles 1 and 4 to demonstrate ‘co-exterior angles’.

![Diagram](image)

**Auditory**

Two lines are co-exterior if they are exterior angles lying on the same side of the transversal. Since the lines are parallel, the co-exterior angles are supplementary. Here angle 1 and angle 4 is a pair of co-exterior angles.

**Visual**

Animation is shown by highlighting angles 2 and 6 to demonstrate ‘alternate-interior angles’.

![Diagram](image)
**Auditory**

The pair of angles on opposite sides of the transversal but inside the two lines are called alternate interior angles. Here angle 2 and angle 6 is a pair of alternate interior angles.

**Visual**

Picture of a carpentry application is shown.

![Carpentry Application Image]

**Auditory**

Here we have an example of carpentry application for two parallel lines are cut by a transversal. Now try to find all the angles associated with it.

**ACTIVITY**

Draw a theme based picture and identify parallel and perpendicular lines in it.

Eg: Drum

![Drum Diagram]
**PUZZLE**

Can you change the direction of the pig using only three moves?

![Puzzle Diagram]

**HOME ASSIGNMENT**

Stuff various types of flowers in your book and measure the angles after it gets dried.

**EXTRA ACTIVITIES**

1. Find examples from surroundings for parallel, perpendicular and intersecting lines.
2. Make angles by folding the paper and mark them using colour pencils. Can you find the angle measures without any tools? Verify the measure with a protractor.
3. Observe various instances of angle formations at your home.
1. Draw and explain as many angles involved in alphabets.

2. Name as many articles involving parallel and perpendicular lines.
   
   Eg: Book shelf has both parallel and perpendicular lines

3. Mark and name all the possible angles on the figure of the tree below.
MODULE III
POLYGONS

<table>
<thead>
<tr>
<th>Sub module : 1</th>
<th>Curves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub module : 2</td>
<td>Types of polygons and their characteristics</td>
</tr>
</tbody>
</table>

SUB MODULE – 1
CURVES

OBJECTIVES
1. To make the learner familiar with curves and its types.
2. To enable the learner distinguish between simple and complex curves.
3. To enable the learner distinguish between open and closed curves.
4. To enable the learner locate various types of curves in his/her surroundings.
5. To enable the learner think creatively on the knowledge of curves.

CONTENT
Curves

The doodling on a paper are examples of curves, which are not straight. Curves that do not cross itself are called simple curves and otherwise called non-simple or complex curves.

- Open curves are curves having distinct starting and end points.
- Closed curves have no distinct end points.
Parts of a Curve

1. Interior
2. Exterior
3. Boundary

PRESENTATION DESCRIPTION

Visual

Examples for simple and non-simple (complex) curves are shown.

Auditory

Curves! Curves that do not cross itself are called simple curves; otherwise non-simple or complex curves. Let us see some examples for simple and complex curves.

Visual

Picture of open curves are shown.
Auditory

Open curves! Curves having distinct starting and end points are called open curves.

Visual

Picture of closed curves are shown. Also interior, exterior and boundary of a curve are illustrated using a picture.

Auditory

Closed curves! Closed curves have no distinct starting and end points. Pictures of closed curves are shown. Here ‘L’ is an interior point, ‘N’ is an exterior point and ‘M’ is a point on the boundary of the curve.

ACTIVITY

The teacher asks students to make various types of curves using coloured threads in a paper.
JIGSAW PUZZLE

Students are given the game of jigsaw puzzle.

HOME ASSIGNMENT

Identify objects with curves from your environment.

Eg:

SUBMODULE - 2

TYPES OF POLYGON AND THEIR CHARACTERISTICS

OBJECTIVES

1. To make the learner know about polygons.
2. To enable the learner compare the properties of various polygons.
3. To enable the learner apply polygons at particular situations.
4. To analyze situations where polygons are involved.
5. To judge the appropriateness of the above mentioned concepts at particular situations.
6. To enable the learner use various polygons creatively.
**CONTENT**

**Polygon**

Closed figures made up entirely of line-segments are known as polygons.

**Properties of a Polygon**

Sides, vertices and diagonals are called the elements of a polygon. Vertices are angular points where two line-segments meet. Sides of a polygon are obtained by joining the adjacent vertices. Diagonals of a polygon are obtained by joining the vertices which are not adjacent.

**Types of Polygons**

<table>
<thead>
<tr>
<th>Type of Polygon</th>
<th>No. of vertices</th>
<th>No. of sides</th>
<th>No. of angles</th>
<th>No. of diagonals from a common vertex</th>
<th>Total no. of diagonals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Quadrilateral</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Pentagon</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Hexagon</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Heptagon</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Octagon</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>N</td>
<td>n</td>
<td>n</td>
<td>n-3</td>
<td>n-3</td>
<td>n (n-3)/2</td>
</tr>
</tbody>
</table>
CONCAVE AND CONVEX POLYGONS

A polygon is concave if part of any diagonal contains points in the exterior of the polygon. If no diagonal contains points in the exterior, then the polygon is convex.

REGULAR AND IRREGULAR POLYGON

A regular polygon is one that is both equilateral (all the sides are congruent) and equiangular (all angles are congruent). If a polygon is not regular it is called irregular.

PRESENTATION DESCRIPTION

Visual

Picture of a polygon is shown for describing about polygons.

[Diagram of a quadrilateral with diagonals drawn]

Auditory

A closed figures made up entirely of line segments are called polygons.

Visual

Elements of a polygon such as vertices, sides, angles and diagonals are explained.

- Sides, vertices and diagonals are called the elements of a polygon.
- Vertices are angular points where two line-segments meet.
- Sides of a polygon are obtained by joining the adjacent vertices.
- Diagonals of a polygon are obtained by joining the vertices which are not adjacent.
**Auditory**

Sides, vertices, angles and diagonals of a polygon are known as the elements of a polygon. Vertices are angular points where two line-segments meet. Sides of a polygon are obtained by joining the adjacent vertices. Diagonals of a polygon are obtained by joining the vertices which are not adjacent.

**Visual**

Picture of a polygon is shown for describing about the elements of a polygon.

![Polygon](image1)

**Auditory**

Look at this polygon. It is a four sided polygon having four vertices, four sides and four angles. It has two diagonals.

**Visual**

Picture of a triangle is shown.

![Triangle](image2)

**Auditory**

Now let us see some types of polygons. A triangle! It is the smallest possible polygon. It has three vertices, three sides and three angles; but no diagonals.
**Auditory**

Quadrilateral! It is a polygon having four vertices, four sides, four angles and two diagonals. Also the number of diagonals that can be drawn from a common vertex is one.

**Visual**

Picture of a quadrilateral is shown.

**Visual**

Picture of a pentagon is shown.

**Auditory**

Now picture of a Pentagon is shown. It has five vertices, five sides, five angles and five diagonals. The number of diagonals that can be drawn from a common vertex is two.

**Visual**

Picture of a hexagon is shown.
**Auditory**

This is a hexagon! A hexagon is a polygon having six sides, six vertices, six angles and nine diagonals. The number of diagonals that can be drawn from a common vertex is three.

**Visual**

Picture of a heptagon is shown.

![Heptagon](image)

**Auditory**

Heptagon is a polygon having seven vertices, seven sides, seven angles and fourteen diagonals. The number of diagonals that can be drawn from a common vertex is four.

**Visual**

Picture of an octagon is shown.

![Octagon](image)

**Auditory**

Octagon is a polygon having eight vertices, eight sides, eight angles and twenty diagonals. The number of diagonals that can be drawn from a common vertex is five.
**Visual**

A table containing number of sides, vertices, angles and diagonals is shown.

<table>
<thead>
<tr>
<th>Type of Polygon</th>
<th>No. of vertices</th>
<th>No. of sides</th>
<th>No. of angles</th>
<th>No. of diagonals from a common vertex</th>
<th>Total no. of diagonals</th>
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<td>20</td>
</tr>
<tr>
<td>N</td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n-3</td>
<td>n (n-3)/2</td>
</tr>
</tbody>
</table>

**Auditory**

From this we can conclude that the number of diagonals that can be drawn in a polygon with ‘n’ sides is ‘n (n-3)/2’. The number of diagonals that can be drawn from a common vertex of a polygon with ‘n’ sides is ‘n-3’. A chart with number of vertices, sides, angles and diagonals of various polygons is shown.

**Visual**

Pictures concave polygons are shown.

**CONCAVE POLYGON**
**Auditory**

Now, look at these polygons! If part of any diagonal of a polygon contains points in the exterior of it, then we call it a concave polygon.

**Visual**

Pictures of convex polygon are shown.

![Convex Polygon](image)

**Auditory**

If no diagonal contains points in the exterior of a polygon, then the polygon is called convex.

**Visual**

Pictures of equiangular polygons are shown.

![Equiangular Polygon](image)

**Auditory**

If all the angles of a polygon are equal we call it an equiangular polygon.

**Visual**

Pictures of equilateral polygons are shown.
If all the sides of a polygon are congruent, we call it an equilateral polygon.

A regular polygon is one that is both equilateral and equiangular.

If a polygon is not regular it is called an irregular polygon.
**ACTIVITY**

Draw a theme of your choice. Mark all the geometric shapes involved in it.

![House with geometric shapes](image)

**GAME**

A game for two players at a time! They are given two different colours to darken the given bubbles. The players can darken the bubble one after the other in such a way that same colour should not come in adjacent cells. The player who cannot darken the bubble as per the rules is the looser.

**HOME ASSIGNMENT**

Using geometrical shapes draw animal pictures.

Eg: ![Cat](image)
1. Find examples of closed and open curves from surroundings.

2. Select the theme ‘children’s park’ and design it with all the geometric shapes you know. (Use as many shapes as you want).

   Eg:

3. Using a semi-circle and a rhombus as compulsory components, design as many objects.
EXTRA ACTIVITIES

1. Dry various types of leaves by placing it between two pages of a book, in prior. Stick these dried leaves in the place of leaves in the following figure. Make impressions using fresh- cut beetroot in the place of flower. Also draw a plant pot and design it with vegetables. For example cut a lady’s finger, dip it in colours and press it in the paper for making designs.

2. Match sticks are given to students to form various polygons.

3. Demolish the house and using the availed shapes and reconstruct an entirely new building.

4. Using the geometric shapes you know, design various electronic gadgets.

5. Four sticks of 4cm, three sticks of 3cm, and three sticks of 2cm are given. Form as many shapes as you can. Name the shape relating it with your daily life articles.
SUBMODULE - 1

CONGRUENCY AND SIMILARITY

OBJECTIVES

1. To make the learner know about the concept of congruency and similarity.
2. To enable the learner distinguish between congruency and similarity.
3. To compare the properties of congruency and similarity.
4. To enable the learner apply knowledge of congruency and similarity in solving puzzles.
5. To analyze situations where the concepts of congruency and similarity are involved.
6. To judge the appropriateness of the concepts of congruency and similarity at particular situations.
7. To enable the learner deal with the concepts of congruency and similarity creatively.
**CONTENT**

**Congruency**

If two or more objects have same shape & same size with corresponding lengths and angles, they are congruent. That is, one is the exact copy of the other.

Eg:  

**Similarity**

Similar objects have same shape but need not be of same size. That is, one is the enlargement of the other.

Eg:

**GAME**

The students are divided into groups and the teacher distributes cards of different geometric shapes cut from colored chart papers. The group’s task is to cut various geometric figures having the same shape from the colour paper. The group which cuts maximum number of shapes within the stipulated time is declared as the winner and is awarded a token of appreciation.
After the game the teacher helps the students to differentiate the shapes into two categories.

1. Figures having same shape and same size.
2. Figures having same shape but different size.

Discussion

Geometric figures having same shape and same size are called congruent and geometric figures having same shape but different size are called similar. Then various instances of similar and congruent objects are given. The students are asked to judge whether they are similar or congruent. Also find more examples from your surroundings.

1. Bangles in a set
2. Pages of the same book
3. A Jodi of ear studs
4. Plates of a set
5. Tiles paved in a room

PRESENTATION DESCRIPTION

Visual

Congruency is explained with an example.
**Congruency**

- If two or more objects have same shape & same size with corresponding lengths and angles, they are congruent. That is, one is the exact copy of the other.

**Auditory**

If two or more objects have same shape and size with corresponding lengths and angles, they are congruent. That is, one is the exact copy of the other.

**Visual**

Characteristics of congruency are explained.

**Characteristics**

- Equal angles
- Equal sides
- Fit exactly over the other

**Auditory**

If two shapes are congruent they have equal angles, equal sides and fit exactly over the other.

**Visual**

Demonstration of congruency using an example question is shown.

Which shape is congruent to the yellow one?
Auditory

Which figure is congruent to the yellow one? Yes, the fifth one.

Visual

Similarity is explained and illustrated with examples.

Similarity

- Similar objects have same shape but need not be of same size. That is, one is the enlargement of the other.

Auditory

Similar objects have same shape but need not be of same size. That is, one is the enlargement of the other.

Visual

Characteristics of similarity are explained.

Characteristics

- Equal angles
- Ratio of sides equal
- One is an enlargement of the other

Auditory

If two figures are similar they have equal angles, equal ratio of sides and one is the enlargement of the other.
Visual

Picture for illustrating similarity is shown.

\[ \text{\includegraphics[width=0.3\textwidth]{image1.png}} \]

Auditory

These figures have same shape but different size and hence they are similar.

**ACTIVITY-1**

Picture of a butterfly is given. Enlarge the shape and draw it in the box given as the example of bee.

\[ \text{\includegraphics[width=0.3\textwidth]{image2.png}} \]

Eg:

**ACTIVITY-2**

Find various instances of congruent shapes from your surroundings.

Eg: bangles in a set.

**PUZZLE**

A farmer has the land holding with the given shape. Divide the land equally among the four sons but with same shape and size.

\[ \text{\includegraphics[width=0.3\textwidth]{image3.png}} \]
HOME ASSIGNMENT

Draw similar figures one inside the other as seen below.

SUBMODULE - 2

SYMMETRY

OBJECTIVES

1. To make the learner know about symmetry.
2. To enable the learner identify symmetry in shapes.
3. To enable the learner compare various geometrical shapes for symmetry.
4. To enable the learner distinguish between congruency, similarity and symmetry.
5. To apply the concept of symmetry in solving puzzles.
6. To develop creative responses for activities related to symmetry.

CONTENT

Line of Symmetry

A line through which a pattern can be folded so that both of its sides match is called the line of symmetry. The line of symmetry can be in any direction-
vertical, horizontal or diagonal. Here the vertical white line is the line of symmetry.

**Symmetry**

If we fold a pattern along the line of symmetry, both the sides match through corresponding parts exactly. They are said to be symmetrical.

**Types of Symmetry**

1. Reflectional symmetry
2. Rotational symmetry

**Reflectional Symmetry (Mirror Symmetry)**

One half is the reflection or the mirror image of the other, such figures are said to have reflectional symmetry. It is the simplest type of symmetry.

**Rotational Symmetry**

Even though an image is rotated, it appears the same two or more times; such images are said to have rotational symmetry about its centre. Number of times it appears the same is called its order.

**Tessellation**

A tessellation (or tiling) is when we cover a surface with a pattern or flat shapes so that there are no overlaps or gaps.

**PRESENTATION DESCRIPTION**

**Visual**

Some figures are shown to explain about symmetry.
**Auditory**

Symmetry! If two things are said to be symmetric then both of its sides match through corresponding parts exactly.

**Visual**

Picture of a butterfly is shown to explain about the line of symmetry.

**Auditory**

For example, a butterfly; if you draw a line down the centre of a butterfly both sides look the same. The line through which a pattern can be folded so that both of its sides match is called the line of symmetry.

**Visual**

A picture is shown to explain about the vertical line of symmetry.
**Auditory**

When the line of symmetry goes up and down it is called vertical symmetry. An example for vertical symmetry is given.

**Visual**

A picture is shown to explain about the horizontal line of symmetry.

---

**Auditory**

When the line of symmetry is drawn left to right or across the plane, it is called horizontal symmetry. Examples for horizontal symmetry are shown.

**Visual**

The types of symmetry are explained.

- **TYPES OF SYMMETRY**
  - Rotation
  - Reflection

**Auditory**

There are two types of symmetry. They are rotational Symmetry and reflectional symmetry.
Visual

A picture is shown to explain reflectional symmetry.

Auditory

Now, mirror symmetry! One half is the reflection or the mirror image of the other, such figures are said to have reflectional symmetry. It is the simplest type of symmetry.

Visual

A picture is shown to explain rotational symmetry.

Auditory

Even though an image is rotated, it appears the same two or more times; such images are said to have rotational symmetry about its centre.

Visual

Examples of tessellation are shown.
**Auditory**

Do you know what tessellation is? When we cover a surface with a pattern or flat shapes so that there are no overlaps or gaps, we call it tiling or tessellation. The tiling patterns we see around are examples for tessellation.

**ACTIVITY**

Ask the students to find out various shapes and classify them according to whether they tessellate or not.

Eg:- The tiles of same shape are paved on a floor tessellates

**PUZZLE**

Set out 20 match sticks in a 5*5 square representing a garden. A centrally positioned 1*1 square represents a well. Divide the garden around the well into 8 symmetrical plots of lands using exactly 20 match sticks. Try it.

Ans:
Brainstorming Session

We learned about similar, congruent and symmetric shapes. From the various objects around let us try to identify and differentiate between them.

- Cards from the same deck
- A set of bangles
- A set of plates
- A pair of shoes
- A pair of ear studs

Also the students are asked to give more examples of each category for clarifying the concepts.

HOME ASSIGNMENT

Draw floral designs on a paper and investigate on figures having ‘multiple lines of symmetry’.
 MODULE TEST-IV

1. Taking the given pattern as ‘basic frame rub off some parts of it and make various geometric designs. Identify the design with various objects you are familiar with.

2. Find articles from your surroundings of the following category.
   a. Congruent shapes   b. Similar shapes

3. Find examples for rotational symmetry from your surroundings.
MODULE V
TRIANGLES

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SUBMODULE - 1
TRIANGLE AND ITS PROPERTIES

OBJECTIVES
1. To make the learner know about triangles.
2. To enable the learner understand properties of triangles.
3. To enable the learner understand angle sum property of triangles.
4. To enable the learner apply the triangles in solving puzzles.
5. To enable the learner creatively use angle sum property of triangles at particular situations.

CONTENT
TRIANGLE

Triangle is the smallest possible polygon having three sides and three angles.

The three angles and the three sides of a triangle are together called the six parts or elements of the triangle.

ANGLE SUM PROPERTY

Sum of three angles of a triangle = $180^\circ$
**PRESENTATION DESCRIPTION**

**Visual**

A picture is shown to explain about a triangle and its parts.

**Auditory**

Triangle is the smallest possible polygon having three sides and three angles. Look at the picture. The three vertices A, B, C and three sides a, b, c are marked. Three vertices and three sides are together called the six parts or elements of a triangle.

**Visual**

Pictures are shown to illustrate triangular objects.

**Auditory**

Now let us look around and find triangular shaped articles.

**Visual**

Animation of angle sum property of triangle is shown.
**Auditory**

A triangle is drawn and angles are marked as 45°, 90° and 45°. Now let us find the sum of three angles of a triangle. We get the sum as 180°. Hence we have sum of three angles of a triangle is equal to one hundred and eighty degrees.

**ACTIVITY**

Triangle shaped cards are cut, their corner parts are cut and shuffled. The activity is to find the set of three angles of a triangle by applying the angle-sum property.

**PUZZLE**

Ten coins are arranged into a triangular pattern with its peak upwards. Change its peak downwards by moving only three coins.

**HOME ASSIGNMENT**

Join the pieces and make meaningful figures. Also name the articles you have drawn.
SUBMODULE - 2

TYPES OF TRIANGLES

OBJECTIVES

1. To make the learner know about various types of triangles.
2. To enable the learner identify types of triangles with their properties.
3. To enable the learner apply knowledge of triangles in solving puzzles.
4. To enable the learner creatively use the concept of triangle at particular situations.

CONTENT

TYPES OF TRIANGLES

1. RIGHT TRIANGLE

A triangle whose one angle is a right angle (that is 90°) is called a right angled triangle or right triangle.

2. OBTUSE TRIANGLE

A triangle having an obtuse angle is called an obtuse angled triangle or obtuse triangle.

3. ACUTE TRIANGLE

A triangle having all the angles are acute is called an acute angled triangle or acute triangle.
4. **SCALENE TRIANGLE**

A triangle in which all the three sides are unequal in length is called a scalene triangle.

5. **ISOSCELES TRIANGLE**

A triangle in which two of its sides are equal is called isosceles triangle.

6. **RIGHT ANGLED ISOSCELES TRIANGLE**

An isosceles triangle whose one angle is 90°is called a right angled isosceles triangle.

7. **EQUILATERAL TRIANGLE**

A triangle in which all the three sides are equal in length is called an equilateral triangle.

**PRESENTATION DESCRIPTION**

*Visual*

Picture of a right angled triangle is shown.
**Auditory**

Right triangle! A triangle whose one angle is a right angle (that is equal to $90^\circ$) is called a right angled triangle or right triangle.

**Visual**

Picture of an obtuse angled triangle is shown.

![Obtuse Triangle](image)

**Auditory**

Obtuse triangle! A triangle having an obtuse angle (that is greater than $90^\circ$) is called an obtuse angled triangle or obtuse triangle.

**Visual**

Picture of an acute angled triangle is shown.

![Acute Triangle](image)

**Auditory**

Acute triangle! A triangle which has all the three angles are acute (that is less than $90^\circ$) is called an acute angled triangle or acute triangle.
**Visual**

Picture of a scalene triangle is shown.

![Scalene Triangle](image)

**Auditory**

Scalene triangle! A triangle in which all the three sides are unequal in length is called a scalene triangle.

**Visual**

Picture of an isosceles triangle is shown.

![Isosceles Triangle](image)

**Auditory**

Isosceles triangle! A triangle in which two of its sides are equal is called an isosceles triangle.

**Visual**

Picture of a right angled isosceles triangle is shown.
**Auditory**

Right angled isosceles triangle! A triangle in which two of its sides are equal and the angle between them is right angle is called a right angled isosceles triangle.

**Visual**

Picture of an equilateral triangle is shown.

**Auditory**

Equilateral triangle! A triangle in which all the three sides are equal in length is called an equilateral triangle.

**ACTIVITY**

An individual activity for children! Using scissors cut and make as many triangles from the given colour papers. Stick them in a chart paper and measure the six elements of the triangle. Also label them with types and measures.
**PUZZLE**

How many triangles are there in the following figure?

**HOME ASSIGNMENT**

Make a chart describing various types of triangles, its characteristics and examples from surroundings.

Eg: Right triangle-1 right angle, 2 acute angles-A right angle is formed when a ladder is placed on the floor forming 30° with the wall.

**MODULE TEST-V**

1. Use nine match sticks and make as many triangles. Also name things you have drawn.

2. Cite examples of articles at public places having triangular shapes in them.

Eg: Bridge
3. Construct toys and other playing articles using various types of triangles.

Eg: Yacht
MODULE VI

QUADRILATERALS

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SUBMODULE - 1

TYPES OF QUADRILATERALS

OBJECTIVES

1. To make the learner know about quadrilaterals.

2. To enable the learner distinguish between various types of quadrilaterals.

3. To enable the learner understand angle sum property of a quadrilateral.

4. To apply the knowledge of square in solving puzzles.

5. To enable the learner use quadrilaterals creatively at particular situations.

CONTENT

QUADRILATERAL

A polygon having four sides and four angles is called a quadrilateral.

ANGLE SUM PROPERTY OF QUADRILATERAL

Sum of angles of a quadrilateral is $360^\circ$. 
TYPES OF QUADRILATERALS

1. TRAPEZIUM

A quadrilateral is called trapezium if a pair of its opposite sides are parallel. If a trapezium has non parallel sides equal, it is called isosceles trapezium.

2. PARALLELOGRAM

A quadrilateral having two pair of opposite sides which are parallel and equal is called a parallelogram. Its opposite angles are equal.

3. RHOMBUS

A rhombus is a parallelogram whose all sides are equal, opposite sides are parallel and opposite angles are equal.

4. RECTANGLE

A rectangle is a parallelogram whose four angles right angles.

5. SQUARE

If the four sides of the rectangle are made equal then it is called a square.

PRESENTATION DESCRIPTION

Visual

Picture of some quadrilaterals are shown.
**Auditory**

A quadrilateral is a polygon having four sides and four angles. Many types of quadrilaterals are shown in the picture.

**Visual**

Animation of angle sum property of a quadrilateral is shown.

Now, let us see the angle sum property of quadrilaterals. In this animation, a quadrilateral is shown. Then it is divided into two triangles with its diagonal. All the four angles of the quadrilateral are marked. Then each of them is picked and placed along a circle. We know that, interior angle of a circle is equal to $360^\circ$. Hence the sum of four angles of a quadrilateral is equal to $360^\circ$.

**Visual**

Picture of a trapezium is shown.

**Trapezium**

- A pair of parallel sides.
**Auditory**

Now, let us see some types of quadrilaterals. Trapezium! If the two opposite sides of a quadrilateral are parallel, it is called a trapezium.

**Visual**

Picture of an isosceles trapezium is shown.

**Auditory**

We know that, a pair of opposite sides of a trapezium is parallel. If the other two non-parallel sides are equal in length, we call it as isosceles trapezium.

**Visual**

Picture of a parallelogram is shown.

**Parallelogram**

- Two pairs of parallel sides
- Opposite sides are equal.
**Auditory**

If both the pair of opposite sides of a quadrilateral is parallel and equal, we call it a parallelogram.

**Visual**

Picture of a rhombus is shown.

**Rhombus**
- Two pairs of parallel sides
- Four sides equal.

![Rhombus Diagram]

**Auditory**

If all the four sides of the parallelogram are equal we call it a rhombus.

**Visual**

Picture of a rectangle is shown.

**Rectangle**
- Two pairs of parallel sides
- Opposite sides equal
- Four right angles

![Rectangle Diagram]

**Auditory**

We are familiar with rectangles and squares. Now, what is the condition for a quadrilateral to be a rectangle? Both pair of opposite sides is parallel and equal.
Also its four angles must be right angles. Then a quadrilateral becomes a rectangle.

**Visual**

Picture of a square is shown.

**Square**

- Two pairs of parallel sides.
- Four equal sides
- Four right angles

**Auditory**

If all the four sides of a rectangle are made equal, we get a square. That is, a square has two pair of parallel sides, four equal sides and four right angles.

**ACTIVITY**

1. The students are grouped and each group is provided with a chart paper and sketch pencils. They are asked to draw their school using various types of quadrilaterals.

2. Make a flower using colour papers! First make five paper-cutting from the colour paper in the shape of a square. Then fold each of them like a kite. Then join the kite shaped papers as the petals of a flower and stick a straw stick for stem as seen below.
**PUZZLE**

How many squares are there in the following figure?

![Image of a grid with squares]

**HOME ASSIGNMENT**

Arrange four squares of same size and make various objects. Also name them.

**SUBMODULE - 2**

**AREA AND PERIMETER**

**OBJECTIVES**

1. To make the learner know about perimeter of a square.
2. To make the learner know about perimeter of a rectangle.
3. To make the learner know about area of a square.
4. To make the learner know about area of a rectangle.
5. To enable the learner solve puzzles involving squares.
6. To enable the learner apply area of squares creatively at particular situations.

**CONTENT**

**PERIMETER**

Perimeter is the distance around a closed figure.
PERIMETER OF A SQUARE

Perimeter of a square is the distance around it. That is four sides of equal length are to be added.

PERIMETER OF A RECTANGLE

Perimeter of a rectangle is the distance around it. That is two lengths and two breadths are to be added.

AREA

The amount of surface enclosed by a closed figure is called its area.

AREA OF A SQUARE

Area is the number of square units it takes to completely fill a square. Since its four sides are equal, area of a square is the square of its side.

AREA OF A RECTANGLE

The area of a rectangle is the breadth times its length. That is area of the rectangle is the product of its length and breadth.

PRESENTATION DESCRIPTION

Visual

Occasions of finding perimeter of square and rectangle are shown.
Auditory

Consider occasions like making a foot path around a garden, fencing a plot, etc. In such cases we find perimeter of the shape. Now let us see how to find perimeter of two common and basic shapes – square and rectangle.

Visual

Picture of a square for illustrating its perimeter is shown.

Auditory

We see that, perimeter is the distance around a closed figure. For a square, there are four sides of equal length. Hence distance around a square that is the perimeter is four times its side.

For example, the given square having side equal to 3 meter has its perimeter 3X4=12 meter.

Visual

Picture of a rectangle for illustrating its perimeter is shown.

Auditory

Now consider a rectangle. We know that rectangle has two pair of parallel sides. That is two lengths and two breadths are to be added. Hence perimeter of
a rectangle is the sum of two times its length and two times its breadth. That is twice the sum of its length and breadth.

For example, the given rectangle has length 5 meter and breadth 3 meter. Hence its perimeter is $2(3+5)$ equal to 16 meters.

**Visual**

Pictures of instances illustrating area of a square and rectangle are shown.

**Auditory**

Now, consider the instances of paving tiles in a room or sticking wall paper on a wall or buying a table cloth etc. in such cases we find the area of a square or rectangle.

**Visual**

Animation of area of a square and then area of a rectangle is shown.

**Auditory**

Consider paving a square shaped room of 3 meter sides using tiles of 1 meter sides. Hence we need $3\times3$ equal to 9 tiles to complete paving tile in the room. That is area of a square is side X side which is equal to square of a side.
If the room is rectangular in shape, we have to fill the room breadth times its length. In this figure, 3 meter is the breadth and 5 meter is the length. Then area is equal to 3X5 equal to 15 meters.

That is area of a rectangle is equal to length X breadth.

**Activity**

A group activity! Measure the sides of classrooms and various other parts of your school using a measuring tape. Mark them in the sketch of your school you already drawn in the previous activity. Now try to find area of various parts of your school such as classrooms, library, laboratory, office, stage etc. Also write scale that you have chosen. Eg: If 10 meter is the actual measurement, it can be reduced for convenience and mark in the sketch by taking 10 centimeters.

**Puzzle**

Can you move only four match sticks to form three squares?

![Matchsticks Puzzle](image)

**Home Assignment**

Find the area of your house, rooms, yard etc. Also sketch the house with all the measurements you took. Also write scale that you have chosen.
MODULE TEST-VI

1. Using various quadrilaterals you know, construct useful articles (drawings) and name them.

2. Using squares draw any furniture of your choice.

3. Using quadrilaterals design various learning aids.

   Eg. Letter pad
MODULE-VII

CIRCLES

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SUBMODULE - 1

CIRCLE – CONCEPTS

OBJECTIVES

1. To make the learner know about the centre and radius of a circle.
2. To make the learner know about the interior and exterior of a circle.
3. To make the learner differentiate between circles and non-circles.
4. To enable the learner apply circles in solving puzzles.
5. To enable the learner use concept of circle creatively at particular situations.

CONTENT

CIRCLE - CENTRE AND RADIUS

Circle is a closed curve consisting of all points at a given distance from a fixed point within. The fixed point within the circle is called the centre of the circle. The line segment joining the centre to any point on the circle is called the radius of the circle.
INTERIOR AND EXTERIOR

The interior of a circle is the set of all points whose distance from the centre is less than the radius. The exterior of a circle is the set of all points whose distance from the centre is greater than the radius.

PRESENTATION DESCRIPTION

LAND AND POND GAME

Draw a circle. One participant in the game becomes the catcher by a lucky draw. The catcher if say land all the other participants should stay outside the circle. If the catcher say pond, all the students should stay inside the circle.

After playing the game for a while, the teacher explains parts of the circle from the context of the game. The shape of the pond is called circle. The pond is an example for interior of the circle and land is an example for exterior of the circle.

Visual

Picture of circular things from surroundings are shown.

Examples for circular things

Auditory

We are familiar with circular things like bangles, rings, plates etc.
Visual

Picture illustrating the circle, its center and radius are shown.

![Circle Diagram]

Auditory

Now, what is a circle? Circle is a closed curve consisting of all points at a given distance from a fixed point within. This fixed point inside the circle is called the centre of the circle. The line segment joining the centre to any point on the circle is called the radius of the circle.

Visual

Picture illustrating the interior and exterior is shown.

![Interior and Exterior Diagram]

Auditory

A Circle has an interior as well as an exterior region as shown. Otherwise we can say that the circle is the collection of all the points equidistant from an interior point. Here the line segment OA is the radius of the circle. The exterior or region outside the circle is shaded bright blue and interior or region inside the circle is shaded pale blue.
ACTIVITY

Activity to find circles and non-circles! A basket full of coloured papers of circular and non-circular shapes is given to students. The task is to differentiate circles and non-circles only through folding.

Fold the paper continuously three to five times. If the fold exactly coincides, we can conclude that ‘if distance from the centre to any point on the curve is a constant, then the curve is called a circle; otherwise not a circle.’

INTERACTIVE SESSION

What all things appear to be circular in their surroundings? (All the petals arranged in a circular manner.) What all things can be used to draw circles?

What are the peculiarities of the shape ‘circle’?

Why wheels, cross-section of tubes, pipes as circle only.

Then the teacher discusses with the children about circular things around them such as bangles, bottles, rings, tiffin box, wheels etc.

PUZZLE

A magic circle of numbers is given. Write numbers 0 to 7 in each circle so that sum of three numbers along each diameter is 10.

HOME ASSIGNMENT

Make a list of circular objects from your surroundings.
SUBMODULE - 2
CIRCLE-PROPERTIES

OBJECTIVES

1. To make the learner know about diameter.
2. To make the learner know about semi-circle.
3. To enable the learner know about concentric circles.
4. To make the learner know the relationship between sector and arc.
5. To make the learner distinguish between chord and segment.
6. To enable the learner find circumference of circles.
7. To enable the learner apply circles in solving puzzles.
8. To enable the learner deal creatively uses the concepts of circles and semicircles.

CONTENT

CHORD

The line segment joining any two points on the circle is called a chord of the circle.

DIAMETER

A chord which passes through the center of the circle is called the diameter.

Diameter of a circle is double the length of its radius.

CIRCUMFERENCE

The distance around the circular region is known as its circumference.
ARC
Arc of a circle is a portion of the circumference of the circle. An arc having length more than half the circumference of the circle is called a major arc and an arc having length less than half the circumference of the circle is called a minor arc. The angle subtended by the arc at the center is called the central angle.

SEMI CIRCLE
A diameter of a circle divides it into two equal parts; each part is called a semi-circle.

SECTOR
Interior part of a circle within a pair of radii and an arc between them is called a circle.

SEGMENT
Interior part of a circle formed by a chord and an arc is called a segment.

CONCENTRIC CIRCLES
Concentric circles are circles with same center but different radius.

PRESENTATION DESCRIPTION

Visual
Picture demonstrating the radius of a circle is shown.
Now let us see some characteristics of a circle. We know, the line-segment drawn from the centre of the circle to any point on the circle is its radius.

Chord is a line-segment joining any two parts of a circle.

If the chord passes through the centre of the circle it is called the diameter of the circle. We can say that diameter is the largest chord of a circle. We can see that diameter is double the length of radius of a circle. That is \( d = 2r \).
**Auditory**

The curve joining any two points on a circle is an arc.

**Visual**

Picture demonstrating the central angle of a circle is shown.

**Auditory**

The angle subtended at the centre by an arc is called the central angle.

**Visual**

Picture demonstrating the major arc and minor arc of a circle is shown.
**Auditory**

If the arc length is larger than half the length of the circle it is called a major arc. And, if it is smaller than half the length of the circle, it is called a major arc.

**Visual**

Picture demonstrating sector of a circle is shown.

**Auditory**

The portion of a circle having an arc and two radii as boundaries is called a sector.

**Visual**

Picture demonstrating the major sector and minor sector is shown.

**Auditory**

If the arc involved is a major arc, the sector is called a major sector. And if the arc involved is a minor arc, the sector is called a minor sector.
**Visual**

Picture demonstrating segment of a circle is shown.

![Segment](image)

**Auditory**

Now, a segment! The portion of a circle having an arc and a chord as boundaries is called a segment. It need not pass through the centre.

**Visual**

Picture differentiating the sector and segment of a circle is shown.

![Sector and Segment](image)

**Auditory**

Now let us differentiate between a sector and a segment. The area shaded in green is a sector. It has two radii and an arc as the boundaries. The area shaded in blue is a segment. Its boundaries are a chord and an arc.

**Visual**

Picture demonstrating semi-circle is shown.
**Auditory**

If it passes through the centre, the segment is called a semi-circle. The boundaries of a semi-circle are a diameter and half length of the circle.

**Visual**

Picture of a shooting target is shown to illustrate concentric circles.

**Auditory**

You may have seen shooting targets. Here all the circles have different radii but a common centre. Such circles having the same centre but different radii are called concentric circles.

**Visual**

Pictures of various occasions of finding circumference of a circle like an athlete running in a circular track, fencing a circular area, making a garland of flowers are shown.
**Auditory**

Now consider making a circular garland, the distance covered when an athlete running around a circular track or fencing a circular plot, etc.

**Visual**

Picture demonstrating circumference of a circle is shown.

![Circumference](image)

**Auditory**

Here we find the distance around a circular shape. You have learnt perimeter of rectangle and square. Here perimeter of a circle! It is called circumference because it has no sides with straight lines but a curved line.

**ACTIVITY**

A group activity for children! Working model of a circle is made by students which can demonstrate all the properties of a circle such as centre, radius, diameter, chord, arc, segment, sector, semi circle etc.

The materials needed for making this model are a piece of card board, a thermocol sheet, threads and needles.
Eg:

**PUZZLE**

The circular clock is broken into four pieces. When added the numbers of each piece, we get twenty. Show how the clock is broken.

**HOME ASSIGNMENT**

1. Divide the circle into pieces using only three sticks, as many possible ways as you can.

   Eg:

2. Draw some patterns on concentric circles. Eg:
1. Find various instances where patterns of circles are seen in your surroundings.

Eg. Circles formed in water surface when stones are thrown.

2. Using circles of various sizes, form as many designs as possible in a paper. Extra drawings (if necessary) are allowed. Name the object you visualized in them.

Eg: Floral design

3. Draw a vehicle of your choice and identify circles and parts of circle in it.


**MODULE-VIII**

**THREE DIMENSIONAL GEOMETRY**

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**SUBMODULE - 1**

**IDENTIFY THREE DIMENSIONAL FIGURES**

**OBJECTIVES**

1. To make the learner know about three dimensional figures.
2. To enable the learner distinguish between two and three dimensional figures.
3. To make the learner identify characteristics of three dimensional figures.
4. To make the learner apply knowledge of three dimensional figures in solving puzzles.
5. To make the learner create various three dimensional figures by assembling two dimensional figures.

**CONTENT**

**DIMENSIONS**

One dimensional figure is that having length only.

Two dimensional figure is that having length and breadth but no thickness.

Three dimensional figure is that having length, breadth and thickness.
PRESENTATION DESCRIPTION

**Game of Snake and Ladder:** The game of snake and ladder is used to introduce the concept of three dimensional figures. The children are grouped and snake and ladder set is provided to each group. The rules are explained and allow them to play a complete round.

Then a large cube is used for demonstration of three dimensional figures. Also various other still models of three dimensional figures are used for demonstration. Then the power point presentation is shown.

**Visual**

Animation of a point transforming into one dimensional figure, and then becoming two dimensional and at last a three dimensional figure is shown.

**Auditory**

A point! Points along a straight path form a line. Many lines join together to make a plane. Many congruent planes form a three dimensional figure or solid.

**Visual**

Picture of three dimensional figures like cube, cylinder and cone are shown.

**Auditory**

Let us see some examples for three dimensional figures as shown.
**ACTIVITY**

Two dimensional figures like squares, rectangles and triangles are distributed to group of students. They are asked to place congruent figures as super positioned. Gradually the two dimensional figure transforms to a three dimensional one.

**PUZZLE**

A wooden cube is painted pink and it was again cut into pieces as shown in the figure.

![Image of a wooden cube cut into pieces](image)

1. How many small cubes are there?
2. How many small cubes have only one pink face?
3. How many small cubes have only two pink faces?
4. How many small cubes have three pink faces?
5. How many small cubes have no pink face?

**HOME ASSIGNMENT**

Identify and make a list of various three dimensional objects in the class room.

Eg: Pencil box
SUBMODULE - 2

CLASSIFICATION OF THREE DIMENSIONAL SHAPES

OBJECTIVES

1. To make the learner know about various three dimensional figures.
2. To make the learner identify a 3D shape with its corresponding net.
3. To enable the learner apply the concept of three dimensions in solving puzzles.
4. To enable the learner assemble various three dimensional figures and to make it a meaningful entity.

CONTENT

PRISM

It is a three dimensional figure having two congruent faces one at the base and the other at the top. It also has four rectangular lateral faces. The prism is named after the shape of face polygon.

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<td>4 Rectangles</td>
<td>Rectangle</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Square Prism</td>
<td>6</td>
<td>4 Rectangles</td>
<td>Square</td>
</tr>
<tr>
<td>Cube</td>
<td>6</td>
<td>4 Rectangles</td>
<td>Square</td>
</tr>
<tr>
<td>Triangular Prism</td>
<td>5</td>
<td>3 Rectangles</td>
<td>Triangle</td>
</tr>
</tbody>
</table>
**PYRAMID**

It has only one base which is a polygon. The lateral faces are triangular in shape. The pyramid is named after the shape of base polygon.

**CONE**

A cone has a circular base and a curved lateral face.

**CYLINDER**

It is a three dimensional figure with two circular faces one at the top and the other at the bottom. Its lateral face is a curved one.

**SPHERE**

It has only one face which is a curved one.

**HEMI-SPHERE**

It has a circular base and a curved lateral face.

**PRESENTATION DESCRIPTION**

**Visual**

Power point presentation explaining prism and its properties is shown.
**Auditory**

Prism is a three dimensional figure having six faces. It has two congruent faces, one at the top and other at the bottom. The prism is named after the shape of base polygon. It also has several lateral faces and all of them are rectangles.

**Visual**

Picture of a rectangular prism or cuboid is shown to describe its properties.

![Rectangular Prism Diagram](image)

**Auditory**

A rectangular prism! Here, all the 6 faces are rectangles. It has eight vertices and twelve edges.

**Visual**

Example for rectangular prism is shown.

![Bricks](image)

**Auditory**

Bricks are examples for rectangular prism.

**Visual**

Picture of a square prism is shown to describe its properties.
**Auditory**

A square prism! Two faces at the top and bottom are squares and the four lateral faces are rectangles. All together it has six faces. It also has eight vertices and twelve edges.

**Visual**

Examples for square prism are shown.

**Auditory**

Here we have examples for square prism.

**Visual**

Picture of a cube is shown to describe its properties.
Auditory

A cube! It has 6 congruent faces, all of them are squares. It also has eight vertices and twelve edges.

Visual

Picture illustrating for cube are shown.

Auditory

Examples for cubes are shown.

Visual

Picture of a triangular prism is shown to describe its properties.

Auditory

A triangular prism! It has two triangular faces and three rectangular faces. It has six vertices and nine edges.
**Visual**

Picture illustrating triangular prism are shown.

**Auditory**

Example for triangular prism is shown.

**Visual**

Picture of pyramid is shown to describe its properties.

**Auditory**

A Pyramid! It has only one base which is a polygon. The lateral faces are triangular in shape. The pyramid is named after the shape of base polygon.

**Visual**

Picture illustrating types of pyramids are shown.
**Auditory**

Various types of pyramids are shown, like square pyramid, rectangular pyramid, triangular pyramid etc.

**Visual**

Picture of pyramids are shown.

![Pyramids](image1)

**Auditory**

Example for pyramid is shown.

**Visual**

Picture of comparison of a prism and a pyramid is shown to describe its properties.

![Prism and Pyramid](image2)

**Auditory**

A comparison of prism and pyramid are shown. A prism has two base polygons whereas a pyramid has only one base. The lateral faces of a prism are rectangular in shape whereas those of a pyramid are triangular shape.

**Visual**

Picture of a cylinder is shown to describe its properties.
**Auditory**

A Cylinder! It is a three dimensional figure with two circular faces one at the top and the other at the bottom. Its lateral face is a curved one. It has two curved edges but no vertex at all.

**Visual**

Picture illustrating cylinder is shown.

**Auditory**

Examples for cylinders are shown.

**Visual**

Picture of a cone is shown to describe its properties.
**Auditory**

A Cone! It has a circular base and a curved lateral face. It has one vertex and one curved edge.

**Visual**

Picture of an ice-cream for illustrating cone is shown.

![Ice-Cream Cone](image)

**Auditory**

Example for cone is shown.

**Visual**

Picture of a sphere with example is shown to describe its properties.

![Sphere](image)

**Auditory**

A Sphere! It is a three dimensional figure having only one face which is a curved one. It has no vertex and edges.

**Visual**

Picture of a globe as an example for sphere is shown.
**Auditory**

Examples for spheres are shown.

**Visual**

Picture of a hemi-sphere is shown to describe its properties.

**Auditory**

A Hemi-Sphere! It has a circular base and a curved lateral face. It has one curved edge and no vertex.

**Visual**

Picture illustrating for hemi-sphere is shown.

**Auditory**

Example for hemi-spheres is shown.
**ACTIVITY**

A group activity! From the given colour papers make as many net of three dimensional figures as possible. The group that makes maximum number of net of three dimensional figures is the winner.

**PUZZLE**

Numbers 1, 2, 3 and 4 on consecutive sides, 5 on top and 6 at the bottom are written on the faces of the cube. The cube is rotated and 1 comes at the top face, then which number is at the bottom side?

**HOME ASSIGNMENT**

Using thermocol pieces make various three dimensional figures. Eg:

Eg: Box
1. Identify various Three Dimensional figures from public places.

   Eg: Pencil box, chalk, Phone etc.

2. Using various three dimensional figures, make the theme ‘My sweet Home’

   Eg:

3. Using three dimensional figures form as many objects as possible and identify them with your household articles.

   Eg: Kitchen vessel
Appendix H

Certificates from Experts
CERTIFICATE

This is to certify that Ms. Jinu M. K., Senior research Fellow, Farook Training College, Research Center in Education, Kozhikode has discussed her research work with me—the content in the package and items to be given at the end of each module.

I have gone through the package and tests of mathematical creativity and have suggested appropriate modifications wherever necessary.

Signature:
Dr. V. Sumangala
Former HoD & Professor in Education
University of Calicut
CERTIFICATE

This is to certify that Ms. Jinu M. K., Senior Research Scholar, Farook Training College, Research centre in Education, Kozhikode, has discussed her research work with me- the content of the Package on Geometry and the items to be given at the end of each module.

I have gone through the Package on Geometry and the tests of Mathematical Creativity and have suggested appropriate modifications wherever necessary.

Signature: [Signature]

Mercy P. R.
Principal (Rtd.)
DIET Kottayam
## Rating Scale

Following is a rating scale based on ‘the Package on Geometry’. Please rate each dimension given below.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Dimensions</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
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</thead>
<tbody>
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<td>The content is appropriate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Activities are suitable</td>
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<td></td>
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<tr>
<td>3</td>
<td>It is practicable</td>
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<td>It is comprehensive</td>
<td></td>
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<td>8</td>
<td>It is student friendly</td>
<td></td>
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<tr>
<td>9</td>
<td>It is capable of fluent production of mathematical ideas</td>
<td></td>
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<td>It facilitate divergent thinking</td>
<td></td>
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Appendix J1

Specimen copy of response sheets of pre-test

on Mathematical Creativity
Four books
Appendix $J_2$

Specimen copy of response sheets of post-test on Mathematical Creativity
1. Square & Triangle Pattern (Tent)

2. Diamond Shape (Window)

3. Pentagon (Wall)

4. Rectangles (Bricks)

5. Triangles (Tile)

6. Grill
2 layer bed

ramp.

wall

wall

Grill

Shelf

Tile
Appendix K

Photographs of participation of the students in the experimental group