GENERAL

all the formulas of maths

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All the Formulas of Maths: A Comprehensive Guide

Mathematics is a language that describes patterns, structures, and relationships in the world around us. From the simple arithmetic you use every day to the complex equations that model the cosmos, formulas are the building blocks that allow us to express ideas with precision. Whether you're a student preparing for exams, a professional applying math in engineering, or simply a curious mind, having a solid grasp of the key formulas across various branches of mathematics can unlock new insights and solve challenging problems.

In this guide, we'll explore **all the formulas of maths**that are essential for beginners and advanced learners alike. We'll cover algebra, geometry, trigonometry, calculus, statistics, and more, presenting each formula in a clear, organized format. By the end, you'll have a handy reference that you can consult whenever you need a quick refresher or a deeper understanding of the underlying principles.

1. Algebraic Formulas

1.1 Linear Equations

A linear equation in one variable takes the form **ax + b = 0**. Solving for **x** gives **x = -b/a** (provided **a "`)0**

1.2 Quadratic Formula

For a quadratic equation **ax² + bx + c = 0**, the solutions are given by:

- x = [-b ± " (b² - 4ac)] / (2a)

Here, the discriminant **9B Ò +" Ò 4e0**determines the nature of the roots.

1.3 Sum of an Arithmetic Series

Given first term **a**,•common difference **d**, and number of terms **n**, the sum is:

- S ™ = n/2 × [2a • + (n - 1)d]

1.4 Sum of a Geometric Series

With first term **a**,•common ratio **r** ("` 1), and**n** terms, the sum is:

- S ™ = a • × (1 - r •) / (1 - r)

1.5 Binomial Theorem

The expansion of **(x + y) i**s:

- (x + y) • = :2 †â 6†ö÷6R ²' …â†âÖ²' •æ² `or k = 0 to n

where **(n choose k) = n! / [k!(n - k)!]**.

1.6 Factorization Identities

- (a + b)(a - b) = a² - b²
- (a + b)² = a² + 2ab + b²
- (a - b)² = a² - 2ab + b²

2. Geometry Formulas

2.1 Area of Common Shapes

- Rectangle: A = l × w
- Triangle: A = ½ × base × height
- Circle: A = < +
- Parallelogram: A = base × height
- Trapezoid: A = ½ × (a + b) × h (a and b are parallel sides)

2.2 Volume of Common Solids

- Cylinder: V = < +&€
- Sphere: V = !T< +0
- Cube: V = a³
- Rectangular Prism: V = l × w × h
- Cone: V = !S< +&€

2.3 Pythagorean Theorem

In a right-angled triangle with legs **a** and **b** and hypotenuse **c**:

- a² + b² = c²

2.4 Circle Formulas

- Circumference: C = 2<
- Arc Length: L = ;, r " *ƒ* ¸ in radians)
- Sector Area: A = ½ ;, +

2.5 Triangle Area – Heron''s Formula

For sides **a, b, c** and semi perimete**s = (a + b + c)/2**:

- A = " [s(s - a)(s - b)(s - c)]

2.6 Euler’s Formula for Polyhedra

For any convex polyhedron with faces **F**, edges **E**, and vertices **V**:

- V - E + F = 2

3. Trigonometry Formulas

3.1 Basic Trigonometric Ratios

- sin ;, Ò ÷ ÷6—FR ò €ypotenuse
- cos ;, Ò F¦ 6VçB ò €ypotenuse
- tan ;, Ò ÷ ÷6—FR ò F¦ 6Vç@

3.2 Co function Identities

- sin(90° - ;,’ Ò 6÷2 ¸
- cos(90° - ;,’ Ò 6–â ¸
- tan(90° - ;,’ Ò 6÷B ¸

3.3 Sum and Difference Formulas

- sin(; ²) = sin ; 6÷2 ² ± cos ; 6–â ²
- cos(; ²) = cos ; 6÷2 ² " sin ; 6–â ²

- tan(; ²) = (tan ; F â ²) / (1 " tan ; F â ²)

3.4 Double Angle Formulas

- sin 2;, Ò " 6–â ¸ cos ;€
- cos 2;, Ò 6÷;#¸ - sin²;, Ò " 6÷;#¸ - 1 = 1 - 2 sin²;€
- tan 2;, Ò " F â ¸ / (1 - tan²;,•

3.5 Inverse Trigonometric Functions

- arcsin x = sin {¹ x
- arccos x = cos {¹ x
- arctan x = tan {¹ x

3.6 Laws of Sines and Cosines

- Law of Sines: a/sin A = b/sin B = c/sin C = 2R
- Law of Cosines: c² = a² + b² - 2ab cos C

3.7 Law of Tangents

(a - b)/(a + b) = tan[(A - B)/2] / tan[(A + B)/2]

4. Calculus Formulas

4.1 Derivative Rules

- Power Rule: d/dx (x •) = n x^(n-1)
- Product Rule: d/dx [u(x)v(x)] = u"v + uv"
- Quotient Rule: d/dx [u/v] = (u"v - uv")/v²
- Chain Rule: d/dx f(g(x)) = f"(g(x)) · g"(x)

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