

ALGEBRA I FORMULA SHEET



CRAM CREW

Mathematical Properties

	Addition	Multiplication
Identity	The sum of zero and any number or variable is that number or variable. $a + 0 = a$	The product of one and any number or variable is that number or variable. $a \times 1 = a$
Equality	If the same number is added to both sides of an equation, the two sides remain equal. If $a = b$, then $a + c = b + c$.	If an equation is multiplied by the same number on both sides, the two sides remain equal. If $a = b$, then $a \times c = b \times c$.
Associative <i>(Note: Does not hold for subtraction or division.)</i>	Changing the grouping of three or more addends does not change their sum. $(a + b) + c = a + (b + c)$	Changing the grouping of three or more factors does not change their product. $(a \times b) \times c = a \times (b \times c)$
Commutative <i>(Note: Does not hold for subtraction or division.)</i>	Changing the order of addends does not change the sum. $a + b = b + a$	Changing the order of factors does not change the product. $a \times b = b \times a$
Distributive	The product of a value and a sum is equal to the sum of the individual products of addends and the number. $a(b + c) = ab + ac$	
Reflexive	Any value is equal to itself. $a = a$	

Arithmetic Operations

Order of Operations: PEMDAS

1. Parentheses
2. Exponents
3. Multiplication
4. Division
5. Addition
6. Subtraction

$$a\left(\frac{b}{c}\right) = \frac{ab}{c} \qquad \left(\frac{a}{b}\right) = \frac{ad}{bc} \qquad \frac{a}{b} \pm \frac{c}{d} = \frac{ad \pm bc}{bd} \qquad ab + ac = a(b + c)$$
$$\frac{a-b}{c-d} = \frac{b-a}{d-c} \qquad \frac{a \pm b}{c} = \frac{a}{c} \pm \frac{b}{c} \qquad \frac{a}{b+c} \neq \frac{a}{b} + \frac{a}{c} \qquad \frac{ab+ac}{a} = b + c$$



Properties of Exponents

$$a^n \cdot a^m = a^{n+m} \quad \frac{a^n}{a^m} = a^{n-m} \quad (a^n)^m = a^{nm} \quad (ab)^n = a^n b^n$$

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad a^{-n} = \frac{1}{a^n} \quad \frac{1}{a^{-n}} = a^n \quad \left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$$

Properties of Radicals

$$\sqrt[n]{a} = a^{\frac{1}{n}} \quad \sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b} \quad \sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}} \quad \sqrt[n]{a^m} = a^{\frac{m}{n}}$$

$$\sqrt[n]{a^n} = a; \text{ if } n \text{ is odd}$$

$$\sqrt[n]{a^n} = |a|; \text{ if } n \text{ is even}$$

Factoring and Solving Polynomials

Quadratics

$$x^2 \pm 2ax + a^2 = (x \pm a)^2$$

$$x^2 + (a+b)x + ab = (x+a)(x+b)$$

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

Cubes

$$x^3 \pm a^3 = (x \pm a)(x^2 \mp ax + a^2)$$

$$(x \pm a)^3 = x^3 \pm 3x^2a + 3xa^2 \pm a^3$$

Quadratic Formula

$$\text{When } ax^2 + bx + c = 0, x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

If $b^2 - 4ac > 0$, there are two unique real solutions.

If $b^2 - 4ac = 0$, there are two repeated real solutions.

If $b^2 - 4ac < 0$, there are two complex solutions.

Probability

$$\text{Probability} = \frac{\text{favorable outcomes}}{\text{possible outcomes}}$$

$$\text{Odds} = \text{favorable: unfavorable}$$

Miscellaneous

Pythagorean Theorem

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

Common Right Triangles

3-4-5

5-12-13

7-24-25

8-15-17

9-40-41

Exponential Growth and Decay

$$y = ab^x$$

Compound Interest

$$A = P(1+r)^t$$



Linear Functions

Slope-intercept form of a linear equation

$$y = mx + b$$

Point-slope form of a linear equation

$$y - y_1 = m(x - x_1)$$

Standard form of a linear equation

$$Ax + By = C, \text{ where } A > 0$$

Slope of a line

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Midpoint of a line

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Distance formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Standard form of an equation for a circle with center (a, b)

$$(x - a)^2 + (y - b)^2 = r^2$$

Variation

Direct

$$\frac{y}{x} = k \text{ or } y = kx$$

Indirect

$$xy = k \text{ or } y = \frac{k}{x}$$

Data Analysis

Mean (\bar{x}):
$$\bar{x} = \frac{x_1 + x_2 + x_3 + \dots + x_n}{n}$$

Median: The middle number of a dataset written in numerical order. If there is an even number of data points, the median is the mean of the middle two numbers.

Mode: The value(s) that occur(s) most frequently in a dataset.

Range: The difference between the highest and lowest values in a dataset.

First (Lower) Quartile: The middle number in the lower half of the dataset.

Third (Upper) Quartile: The middle number in the upper half of the dataset.

Box and Whisker Plot

