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GEOMETRY FORMULA CONCEPT CHEAT SHEET

1. Lines & Angles

Parallel Lines Cut by Transversal:

- **Corresponding Angles:** Equal (e.g., $\angle 1 = \angle 5$)
- **Alternate Interior Angles:** Equal ($\angle 3 = \angle 6$)
- **Consecutive Interior Angles:** $\angle 3 + \angle 5 = 180^\circ$

Polygons (Sides = n):

- Sum of Interior Angles: $(n - 2) \times 180^\circ$
- Sum of Exterior Angles: 360°
- Number of Diagonals: $\frac{n(n-3)}{2}$

2. Triangles

General Formulas:

- Area $A = \frac{1}{2}bh = \frac{1}{2}ab \sin C$
- **Heron's Formula:** $A = \frac{\sqrt{s(s-a)(s-b)(s-c)}}{2}$
where $s = \frac{a+b+c}{2}$

Special Triangles:

- **Equilateral:** $A = \frac{\sqrt{3}}{4}a^2$, $h = \frac{\sqrt{3}}{2}a$
- **Right Triangle (Pythagoras):** $a^2 + b^2 = c^2$

Triangle Centers:

- **Centroid (G):** Intersection of medians. Divides median in ratio 2 : 1.
- **Incenter (I):** Angle bisectors. $A = r \cdot s$.
- **Circumcenter (O):** Perpendicular bisectors. $R = \frac{abc}{4A}$.
- **Orthocenter (H):** Intersection of altitudes.

3. Circles

Basic Formulas:

- Circumference: $C = 2\pi r = \pi d$
- Area: $A = \pi r^2$
- Arc Length: $L = \frac{\theta}{360^\circ} \times 2\pi r$
- Sector Area: $A_{sec} = \frac{\theta}{360^\circ} \times \pi r^2$

Circle Theorems:

- Angle at center is double the angle at circumference: $\theta_{center} = 2\theta_{subtended}$.
- Angle in a semicircle is 90° .
- **Intersecting Chords:** $PA \cdot PB = PC \cdot PD$
- **Tangent-Secant:** $PT^2 = PA \cdot PB$

4. Quadrilaterals

- **Parallelogram:** $A = b \times h$
- **Rectangle:** $A = l \times w$, Diagonal $d = \sqrt{l^2 + w^2}$
- **Rhombus:** $A = \frac{1}{2}d_1d_2$, Sides are equal, diagonals $\perp$.
- **Trapezoid:** $A = \frac{a+b}{2} \times h$
- **Kite:** $A = \frac{1}{2}d_1d_2$

5. 3D Surface Area & Volume

Prisms & Cylinders:

- **Cube:** $V = a^3$, $TSA = 6a^2$
- **Rectangular Prism:** $V = lwh$, $TSA = 2(lw + lh + wh)$
- **Cylinder:** $V = \pi r^2 h$, $CSA = 2\pi rh$, $TSA = 2\pi r(r + h)$

Pyramids, Cones & Spheres:

- **Cone:** $V = \frac{1}{3}\pi r^2 h$, $CSA = \pi rl$ where $l = \sqrt{r^2 + h^2}$
- **Sphere:** $V = \frac{4}{3}\pi r^3$, $SA = 4\pi r^2$
- **Hemisphere:** $V = \frac{2}{3}\pi r^3$, $CSA = 2\pi r^2$, $TSA = 3\pi r^2$

6. Coordinate Geometry

2D Formulas ($P_1(x_1, y_1), P_2(x_2, y_2)$):

- **Distance:** $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- **Midpoint:** $M = (\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})$
- **Slope:** $m = \frac{y_2 - y_1}{x_2 - x_1} = \tan \theta$
- **Parallel Lines:** $m_1 = m_2$
- **Perpendicular Lines:** $m_1 \cdot m_2 = -1$
- **Distance Point-Line:** $d = \frac{|Ax_0 + By_0 + C|}{\sqrt{A^2 + B^2}}$