

# 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  $A + B = 90^\circ$ ):

- $\sin(A) = \cos(B)$
- $\sin(A) = \cos(90^\circ - A)$

**Reciprocal Tangent Rule:**

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

#### 2. The Pythagorean Identity

For any angle  $\theta$ :

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

### 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  $30^\circ$  ( $x$ )
- Side opposite  $60^\circ$  ( $x\sqrt{3}$ )
- 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  $k^2$ .
- **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

- $\pi$  radians =  $180^\circ$
- **Degrees**  $\rightarrow$  **Radians:** Multiply by  $\frac{\pi}{180}$
- **Radians**  $\rightarrow$  **Degrees:** Multiply by  $\frac{180}{\pi}$

## B. Arc Length & Sector Area

If  $\theta$  is in **Radians**:

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