Algebra 1 Cheat Sheet

Polynomial

An expression of the form:

$$a_x x^n + a_{n-1}x^{n-1} + \cdots + a^2x^2 + a_1x + a_0$$

Where $a_i \in \mathbb{R}$; $i = 0, 1, 2, \ldots, n$; $n \in \mathbb{N}$.

Types Of Polynomials

Linear *(degree 1)*	$ax + b$
Quadratic *(degree 2)*	$ax^2 + bx + c$
Cubic *(degree 3)*	$ax^3 + bx^2 + cx + d$

Factoring

Difference Of Two Squares	$a^2 - b^2 = (a + b)(a - b)$
Difference Of Two Cubes	$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$
Sum Of Two Cubes	$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

Polynomial Long Division

$(x^3 + x^2 - 2x) \div (x - 1)$

Solution:

$$\begin{array}{r|l} & x^2 + 2x \\ \hline x - 1 & x^3 + x^2 - 2x \\ & \underline{-x^3 + x^2} \\ & 2x^2 - 2x \\ & \underline{-2x^2 + 2x} \\ & 0 \end{array}$$

Algebraic Fractions

$$a(\frac{b}{c}) = \frac{ab}{c} \qquad \frac{(\frac{a}{b})}{c} = \frac{a}{bc}$$

$$\frac{a}{(\frac{b}{c})} = \frac{ac}{b} \qquad \frac{(\frac{a}{b})}{(\frac{c}{d})} = \frac{ad}{bc}$$

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

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

Binomial Coefficient

The binomial coefficient represents the number of ways you can choose r objects from a group of n objects.

$$\binom{n}{r} = \frac{n!}{r!(n-r)!} \qquad \binom{n}{r} = \binom{n}{n-r}$$

$$\binom{n}{r} = \frac{n(n-1)(n-2)\ldots(n-(k-1))}{k(k-1)(k-2)\ldots 1}$$

Binomial Theorem

For any positive integer n,

$$\begin{aligned}(a+b)^n &= \sum_{m=0}^{n} \binom{n}{m} a^{n-m}b^n \\ &= \binom{n}{0}a^n + \binom{n}{1}a^{n-1}b^1 + \cdots + \binom{n}{n}b^n\end{aligned}$$

Algebraic Identities

In an **identity**, all coefficients of like powers are equal.

An identity must be true for *all values* of the independent variables

Example: $3x + 7 = ax + b$ implies $a = 3$ and $b = 7$.