Chapter 20

Lines angles and geometric shapes

Learn the ideas below, follow each worked example, then attempt the practice before checking the answers.

20.1 Points lines rays and segments

A point marks a position. A line extends endlessly in both directions; a ray has one endpoint; a segment has two endpoints. Parallel lines in a plane never meet. Perpendicular lines meet at a right angle. An angle measures a turn, usually in degrees.

Worked example In a rectangle, opposite sides are parallel and adjacent sides are perpendicular. A right angle measures 90°. A full turn measures 360° and a half turn 180°.

20.2 Types of angles and measuring

An acute angle is between 0° and 90°. A right angle is 90°. An obtuse angle is between 90° and 180°. A straight angle is 180° and a reflex angle is between 180° and 360°. To use a protractor, place its centre on the vertex and its baseline along one arm, then read from zero on that arm.

Worked example If an angle opens wider than a right angle but less than a straight angle, it is obtuse. An angle of 235° is reflex. Its smaller remaining angle around the point is 360° − 235° = 125°.

20.3 Angle relationships

Angles on a straight line total 180° and angles around a point total 360°. Vertically opposite angles are equal. For parallel lines cut by a transversal, corresponding angles are equal, alternate angles are equal, and interior angles on the same side total 180°. State the reason for each step.

Worked example Two adjacent angles on a straight line are x and 68°. Therefore x = 180° − 68° = 112°. If a corresponding angle lies on a parallel line, it also measures 68°.

20.4 Triangles and quadrilaterals

A triangle has angle sum 180°. An equilateral triangle has three equal sides and three 60° angles. An isosceles triangle has equal base angles. A quadrilateral has angle sum 360°. Rectangles have four right angles; squares also have four equal sides. A rhombus has four equal sides; a parallelogram has two pairs of parallel sides.

Worked example A triangle has angles 48° and 67°, so the third is 180° − 48° − 67° = 65°. A square is also a rectangle, rhombus and parallelogram because it satisfies each definition.

20.5 Polygons circles and symmetry

An n sided polygon has interior angle sum (n − 2) × 180°. In a regular polygon all sides and all interior angles are equal, and each exterior angle is 360° ÷ n. A circle has radius from centre to circumference and diameter twice the radius. A line of symmetry reflects a shape onto itself; rotational symmetry counts matching positions in a full turn.

Worked example A regular hexagon has each exterior angle 360° ÷ 6 = 60° and each interior angle 120°. A square has four lines of symmetry and rotational symmetry of order 4. A circle of radius 5 cm has diameter 10 cm.

20.6 Solids and nets

A solid has three dimensions. A polyhedron has flat polygonal faces, straight edges and vertices. A net unfolds a solid into a flat arrangement of its surfaces. A cube has 6 square faces, 12 edges and 8 vertices. A cylinder has two circular flat faces and one curved surface.

Worked example A cuboid net contains six rectangles, arranged so that folding pairs opposite faces. A triangular prism has 5 faces, 9 edges and 6 vertices. Its two end faces are congruent triangles.

Chapter 20 practice

Work in your notebook. Show your method and include units where needed.

1. Find the supplement of 73°.
2. An isosceles triangle has vertex angle 38°. Find each base angle.
3. Find each interior angle of a regular octagon.
4. A circle has diameter 14 cm. Find its radius.
5. How many edges does a cube have?

Answers with methods

1. 180° − 73° = 107°.

2. (180° − 38°) ÷ 2 = 71°.

3. Sum = 6 × 180° = 1,080°. Each angle = 1,080° ÷ 8 = 135°.

4. 14 ÷ 2 = 7 cm.

5. 12 edges. Each joins two vertices and belongs to two faces.

Common mistake to avoid

A diagram may not be drawn to scale. Use stated measurements and geometric reasons rather than judging an angle by its appearance.