Basics

Factorial → $5! = 5\times4\times3\times2\times1 = 120$

$n! = n(n-1)(n-2)\cdots3.2.1$

$= n\left[(n-1)(n-2)\cdots3.2.1\right] = n(n-1)!$

$n! = n(n-1)!$

$1! = 1,\ 2! = 2,\ 3! = 6,\ 4! = 24,\ 5! = 120,\ 6! = 720\ \ 7! = 5040\ .\ 8! = 40320$

Indian system

1 00,00,00,000

arab crore lakh thou

International

1,000,000,000,000

tr b m t h

1 trillion = 10^{12} = 1000000000000
1 billion = 10^9 = 1000000000
1 million = 10^6 = 1000000
1 crore = 10^7 = 100 lakh
10 lakh = 10^6 = 1 million
1 lakh = 10^5 = 100000 = 100 thousand
1 thousand = 10^3 = 1000

Modulus

$$|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$

$|6| = 6$, $|-2| = -(-2) = 2$

Exponents

(1) $a^m \cdot a^n = a^{m+n}$

(2) $a^m / a^n = a^{m-n}$, $a \neq 0$, $m > n$

or $1/a^{n-m}$, if $n > m$

(3) $(a^m)^n = a^{mn}$

(4) $a^n \cdot b^n = (ab)^n$

(5) $a^{-n} = 1/a^n$, $a \neq 0$

(*) (6) $a^0 = 1$ (Hw ← prove)

(i) $(a+b)^2 = a^2 + 2ab + b^2$
(ii) $(a-b)^2 = a^2 - 2ab + b^2$
(iii) $a^2 - b^2 = (a+b)(a-b)$
(iv) $(x+a)(x+b) = x^2 + (a+b)x + ab$
(v) $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

Pascal's triangle

$(a+b)^3 = (a+b)^2 \cdot (a+b)$

$= a^3 + b^3 + 3ab(a+b)$

$= a^3 + 3a^2b + 3ab^2 + b^3$

$(a-b)^3 = a^3 - b^3 - 3ab(a-b) = a^3 - 3a^2b + 3ab^2 - b^3$

$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$ | $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

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

(*) Squares → 1 to 20, Cubes → 1 to 10

Questions

1. $287 \times 287 + 269 \times 269 - 2 \times 287 \times 269 = ?$

(a) 534 (b) 446

(c) 354 (d) 324

2. If $(64)^2 - (36)^2 = 20 \times x$, then $x = ?$

(a) 70 (b) 120

(c) 180 (d) 140

3. If $\sqrt{3} = 1.732$ and $\sqrt{2} = 1.414$, the value of $\frac{1}{\sqrt{3}+\sqrt{2}}$ is

(a) 0.064 (b) 0.308

(c) 0.318 (d) 2.146