Grade 9 Math Formulas

Number Systems Formulas

Based on Maharashtra Board Syllabus (NEP 2025-26)

Note:

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

Classification of Numbers

- Natural Numbers (N): {1, 2, 3, ...}
- Whole Numbers (W): {0, 1, 2, 3, ...}
- Integers (Z): {..., -2, -1, 0, 1, 2, ...}
- Rational Numbers (Q): Numbers that can be expressed in the form p/q, where p and q are integers and q is not equal to 0. Includes terminating and non-terminating repeating decimals.
- Irrational Numbers: Numbers that cannot be expressed in the form p/q. Non-terminating, non-repeating decimals (e.g., $\sqrt{2}$, π).
- Real Numbers (R): The collection of all rational and irrational numbers.

Operations on Real Numbers

- Addition, Subtraction, Multiplication, and Division of rational numbers follow standard arithmetic rules.

- Properties of Real Numbers (Addition and Multiplication):
    - Closure: The sum/product of two real numbers is a real number.
    - Commutativity: a + b = b + a, a * b = b * a
    - Associativity: (a + b) + c = a + (b + c), (a * b) * c = a * (b * c)
    - Distributivity: a * (b + c) = a * b + a * c
    - Identity Element: 0 for addition (a + 0 = a), 1 for multiplication (a * 1 = a)
    - Inverse Element: For every real number 'a', there is an additive inverse '-a' (a + (-a) = 0). For every non-zero real number 'a', there is a multiplicative inverse '1/a' (a * (1/a) = 1).
- Operations involving irrational numbers:
    - Sum/Difference of a rational and an irrational number is irrational.
    - Product/Quotient of a non-zero rational and an irrational number is irrational.
    - Sum, difference, product, or quotient of two irrational numbers can be either rational or irrational.

Laws of Exponents for Real Numbers

- If a > 0 is a real number and p and q are rational numbers:
    - a^p multiplied by a^q = a^(p+q)
    - a^p divided by a^q = a^(p-q)
    - (a^p)^q = a^(p multiplied by q)
    - a^p multiplied by b^p = (a multiplied by b)^p
    - a^0 = 1
    - a^(-p) = 1 / a^p
    - a^(p/q) = (a^p)^(1/q) = (a^(1/q))^p = $\sqrt[q]{a^p}$

Rationalizing the Denominator

- To rationalize a denominator of the form $1/\sqrt{a}$, multiply the numerator and denominator by $\sqrt{a}$. Example: $1/\sqrt{2} = (1 * \sqrt{2}) / (\sqrt{2} * \sqrt{2}) = \sqrt{2} / 2$.
- To rationalize a denominator of the form $1/(a + \sqrt{b})$, multiply the numerator and denominator by the conjugate $(a - \sqrt{b})$. Example: $1/(3 + \sqrt{2}) = (1 * (3 - \sqrt{2})) / ((3 + \sqrt{2}) * (3 - \sqrt{2})) = (3 - \sqrt{2}) / (3^2 - (\sqrt{2})^2) = (3 - \sqrt{2}) / (9 - 2) = (3 - \sqrt{2}) / 7$.
- To rationalize a denominator of the form $1/(\sqrt{a} + \sqrt{b})$, multiply the numerator and denominator by the conjugate $(\sqrt{a} - \sqrt{b})$. Example: $1/(\sqrt{3} + \sqrt{2}) = (1 * (\sqrt{3} - \sqrt{2})) / ((\sqrt{3} + \sqrt{2}) * (\sqrt{3} - \sqrt{2})) = (\sqrt{3} - \sqrt{2}) / ((\sqrt{3})^2 - (\sqrt{2})^2) = (\sqrt{3} - \sqrt{2}) / (3 - 2) = \sqrt{3} - \sqrt{2}$.

End of Formulas - Number Systems Formulas