

Grade 9 Math Formulas

Polynomials Formulas

Based on Maharashtra Board Syllabus (NEP 2025-26)

Note:

This document contains key concepts and formulas related to Polynomials for Grade 9.

Basic Concepts

- **Polynomial:** An algebraic expression consisting of variables and coefficients, that involves only the operations of addition, subtraction, multiplication, and non-negative integer exponents of variables.
- **Term:** Each part of a polynomial separated by addition or subtraction. Example: In $3x^2 + 2x - 5$, the terms are $3x^2$, $2x$, and -5 .
- **Coefficient:** The numerical factor of a term. Example: In $3x^2$, the coefficient is 3.
- **Degree of a Term:** The sum of the exponents of the variables in a term. Example: Degree of $3x^2y^3$ is $2 + 3 = 5$.
- **Degree of a Polynomial:** The highest degree among all the terms in the polynomial. Example: Degree of $4x^3 + 2x^2 - 7x + 1$ is 3.
- **Constant Polynomial:** A polynomial with degree 0 (a non-zero constant). Example: 5.
- **Zero Polynomial:** The polynomial 0. Its degree is undefined.

Types of Polynomials

- Based on number of terms:
 - Monomial: 1 term (e.g., $5x$)
 - Binomial: 2 terms (e.g., $2x + 3$)
 - Trinomial: 3 terms (e.g., $x^2 - 5x + 6$)
- Based on degree:
 - Linear Polynomial: Degree 1 (e.g., $3x + 5$)
 - Quadratic Polynomial: Degree 2 (e.g., $2x^2 - x + 1$)
 - Cubic Polynomial: Degree 3 (e.g., $x^3 - 4x^2 + 2x - 9$)

Operations on Polynomials

- Addition and Subtraction: Combine like terms (terms with the same variable and same exponent) by adding or subtracting their coefficients.
- Multiplication: Multiply each term of one polynomial by each term of the other polynomial and then combine like terms. Use the distributive property.

Algebraic Identities

- $(a + b)^2 = a^2 + 2ab + b^2$
- $(a - b)^2 = a^2 - 2ab + b^2$
- $(a + b)(a - b) = a^2 - b^2$
- $(x + a)(x + b) = x^2 + (a + b)x + ab$
- $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
- $(a + b)^3 = a^3 + b^3 + 3ab(a + b) = a^3 + 3a^2b + 3ab^2 + b^3$
- $(a - b)^3 = a^3 - b^3 - 3ab(a - b) = a^3 - 3a^2b + 3ab^2 - b^3$
- $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
- $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

- $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$
- If $a + b + c = 0$, then $a^3 + b^3 + c^3 = 3abc$

Factor Theorem and Remainder Theorem

- Remainder Theorem: If a polynomial $P(x)$ is divided by $(x - a)$, then the remainder is $P(a)$.
- Factor Theorem: $(x - a)$ is a factor of the polynomial $P(x)$ if and only if $P(a) = 0$.

Factorisation of Polynomials

- Taking out common factors.
- Grouping terms.
- Using algebraic identities.
- Splitting the middle term (for quadratic trinomials).
- Using the Factor Theorem.

End of Formulas - Polynomials Formulas

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