Focusing on Formulas

Preface

There are two main times when formulas are used in the SAT: Plugging formulas into equations and formula recognition. There are many examples of when you need formulas, but I will spare you the lecture. What is important is that you can recognize what formulas you need to use at what time. To understand which formulas to use, you must know which formulas are available!

Below is a list of formulas that are necessary to memorize (and some rules too) to maximize your familiarity with the test.

Summary of Different Formulas and Laws

Standard formula (y-intercept)

- $Ax + By = C$

Factored formula (x-intercept)

- $a^2 - 2ab + b.$

Mean/average:

- $\frac{\text{sum of terms}}{\text{number of terms.}}$

Speed:

- $\frac{\text{distance}}{\text{total time}}$

Quadratic formula

- $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Discriminant formula

- $b^2 - 4ac$

Vertex formula

- $y = a(x - h)^2 + k$

Difference of cubes

- $a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$

Sum of cubes

- $a^3 + b^3 = (a + b)(a^2 - b^2 + ab)$

Difference of squares

- $a^2 - b^2 = (a - b)(a + b)$

Slope intercept formula

- $y = mx + b$

Parabola equation

- $y = a(x - p)(x - q)$

Rules for exponents:

- $a^2(a^2) = a^{2+2}$
- $\frac{a^5}{a^3} = a^{5-3}$
- $(a^2)^2 = a^{2\times 2}$
- $3^4 \times 3^5 = 3^9$
- $6^5 \times 4^5 = (6 + 4)^5$
- $5^5 \times 4^3 \neq (5 + 4)^{5+3}$
- $\sqrt[n]{a^m} = a^{\frac{m}{n}}$
- $\sqrt[2]{\frac{a}{b}} = \frac{\sqrt[2]{a}}{\sqrt[2]{b}}$
- $\sqrt[2]{ab} = \sqrt[2]{a}\sqrt[2]{b}$
- $x^{-n} = \frac{1}{x^n}$

Circle formula

- $(x - h)^2 + (y - k)^2 = r^2$
- Think: (point – center) + (point – center) = Radius

Pythagorean theorem

- $a^2 + b^2 = c^2$

Sin cos tan rules

SOH: $SINE = \frac{opposite}{Hypotenuse}$

CAH: $COS = \frac{Adjacent}{Hypotenuse}$

TOA: $TAN = \frac{Opposite}{Adjacent}$

Length of the arc

- $s = r\theta$

Area of the sector

- $A = \frac{1}{2}\theta r^2$

Laws:

- There are 360 degrees in a circle.
- 2π = radians (θ)
- Triangles have 180 degrees of angles.

Circumference of a circle

- $C = 2\pi r$

Area of a circle

- $A = \pi r^2$

Area of a rectangle

- $A = Length(width)$

Area of a triangle

- $A = \frac{1}{2}B(H)$

Isosceles Right Triangle (45-45-90 Triangle):

Angles: The angles are 45°, 45°, and 90°.

Side Lengths: In a 45-45-90 triangle, the two legs are congruent (equal in length), and the hypotenuse is $(\sqrt{2})$ times the length of each leg.

If each leg is of length \(x\), then the hypotenuse is $(x\sqrt{2})$.

Formulas:

Hypotenuse = $(x\sqrt{2})$

Legs = (x)

30-60-90 Triangle:

Angles: The angles are 30°, 60°, and 90°.

Side Lengths: The side opposite the 30° angle is the shortest side. The side opposite the 60° angle is $(\sqrt{3})$ times the length of the shortest side. The hypotenuse is twice the length of the shortest side.

If the shortest side (opposite 30°) is (x), then the side opposite the 60° angle is $(x\sqrt{3})$, and the hypotenuse is $(2x)$.

Formulas:

Shortest side (opposite 30°) = (x)

Side opposite 60° = $(x\sqrt{3})$

Hypotenuse = ($2x$)

Volume of a Rectangular Solid (Cuboid):

- $[V = l \times w \times h]$

Volume of a Cylinder:

- $[V = \pi r^2 h]$

Volume of a Sphere:

- $[V = \frac{4}{3}\pi r^3]$

Volume of a Cone:

- $[V = \frac{1}{3}\pi r^2 h]$

Volume of a Pyramid:

- $[V = \frac{1}{3}Bh]$