Arithmetic Operations

Examples

$ab + ac = a(b + c)$

$a \cdot \frac{b}{c} = \frac{ab}{c}$

$\frac{a/b}{c} = \frac{a}{bc}$

$\frac{a}{b/c} = \frac{ac}{b}$

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

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

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

$\frac{a + b}{c} = \frac{a}{c} + \frac{b}{c}$

$\frac{ab + ac}{a} = b + c, a \neq 0$

$\frac{a/b}{c/d} = \frac{ad}{bc}$

Exponent Properties

$a^n a^m = a^{n+m}$

$(a^n)^m = a^{nm}$

$(ab)^n = a^n b^n$

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

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

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

$a^0 = 1, a \neq 0$

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

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

$a^{\frac{n}{m}} = (a^{\frac{1}{m}})^n = (a^n)^{\frac{1}{m}}$

Radical Properties

$a, b \geq 0$ for even n

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

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

$\sqrt[n]{ab} = \sqrt[n]{a}\sqrt[n]{b}$

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

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

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

Absolute Value

$|a| = \begin{cases} a, \text{if } a \geq 0 \\ -a, \text{if } a < 0 \end{cases}$

$|a| = |-a|$

$|a| \geq 0$

$|ab| = |a||b|$

$\left|\frac{a}{b}\right| = \frac{|a|}{|b|}$

$|a + b| \leq |a| + |b|$

Logarithm Properties

if $y = \log_b x$ then $b^y = x$

$\log_b b = 1$ and $\log_b 1 = 0$

$\log_b b^x = x$

$b^{\log_b x} = x$

$\log_a x = \frac{\log_b x}{\log_b a}$

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

$\log_b(xy) = \log_b x + \log_b y$

$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$

Common Factoring Examples

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

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

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

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

Arithmetic Properties

Associative: $a(bc) = (ab)c$

Commutative: $a + b = b + a$ and $ab = ba$

Distributive: $a(b + c) = ab + ac$

Quadratic Equation

For the equation $ax^2 + bx + c = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Properties of Inequalities

If $a < b$ then $a + c < b + c$ and $a - c < b - c$

If $a < b$ and $c > 0$ then $ac < bc$ and $a/c < b/c$

If $a < b$ and $c < 0$ then $ac > bc$ and $a/c > b/c$

Properties of Complex Numbers

$i = \sqrt{-1}$

$i^2 = -1$

$\sqrt{-a} = i\sqrt{a}, a \geq 0$

$(a + bi) + (c + di) = a + c + (b + c)i$

$(a + bi) - (c + di) = a - c + (b - c)i$

$(a + bi)(c + di) = ac - bd + (ad + bc)i$

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

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