# Mathematics Formulae At Glance: A Comprehensive Guide for Every Student

Mathematics, the universal language of science and technology, plays a crucial role in our daily lives. From the calculations we make while shopping to the complex equations used in engineering and physics, mathematics is indispensable. At the heart of mathematics lie formulae, which are concise expressions that represent important mathematical relationships. They serve as a powerful tool, enabling us to solve problems, make predictions, and gain insights into the world around us.

This comprehensive guide aims to provide a comprehensive overview of essential mathematics formulae, covering a wide range of topics from basic arithmetic to advanced calculus. Whether you are a student preparing for exams, a researcher delving into complex mathematical concepts, or simply someone who wants to brush up on their math skills, this article will serve as an invaluable resource.
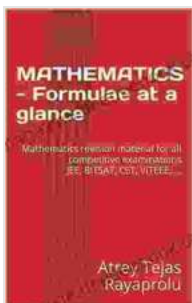
MATHEMATICS - Formulae at a glance: Mathematics revision material for all competitive examinations JEE, BITSAT, CET, VITEEE, ... by Atrey Tejas Rayaprolu

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Arithmetic and Algebra

Arithmetic, the foundation of mathematics, deals with the basic operations of addition, subtraction, multiplication, and division. The following formulae are essential for performing arithmetic operations:

- Sum of two numbers: $a + b$

- Difference between two numbers: $a - b$

- Product of two numbers: $a \times b$

- Quotient of two numbers: $a \div b$

- Powers and exponents: a^n (where a is the base and n is the exponent)

- Factorials: $n!$ (where n is the factorial, defined as the product of all positive integers from 1 to n)

Algebra builds upon arithmetic and introduces variables, which represent unknown quantities. The following formulae are fundamental to solving algebraic equations and inequalities:

- Linear equation: $ax + b = c$

- Quadratic equation: $ax^2 + bx + c = 0$

- System of linear equations: $a_{11}x + a_{12}y = c_1$, $a_{21}x + a_{22}y = c_2$

- Logarithms: $\log_a(b)$ (where a is the base, b is the argument, and $\log_a(b)$ is the exponent to which a must be raised to get b)

- Exponents: $a^{\log_a(b)} = b$

Geometry

Geometry deals with the properties of shapes and their relationships in space. The following formulae are essential for calculating the area, perimeter, volume, and surface area of various geometric shapes:

- Area of a triangle: $A = \frac{1}{2} bh$ (where b is the base and h is the height)

- Perimeter of a triangle: $P = a + b + c$ (where a, b, and c are the lengths of the sides)

- Area of a circle: $A = \pi r^2$ (where r is the radius)

- Circumference of a circle: $C = 2\pi r$

- Volume of a cube: $V = a^3$ (where a is the length of a side)

- Surface area of a cube: $A = 6a^2$

Trigonometry

Trigonometry deals with the relationships between the sides and angles of triangles. The following formulae are essential for solving trigonometric problems:

- Sine of an angle: $\sin(\theta) = \text{opposite/hypotenuse}$

- Cosine of an angle: $\cos(\theta) = \text{adjacent/hypotenuse}$

- Tangent of an angle: $\tan(\theta) = \text{opposite/adjacent}$

- Pythagorean theorem: $a^2 + b^2 = c^2$ (where a and b are the lengths of the shorter sides and c is the length of the hypotenuse of a right triangle)

- Law of cosines: $c^2 = a^2 + b^2 - 2ab \cos(\theta)$ (where a, b, and c are the lengths of the sides and θ is the angle opposite to side c)

Calculus

Calculus, a branch of mathematics that deals with change, is essential for studying motion, dynamics, and many other real-world phenomena. The following formulae are fundamental to calculus:

- Derivative of a function: $f'(x) = \lim_{h \to 0} (f(x + h) - f(x))/h$

- Integral of a function: $\int f(x)\, dx = F(x) + C$ (where $F(x)$ is an antiderivative of $f(x)$ and C is an arbitrary constant)

- Chain rule: $f'(x) = f'(g(x)) \times g'(x)$

- Product rule: $(fg)'(x) = f'(x)g(x) + f(x)g'(x)$

- Quotient rule: $(f/g)'(x) = (f'(x)g(x) - f(x)g'(x))/(g(x))^2$

Probability and Statistics

Probability and statistics deal with the likelihood of events and the analysis of data. The following formulae are essential for probability and statistics:

- Probability of an event: $P(A)$ = number of favorable outcomes/number of possible outcomes

- Conditional probability: $P(A|B) = P(A \text{ and } B)/P(B)$

- Bayes' theorem: $P(A|B) = P(B|A) \times P(A)/P(B)$

- Mean of a dataset: mean = (sum of all values)/number of values

- Standard deviation of a dataset: standard deviation = $\sqrt{}$(sum of squared deviations from the mean/number of values - 1)

This comprehensive guide provides a snapshot of essential mathematics formulae that cover a wide range of topics from basic arithmetic to advanced calculus. By mastering these formulae, students can enhance their problem-solving skills, improve their understanding of mathematical concepts, and prepare for exams and academic challenges.

Mathematics is an ever-evolving field, and the formulae presented here provide a solid foundation for further exploration. By embracing the power of mathematics and harnessing the knowledge of its formulae, we can unlock the secrets of the universe and shape the future of science and technology.
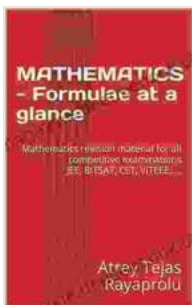
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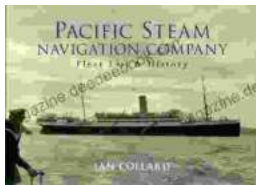|	
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