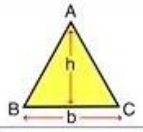
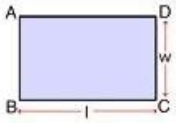
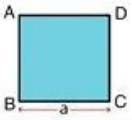
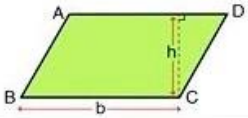
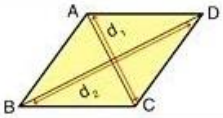
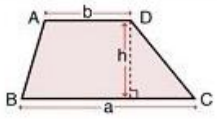
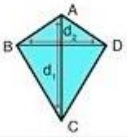
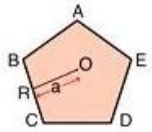
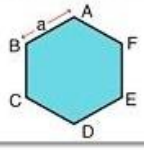
Area of a Polygon

Understanding of Area of a Polygon

- A polygon is a closed figure made up of three or more straight line segments.
- Common polygons include triangle, quadrilateral, pentagon, hexagon, etc.
- To find the area of a polygon, we divide it into simpler shapes like triangles and rectangles, find their areas, and add them.
- For regular polygons (all sides and angles equal), special formulas can be used, but usually basic division method is enough.

Polygons	Shapes	Formulas
Triangle		Area (A) = $\frac{1}{2}$ (b × h) *here*, b = base, h = height
Rectangle		Area (A) = w × l *here*, w = width, l = length
Square		Area (A) = a^2 *here*, a = side
Parallelogram		Area (A) = b × h *here*, b = base, h = height
Rhombus		Area (A) = $\frac{d_1 \times d_2}{2}$ *here*, d_1 and d_2 are the diagonals
Trapezoid		Area (A) = $\frac{1}{2}$ (a + b) x h *here*, a = long base b = short base h = height
Kite		Area (A) = $\frac{d_1 \times d_2}{2}$ *here*, d_1 and d_2 are the diagonals
Pentagon		Area (A) = $\frac{1}{2}$ (p x a) *here*, p = perimeter a = apothem
Hexagon		Area (A) = $\frac{3\sqrt{3}}{2}$ x $(a)^2$ *here*, a = side

Important Points

- Divide complex polygons into known shapes like triangles, rectangles, and trapeziums.
- Find the area of each part separately.
- Add the areas of all parts to get the total area.
- Always use correct units like cm^2, m^2 etc.
- In regular polygons with given side length and apothem, Area = $\frac{1}{2}$ × Perimeter × Apothem

Examples with Solutions

Example: Area of Polygon Divided into Triangles

➢ **A quadrilateral is divided into two triangles with areas 25 cm^2 and 35 cm^2. Find the area of the polygon.**

Solution: Total Area = 25 + 35 = 60 cm^2

Example 2: Polygon Divided into Rectangle and Triangle

➢ **A polygon consists of a rectangle of length 8 m and width 5 m attached to a triangle with base 8 m and height 6 m. Find the total area.**

Solution: Area of rectangle = 8 × 5 = 40 m^2

Area of triangle = $\frac{1}{2}$ × 8 × 6 = 24 m^2

Total Area = 40 + 24 = 64 m^2

Example: Area of Regular Pentagon

➢ **A regular pentagon has perimeter 30 cm and apothem 5 cm. Find its area.**

Solution: Area = $\frac{1}{2}$ × Perimeter × Apothem

Area = $\frac{1}{2}$ × 30 × 5 = 15 × 5 = 75 cm^2

Example: Area of Irregular Polygon

➢ **A five-sided irregular polygon is divided into 2 triangles and 1 rectangle. Areas of triangles are 20 m^2 and 30 m^2, and area of rectangle is 40 m^2. Find the total area.**

Solution: Total Area = 20 + 30 + 40 = 90 m^2

Example: Polygon with Fractional Dimensions

➢ **A polygon is made up of a rectangle $\frac{7}{2}$ m by $\frac{5}{2}$ m and a triangle of base $\frac{7}{2}$ m and height 3 m. Find total area.**

Solution: Area of rectangle = $\left(\frac{7}{2}\right) \times \left(\frac{5}{2}\right)$

$= \frac{35}{4} = 8.75$ m²

Area of triangle = $\frac{1}{2} \times \left(\frac{7}{2}\right) \times 3$

$= \left(\frac{7}{4}\right) \times 3 = \frac{21}{4} = 5.25$ m²

Total Area = 8.75 + 5.25 = 14 m²

Summary Points

- Divide polygons into known shapes
- Find area of each shape separately
- Add all areas carefully
- Use proper units like cm², m²
- **Regular polygon formula:** Area = $\frac{1}{2}$ × Perimeter × Apothem