## Circles

By studying this lesson you will be able to,

- identify that a circle has infinitely many axes of symmetry,
- identify what a chord of a circle is, and
- identify what an arc of a circle, a segment of a circle and a sector of a circle are.


### 23.1 The axes of symmetry of a circle

In Grades 6 and 7 you learnt to draw circles by using either objects with circular shapes or a pair of compasses and a pencil.


## Activity 1

Step 1 - Take a sheet of paper, draw a circle and cut out the circular lamina.


Step 2-Fold the circular lamina such that you get two equal parts which coincide with each other.


Step 3 - Mark the fold line using a pencil and a ruler.
Step 4 - Unfold the circular lamina, and as above, fold the lamina again along a different fold line to get two equal parts. Repeat this a few times and mark all the fold lines.

Step 5- You would have observed that there are many such fold lines and that all of them pass through the same point.


A line which divides a circle into two equal parts is an axis of symmetry of that circle. From the above activity it must be clear to you that a circle has infinitely many axes of symmetry. A straight line segment joining two points which are the points of intersection of an axis of symmetry and the circle, is a diameter of the circle.

The point at which the axes of symmetry of a circle intersect is the centre of the circle.

A straight line segment joining the center of a circle to any point on the circle is called a radius of the circle. The length of this line segment is independent of the point on the circle which is selected. This length is also called the radius of the circle.


In the given circle, the center is $O . A D$ is a diameter of the circle. $O A, O B$, $O C$ and $O D$ are radii of the circle. If $O A=1.3 \mathrm{~cm}$, then the radius of the circle is 1.3 cm .
$O A=O B=O C=O D=1.3 \mathrm{~cm}$

### 23.2 Chord of a circle

## Activity 2

Step 1 - Using a pair of compasses and a pencil, draw a circle of radius 4 cm on a piece of paper.
Step 2 - Mark the centre of the circle and name it $O$.
Step 3 - Mark a point on the circle and name it $X$. Join $X$ and $O$.


Step 4 - Produce $X O$ to meet the circle again and name the point of intersection as $Y$.

Step 5 - Mark a few points on the circle and name them $A, B, C, D, E$ and $F$.


Step 6 - Join the above points to $X$.
Step 7 - Measure and write the lengths of $X A, X B, X C$, $X D, X E, X F$ and $X Y$.

Step 8 - Observe that the longest line among them is $X Y$.

$X A, X B, X C, X D, X E, X F$ and $X Y$ are known as chords of the circle. A straight line segment joining any two points on a circle is called a chord of that circle. The longest chord of a circle is its diameter.


### 23.3 Arc of a circle

## Activity 3

Step 1- Using a pencil and a pair of compasses, draw a circle of radius 4 cm on a piece of paper.

Step 2- Mark four points on the circle and name them $P, Q, R$ and $S$ respectively.


Step 3 - $\quad$ Join $P$ and $R$.
Step 4 - $\quad$ Highlight the section $P Q R$ of the circle in blue and the section $P S R$ in red.


In this figure, the line $P R$ is a chord of the circle. The sections $P Q R$ and $P S R$ of the circle are called arcs of the circle. The section $P Q R$ is called a minor arc and the section $P S R$ is called a major arc.


Exercise 23.1
(1) Draw a circle of radius 3 cm and name its centre $O$. Draw a diameter of this circle and name it $P Q$. Measure the length of the diameter.
(2) Draw a circle of radius 3.5 cm . Mark a point $A$ on the circle. Draw several chords starting from $A$. Find the length of the longest chord you have drawn.
(3) Draw any circle and mark the points $A, B, C$ and $D$ on it.
(i) Draw the chord $A C$.
(ii) Name the two arcs separated by the chord $A C$.
(4) (i) Draw a circle of radius 4 cm .
(ii) Draw a chord such that two equal arcs are obtained. Name it $A B$.
(iii) What is the name suitable for the chord $A B$ ?
(5) (i) Draw a circle of radius 5 cm . Name its center $O$.
(ii) Draw a chord which is 6 cm in length and name it $A B$.
(iii) Name the midpoint of $A B$ as $P$ and join $O P$.
(iv) Measure and write down the magnitudes of $A \widehat{P} O$ and $B \hat{P} O$.

### 23.4 Segments of circles and sectors of circles

## - Segment of a circle

## Activity 4

Step 1 - Draw a circle on a sheet of paper using a pair of compasses and a pencil.

Step 2 - Draw a chord $A B$ of the circle, which is not a diameter.

Step 3 - $\quad$ Mark two points $C$ and $D$ on the circle on either side of the chord $A B$ as shown in the figure.

Step 4 - Color the region bounded by the chord $A B$ and the


#### Abstract

minor arc $A C B$ in blue and the region bounded by the chord $A B$ and the major arc $A D B$ in red.




A region of a circle bounded by a chord and an arc is called a segment of the circle.

The region bounded by the chord $A B$ and the minor arc is called a minor segment of the circle.


The region bounded by the chord $A B$ and the major arc $A D B$ is called a major segment of the circle.

- Sector of a circle


## Activity 5

Step 1- Draw a circle using a pair of compasses and a pencil and name its centre $O$.
Step 2 - Mark two points $A$ and $B$ on the circle and join $A O$ and $B O$.


Step 3 - Color in blue, the region bounded by the radii $A O$ and $B O$ and the arc $A B$ where $A \hat{O} B$ is an acute angle. Color in red, the region bounded by the radii $A O$ and $B O$ and the arc $A B$ where $A \hat{O} B$ is a reflex angle.


In a circle, a region bounded by two radii and an arc is called a sector of the circle. The angle subtended at the centre of the circle by the arc is called the central angle. Two sectors are shown in the above circle.

The sector bounded by the minor arc and two radii
is called a minor sector, and the sector bounded by the major arc and two radii is called a major sector. The acute angle $A \hat{O} B$ is the central angle of the minor sector and the reflex angle $A \hat{O} B$ is the central angle of the major sector.

(1) From the given terms, select and write the most suitable term for each of the regions indicated by an English letter.
(i)

(ii)

(iii)

(iv)

(v)

(vi)

(vii)

(viii)

(ix)

(a radius, a sector, a chord, a minor arc, a minor segment, a major segment, a diameter, a major arc, a central angle)
(2) Fill in the blanks.
(i) A straight line segment which joins the centre of a circle to any point on the circle is called a $\qquad$ of the circle.
(ii) The longest chord of a circle is called a $\qquad$
(iii) If the diameter of a circle is 200 mm , then its radius is cm .
(iv) A region of a circle bounded by a chord and an arc is called a
(v) A region of a circle bounded by two radii and an arc is called a
(3) (i) Name the segments in the figure.
(ii) Shade the minor segment of the circle.
(4) (i) Draw a circle of radius 3.5 cm and name its centre $O$.
(ii) Draw a chord $A B$ through $O$.

(iii) What can you say about the two segments you get?
(iv) What is a suitable name for the above two segments?
(5) (i) What is the name given to the shaded part of the circle?
(ii) Write down its boundaries.
(iii) What is the name given to the angle $X \hat{O} Y$ ?
(6) Draw a circle with centre $O$. Mark two points $M$ and $N$ on the circle such that a minor arc and a major arc are obtained. Shade the sector with central angle equal to the reflex angle $M \hat{O} N$.
(7) Draw a circle with centre $O$. Draw a diameter $A B$. Mark a point $X$ on the circle distinct from $A$ and $B$.
(i) Shade the sector $A X B$.
(ii) Measure and write down the magnitude of the central angle of the sector $A X B$.
(8) (i) Draw a circle of radius 5 cm . Name its centre $O$.
(ii) Mark a point $P$ on the circle and join $O P$.
(iii) Using the protractor, draw the sector $P O Q$ such that $P \hat{O Q}=60^{\circ}$.
(iv) Draw the sector $Q O R$ such that $Q \hat{O} R=150^{\circ}$.
(v) Name the remaining sector and write the magnitude of its central angle.

## Summary

A circle has infinitely many axes of symmetry.
(1) A line segment which joins any two points on a circle is a chord of that circle. The longest chord is a diameter of the circle.
(1) A section of a circle between any two points on the circle is known as an arc of the circle.
[1] A region of a circle, bounded by two radii and an arc is known as a sector of the circle.
A region of a circle bounded by a chord and an arc is called a segment of the circle.

