Grade 10 Math Formulas

Complete Formula Sheet

Based on Maharashtra Board Syllabus (NEP 2025-26)

Note:

This document contains a collection of key mathematical formulas and concepts typically covered in Grade 10.

Real Numbers Formulas

Euclid's Division Lemma

- Given positive integers 'a' and 'b', there exist unique integers 'q' and 'r' satisfying a = bq + r, where 0 <= r < b.
- This lemma is the basis for Euclid's Division Algorithm, which is used to find the Highest Common Factor (HCF) of two positive integers.

Fundamental Theorem of Arithmetic

- Every composite number can be expressed (factorised) as a product of primes, and this factorisation is unique, apart from the order in which the prime factors occur.
- Example: 12 = 2 multiplied by 2 multiplied by 3 = 2 squared multiplied by 3.

Relationship between HCF and LCM

- For any two positive integers 'a' and 'b':
  HCF(a, b) multiplied by LCM(a, b) = a multiplied by b
- This relationship is only true for two numbers.

Revisiting Rational and Irrational Numbers

- Rational Numbers: Terminating or non-terminating repeating decimals.
- Irrational Numbers: Non-terminating, non-repeating decimals.
- Theorem: If p is a prime number, then square root of p is irrational. Example: square root of 2, square root of 3, square root of 5 are irrational.
- Theorem: Let x be a rational number whose decimal expansion terminates. Then x can be expressed in the form p/q, where p and q are coprime, and the prime factorization of q is of the form 2 to the power of n multiplied by 5 to the power of m, where n and m are non-negative integers.
- Theorem: Let x = p/q be a rational number, such that the prime factorization of q is not of the form 2 to the power of n multiplied by 5 to the power of m, where n and m are non-negative integers. Then x has a non-terminating repeating decimal expansion.

Quadratic Equations Formulas

Standard Form of a Quadratic Equation

- A quadratic equation in the variable x is an equation of the form:
  ax squared + bx + c = 0
  where a, b, and c are real numbers, and a is not equal to 0.

- 'a' is the coefficient of x squared, 'b' is the coefficient of x, and 'c' is the constant term.

Methods of Solving Quadratic Equations

- **Factorization Method:**
  - Factorize the quadratic polynomial ax squared + bx + c into a product of two linear factors.
  - Set each factor equal to zero and solve for x.
  - Example: x squared - 5x + 6 = 0 -> (x - 2)(x - 3) = 0 -> x - 2 = 0 or x - 3 = 0 -> x = 2 or x = 3.
- **Completing the Square Method:**
  - Transform the equation ax squared + bx + c = 0 into the form (x + p) squared = q.
  - Take the square root of both sides and solve for x.
- **Quadratic Formula:**
  - The roots of the quadratic equation ax squared + bx + c = 0 are given by the formula:
    x = [-b plus or minus square root of (b squared - 4ac)] divided by 2a

Discriminant and Nature of Roots

- The discriminant of a quadratic equation ax squared + bx + c = 0 is given by:
  Discriminant (Δ) = b squared - 4ac
- The discriminant determines the nature of the roots:
  - If $\Delta > 0$: The equation has two distinct real roots.
  - If $\Delta = 0$: The equation has two equal real roots.
  - If $\Delta < 0$: The equation has no real roots (The roots are complex and distinct).

Relationship between Roots and Coefficients

- If alpha and beta are the roots of the quadratic equation ax squared + bx + c = 0, then:
  Sum of roots: alpha + beta = -b divided by a
  Product of roots: alpha multiplied by beta = c divided by a
- A quadratic equation whose roots are alpha and beta can be written as:
  x squared - (Sum of roots)x + (Product of roots) = 0
  x squared - (alpha + beta)x + (alpha multiplied by beta) = 0

Trigonometry Formulas

Trigonometric Ratios (for a right-angled triangle)

Let theta be an acute angle in a right-angled triangle.

- Sine of angle theta (sin theta) = Opposite side / Hypotenuse
- Cosine of angle theta (cos theta) = Adjacent side / Hypotenuse
- Tangent of angle theta (tan theta) = Opposite side / Adjacent side
- Cosecant of angle theta (cosec theta) = Hypotenuse / Opposite side = 1 / sin theta
- Secant of angle theta (sec theta) = Hypotenuse / Adjacent side = 1 / cos theta
- Cotangent of angle theta (cot theta) = Adjacent side / Opposite side = 1 / tan theta
- Also, tan theta = sin theta / cos theta, and cot theta = cos theta / sin theta.

Trigonometric Ratios of Some Specific Angles

- sin 0° = 0
- cos 0° = 1
- tan 0° = 0
- sin 30° = 1/2
- cos 30° = square root of 3 / 2
- tan 30° = 1 / square root of 3
- sin 45° = 1 / square root of 2
- cos 45° = 1 / square root of 2
- tan 45° = 1
- sin 60° = square root of 3 / 2
- cos 60° = 1/2
- tan 60° = square root of 3
- sin 90° = 1
- cos 90° = 0
- tan 90° = Undefined

Trigonometric Ratios of Complementary Angles

- sin (90° - theta) = cos theta
- cos (90° - theta) = sin theta
- tan (90° - theta) = cot theta
- cot (90° - theta) = tan theta
- sec (90° - theta) = cosec theta
- cosec (90° - theta) = sec theta

Trigonometric Identities

- sin squared theta + cos squared theta = 1
- 1 + tan squared theta = sec squared theta (for 0° <= theta < 90°)
- 1 + cot squared theta = cosec squared theta (for 0° < theta <= 90°)

End of Complete Formula Sheet - Grade 10