



Algebra Basics & Order of Operations

Algebraic Formulas

Expanding Brackets: $a(b + c) = ab + ac$	Example: $2(x + 3) = 2x + 6$
Factoring: $ab + ac = a(b + c)$	Example: $3y + 6 = 3(y + 2)$
Difference of Squares: $a^2 - b^2 = (a + b)(a - b)$	Example: $x^2 - 9 = (x + 3)(x - 3)$
Perfect Square Trinomial: $a^2 + 2ab + b^2 = (a + b)^2$	Example: $(x + 2)^2 = x^2 + 4x + 4$
Perfect Square Trinomial: $a^2 - 2ab + b^2 = (a - b)^2$	Example: $(x - 3)^2 = x^2 - 6x + 9$
Distributive Property: $a(b+c) = ab + ac$	Useful for expanding and simplifying expressions.

Order of Operations (PEMDAS/BODMAS)

Parentheses / Brackets Exponents / Orders Multiplication and Division (from left to right) Addition and Subtraction (from left to right)
Example: $2 + 3 * 4 = 2 + 12 = 14$
Example: $(2 + 3) * 4 = 5 * 4 = 20$

Evaluating Algebraic Expressions

Substitute values into the expression.	Example: Evaluate $2x + 3$ when $x = 5$ $2(5) + 3 = 10 + 3 = 13$
Follow the order of operations.	Example: Evaluate $x^2 - 4$ when $x = -2$ $(-2)^2 - 4 = 4 - 4 = 0$

Fractions, Ratios & Percentages

Fractions

Equivalent Fractions	Multiply or divide both numerator and denominator by the same number. Example: $1/2 = 2/4 = 3/6$
Comparing Fractions	Find a common denominator. Example: Compare $1/3$ and $1/4$. $4/12 > 3/12$, so $1/3 > 1/4$
Operations with Fractions	Addition/Subtraction: Common denominator needed. Multiplication: Multiply numerators and denominators. Division: Invert the second fraction and multiply.
Improper Fractions	Numerator is greater than or equal to the denominator. Convert to mixed number for easier understanding.
Simplifying Fractions	Divide numerator and denominator by their greatest common divisor (GCD).

Ratios & Unit Conversion (Money)

Ratios	Express a relationship between two quantities. Can be written as $a:b$, a to b , or a/b .
Unit Conversion (Money)	Use conversion factors to change units. Example: If £1 = \$1.20, then £5 = \$6.00
Proportions	Two ratios that are equal to each other. Example: $a/b = c/d$

Percentages

Converting Fractions to Percentages	Multiply the fraction by 100. Example: $1/4 = (1/4) * 100\% = 25\%$
Percentage Increase	$[(\text{New Value} - \text{Original Value}) / \text{Original Value}] * 100\%$
Finding the Whole from a Part and a Percentage	$\text{Whole} = \text{Part} / (\text{Percentage} / 100)$
Percentages and Volume/Capacity	Calculate a percentage of a given volume or capacity. Example: 20% of 500ml = $(20/100) * 500\text{ml} = 100\text{ml}$
Profit Calculation	$\text{Profit} = \text{Revenue} - \text{Cost}$ $\text{Profit Margin} = (\text{Profit} / \text{Revenue}) * 100\%$

Geometry & Data Analysis

Pythagorean Theorem

Formula	$a^2 + b^2 = c^2$ (where 'c' is the hypotenuse)
Applications	Finding the length of a side in a right-angled triangle.
Example	If $a = 3$ and $b = 4$, then $c = \sqrt{3^2 + 4^2} = 5$

Decimal Places & Ordering Numbers

Decimal Places	Counting the number of digits after the decimal point.
Rounding	5 or more, raise the score. 4 or less, let it rest.
Ordering Numbers	Compare the values from left to right.
Significant Figures	Start counting from the first non-zero digit.

Data Analysis

Mean: Average of all values. Sum of values divided by the number of values.
Median: Middle value when data is ordered. If there are two middle values, it's their average.
Interquartile Range (IQR): Difference between the upper quartile (Q3) and the lower quartile (Q1). $IQR = Q3 - Q1$
Box Plots: A visual representation of data distribution, showing the median, quartiles, and outliers.

Graphs & Coordinate Geometry

Gradients

Formula	Gradient (m) = (Change in y) / (Change in x) = (y2 - y1) / (x2 - x1)
Positive Gradient	Line slopes upwards from left to right.
Negative Gradient	Line slopes downwards from left to right.
Zero Gradient	Horizontal line.
Undefined Gradient	Vertical line.

Quadrants

A coordinate plane is divided into four quadrants:
Quadrant I: (+x, +y)
Quadrant II: (-x, +y)
Quadrant III: (-x, -y)
Quadrant IV: (+x, -y)

Applying Geometric Principles to Algebraic Expressions

Area of a rectangle	Area = length * width
Area of a triangle	Area = (1/2) * base * height
Volume of a cube	Volume = side^3