LINES ANDANGLES



Sum of the angles in a straight line is 180°

Vertically opposite angles are congruent (equal).

If any point is equidistant from the endpoints of a segment, then it must lie on the **perpendicular bisector**.

When two **parallel lines** are intersected by a **transversal**, **corresponding angles** are equal, **alternate angles** are equal and **co-interior angles** are supplementary. (All acute angles formed are equal to each other and all obtuse angles are equal to each other)

Concept: The ratio of intercepts formed by a transversal intersecting three parallel lines is equal to the ratio of corresponding intercepts formed by any other transversal.



$$\Rightarrow \frac{a}{b} = \frac{c}{d} = \frac{e}{f}$$

Triangles

- \Rightarrow Sum of interior angles of a triangle is 180° and of exterior angles is 360°.
- \Rightarrow Exterior Angle = Sum of remote interior angles.
- ⇒ Sum of two sides is always greater than the third side and the difference of two sides is always lesser than the third side.
- \Rightarrow Side opposite to the biggest angle is longest and side opposite to the smallest angle is the shortest.

Area of a triangle:



= $\frac{1}{2}$ × Base × Height

= $\frac{1}{2}$ × Product of sides × Sine of included angle

$$=\sqrt{s(s-a)(s-b)(s-c)}$$
; here s is the semi perimeter $\left[S=\frac{a+b+c}{2}\right]$

- $= r \times s$ [r is radius of incircle]
- $= \frac{abc}{4R}$ [R is radius of circumcircle]

A **Median** of a triangle is a line segment joining a vertex to the midpoint of the opposing side. The three medians intersect in a single point, called the **Centroid** of the triangle. Centroid divides the median in the ratio of 2:1



An **Altitude** of a triangle is a straight line through a vertex and perpendicular to the opposite side or an extension of the opposite side. The three altitudes intersect in a single point, called the **Orthocenter** of the triangle.

A **Perpendicular Bisector** is a line that forms a right angle with one of the triangle's sides and intersects that side at its midpoint. The three perpendicular bisectors intersect in a single point, called the **Circumcenter** of the triangle. It is the center of the circumcircle which passes through all the vertices of the triangle.

An**AngleBisector** is a line that divides the angle at one of the vertices in two equal parts. The three angle bisectors intersect in a single point, called the **Incenter** of the triangle. It is the center of the incircle which touches all sides of a triangle.

Concept: *Centroid* and *Incenter* will always lie inside the triangle.

- Foran**acuteangledtriangle**, the *Circumcenter* and the *Orthocenter* will lie inside the triangle.
- For an **obtuse angled triangle**, the *Circumcenter* and the *Orthocenter* will lie outside the triangle.
- For a **right angled triangle** the *Circumcenter* will lie at the midpoint of the hypotenuse and the *Orthocenter* will lie at the vertex at which the angle is 90°.

Concept: The *orthocenter*, *centroid*, and *circumcenter* always lie on the same line known as **EulerLine**.

- The orthocenter is twice as far from the centroid as the circumcenter is.
- If the triangle is **Isosceles** then the incenter lies on the **same line**.
- If the triangle is **equilateral**, all four are the **same point**.