SAT Math Cheat Sheet

Geometry, Trigonometry & Inscribed Shapes

*The SAT Math section relies on **patterns**. Memorize these rules to solve problems in seconds.*

1 The "Must-Memorize" Identities

These rules allow you to solve trig problems without drawing a triangle.

1. The Complementary Rule (Cofunction)

For any right triangle with acute angles A and B (where $A + B = 90°$):

- $\sin(A) = \cos(B)$
- $\sin(A) = \cos(90° - A)$

Reciprocal Tangent Rule:

- $\tan(A) = \frac{1}{\tan(B)}$

2. The Pythagorean Identity

For any angle θ:

$$\sin^2(\theta) + \cos^2(\theta) = 1$$

2 Right Triangles (The Core)

A. Pythagorean Triples

Memorize these integer sets. If you see two, you know the third instantly.

- **3 - 4 - 5** (and multiples like 6 - 8 - 10)
- **5 - 12 - 13**
- **8 - 15 - 17**
- **7 - 24 - 25**

B. Special Right Triangles

Shortcuts

30-60-90 Triangle

- Side opposite 30° (x)
- Side opposite 60° ($x\sqrt{3}$)
- Hypotenuse ($2x$) *(Hypotenuse is double the short leg)*

45-45-90 Triangle (Isosceles)

- Legs (x)
- Hypotenuse ($x\sqrt{2}$)

3 Inscribed Shapes (Shapes Inside Shapes)

This is essentially the "Hidden Rules" section.

1. Square Inscribed in a Circle

Visual: A square inside a circle, corners touching the edge.

- **Rule:** The **Diagonal** of the square = The **Diameter** of the circle.
- **Math:** If side is s: Diameter $d = s\sqrt{2}$

2. Circle Inscribed in a Square

Visual: A circle inside a square, edges touching the sides.

- **Rule:** The **Side Length** of the square = The **Diameter** of the circle.
- **Math:** If side is s: Diameter $d = s$ (Radius $r = s/2$)

3. Hexagon Inscribed in a Circle

Visual: A 6-sided regular polygon inside a circle.

- **Rule:** The **Side Length** of the hexagon = The **Radius** of the circle.

4. Triangle on Diameter (Thales's Theorem)

Visual: A triangle inside a circle where one side is the Diameter.

- **Rule:** The angle opposite the diameter is always **90°**.
- **Strategy:** This automatically creates a Right Triangle. Use Pythagorean Theorem.

4 Non-Right Triangles & Similarity

A. Similarity & Scale Factors

If two triangles have the **same angles**, they are **Similar**.

- **Side Lengths:** Scale by factor k.
- **Perimeter:** Scales by factor k.
- **Area:** Scales by factor $\mathbf{k^2}$.
- **Trig Functions:** Do **NOT** change. $\sin(A)$ in a tiny triangle is equal to $\sin(A)$ in a huge similar triangle.

B. Triangle Inequality Theorem

The sum of any two sides must be greater than the third side.

$$\text{Difference} < \text{Third Side} < \text{Sum}$$

C. Equilateral Triangle Area Shortcut

$$\text{Area} = \frac{s^2\sqrt{3}}{4}$$

5 Circles & Radians

A. Conversions

- π radians = 180°
- **Degrees** → **Radians**: Multiply by $\frac{\pi}{180}$
- **Radians** → **Degrees**: Multiply by $\frac{180}{\pi}$

B. Arc Length & Sector Area

If θ is in **Radians**:

- **Arc Length:** $s = r\theta$
- **Sector Area:** $A = \frac{1}{2}r^2\theta$