Important Algebra Formulas(List of Algebraic Identities)

- $(a+b)^2 = a^2 + b^2 + 2ab$
- $(a-b)^2 = a^2 + b^2 - 2ab$
- $(a+b)^2 = (a-b)^2 + 4ab$
- $(a-b)^2 = (a+b)^2 - 4ab$
- $a^2 + b^2 = \frac{1}{2}[(a+b)^2 + (a-b)^2]$
- $a^2 - b^2 = (a-b)(a+b)$
- $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$
- $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$
- $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
- $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$
- $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
- $(a-b-c)^2 = a^2 + b^2 + c^2 - 2ab - 2bc - 2ca$
- $(a+b+c)^3 = a^3 + b^3 + c^3 + 3(a+b)(b+c)(c+a)$
- $a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ca)$
- If $a+b+c=0$ then $a^3 + b^3 + c^3 = 3abc$
- $a^4 + b^4 + a^2b^2 = (a^2 + b^2 + ab)(a^2 + b^2 - ab)$
- $a^4 - b^4 = (a-b)(a+b)(a^2 + b^2)$
- $a^8 - b^8 = (a-b)(a+b)(a^2 + b^2)(a^4 + b^4)$
- If "n" is a natural number then

  $a^n - b^n = (a-b)(a^{(n-1)} + a^{(n-2)}b + ... + b^{(n-2)}a + b^{n-1})$
- If "n" is a even number then

  $a^n + b^n = (a+b)(a^{(n-1)} - a^{(n-2)}b + ... + b^{(n-2)}a - b^{(n-1))})$
- If "n" is an odd number then

  $a^n + b^n = (a-b)(a^{(n-1)} - a^{(n-2)}b + ... - b^{(n-2)}a + b^{(n-1)})$
- $a^3 + b^3 + c^3 - 3abc = \frac{1}{2}(a+b+c)[(a-b)^2 + (b-c)^2 + (c-a)^2]$

- If $a^3 + b^3 + c^3 = ab + bc + ca$ then $a = b = c$
- $If \sqrt{x + \sqrt{x + \sqrt{x + \sqrt{x + ...\infty}}}}\ where\ x = n(n+1)$ then
  $If \sqrt{x + \sqrt{x + \sqrt{x + \sqrt{x + ...\infty}}}} = n + 1$
- $If \sqrt{x - \sqrt{x - \sqrt{x - \sqrt{x - ....\infty}}}}\ where\ x = n(n+1)$ then
  $If \sqrt{x - \sqrt{x - \sqrt{x - \sqrt{x - ....\infty}}}} = n$

Remainder Theorem:

Let $p(x) = a_0 + a_1x + a_2x^2 + ... + a_nx^n$ be a polynomial of degree $n \geq 1$, and let a be any real number. When is $p(x)$ divided by $(x - a)$, then the remainder is $p(a)$.

Factor theorem :

Let $p(x)$ be a polynomial of degree greater than or equal to 1 and a be a real number such that $p(a)$= 0 , then $(x - a)$ is a factor of $p(x)$.

Conversely, if $(x - a)$ is a factor of $p(x)$, then $p(a)$= 0 .