Geometry: Basic Concepts and Important Formulas

Important Formulas

Complementary Angles: If sum of two angles is $90°$, then they are Complementary.

Supplementary Angles: If sum of two angles is $180°$, then they are Supplementary.

Properties of Triangles:

1) Sum of two sides is always greater than the third side (Largest side).

2) Greater angle has greater side opposite to it and smaller angle has smaller side opposite to it.

3) Let a, b, c be the sides of the triangle such that, c is the largest side then,

For acute angled triangle $a^2 + b^2 > c^2$

For right angled triangle $a^2 + b^2 = c^2$

For obtuse angled triangle $a^2 + b^2 < c^2$

Altitude: Perpendicular drawn to a side of a triangle from the vertex opposite to that side. Point at which all the altitudes of a triangle meet is known as orthocentre.

Angle Bisector: It is the bisector of the angle contained in the vertex of a triangle. All the three angle bisectors of a triangle meet at a point called *incenter*.

Perpendicular Bisector: It is the line passing through the mid-point of the side of a triangle and perpendicular to it. All the three perpendicular bisectors of a triangle meet at a point called *circumcenter*.

Median: It is the line joining the mid-point of the side of a triangle with the vertex opposite to that side. All the three medians of a triangle meet at a point called *centroid* of a triangle. Let AD, BE, CF be the medians of a triangle ABC and G be the centroid of triangle ABC. Then, $\frac{AG}{GD} = \frac{BG}{GE} = \frac{CG}{GF} = 2$

Properties of Quadrilaterals:

Parallelogram: A Quadrilateral in which opposite sides are parallel and equal, is called a Parallelogram. In Parallelogram ABCD, $A + B = B + C = C + D = D + A = 180°$
$A = C$ and $B = D$

1) Line joining the mid points of the adjacent sides of a quadrilaterals forms a parallelogram.

2) Line joining the mid points of the adjacent sides of a parallelogram forms a parallelogram.

3) Parallelogram inscribed in a circle is a rectangle and circumscribed about the circle is a rhombus.

$$AC^2 + BD^2 = 2(AB^2 + BC^2)$$

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Rhombus: A Parallelogram in which all the sides are equal, is called a Rhombus. In Rhombus ABCD,

1) Opposite sides are parallel and all the sides are of equal lengths. $AB = BC = CD = DA$

2) Sum of any two adjacent interior angles is equal to $180°$

$$A + B = B + C = C + D = D + A = 180°$$

3) Opposite angles are equal in magnitude i.e. $A = C$ and $B = D$

4) Diagonals bisect each other at right angles and form four right angled triangles (Each having the same area).

5) Line joining the mid points of the adjacent sides of a rhombus forms a rectangle.

Rectangle: A Parallelogram in which the adjacent sides are perpendicular to each other and opposite sides are equal, is called a rectangle. In rectangle ABCD,

1) Diagonals of a rectangle are equal and bisect each other i.e. AC = BD.

2) Line joining the mid points of the adjacent sides of a rectangle forms a Rhombus.

Square: A Parallelogram in all the sides are equal and perpendicular to each other, is called a square. In square ABCD,

1) Diagonals of a square are equal and bisect each other at right angles. Diagonals of a square form four isosceles right angled triangles.

2) Line joining the mid points of the adjacent sides of a square forms a square.

Trapezium: It is a quadrilateral where only one pair of opposite sides are parallel. ABCD is a trapezium as $AB||CD$.

1) If the non parallel sides i.e. (AD and BC) are equal, then diagonals will also be equal to each other.

2) Line joining the mid points of oblique (non-parallel) sides is half the sum of parallel sides and is called the median. Median $= \frac{AB+CD}{2}$

Cyclic Quadrilateral: A Quadrilateral whose vertices are on the circumference of a circle, is called a Cyclic Quadrilateral. The opposite angles of a cyclic quadrilateral are supplementary.

Q1) An angle which is less than $360°$ and more than $180°$, is calles

1) A Reflex angle   2) A Straight angle   3) An Acute angle   4) An Obtuse angle

Solutions: An angle which is less than $360°$ and more than $180°$, is called a reflex angle.

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Q2) The supplement of $80°$ is

1) $10°$ 2) $100°$ 3) $280°$ 4) $120°$

Solutions: Supplement of $80° = 180° - 80° = 100°$

Q3) Three angles of a quadrilateral are $80°, 95°$ and $112°$ is

1) $78°$ 2) $73°$ 3) $85°$ 4) $100°$

Solutions: Let the fourth angle be $x°$

$$80° + 95° + 112° + x° = 360°$$
$$x° = 73°$$