

REGINA PACIS COLLEGE GARKI II ABUJA
SS1 TECHNICAL DRAWING LESSON NOTES

Week 1-Topic: Definition of Technical Drawing, Importance of Technical Drawing, Identification and Uses of Technical Drawing Instruments, Materials, and Branches of Technical Drawing

Learning Objectives

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

1. Define technical drawing.
2. Explain the importance of technical drawing.
3. Identify common technical drawing instruments and state their uses.
4. Identify materials used in technical drawing.
5. Explain the branches of technical drawing.

1. Definition of Technical Drawing

Technical drawing is the art and science of representing objects accurately using lines, symbols, dimensions, and standard conventions. It is a universal language used by engineers, architects, builders, technicians, and designers to communicate ideas and manufacturing or construction details.

Technical drawing is also known as **engineering drawing** or **drafting**.

Characteristics of Technical Drawing

- It is accurate and precise.
- It follows international standards.
- It uses symbols and conventions.
- It is drawn to scale.
- It communicates technical information clearly.

2. Importance of Technical Drawing

Technical drawing is important because it:

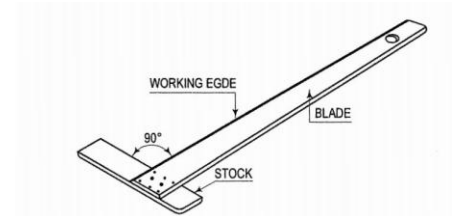
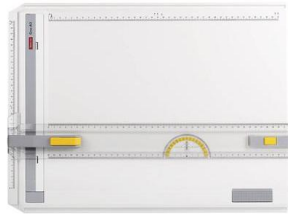
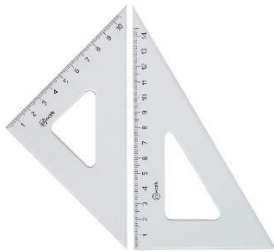
1. Communicates ideas clearly between designers and builders.
2. Serves as the universal language of engineering and technology.
3. Guides the manufacture of machines and products.
4. Helps in the construction of buildings, roads, and bridges.
5. Ensures accuracy in production and construction.
6. Saves time and reduces errors.
7. Helps in estimating materials and costs.
8. Improves creativity and problem-solving skills.
9. Provides permanent records of designs.
10. Develops precision, neatness, and patience in students.

Technical drawing is a core subject in the engineering and / or Technology courses. Some of the branches include:

Technical drawing is sub-divided into three main branches: These are:

1. Geometrical Constructions: These are made up of plane geometry and solid geometry
2. Building Drawing: This involves all design and drawing of building plans, roads, bridges, structure and installations.
People who draw or prepare the drawings as designed by the architects are called draughtsman or draftsmen
3. Engineering drawing / Mechanical Drawing: deals with the drawing of engines, machines and machine parts.

3. Identification and Uses of Technical Drawing Instruments



Instrument	Identification	Uses
Drawing Board	Flat wooden or plastic board	Supports drawing paper while drawing.
T-Square	T-shaped instrument	Draws horizontal lines and guides set squares.
Set Squares	Triangular plastic rulers	Draw vertical, inclined, 30°, 45°, 60°, and 90° lines.
Protractor	Semi-circular or circular instrument	Measures and constructs angles.
Compass	Instrument with two legs	Draws circles and arcs.
Divider	Similar to a compass with pointed legs	Transfers measurements and divides lines.
Scale Rule	Special ruler with different scales	Draws objects to scale and measures distances.
French Curve	Curved plastic template	Draws irregular curves smoothly.
Flexible Curve	Bendable ruler	Draws complex curved lines.
Pencils (2H, H, HB, B)	Graphite pencils	Produce different line thicknesses and darkness.
Eraser	Rubber material	Removes unwanted pencil marks.
Erasing Shield	Thin metal sheet with holes	Erases specific areas without affecting nearby lines.
Sharpener	Small cutting device	Sharpens pencils.

Instrument	Identification	Uses
Masking Tape/Drawing Pins	Adhesive tape or pins	Holds drawing paper firmly on the board.
Dusting Brush	Soft brush	Removes eraser dust without damaging the drawing.

4. Materials Used in Technical Drawing

The common materials include:

- Drawing paper
- Tracing paper
- Tracing cloth
- Cartridge paper
- Graph paper
- Pencils
- Erasers
- Ink (for permanent drawings)
- Drawing board
- Masking tape

Uses of Drawing Materials

- **Drawing paper:** Used for preparing drawings.
- **Tracing paper:** Used for copying drawings.
- **Tracing cloth:** Produces durable copies.
- **Graph paper:** Used for plotting graphs and layouts.
- **Drafting film:** Used for high-quality professional drawings.
- **Masking tape:** Holds paper in place.

5. Branches of Technical Drawing

a. Engineering Drawing: Deals with the drawing of machines, machine parts, tools, and engineering components.

b. Building Drawing: Deals with drawings used in building construction. Floor plans, Elevations **and** Sections etc.

c. Architectural Drawing: Focuses on the appearance, design, and planning of buildings. Residential houses etc.

d. Mechanical Drawing: Deals with machine parts and mechanical assemblies. Engine components, Machine assemblies, Automobile parts etc.

e. Electrical Drawing: Represents electrical installations using symbols. House wiring, Power distribution **and** Lighting circuits

f. Civil Engineering Drawing: Deals with infrastructure projects. Roads, Bridges **and** Drainage systems

g. Structural Drawing: Shows the structural members of buildings. Columns, Beams, Foundations **and** Reinforcements

h. Survey Drawing: Represents land features and boundaries. Site plans, Topographic maps **and** Boundary plans

Assignment

1. Draw and label **eight technical drawing instruments** in your drawing notebook.
2. State **one use** of each instrument.
3. List **six branches of technical drawing** and give **one example** of each.

Week 2-Topic: Board Practice Techniques, Fixing Drawing Paper on Drawing Board, Drawing Border Lines and Title Block, and Freehand Lettering (Upper Case)

Learning Objectives

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

1. Explain board practice techniques in technical drawing.
2. Demonstrate how to fix drawing paper correctly on a drawing board.
3. Draw standard border lines and a title block.
4. Practice neat freehand uppercase lettering.
5. Appreciate the importance of neatness and accuracy in technical drawing.

1. Board Practice Techniques

Definition: **Board practice** refers to the correct methods of preparing and using the drawing board and drawing instruments before and during technical drawing to produce accurate and neat drawings.

Board Practice Procedures

1. Clean the drawing board before use.
2. Ensure all drawing instruments are clean and in good condition.
3. Select the appropriate drawing paper size.
4. Fix the drawing paper firmly to the drawing board.
5. Place the T-square correctly against the working edge of the board.
6. Use set squares together with the T-square to draw vertical and inclined lines.
7. Sit comfortably with proper posture.
8. Keep the drawing surface free from dust and eraser particles.
9. Avoid pressing the pencil too hard.
10. Handle all instruments carefully to prevent damage.

Importance of Good Board Practice

- Produces neat drawings.
- Improves drawing accuracy.
- Prevents wrinkles and movement of the drawing paper.
- Reduces drawing errors.
- Increases the lifespan of drawing instruments.
- Encourages safe working habits.

2. Fixing Drawing Paper on the Drawing Board

Definition

Fixing drawing paper is the process of attaching the drawing sheet securely to the drawing board so that it does not move during drawing.

Materials Required

- Drawing board
- Drawing paper
- Masking tape or drawing pins
- T-square

Steps for Fixing Drawing Paper

1. Place the drawing board on a flat table.
2. Position the drawing paper correctly on the board.
3. Align the top edge of the paper with the top edge of the drawing board using the T-square.
4. Fix the upper corners using masking tape or drawing pins.
5. Stretch the paper gently to remove wrinkles.
6. Secure the lower corners.
7. Ensure the paper is flat and firmly attached.

Precautions

- Do not fold the drawing paper.
- Avoid excessive use of tape.
- Ensure the paper is properly aligned.
- Keep the paper clean.
- Avoid tearing the paper while removing tape.

3. Drawing Border Lines

Definition: Border lines are lines drawn around the edges of a drawing sheet to provide a neat working area and protect the drawing from damage.

Importance of Border Lines

- Gives the drawing a neat appearance.
- Protects the drawing.
- Defines the drawing space.
- Provides room for filing and handling.
- Follows standard drawing practice.

Procedure

1. Measure the required margin from each edge of the paper.
2. Use the T-square and set squares.
3. Draw thin construction lines first.
4. Darken the border lines using the correct line thickness.

Standard Margins (Typical)

- Left side: **20 mm**
- Top: **10 mm**
- Right side: **10 mm**
- Bottom: **10 mm**

4. Title Block

Definition: A **title block** is a rectangular space usually located at the bottom right-hand corner of a drawing sheet that contains important information about the drawing.

Importance of a Title Block

- Identifies the drawing.
- Shows ownership of the drawing.
- Makes filing easier.
- Provides reference information.
- Helps in record keeping.

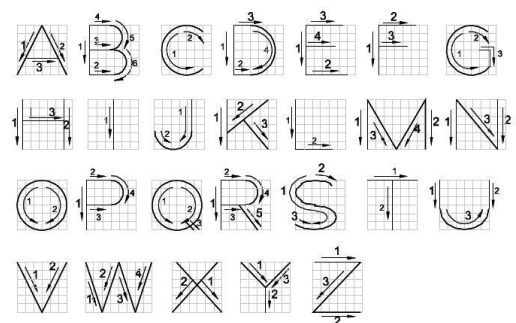
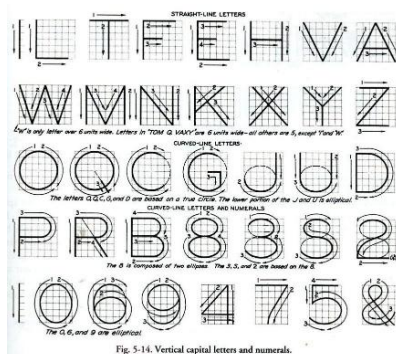
Information Found in a Title Block

- Title of drawing
- Student's name
- Class
- Admission number
- School name
- Date
- Scale
- Sheet number
- Drawing number
- Teacher's name (if required)

Example of a Simple Title Block

Item	Information
School	ABC Secondary School
Subject	Technical Drawing
Title	Hexagonal Prism
Name	Student's Name
Class	JSS/SSS
Date	_____
Scale	1:1
Sheet No.	1

5. Freehand Lettering (Upper Case)



Definition

Freehand lettering is the art of writing letters neatly without the use of lettering guides or stencils.

In technical drawing, uppercase block letters are commonly used because they are clear, simple, and easy to read.

Characteristics of Good Lettering

- Uniform height.
- Uniform width.
- Correct spacing between letters.
- Vertical or slightly inclined letters.
- Simple block style.
- Clear and legible.
- Neat appearance.

Guidelines for Uppercase Lettering

- Draw light guide lines before lettering.
- Maintain equal letter height.
- Leave equal spacing between letters and words.
- Keep letters upright.
- Use a sharp HB or H pencil.
- Write slowly and neatly.
- Erase guide lines after completing the lettering.

Advantages of Good Lettering

- Makes drawings easy to read.
- Improves communication.
- Gives drawings a professional appearance.
- Reduces misunderstanding.
- Enhances presentation.

Assignment

1. Fix an **A3 drawing sheet** correctly on a drawing board using masking tape.
2. Draw standard **border lines** and a **title block** on the sheet.
3. Practice writing the uppercase alphabet (A–Z) in freehand block letters, ensuring uniform size and spacing.

Week 3 - Topic: Safe Working Habits in the Drawing Studio

Learning Objectives

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

1. Define safe working habits.
2. Explain the concept of safe working habits in the drawing studio.
3. Identify safe practices when using drawing tools and equipment.
4. Explain the proper care and maintenance of drawing instruments.
5. Describe the importance of cleanliness, proper ventilation, and adequate lighting in the drawing studio.

1. Definition of Safe Working Habits

Safe working habits are the rules, practices, and attitudes that help prevent accidents, injuries, and damage to equipment while working in the drawing studio.

Safe working habits ensure that students work in a healthy, organized, and accident-free environment.

2. Concept of Safe Working Habits in the Drawing Studio

The drawing studio is a place where students prepare technical drawings using different instruments and equipment. Although it is generally safer than workshops with heavy machinery, accidents can still occur due to carelessness, poor housekeeping, or improper use of drawing tools.

Safe working habits involve:

- Following studio rules and instructions.
- Using drawing tools correctly.
- Keeping the work area clean and organized.
- Maintaining good posture while drawing.
- Handling instruments carefully.
- Reporting damaged tools or unsafe conditions immediately.

3. Importance of Safe Working Habits

Safe working habits:

1. Prevent accidents and injuries.
2. Protect drawing instruments from damage.
3. Promote a clean and healthy learning environment.
4. Improve concentration and productivity.
5. Increase the lifespan of drawing equipment.
6. Encourage discipline and responsibility.
7. Reduce wastage of materials.
8. Produce neat and accurate drawings.

4. Safe Use and Care of Drawing Tools and Equipment

Safe Use of Drawing Tools

Drawing Board: Place the board on a stable table. Keep the board clean and dry. Do not sit or lean heavily on it.

T-Square: Use only on the working edge of the drawing board. Do not use it as a cutting tool or ruler for rough work. Store it flat to prevent warping.

Set Squares: Handle carefully to avoid cracks. Do not bend or drop them. Keep edges clean for accurate drawing.

Compass and Divider: Handle the sharp points with care. Cover the points when not in use. Never point them toward yourself or others.

Pencils: Sharpen pencils carefully. Avoid dropping pencils. Use the correct pencil grade for each type of line.

Eraser: Use a clean eraser. Erase gently to avoid tearing the paper.

Scale Rule: Keep the scale clean. Avoid using it for cutting or striking objects.

5. Care and Maintenance of Drawing Instruments

To keep drawing instruments in good condition:

- Clean instruments after use.
- Store instruments in a drawing case or toolbox.
- Protect instruments from moisture and rust.
- Replace damaged or worn-out tools.
- Avoid dropping instruments.
- Keep pencils properly sharpened.
- Do not expose plastic instruments to excessive heat.
- Return tools to their proper storage after use.

6. Clean Habits in the Drawing Studio: A clean drawing studio promotes health, safety, and good-quality work.

Good Clean Habits

- Sweep or clean the studio regularly.
- Remove eraser dust with a soft brush.
- Dispose of waste paper properly.
- Keep desks and drawing boards clean.
- Arrange tools neatly after use.
- Clean spills immediately.
- Avoid eating or drinking in the drawing studio.
- Wash hands before handling drawing paper.
- Keep bags and personal items away from walkways.

7. Proper Ventilation

Definition: Ventilation is the circulation and replacement of fresh air within a room.

Importance of Proper Ventilation

- Provides fresh air.
- Removes heat and unpleasant odors.
- Reduces dust accumulation.
- Prevents fatigue and discomfort.
- Improves concentration.
- Creates a healthy learning environment.

Ways to Ensure Good Ventilation

- Open windows and doors.
- Use ceiling or standing fans.
- Install ventilation systems where necessary.
- Avoid overcrowding the studio.

8. Proper Lighting

Definition: Lighting is the provision of enough natural or artificial light to enable clear vision while working.

Importance of Proper Lighting

- Makes drawings clear and accurate.
- Reduces eye strain.
- Prevents mistakes caused by poor visibility.
- Improves concentration.
- Increases productivity.

Sources of Lighting

- Natural light (sunlight)
- Electric bulbs
- Fluorescent lamps

Good Lighting Practices

- Ensure sufficient light reaches the drawing surface.
- Avoid shadows falling on the drawing.
- Keep light fixtures clean.
- Replace faulty bulbs promptly.
- Position lights to minimize glare.

9. General Safety Rules in the Drawing Studio

- Follow the teacher's instructions at all times.
- Walk; do not run in the studio.

- Keep aisles exits clear.
- Report broken tools or damaged furniture immediately.
- Do not play with drawing instruments.
- Handle sharp tools carefully.
- Sit with good posture while drawing.
- Keep electrical equipment away from water.
- Switch off lights and fans after use.
- Wash hands after practical work.

Assignment

1. List **ten** safe working habits that should be observed in a technical drawing studio.
2. Explain **five** ways of caring for technical drawing instruments.
3. Write short notes on:
 - Proper ventilation
 - Proper lighting
 - Clean habits in the drawing studio.

WEEK 4 - Topic: Lines and Line Work

Learning Objectives

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

1. Define a line and line work.
2. Explain the concept of lines in technical drawing.
3. Identify the different types of lines and their uses.
4. Distinguish between various line styles.
5. Draw parallel lines correctly.
6. Draw inclined lines accurately using drawing instruments.

1. Definition of a Line

A **line** is a continuous mark made by a pencil or pen joining two points. In technical drawing, lines are used to represent the shape, size, edges, boundaries, and details of an object.

2. Concept of Line Work

Line work refers to the proper use of different types of lines in technical drawing according to internationally accepted drawing standards. Each type of line has a specific thickness, style, and purpose.

Good line work ensures that drawings are:

- Clear and easy to read.
- Accurate and neat.
- Professionally presented.
- Easy to interpret.

3. Importance of Lines in Technical Drawing

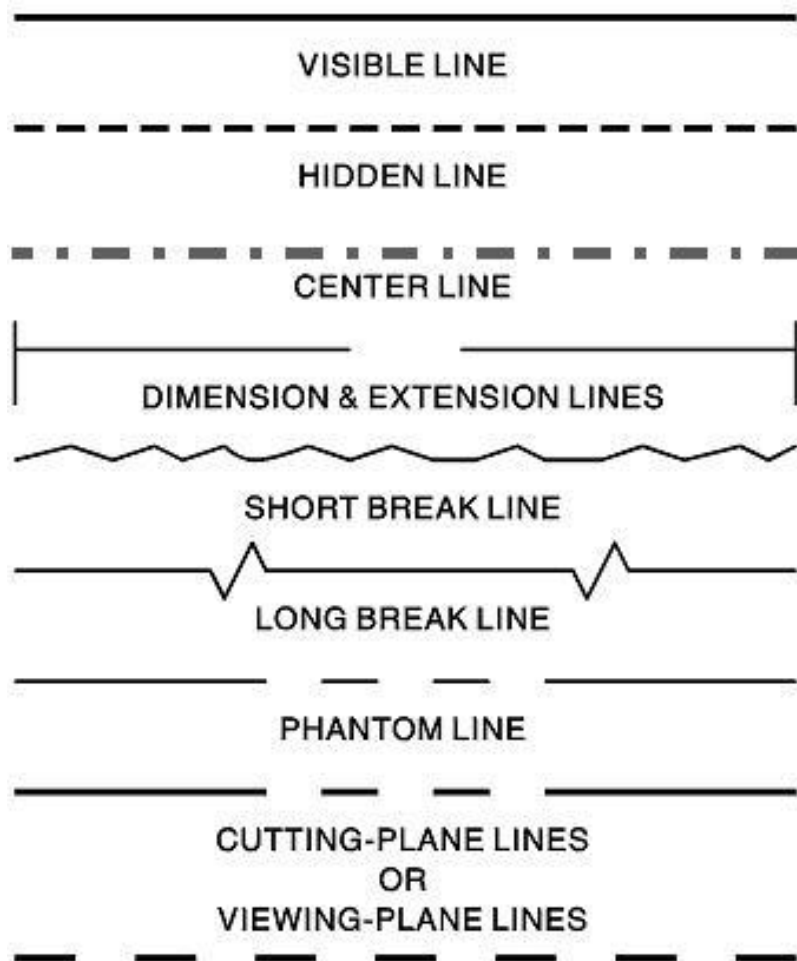
Lines are used to:

1. Represent the outline of objects.
2. Show hidden details.
3. Indicate dimensions.
4. Show centre positions.
5. Indicate cutting planes.
6. Show construction details.
7. Represent symmetry.
8. Improve communication between designers and manufacturers.

4. Types of Lines and Their Uses

Line Types

- Object Lines  thick
- Hidden Lines  thin
- Center Lines  thin
- Phantom Lines  thin
- Dimension Lines
Extension Lines
Leader Lines  thin
- Cutting Plane Line  thick
- Sections - Hatching 
- Break Lines  thin thick



Type of Line	Appearance	Uses
Visible (Object) Line	Thick continuous line	Shows visible edges and outlines of objects.
Hidden Line	Thin broken (dashed) line	Represents edges that cannot be seen from the viewing position.
Centre Line	Thin chain line (long dash–short dash)	Indicates the centre of circles, arcs, and symmetrical objects.
Dimension Line	Thin continuous line with arrowheads	Shows the size or dimensions of an object.
Extension Line	Thin continuous line	Extends from the object to indicate where dimensions begin and end.
Construction Line	Very thin continuous line	Used as guide lines during drawing and usually erased afterward.
Leader Line	Thin line ending with an arrowhead	Connects notes or labels to parts of a drawing.

Type of Line	Appearance	Uses
Cutting Plane Line	Thick chain line with arrows	Indicates where an object is imagined to be cut for sectional views.
Section (Hatching) Lines	Thin, equally spaced inclined lines	Show surfaces exposed after cutting an object.
Phantom Line	Long dash followed by two short dashes	Indicates alternate positions or repeated movement of parts.
Border Line	Thick continuous line	Forms the boundary around the drawing sheet.

5. Line Styles: **Line style** refers to the pattern and thickness of a line used for a particular purpose.

Common Line Styles

- Thick continuous line
- Thin continuous line
- Dashed line
- Chain line (long dash–short dash)
- Chain double-dashed line
- Zigzag line (used as a break line)
- Freehand break line

Importance of Correct Line Styles

- Improves clarity.
- Prevents misunderstanding.
- Makes drawings conform to international standards.
- Produces professional-looking drawings.

6. Methods of Drawing Parallel Lines

Definition: Parallel lines are two or more lines that are always the same distance apart and never meet, even if extended.

Method 1: Using a T-Square

1. Place the T-square firmly against the working edge of the drawing board.
2. Draw the first horizontal line.
3. Slide the T-square upward or downward without changing its position.
4. Draw another horizontal line.
5. Repeat until the required number of parallel lines is obtained.

Method 2: Using T-Square and Set Square

1. Place the T-square on the drawing board.
2. Rest the set square on the T-square.

3. Draw the first line.
4. Slide the set square while keeping it against the T-square.
5. Draw additional parallel lines.

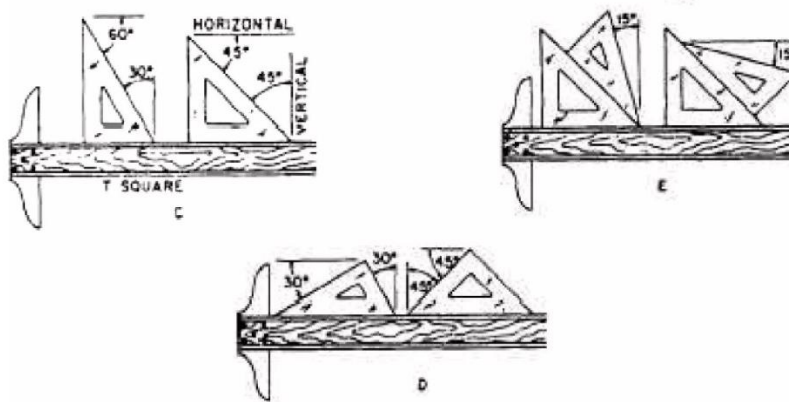
Method 3: Using a Ruler

1. Draw the first line.
2. Measure equal distances from the first line.
3. Mark the points.
4. Join the points with the ruler.

7. Methods of Drawing Inclined Lines

Definition: An **inclined line** is a line that slopes at an angle. It is neither horizontal nor vertical.

Inclined Lines



Method 1: Using Set Squares

1. Place the T-square horizontally.
2. Position the 45° or 30°–60° set square against the T-square.
3. Hold both instruments firmly.
4. Draw the inclined line at the required angle (30°, 45°, 60°, or 90°).

Method 2: Using a Protractor

1. Draw a horizontal base line.
2. Mark the required angle using the protractor.
3. Place a ruler through the marked point.
4. Draw the inclined line.

8. Precautions When Drawing Lines

- Use a sharp pencil (2H or H for construction work).
- Draw lines lightly first before darkening.
- Keep the T-square firmly against the edge of the drawing board.

- Hold set squares securely to prevent slipping.
- Avoid excessive pressure on the pencil.
- Keep drawing instruments clean.
- Check measurements before drawing permanent lines.

Assignment

1. Draw and label the following line types:
 - Visible line
 - Hidden line
 - Centre line
 - Dimension line
 - Extension line
 - Construction line
 - Cutting plane line
 - Section (hatching) line
2. Using a T-square and set squares:
 - Draw **10 horizontal parallel lines** spaced **10 mm** apart.
 - Draw **5 inclined lines** at **30°, 45°, and 60°**.

WEEK 5 -Topic: Angles – Concept of Angles, Types and Identification of Angles, and Construction of Angles

Learning Objectives

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

1. Define an angle.
2. Explain the concept of angles.
3. Identify the different types of angles.
4. Measure and classify angles correctly.
5. Construct common angles using drawing instruments.
6. Apply angle construction in technical drawing.

1. Concept of Angles

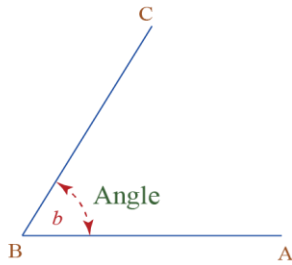
Definition of an Angle: An **angle** is the figure formed when two lines or rays meet at a common point called the **vertex**.

An angle measures the amount of turning between the two lines and is measured in **degrees (°)**.

Parts of an Angle

- **Vertex:** The point where the two lines meet.
- **Arms (Sides):** The two rays or lines forming the angle.
- **Interior:** The space between the two arms.

Example:



$\angle CBA$

Where:

- B = Vertex
- CB and BA = Arms

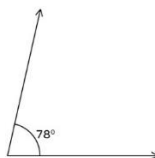
2. Importance of Angles in Technical Drawing

Angles are used for:

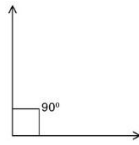
- Construction of geometrical figures.
- Engineering drawings.
- Building construction.
- Machine design.
- Road and bridge design.
- Surveying.
- Architectural drawings.

3. Types and Identification of Angles

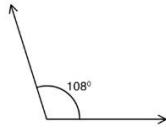
(a) Acute Angle: An acute angle is **less than 90°**.



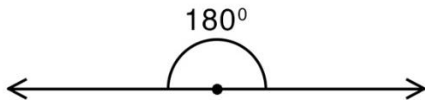
(b) Right Angle: A right angle measures **exactly 90°**.



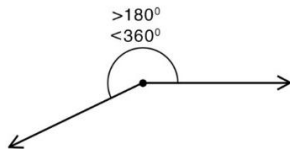
(c) Obtuse Angle: An obtuse angle is **greater than 90° but less than 180°** .



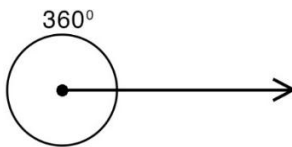
(d) Straight Angle: A straight angle measures **exactly 180°** .



(e) Reflex Angle: A reflex angle measures **more than 180° but less than 360°** .



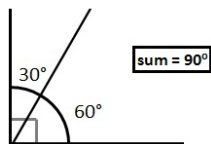
(f) Complete Angle (Full Angle): A complete angle measures **360°** .



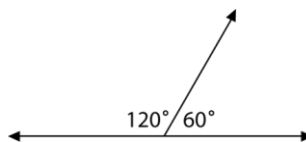
Summary Table of Angles

Type of Angle	Measurement
Acute	Less than 90°
Right	Exactly 90°
Obtuse	More than 90° but less than 180°
Straight	180°
Reflex	More than 180° but less than 360°
Complete	360°

Angles could also be complementary or supplementary. Where two angles located side by side share a common arm and a common vertex, such angles can either be called complementary or supplementary angle



Angles are complementary when they add up to 90°



Angles are supplementary when they add up to 180°

Supplementary Angle

The following are various methods of constructing or drawing angles

- Using setsquares
- Using combination of setsquares
- Using a protractor
- Using a pair of compasses

STANDARD ANGLES

Standard angles are angles 30° , 45° , 60° and 90° . These angles can be simply drawn using a setsquare.

Key Terms

- **Angle:** The space between two intersecting lines or rays.
- **Vertex:** The common meeting point of two rays.
- **Ray:** A line with one endpoint extending infinitely in one direction.
- **Degree ($^\circ$):** The unit used to measure angles.
- **Bisector:** A line that divides an angle into two equal angles.

Assignment

- Construct the following angles neatly using drawing instruments:
 - 45°
 - 60°
 - 90°
 - 120°
 - 135°
 - 150°
- Label each angle and state whether it is **acute**, **right**, **obtuse**, **straight**, **reflex**, or **complete**.

WEEK 6 -TOPIC: Triangles

Lesson Objectives

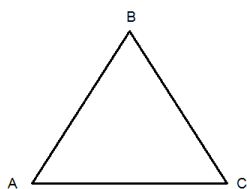
At the end of this lesson, students should be able to:

1. Define a triangle.
2. Identify the types of triangles.
3. Name the parts of a triangle.
4. State the properties of triangles.
5. Construct different types of triangles using drawing instruments.

1. Definition of a Triangle

A **triangle** is a closed plane figure (polygon) formed by **three straight sides** joined end-to-end. It has **three sides, three angles, and three vertices (corners)**.

A triangle is the simplest polygon because it has only three sides.



- Vertices: A, B, C
- Sides: AB, BC, AC
- Angles: $\angle A$, $\angle B$, $\angle C$

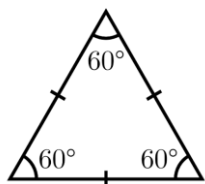
2. Types of Triangles

Triangles are classified according to **their sides** and **their angles**.

A. Classification According to Sides

(i) Equilateral Triangle

- Has **three equal sides**.
- Has **three equal angles of 60° each**

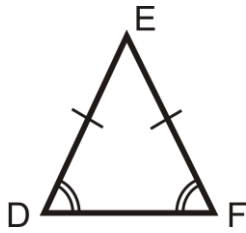


Properties

- Three equal sides
- Three equal angles (60°)

(ii) Isosceles Triangle

- Has **two equal sides**.
- Two angles are equal.

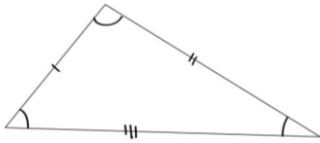


Properties

- Two equal sides
- Two equal angles

(iii) Scalene Triangle

- Has **three unequal sides**.
- All angles are different.

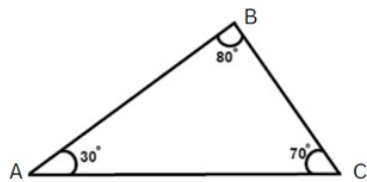


Properties

- No equal sides
- No equal angles

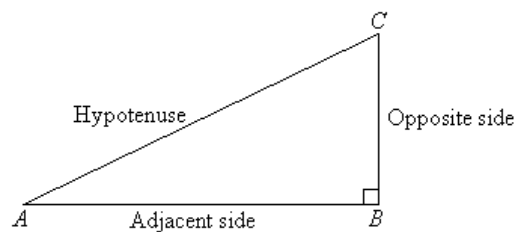
B. Classification According to Angles

(i) Acute Triangle



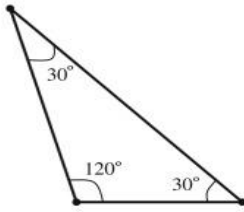
- All three angles are **less than 90°**.

(ii) Right-Angled Triangle



- Has **one angle equal to 90°**.

(iii) Obtuse Triangle

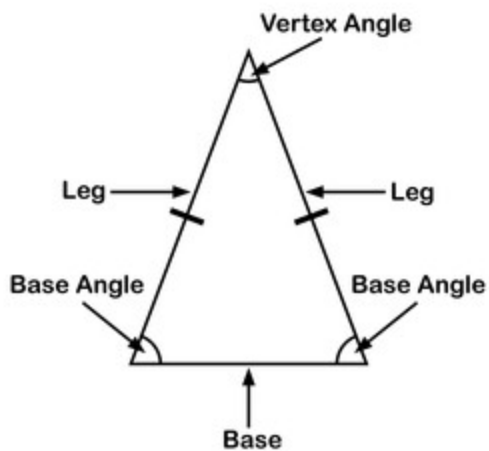


- Has **one angle greater than 90°**.

3. Parts of a Triangle

The main parts of a triangle are:

1. **Sides** – Three-line segments forming the triangle.
2. **Vertices** – Three corner points.
3. **Angles** – Three interior angles.
4. **Base** – Any side chosen as the bottom side.
5. **Height (Altitude)** – A perpendicular line drawn from a vertex to the opposite side.



- Base = BC
- Height = AD
- Vertices = A, B, C
- Sides = AB, BC, AC

4. Properties of Triangles

1. **Sum of Interior Angles:** The sum of the three interior angles of a triangle is always **180°**
2. **Number of Sides:** A triangle always has **three sides**.
3. **Number of Angles:** A triangle has **three angles**.
4. **Number of Vertices:** A triangle has **three vertices**.
5. **Exterior Angle Property:** An exterior angle of a triangle equals the sum of the two opposite interior angles.
6. **Longest Side Rule:** The longest side is opposite the largest angle.

7. Triangle Inequality Property: The sum of any two sides of a triangle must always be greater than the third side.

5. Construction of Triangles: Construction of triangles is done using **a ruler, compass, protractor, set squares, and pencil.**

A. Construction of an Equilateral Triangle

Given: Side = 60 mm

Steps

1. Draw a line $AB = 60$ mm.
2. With A as centre and radius 60 mm, draw an arc.
3. With B as centre and the same radius, draw another arc intersecting the first at C.
4. Join AC and BC.

Result: Triangle ABC is an equilateral triangle.

B. Construction of an Isosceles Triangle

Given: Base = 70 mm; Equal sides = 50 mm

Steps

1. Draw base $AB = 70$ mm.
2. With A as centre and radius 50 mm, draw an arc.
3. With B as centre and radius 50 mm, draw another arc intersecting at C.
4. Join AC and BC.

C. Construction of a Scalene Triangle

Given: $AB = 70$ mm, $AC = 60$ mm, $BC = 50$ mm

Steps

1. Draw $AB = 70$ mm.
2. With A as centre and radius 60 mm, draw an arc.
3. With B as centre and radius 50 mm, draw another arc cutting the first at C.
4. Join AC and BC.

D. Construction of a Right-Angled Triangle

Given: Base = 80 mm, Height = 60 mm

Steps

1. Draw $AB = 80$ mm.
2. At point A, construct a 90° angle.
3. Measure $AC = 60$ mm on the perpendicular line.
4. Join BC.

Drawing Instruments Required

- | | | |
|---|--------------|----------|
| • Drawing board | • Compass | • Eraser |
| • T-square | • Protractor | |
| • Set squares (45° and 60°) | • Ruler | |
| | • HB pencil | |

Assignment

1. List the three types of triangles according to their sides.
2. List the three types of triangles according to their angles.
3. Construct an equilateral triangle of side **60 mm**.
4. Construct an isosceles triangle with a base of **70 mm** and equal sides of **50 mm**.

WEEK 7 - TOPIC: Circles

Lesson Objectives

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

1. Define a circle.
2. Identify the types of circles.
3. Name the parts of a circle.
4. Construct concentric and eccentric circles.
5. Construct inscribed, escribed, and circumscribed triangles.

1. Definition of a Circle: A circle is a plane figure bounded by a curved line in which **every point on the boundary is at the same distance from a fixed point called the centre.**

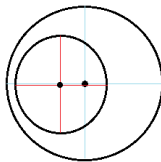
The fixed distance from the centre to the circumference is called the **radius**.

2. Types of Circles

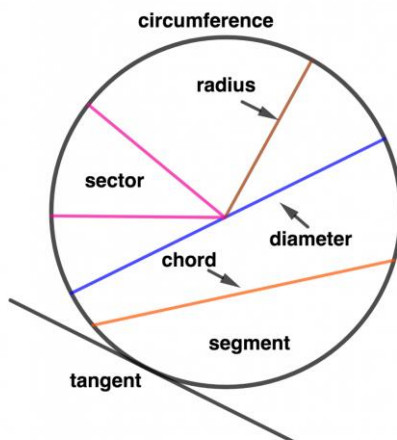
(i) Concentric Circles: Concentric circles are **two or more circles that have the same centre but different radii.**



(ii) Eccentric Circles: Eccentric circles are **two or more circles with different centres and different radii.**



3. **Parts of a Circle:** The important parts of a circle include:



1. **Centre (O):** The fixed point from which all points on the circle are equally distant.
2. **Radius (r):** A straight line from the centre to the circumference.
3. **Diameter (d):** A straight line passing through the centre and joining two points on the circumference.
4. **Circumference:** The boundary or outer curved line of the circle.
5. **Chord:** A straight line joining any two points on the circumference.
6. **Arc:** A portion of the circumference.
7. **Sector:** The region enclosed by two radii and an arc.
8. **Segment:** The region enclosed by a chord and an arc.
9. **Tangent:** A straight line touching the circle at only one point.
10. **Secant:** A straight line cutting the circle at two points.

4. Construction of Concentric Circles

Steps

1. Mark a centre point **O**.
2. Set the compass to the first radius (e.g., 20 mm) and draw a circle.
3. Without changing the centre, increase the compass to another radius (e.g., 35 mm) and draw a second circle.
4. Repeat for any additional circles.

Result: All circles have the same centre but different sizes.

5. Construction of Eccentric Circles

Steps

1. Mark centre **O₁** and draw the first circle.
2. Mark another centre **O₂** at a different position.
3. Draw the second circle with the desired radius.
4. The circles may overlap or remain separate depending on the chosen centres.

6. Construction of an Inscribed Triangle

Definition: An **inscribed triangle** is a triangle drawn **inside a circle**, with all three vertices lying on the circumference.

Steps

1. Draw a circle.
2. Draw any diameter or locate three suitable points on the circumference.
3. Label the points A, B, and C.
4. Join A to B, B to C, and C to A using a ruler.

Result: Triangle ABC is inscribed in the circle.

7. Construction of a Circumscribed Triangle

Definition: A **circumscribed triangle** is a triangle drawn **around a circle**, such that each side of the triangle touches the circle at exactly one point.

Steps

1. Draw a circle.
2. Select three points on the circumference.
3. Draw tangents at the three selected points.
4. Extend the tangents until they intersect.
5. The intersections form the vertices of the triangle.

Result: The circle is inside the triangle and touches all three sides.

8. Construction of an Escribed Triangle

Definition: An **escribed triangle** is associated with an **excircle**, which is a circle outside the triangle that touches one side and the extensions of the other two sides.

Steps

1. Draw triangle ABC.
2. Extend two sides of the triangle.
3. Construct the external angle bisectors and one internal angle bisector to locate the excentre.
4. With the excentre as the centre, draw the excircle so that it touches one side of the triangle and the extensions of the other two sides.

Result: The excircle lies outside the triangle and is tangent to one side and the extensions of the other two sides.

Definition of Division of Circles into Equal Parts

The **division of a circle into equal parts** is the process of separating a circle into two or more equal sections using geometric construction methods or drawing instruments. The points obtained on the circumference can be joined to form regular polygons such as triangles, squares, pentagons, hexagons, and octagons

Assignment

1. Differentiate between concentric and eccentric circles.
2. Explain how to construct concentric circles.
3. Explain how to construct eccentric circles.
4. Define an inscribed triangle.
5. Define a circumscribed triangle.
6. What is an escribed triangle?

WEEK 8 - Topic: Quadrilaterals

Learning Objectives

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

1. Define a quadrilateral.
2. Identify the different types of quadrilaterals.
3. State the general properties of quadrilaterals.
4. Explain the specific properties of each type of quadrilateral.
5. Apply the properties of quadrilaterals in technical drawing and geometric constructions.

Definition of a Quadrilateral

A **quadrilateral** is a closed plane figure (polygon) that has **four sides, four angles, and four vertices (corners)**. It is formed by joining four straight line segments end to end.

Examples of quadrilaterals include the square, rectangle, parallelogram, rhombus, trapezium, and kite.

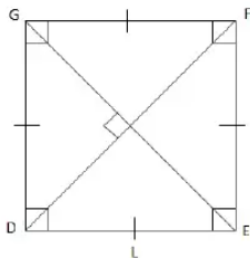
Parts of a Quadrilateral

Every quadrilateral consists of:

- Four sides
- Four vertices (corners)
- Four interior angles
- Two diagonals (lines joining opposite vertices)

Types of Quadrilaterals

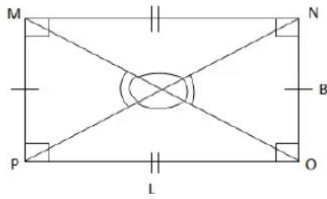
1. **Square:** A square is a quadrilateral with four equal sides and four right angles (90°).



Properties

- Four equal sides.
- Four right angles (90° each).
- Opposite sides are parallel.
- Diagonals are equal.
- Diagonals bisect each other at right angles.
- Diagonals bisect the interior angles.

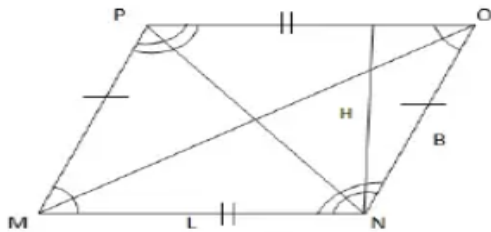
2. **Rectangle:** A rectangle is a quadrilateral having opposite sides equal and parallel with four right angles.



Properties

- Opposite sides are equal.
- Opposite sides are parallel.
- Four right angles.
- Diagonals are equal.
- Diagonals bisect each other.

3. Parallelogram

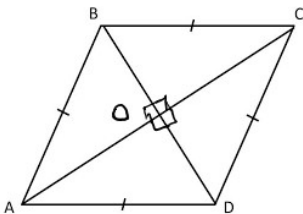


A parallelogram is a quadrilateral whose opposite sides are parallel and equal.

Properties

- Opposite sides are equal.
- Opposite sides are parallel.
- Opposite angles are equal.
- Adjacent angles add up to 180° .
- Diagonals bisect each other.

4. Rhombus: A rhombus is a quadrilateral with four equal sides.

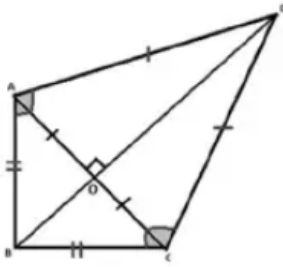


Properties

- Four equal sides.
- Opposite sides are parallel.
- Opposite angles are equal.
- Diagonals bisect each other at right angles.
- Diagonals are not usually equal.

- Diagonals bisect the angles.

6. Kite

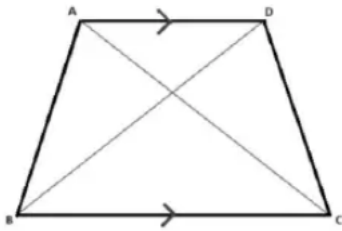


A kite is a quadrilateral with two pairs of adjacent equal sides.

Properties

- Two pairs of adjacent sides are equal.
- One pair of opposite angles is equal.
- Diagonals intersect at right angles.
- One diagonal bisects the other.
- One diagonal bisects two opposite angles.

7. Trapezium



A trapezium is a quadrilateral with **one pair of parallel sides**.

Properties

- One pair of opposite sides is parallel.
- The other two sides are not parallel.
- Interior angles on the same side of a leg add up to 180° .
- The diagonals are generally unequal.

General Properties of Quadrilaterals

All quadrilaterals have the following common properties:

1. They have **four sides**.
2. They have **four vertices (corners)**.
3. They have **four interior angles**.
4. They have **two diagonals**.
5. The sum of the interior angles is 360° .
6. They are closed plane figures.
7. They can be regular or irregular.

Specific Properties of Quadrilaterals

Quadrilateral	Equal Sides	Parallel Sides	Right Angles	Equal Diagonals
Square	Four	Two pairs	Yes	Yes
Rectangle	Opposite	Two pairs	Yes	Yes
Parallelogram	Opposite	Two pairs	No	No
Rhombus	Four	Two pairs	No	No
Kite	Adjacent pairs	None	No	No
Trapezium	Usually none	One pair	Not always	No

Importance of Quadrilaterals in Technical Drawing

Quadrilaterals are important because they:

- Form the basis of many engineering and architectural designs.
- Help in the construction of buildings, machines, and furniture.
- Improve accuracy in geometric constructions.
- Develop students' understanding of plane geometry.

Assignment

1. Define the following quadrilaterals:
 - (a) Square
 - (b) Rectangle
 - (c) Parallelogram
 - (d) Rhombus
 - (e) Kite
 - (f) Trapezium
2. Draw and label each of the six quadrilaterals using appropriate technical drawing instruments.
3. State **five general properties** of quadrilaterals.
5. State **two practical applications** of each type of quadrilateral in engineering, architecture, or everyday life.

WEEK 9 - Topic: Construction of Quadrilaterals (Square, Rectangle, Parallelogram, Rhombus, Kite and Trapezium)

Learning Objectives

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

1. Define the construction of quadrilaterals.
2. Identify the instruments used in constructing quadrilaterals.
3. Construct a square accurately.
4. Construct a rectangle using given dimensions.
5. Construct a parallelogram using given sides and angle.
6. Construct a rhombus using its side and angle.
7. Construct a kite using the lengths of its sides.
8. Construct a trapezium using given dimensions.

Definition of Construction of Quadrilaterals

The **construction of quadrilaterals** is the process of drawing four-sided plane figures accurately using drawing instruments such as a ruler, compass, T-square, set squares, and protractor according to given measurements.

General Rules for Construction

1. Draw lightly with an HB pencil.
2. Measure accurately.
3. Use the compass correctly for arcs.
4. Keep construction lines neat.
5. Darken only the final outline after completing the construction.

1. Construction of a Square

Example: Construct a square of side **60 mm**.

Steps

1. Draw a horizontal line **AB = 60 mm**.
2. At points **A** and **B**, construct perpendicular lines (90°).
3. Measure **60 mm** upward on both perpendiculars to obtain points **D** and **C** respectively.
4. Join **C** to **D**.
5. Darken the completed square **ABCD**.

2. Construction of a Rectangle

Example: Construct a rectangle **80 mm × 50 mm**.

Steps

1. Draw **AB = 80 mm**.
2. Draw perpendiculars at **A** and **B**.
3. Mark **AD = 50 mm** and **BC = 50 mm**.
4. Join **C** to **D**.
5. Darken rectangle **ABCD**.

3. Construction of a Parallelogram

Example: Construct a parallelogram with **AB = 70 mm**, **AD = 45 mm**, and angle **A = 60°** .

Steps

1. Draw **AB = 70 mm**.

2. At **A**, construct a **60°** angle.
3. Measure **45 mm** along the inclined line to locate **D**.
4. Through **B**, draw a line parallel to **AD**.
5. Through **D**, draw a line parallel to **AB**.
6. The two lines meet at **C**.
7. Join the sides to complete parallelogram **ABCD**.

4. Construction of a Rhombus

Example: Construct a rhombus with side **50 mm** and one angle **60°**.

Steps

1. Draw **AB = 50 mm**.
2. At **A**, construct a **60°** angle.
3. Measure **50 mm** along the inclined line to locate **D**.
4. With centres **B** and **D** and radius **50 mm**, draw arcs intersecting at **C**.
5. Join **BC** and **CD**.
6. Darken rhombus **ABCD**.

5. Construction of a Kite

Example: Construct a kite with adjacent sides **60 mm** and **40 mm**.

Steps

1. Draw a vertical line **AC**.
2. Mark point **B** so that **AB = 60 mm**.
3. Mark point **D** so that **AD = 40 mm**.
4. With centres **B** and **D**, draw arcs of equal radius to intersect on either side of **AC**.
5. Join the intersection points to **B** and **D**.
6. Darken the completed kite.

6. Construction of a Trapezium

Example: Construct a trapezium with parallel sides **80 mm** and **50 mm**, and height **40 mm**.

Steps

1. Draw the longer base **AB = 80 mm**.
2. At point **A**, draw a perpendicular **40 mm** high.
3. Through the top point, draw a line parallel to **AB**.
4. Measure **50 mm** on the parallel line to locate point **D**.
5. Join **B** to **D**.
6. Join **D** to the top left point **C**.
7. Darken trapezium **ABCD**.

Summary of Construction

Quadrilateral	Information Required
Square	One side
Rectangle	Length and width
Parallelogram	Two adjacent sides and one angle
Rhombus	One side and one angle
Kite	Two pairs of adjacent sides
Trapezium	Two parallel sides and height

Assignment

1. Using your drawing instruments, construct the following neatly on an A4 drawing sheet:
 - (a) A square of side **60 mm**.
 - (b) A rectangle measuring **80 mm × 50 mm**.
 - (c) A parallelogram with sides **70 mm** and **50 mm**, and an included angle of **60°**.
 - (d) A rhombus of side **50 mm** with one angle of **60°**.
 - (e) A kite with adjacent sides **60 mm** and **40 mm**.
 - (f) A trapezium with parallel sides **80 mm** and **50 mm**, and a height of **40 mm**.
2. Label all vertices correctly (A, B, C, and D).
3. State **two properties** of each quadrilateral constructed.