

Algebra Cheat Sheet

Basic Properties & Facts

Arithmetic Operations

$$ab + ac = a(b + c) \quad a\left(\frac{b}{c}\right) = \frac{ab}{c}$$

$$\frac{\left(\frac{a}{b}\right)}{c} = \frac{a}{bc} \quad \frac{a}{\left(\frac{b}{c}\right)} = \frac{ac}{b}$$

$$\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd} \quad \frac{a}{b} - \frac{c}{d} = \frac{ad - bc}{bd}$$

$$\frac{a-b}{c-d} = \frac{b-a}{d-c} \quad \frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}$$

$$\frac{ab+ac}{a} = b+c, \quad a \neq 0 \quad \frac{\left(\frac{a}{b}\right)}{\left(\frac{c}{d}\right)} = \frac{ad}{bc}$$

Exponent Properties

$$a^n a^m = a^{n+m} \quad \frac{a^n}{a^m} = a^{n-m} = \frac{1}{a^{m-n}}$$

$$(a^n)^m = a^{nm} \quad a^0 = 1, \quad a \neq 0$$

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

$$a^{-n} = \frac{1}{a^n} \quad \frac{1}{a^{-n}} = a^n$$

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

Properties of Radicals

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

$$\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a} \quad \sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$$

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

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

Properties of Inequalities

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$$i = \sqrt{-1} \quad i^2 = -1 \quad -a = i a, \quad a \geq 0$$

$$a+bi + c+di = a+c + b+d i$$

$$a+bi - c+di = a-c + b-d i$$

$$a+bi \cdot c+di = ac-bd + ad+bc i$$

$$a+bi \cdot a-bi = a^2 + b^2$$

$$|a+bi| = \sqrt{a^2 + b^2} \quad \text{Complex Modulus}$$

$$\overline{a+bi} = a-bi \quad \text{Complex Conjugate}$$

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

Logarithms and Log Properties

Definition

$y = \log_b x$ is equivalent to $x = b^y$

Example

$\log_5 125 = 3$ because $5^3 = 125$

Special Logarithms

$\ln x = \log_e x$ natural log

$\log x = \log_{10} x$ common log

where $e = 2.718281828$

Logarithm Properties

$\log_b a + \log_b c = \log_b (ac)$

$\log_b \frac{a}{c} = \log_b a - \log_b c$

$\log_b (a^x) = x \log_b a$

$\log_b a = \frac{\log a}{\log b}$

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For a complete set of

