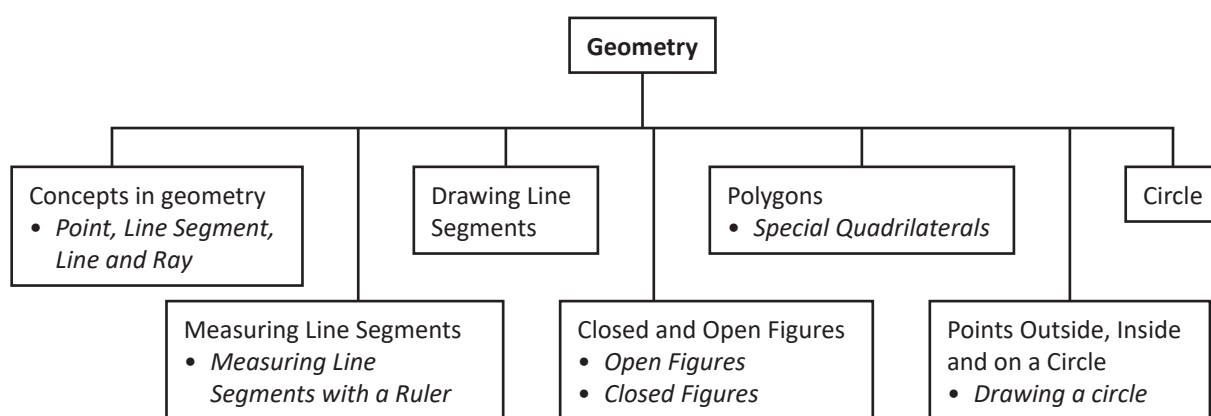# Geometry

LESSON OUTCOMES

At the end of the lesson students will be able to:

- define point, segment, line and ray.
- measure a line segment.
- draw a line segment.
- identify different kinds of closed figures.

- identify polygons and special quadrilaterals.
- find the centre, radius and diameter of a circle.
- draw a circle.

Geometry

- Concepts in geometry
  - *Point, Line Segment, Line and Ray*
- Drawing Line Segments
- Polygons
  - *Special Quadrilaterals*
- Circle

- Measuring Line Segments
  - *Measuring Line Segments with a Ruler*
- Closed and Open Figures
  - *Open Figures*
  - *Closed Figures*
- Points Outside, Inside and on a Circle
  - *Drawing a circle*

PREREQUISITE KNOWLEDGE

- Lines and shapes around us

LESSON PLAN   Number of sessions: 12

Session Plan

Session 1: Introduction; Concepts in Geometry [IL: Real-Life; India Knowledge]; *Point, Line Segment, Line and Ray*

Session 2: Explore! [Game-based Learning; Discovery-based Learning; MI]; Practice 1

Session 3: Measuring Line Segments [IL: Real-life]; *Measuring Line Segments with a Ruler IA: Finding Length of Objects*

Session 4: Practice 2

Session 5: Drawing Line Segments; Practice 3

Session 6: Closed and Open Figures [IL: India Knowledge, Art Integration]; Digital/IA - Identify Open and Closed Figures; Explore! [Game-based Learning; Discovery-based Learning; MI] TRM/Add-on Activity 1-To draw open and closed figures on a geoboard

Session 7: Polygons; *Special Quadrilaterals*; TRM/Add-on Activity 2- To form different polygons using a geoboard; Practice 4

Session 8: Circle; Digital/Animation - Circle; Digital/IA AND PPT - Finding Radius and Diameter of a Circle; Thinking Cap!

Session 9: Points outside, inside and on a circle [IL: Science; Game-based Learning; MI]; Quick Drill!

Session 10: *Drawing a circle*

Session 11: *Drawing a circle* (continued); Be Alert! Thinking Cap! Practice 5

Session 12: Worksheets 1 and 2 [Higher Order Thinking Skills]

Introduction　　　　[IL: Real-life; India Knowledge] ! [Game-based Learning; Discovery-based Learning] [MI]

- Introduce Udita's visit to Assam and the celebration of Bihu, highlighting the cultural significance of pithas (traditional sweets) in the festival.
- Encourage students to name a winter festival celebrated in their own area. Discuss how various festivals involve unique foods and traditions that can be related to different shapes.
- Encourage students to share examples of shapes they see in their daily lives or during celebrations. Read out shape riddles related to everyday objects and ask students to identify the shapes based on the descriptions.

Concepts in Geometry

- Using the story of Udita and her grandfather, ask the students how they spend time outdoors and discuss the importance of sunlight for health such as getting Vitamin D.
- Show the students the sketch of the chair and ask them to identify the line segment (armrest), point (where the wooden bars cross), and rays (sunlight).
- Encourage the students to look around the classroom or their home and identify real-life examples of these geometric elements. Reflect on how geometry is not just something in textbooks but is present all around us in our daily lives.

Points, lines and planes

- Explain the definitions of points, line segments, lines, and rays.
- Divide students into small groups and give them a list of geometric elements (points, line segments, lines, and rays) to find around the school.
- Set a time limit for the hunt and encourage students to be creative in their observations.
- They can draw these in their notebooks.

Measuring Line Segments　　　　　　　　　　　　　　　　　　　　[IL: Real-life]

- Begin by narrating Udita's story, focusing on the moment when her father was considering buying a study table. Emphasise how Udita estimates the length of the table using the span of her outstretched arms.
- Ask the students to share any experiences they might have had or observed of estimating lengths using body parts, like a carpenter using a handspan for estimation.
- Lead a discussion on how estimations can be useful in various situations, though they may not always be perfectly accurate.

Measuring Line Segments with a Ruler

- Relate the story to the concept of measurement by explaining that, just like Udita's father, they can measure objects around them.
- Ask students to share instances where they have measured objects using a ruler.
- Highlight how these skills are not just for the classroom but can be applied in everyday life, just like Udita's father did when buying her study table.
- Ask the students to measure the doors of their house and other objects using a ruler.

Drawing Line Segments

- Demonstrate how to draw a line segment of a given length on the board.

- Allow students time to complete the exercise, encouraging them to take their time and ensure accuracy.
- Once completed, discuss the importance of accuracy in drawing and measuring.
- Highlight how these skills can be used in other subjects and real-life situations.

Closed and Open Figures

[IL: India Knowledge, Art Integration] [Game-based Learning; Discovery-based Learning] [MI]

- Begin by introducing Kolam as a traditional South Indian art form, drawn using rice flour or paste, which also serves as food for ants and birds. Explain that similar beautiful geometrical patterns are made in other parts of India, known by different names: Pookalam in Kerala, Aipan in Uttarakhand, Aripana in Bihar, Jhoti in Odisha, and Alpona in West Bengal.
- Relate these traditional art forms to the concept of open and closed figures.
- Show images or draw examples of these patterns on the blackboard, pointing out how some are open figures (not closed from all sides) and others are closed figures (enclosed from all sides).
- Ask students to create their own designs using a combination of open and closed figures.
- Explain that students will create their own Kolam art using colourful powders and encourage them to experiment with both open and closed figures in their designs.

Add-on Activity 1

[Discovery-based Learning] [MI]

To draw open and closed figures on a geoboard

- Ask students to make open and closed shapes using threads and bands on a geoboard.
- Check the shapes.

Polygons

- Draw a few examples of polygons on the blackboard, such as a triangle, square, and pentagon. Ask them to find the polygonal-shaped items in the class.
- Explain that polygons are named based on the number of sides they have.
- Reinforce that polygons are important in both mathematics and real-life applications, such as in architecture and design.

Special Quadrilaterals

- Explain that some quadrilaterals have special features that make them unique, known as special quadrilaterals. Mention that rectangles and squares are examples of these special quadrilaterals.
- Ask students to compare the sides of the rectangles and squares using a ruler, reinforcing that in a rectangle, only opposite sides are equal, while in a square, all sides are equal.
- Discuss with the students and ask them to give examples of square-shaped and rectangular-shaped objects such as tiles, towels and so on.

Add-on Activity 2

[Discovery-based Learning] [MI]

To form different polygons using a geoboard

- Ask students to make a triangle, a quadrilateral, a pentagon, a hexagon, a heptagon and an octagon using a geoboard.

Circles

- Ask students to join hands and first form a square, then a rectangle, and finally a circle.
- Ask them in which shape they were able to see everyone clearly.
- Elicit the answer "circle."
- Define a circle and explain its parts.
- Ask the students to provide examples of circles in real life.
- Explain the relationship between the radius and the diameter of a circle.
- Use the activity in the 'Thinking Cap' to draw and find the number of circles in the design.

Points Outside, Inside and on a Circle [IL: Science]

- Conduct the game from the coursebook. Introduce students to different animal habitats and encourage them to learn more about arboreal and aerial animals on their own.
- After the game, discuss with the students which animals were inside, outside, and on the circle, reinforcing the concepts of points inside, outside, and on a circle.
- Explain that they can apply this concept to real-life situations, such as the position of a dart on a dartboard or objects inside, outside, or on the edge of a circular playground.

Drawing a circle

- Demonstrate the correct way to hold a compass. Explain the radius and the centre in a compass. Demonstrate how to draw a circle using the compass.
- Explain that similar tools, such as a rope attached to a stick, can be used to draw circles in rangolis and *kolams*.
- Give real-life examples that apply the concept of drawing circles, such as removing batter from a rotating grinder and making pots.
- Instruct students to do the task of drawing exactly seven lines to connect the circles given in the 'Thinking Cap' that develop the special reasoning and problem-solving skills. Review the solutions as a class. Discuss different strategies used to complete the task and address any challenges faced.

WORKSHEETS 1 AND 2

- Worksheet 1 has questions under Mental Maths, MCQs and Mixed Bag that test the understanding of concepts of geometry. They have a few HOTS questions too.
- Worksheet 2 has Higher Order Thinking Skills (HOTS) questions on Geometry.
- Guide students to complete the worksheets.
- You can give these worksheets as home assignments or discuss them in the classroom.

A. MCQs.

1. When aiming at a dartboard, the dart hits the dartboard at:

   a) a line   b) a point   c) a ray   d) a triangle

2. A photo frame has four sides. The shape that could be used is:

   a) a triangle   b) a pentagon   c) a quadrilateral   d) a hexagon

3. The light from a flashlight represents:

   a) a line   b) a ray   c) a line segment   d) a point

4. In a roundabout, the circle does not have:

   a) radius   b) diameter   c) centre   d) vertices

5. The shape that is usually cut for the Sun in the art class is:

   a) square   b) circle   c) triangle   d) rectangle

B. Who am I?

1. I am a polygon with 4 sides. My opposite sides are equal. You often find me as the shape of doors and windows in buildings.

2. I am a polygon with 6 sides. You can find me in the shape of tiles on the floor or a snowflake.

3. I am a polygon with 4 sides. All my sides are equal. You can find me on the chessboard.

C. Match the polygon with the name.

1.   a) Heptagon

2.   b) Triangle

3.   c) Quadrilateral

4.   d) Octagon

5.   e) Hexagon

6.   f) Pentagon

D. Write O for open figures and C for closed figures.

1.   _____

2.   _____

3.   _____

4.   _____

E. State whether true or false. If false, give reasons.

1. A triangle can have four sides.   2. A diameter is twice the radius.

3. A circle has an infinite number of diameters.   4. A line has an ending point.

F. Write if the following represents a line segment, line or a ray.

    1. $\vec{AB}$: _____
    2. $\overleftrightarrow{AB}$: _____
    3. $\overline{AB}$: _____

G. Mark three points on a paper. What is the greatest number of lines you can draw using the three points.

H. Find the number of line segments in each of the following:

    1. Rungs of the ladder
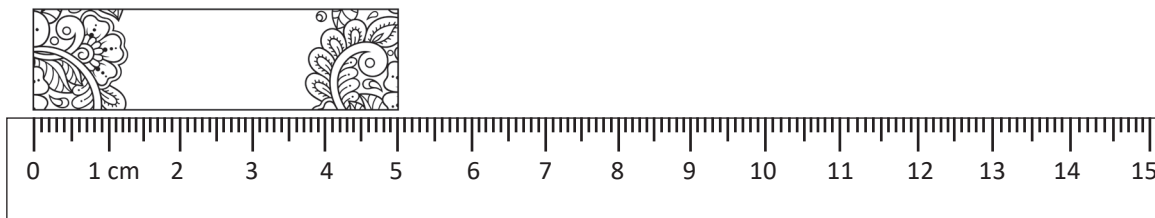   2. Road dividers
    3. Cricket stump

I. Estimate the lengths of the line segments and measure them using a ruler.

                          Estimated length   Actual length

    1. _____

    2. _____

J. Write down the length of the bookmark.

K. Draw line segments of the following lengths.

    1. 4 cm
    2. 6 cm
    3. 9 cm
    4. 11 cm
    5. 14 cm

L. In the given circle with centre O, mark the following.

    1. Radius OP
    2. Diameter AB
    3. Point inside the circle C
    4. Point on the circle D
    5. Point outside the circle E
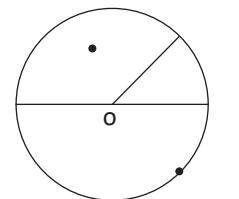
M. Find the radii of the hula hoops with the following diameters.

    1. 40 cm
    2. 50 cm
    3. 60 cm
    4. 70 cm

N. Find the diameter of circular rings with the following radii.
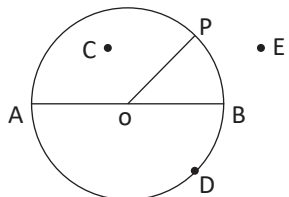
    1. 1 cm
    2. 2 cm
    3. 3 cm
    4. 4 cm

ANSWER KEY TO THE QUESTION BANK

A. 1. b   2. c   3. b   4. d   5. b   **B.** 1. Rectangle   2. Hexagon   3. Square   **C.** 1. f   2. a
3. e   4. c   5. b   6. d   **D.** 1. C   2. O   3. O   4. C   **E.** 1. False. It can have only three sides
2. True   3. True   4. False. A line extends infinitely in both directions.   **F.** 1. Ray   2. Line
3. Line Segment   **G.** Three lines   **H.** 1. 7   2. 34   3. 5   **J.** 5 cm

L.


**M.** 1. 20 cm   2. 25 cm   3. 60 cm   4. 35 cm   **N.** 1. 2 cm

2. 4 cm   3. 6 cm   4. 8 cm

A. MCQs

1. You can measure the length of:

   a) a point   b) a line   c) a line segment   d) a ray

2. The radius of the circle is the distance from centre of a circle to:

   a) the centre of the circle   b) a point inside the circle

   c) a point on the circle   d) a point outside the circle

3. The geometric shape that is not a polygon is:

   a) a square   b) a triangle   c) a pentagon   d) a circle

4. Among these, the open figure is:

   a)   b)   c)   d)
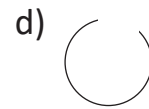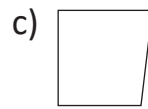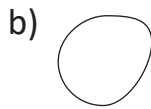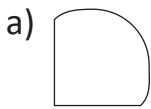
5. Among these, the shape that shows a polygon is:

   a)   b)   c)   d)
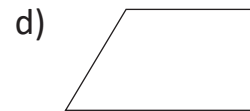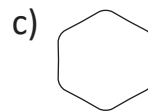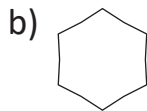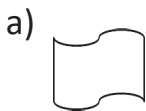
B. Without measuring, tick the box of the circle with the greatest diameter.
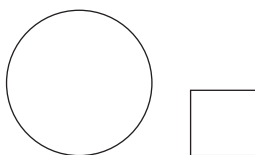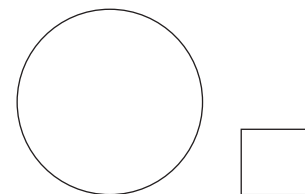
1.   2.   3.

C. In a circular garden, a fountain is located at the centre. Rohan, Meena, Arjun, Kavya, Sara, and Arnav are standing at different points along the edge of the garden. The distance from Rohan to the fountain is 1 metre. What will be the distances from the fountain to Meena, Arjun, Kavya, Sara, and Arnav?

_____

D. During the annual school sports day, a mat is placed on the ground for the high jump event. The coach announces that the mat has equal length and width, each measuring 4 metres. What is the shape of the mat?
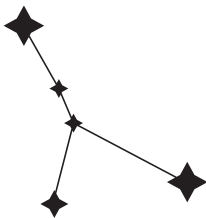
_____

A. Join the open end to make the open figure closed.

1.   2.   3.   4.

B. My grandmother makes a round papad. I break it exactly into two equal parts. The line along which it breaks is called the _____ of the circular papad.

C. A constellation is a group of stars that form a line pattern in the sky. Look at these constellations. Count the number of line segments in each constellation.

1. Cancer   2. Virgo   3. Libra   4. Leo

_____   _____   _____   _____

D. A gardener is planting flowers in a circular flower bed with a radius of 1 metre. What is the name and length of the path that passes through the centre of the bed and touches the edges on both sides?

_____

E. A thalipeeth is a circular Indian dish. How many diameters can you cut on a large circular thalipeeth to make equal slices? _____

F. On a circular dartboard with a radius of 5 cm, Neha places one marker on the edge and another one inside the circle. Is the distance between these two markers less than or greater than the diameter of the dartboard?

_____

ANSWER KEY TO THE WORKSHEET 1

A. 1. c   2. c   3. d   4. d   5. d   **B.** 3   **C.** 1 metre from each person   **D.** Square

ANSWER KEY TO THE WORKSHEET 2

A. open-ended answers   **B.** diameter   **C.** 1. 4   2. 13   3. 8   4. 9   **D.** diameter; 2 metres
E. infinite number of diameters   **F.** less than the diameter