

## Topic: Circles

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### Lesson Objectives:

At the end of this lesson, students should be able to:

- Identify and define the **parts of a circle**
  - Understand the **types of circles**
  - Learn methods for **dividing circles into equal parts**
  - Recognize **real-life circular objects** and their uses
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### 1. What is a Circle?

A **circle** is a **2-dimensional closed figure** where **every point on the circumference is exactly the same distance from a fixed point called the center**.

#### Mathematical Definition:

**Circle:** The set of all points in a plane that are at a **fixed distance (radius)** from a **fixed point (center)**.

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### 2. Parts of a Circle (With Definitions)

Part	Meaning	Illustration/Example
<b>Center (O)</b>	The <b>fixed point</b> in the middle of the circle	The small dot in the middle
<b>Radius (r)</b>	The <b>distance from the center to the circumference</b>	From O to point A
<b>Diameter (d)</b>	A <b>straight line passing through the center</b> , connecting two points on the circumference. It is <b>twice the radius (<math>d = 2r</math>)</b>	From point B to point C through O
<b>Circumference</b>	The <b>boundary or perimeter</b> of the circle	The circular outer edge
<b>Chord</b>	A <b>straight line connecting any two points on the circumference</b> , but <b>not necessarily passing through the center</b>	Line CD

Part	Meaning	Illustration/Example
Arc	A <b>portion of the circumference</b> , a curved line between two points	Curve between points C and D
Sector	A <b>slice of the circle</b> , formed by <b>two radii and the arc between them</b>	Like a piece of pizza
Segment	The <b>part of the circle cut off by a chord</b> , smaller than a sector	The area between chord CD and arc CD
Tangent	A straight line that <b>touches the circle at exactly one point</b>	Touches at point E
Annulus	The <b>region between two concentric circles</b>	Like a ring or washer

### 3. Types of Circles

Type of Circle	Explanation	Example
Concentric Circles	Two or more circles with <b>the same center</b> but <b>different radii</b>	Tree rings, ripples in water
Eccentric Circles	Two circles that have <b>different centers</b>	Gears with holes off-center
Inscribed Circle	A circle <b>inside a polygon</b> , touching all sides	Circle inside a triangle
Circumscribed Circle	A circle <b>outside a polygon</b> , passing through all the vertices	Circle around a square
Semi-circle	<b>Half of a circle</b> , formed by cutting along the diameter	Semi-circular protractor

### 4. Methods of Dividing a Circle

Dividing a circle is necessary for:

- Clock faces
- Gear teeth

- **Design of circular windows, grills, or fans**
  - **Engineering and machine parts**
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#### **a) Dividing a Circle into 4 Equal Parts (Quadrants)**

##### **Steps:**

1. **Draw the circle** using a compass.
  2. Draw a **vertical diameter** (center to top and bottom).
  3. Draw a **horizontal diameter** (center to left and right).
  4. The circle is now divided into **four equal parts (90° each)**.
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#### **b) Dividing a Circle into 6 Equal Parts (Hexagon Method)**

##### **Steps:**

1. Draw a **circle with center O**.
  2. Place the **compass point on the circumference** (point A).
  3. Without changing the compass width (keep the radius), **step around the circle**, marking 6 points.
  4. Connect each point to the **center O** to create **6 equal sectors (60° each)**.
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#### **c) Dividing a Circle into 8 or 12 Equal Parts**

##### **Using a Protractor:**

- For **8 parts**: Measure and mark **45° intervals**.
- For **12 parts**: Measure and mark **30° intervals**.

##### **Steps:**

1. Draw the **circle**.
2. Mark the **center**.
3. Use a **protractor** to measure the angles from the center.

4. Draw lines from the **center to the circumference** through the points.

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#### d) General Method (Compass and Set Square Method)

This method is used when you don't have a protractor:

1. Draw the circle and the **diameter**.
2. Use a **set square** to draw perpendicular and diagonal lines.
3. Continue bisecting angles to get **finer divisions** (e.g., 8, 16 parts).

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### 5. Real-Life Circular Objects

Object	Use/Application
Clock face	Time display
Coins	Money
Car wheels	Movement
Plates and bowls	Eating utensils
Fans and propellers	Air circulation
CDs/DVDs	Data storage
Gears	Machine parts
Pipes (cross-section)	Construction
Circular tables	Furniture
Manholes	Access covers

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### 6. Importance of Circles in Technical Drawing

Field	Why Important
Engineering	For drawing gears, wheels, pulleys

Field	Why Important
Architecture	For designing arches, domes, circular windows
Manufacturing	For parts like disks, gaskets, washers
Design	For layouts, furniture, patterns
Mathematics	For calculations of area, perimeter (circumference), sectors

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## 7. Tools Needed for Drawing and Dividing Circles

Tool	Purpose
Compass	Drawing circles and arcs
Ruler	Drawing diameters and chords
Protractor	Measuring angles
Set Square	Drawing perpendicular or diagonal lines
Divider (optional)	Stepping off equal spaces
Pencil (2H or HB)	For neat, light drawing

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## 8. Summary of Key Points

Concept	Details
Circle	Closed 2D figure with equal distance from center
Parts	Center, radius, diameter, chord, arc, sector, segment
Division	Use compass and protractor to divide into equal parts
Types	Concentric, Eccentric, Inscribed, Circumscribed
Real-life Uses	Wheels, gears, clocks, coins