SREE VISHNU ACADEMY.
[A Franchise of IIPC]

IMPORTANT BASIC FORMULAE   Class: X CBSE.

Algebra:

1. $(a+b)^2 = a^2 + 2ab + b^2$.
2. $(a-b)^2 = a^2 - 2ab + b^2$
3. $a^2 - b^2 = (a+b)(a-b)$
4. $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$.
5. $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$ [or] $a^3 + 3a^2b + 3ab^2 + b^3$
6. $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$ [or] $a^3 - 3a^2b + 3ab^2 - b^3$.
7. $[a^3+b^3] = (a+b)(a^2 - ab + b^2)$
8. $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$
9. $(x+a)(x+b) = x^2 + (a+b)x + ab$.
10. $(x-a)(x-b) = x^2 - (a+b)x + ab$.
11. $(x+a)(x+b)(x+c) = x^3 + (a+b+c)x^2 + (ab+bc+ca)x + abc$.
12. $a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ca)$

Indices:

13. $a^m \cdot a^n = a^{m+n}$ (Product Rule)
14. $a^m \div a^n = a^{m-n}$ (Quotient Rule)
15. $(a^m)^n = a^{mn}$ (Power Rule)
16. $a^0 = 1$
17. $\frac{1}{a^m} = a^{-m}$ (Inverse Rule)

Logerthmics:

18. $\log_{10} ab = \log_{10} a + \log_{10} b$ (Product Rule)
19. $\log_{10} a/b = \log_{10} a - \log_{10} b$ (Quotient Rule)
20. $\log_{10} a^b = b \log_{10} a$ (Power Rule)
21. $\log_a a = \log_b b = 1$.
22. $\log_b a = \frac{1}{\log_a b}$ [basechange Rule]

(23) $\log_b a = \dfrac{\log_{10} a}{\log_{10} b}$ [base change Rule]

(24) If $\log_b a = x$, then $b^x = a$ [expontial Rule]

Polynomial

If α and β are the zeros of the polynomial $f(x) = ax^2 + bx + c$.

(25) $\alpha + \beta = -b/a$.

(26) $\alpha\beta = c/a$.

(27) The new quadratic polynomial can be formed by
$$f(x) = \pm k\left[x^2 - (\alpha+\beta)x + \alpha\beta\right]$$

If α, β and γ are the zeros of the polynomial $f(x) = ax^3 + bx^2 + cx + d$.

(28) $\alpha + \beta + \gamma = -b/a$.

(29) $\alpha\beta + \beta\gamma + \gamma\alpha = c/a$

(30) $\alpha\beta\gamma = -d/a$.

(31) The new cubic polynomial can be formed by.
$$f(x) = \pm k\left[x^3 - (\alpha+\beta+\gamma)x^2 + (\alpha\beta+\beta\gamma+\gamma\alpha)x - \alpha\beta\gamma\right]$$

If α, β, γ and δ are the zeros of the polynomial $f(x) = ax^4 + bx^3 + cx^2 + dx + e$.

(32) $\alpha + \beta + \gamma + \delta = -b/a$.

(33) $\alpha\beta + \beta\gamma + \gamma\delta + \delta\alpha = c/a$

(34) $\alpha\beta\gamma + \beta\gamma\delta + \gamma\delta\alpha + \delta\alpha\beta = -d/a$.

(35) $\alpha\beta\gamma\delta = e/a$.

(37) If $ax^2 + bx + c = 0$, then the zeros of the polynomial $f(x) = ax^2 + bx + c$ are given by $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

(38) Factor theorem:- If $f(x)$ is divided by $(x-a)$ then the remainder is 0.

(39) Remainder theorem: If $f(x)$ is divided by $(x-a)$ then the remainder is $f(a)$.

(40) Division Algorithm: (Quotient x Divisor) + Remainder = Divident.

Linear Equation:

If $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are the equations of the two given lines

41. If $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, then the system is consistant with a unique solution.

42. If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ then the system-inconsistant and has no solution. The lines are $\parallel$el.

43. If $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ the the system is consistant and has infinitely many Solutions.

Quadratic Equation:

44. If $ax^2 + bx + c = 0$ then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

45. Descriminant $(\Delta) = b^2 - 4ac$.

46. If $\Delta > 0$ and perfect then the roots are real, unequal, distinct and rational.

47. If $\Delta > 0$ and imperfect then the roots are real, unequal, distinct and irrational.

48. If $\Delta = 0$ then the roots are real, equal, distinct and rational.

49. If $\Delta < 0$ then the roots are imaginary.

Number System:

50. $1 + 2 + 3 + \cdots + n = \sum n = \frac{n(n+1)}{2}$

51. $1^2 + 2^2 + 3^2 + \cdots + n^2 = \sum n^2 = \frac{n(n+1)(2n+1)}{6}$.

52. $1^3 + 2^3 + 3^3 + \cdots + n^3 = \sum n^3 = \left[\frac{n(n+1)}{2}\right]^2$.

53. $1 + 3 + 5 + \cdots$ to n terms $= n^2$.

Arithimatic Progression:

54. General Expression of an AP. $= a, a+d, a+2d, a+3d, \cdots a+(n-1)d$. where a = first term, d = Common difference. & n = number of terms.

55. Common difference $(d) = t_2 - t_1$

(56) Condition for an AP.

$$t_2 - t_1 = t_3 - t_2 = t_4 - t_3 = \text{-----}$$

(57) nth term of an AP $(t_n) = a + (n-1)d$.

(58) The number of terms of an AP when the last term (l) is given.

$$n = \frac{l-a}{d} + 1$$

	No of terms	Selecting terms	Common difference
(59)	3	$a-d, a, a+d$	d.
(60)	4	$a-3d, a-d, a+d, a+3d$	$2d$.
(61)	5	$a-2d, a-d, a, a+d$ & $a+2d$.	d
(62)	6	$a-5d, a-3d, a-d$ $a+d, a+3d, a+5d$.	$2d$.

(63) nth term of an AP from the end $= (m-n+1)^{th}$ term from the beginning.
$= a + (m-n)d$.

(64) nth term from the end when the last term 'l' is given $= l - (n-1)d$.

(65) Sum to 'n' terms of an AP $(S_n) = \frac{n}{2}[2a + (n-1)d]$

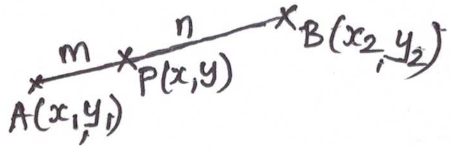
(66) Sum to 'n' terms of an AP when the last term 'l' is given $(S_n) = \frac{n}{2}[a + l]$

Co-ordinate Geomentry:

(67) Distance formula: Distance between the points $A(x_1, y_1)$ and $B(x_2, y_2)$ is given by $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

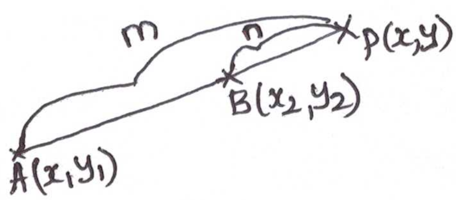
(68) Internal Ratio formula:

If the line joining the points $A(x_1, y_1)$ & $B(x_2, y_2)$ is divided by the point $P(x, y)$ internally in the ratio $m:n$, then $P(x, y) = \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$



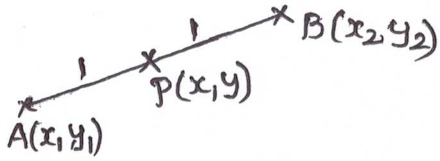
(69) External Ratio formula:

If the line joining the points $A(x_1, y_1)$ & $B(x_2, y_2)$ is divided by the point $P(x, y)$ externally in the ratio $m:n$ then $P(x, y) = \left(\frac{mx_2 - nx_1}{m-n}, \frac{my_2 - ny_1}{m-n}\right)$



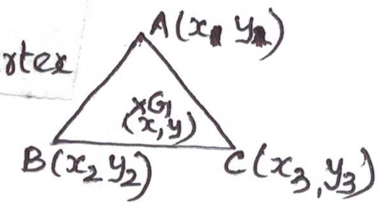
(70) <u>Mid point Formula</u>

If the line joining the points $A(x_1, y_1)$ & $B(x_2, y_2)$ is divided by the point $P(x, y)$ internally in the ratio 1 : 1 then $P(x, y) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$



(71) <u>Centroid Formula:</u>

The centroid $G(x, y)$ of ΔABC whose vertex co-ordinates are $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ is given by



$$G(x, y) = \left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right).$$

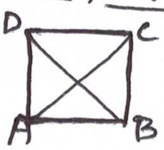
(72) <u>Area formula</u>

The area of Δ^{le} whose vertices are (x_1, y_1); (x_2, y_2) and (x_3, y_3) is given by

$$\text{Area} = \Delta = \tfrac{1}{2}\Sigma x_1(y_2 - y_3) = \tfrac{1}{2}\left[x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)\right]$$

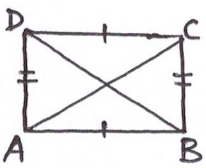
<u>Conditions to prove the following objects:</u>

(73) Square:



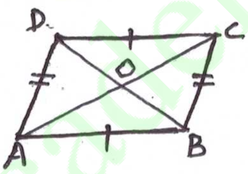
(i) $AB = BC = CD = DA$.
(ii) $AC = BD$.

(74) Rectangle:



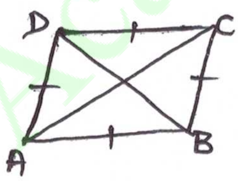
(i) $AB = CD$ (ii) $BC = AD$.
(iii) $AC = BC$.

(75) <u>Parallelogram</u>:



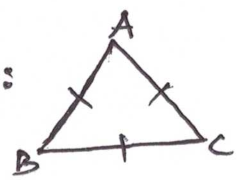
(i) $AB = CD$ (ii) $AD = BC$.
(iii) $AC \neq BD$. [or] Mid point of AC = Mid point of BD.

(76) <u>Rhombus</u>:



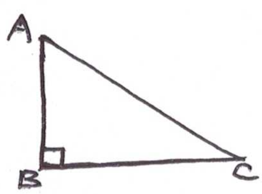
(i) $AB = BC = CD = DA$
(ii) $AC \neq BD$.

(77) <u>Equilateral Δ^{le}</u>:



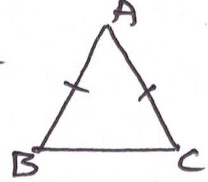
$AB = BC = CA$.

(78) <u>Right angled Δ^{le}</u>:



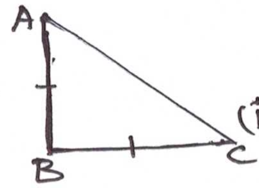
$AC^2 = AB^2 + BC^2$.

(79) Isosceles Δ^{le}



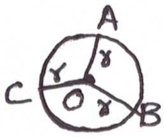
$AB = AC$

(80) Right angled isosceles Δ^{le}.



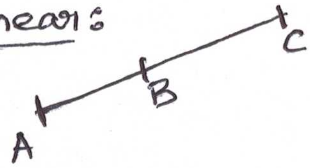
(i) $AB = BC$, (ii) $AC^2 = AB^2 + BC^2$.

(81) Circle:



$OA = OB = OC =$ radius of $\odot^{le}$.

(82) Collinear:

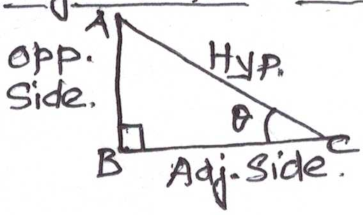


$AB + BC = AC$. (or) Area of $\Delta^{le}\, ABC = 0$.

Trigonometry:

(83) Conversion: $180^\circ = \pi$ radian.

Trigonometric ratios.



(84) $\sin\theta = \dfrac{\text{opp. Side}}{\text{Hyp.}} = \dfrac{AB}{AC} = \dfrac{1}{\operatorname{cosec}\theta}$.

(85) $\cos\theta = \dfrac{\text{Adj. Side}}{\text{Hyp.}} = \dfrac{BC}{AC} = \dfrac{1}{\sec\theta}$.

(86) $\tan\theta = \dfrac{\text{opp. Side}}{\text{Adj. Side}} = \dfrac{AB}{BC} = \dfrac{1}{\cot\theta} = \dfrac{\sin\theta}{\cos\theta}$.

(87) $\cot\theta = \dfrac{\text{Adj. Side}}{\text{opp. Side}} = \dfrac{BC}{AB} = \dfrac{1}{\tan\theta} = \dfrac{\cos\theta}{\sin\theta}$

(88) $\sec\theta = \dfrac{\text{HYP.}}{\text{Adj. Side}} = \dfrac{AC}{BC} = \dfrac{1}{\cos\theta}$

(89) $\operatorname{cosec}\theta = \dfrac{\text{HYP}}{\text{opp. Side}} = \dfrac{AC}{AB} = \dfrac{1}{\sin\theta}$

Identities:

(90) $\sin^2\theta + \cos^2\theta = 1$

91. $\sin^2\theta = 1-\cos^2\theta$.

92. $\cos^2\theta = 1-\sin^2\theta$.

93. $\sec^2\theta - \tan^2\theta = 1$.

94. $\sec^2\theta = 1+\tan^2\theta$

95. $\tan^2\theta = \sec^2\theta - 1$.

96. $\operatorname{cosec}^2\theta - \cot^2\theta = 1$.

97. $\operatorname{cosec}^2\theta = 1+\cot^2\theta$.

98. $\cot^2\theta = \operatorname{cosec}^2\theta - 1$.

99. Std. Angle Values:

θ	0°	30°	45°	60°	90°
sin	0	$1/2$	$1/\sqrt{2}$	$\sqrt{3}/2$	1
cos	1	$\sqrt{3}/2$	$1/\sqrt{2}$	$1/2$	0
tan	0	$1/\sqrt{3}$	1	$\sqrt{3}$	∞
cot	∞	$\sqrt{3}$	1	$1/\sqrt{3}$	0
sec	1	$2/\sqrt{3}$	$\sqrt{2}$	2	∞
cosec	∞	2	$\sqrt{2}$	$2/\sqrt{3}$	1

Phase Angle Rule

100.
$\sin(90-\theta) = \cos\theta$
$\cos(90-\theta) = \sin\theta$
$\tan(90-\theta) = \cot\theta$
$\cot(90-\theta) = \tan\theta$
$\sec(90-\theta) = \operatorname{cosec}\theta$
$\operatorname{cosec}(90-\theta) = \sec\theta$

101.
$\sin(90+\theta) = +\cos\theta$
$\cos(90+\theta) = -\sin\theta$
$\tan(90+\theta) = -\cot\theta$
$\cot(90+\theta) = -\tan\theta$
$\sec(90+\theta) = -\operatorname{cosec}\theta$
$\operatorname{cosec}(90+\theta) = +\sec\theta$

(102) $\sin(180-\theta) = +\sin\theta$
$\cos(180-\theta) = -\cos\theta$
$\tan(180-\theta) = -\tan\theta$
$\cot(180-\theta) = -\cot\theta$
$\sec(180-\theta) = -\sec\theta$
$\operatorname{cosec}(180-\theta) = +\operatorname{cosec}\theta$

(103) $\sin(180+\theta) = -\sin\theta$
$\cos(180+\theta) = -\cos\theta$
$\tan(180+\theta) = +\tan\theta$
$\cot(180+\theta) = +\cot\theta$
$\sec(180+\theta) = -\sec\theta$
$\operatorname{cosec}(180+\theta) = -\operatorname{cosec}\theta$

(104) $\sin(270-\theta) = -\cos\theta$
$\cos(270-\theta) = -\sin\theta$
$\tan(270-\theta) = +\cot\theta$
$\cot(270-\theta) = +\tan\theta$
$\sec(270-\theta) = -\operatorname{cosec}\theta$
$\operatorname{cosec}(270-\theta) = -\sec\theta$.

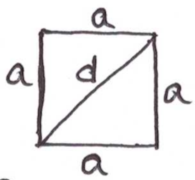
(105) $\sin(270+\theta) = -\cos\theta$
$\cos(270+\theta) = +\sin\theta$
$\tan(270+\theta) = -\cot\theta$
$\cot(270+\theta) = -\tan\theta$
$\sec(270+\theta) = +\operatorname{cosec}\theta$
$\operatorname{cosec}(270+\theta) = -\sec\theta$

(106) $\sin(360-\theta) = -\sin\theta$
$\cos(360-\theta) = +\cos\theta$
$\tan(360-\theta) = -\tan\theta$
$\cot(360-\theta) = -\cot\theta$
$\sec(360-\theta) = +\sec\theta$
$\operatorname{cosec}(360-\theta) = -\operatorname{cosec}\theta$

(107) $\sin(360+\theta) = \sin\theta$
$\cos(360+\theta) = \cos\theta$
$\tan(360+\theta) = \tan\theta$
$\cot(360+\theta) = \cot\theta$
$\sec(360+\theta) = \sec\theta$
$\operatorname{cosec}(360+\theta) = \operatorname{cosec}\theta$.

Area Related to 2-D objects

Square:

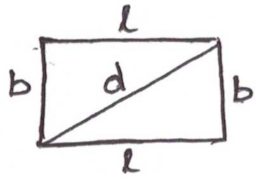


(108) Area $= a^2$

(109) Perimeter $= 4a$.

(110) diagonal $= a\sqrt{2}$.

Rectangle

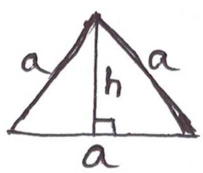


(111) Area $= lb$.

(112) Perimeter $= 2(l+b)$

(113) diagonal $= \sqrt{l^2+b^2}$.

Equilateral Δ^{le}.



(114) Area $= \frac{\sqrt{3}}{4}a^2$

(115) Perimeter $= 3a$.

(116) height $= \frac{\sqrt{3}}{2}a$.

(117) Area of $\Delta^{le} = \frac{1}{2}bh$.

(118) Area of Rightangled $\Delta^{le} = \frac{1}{2}ab$.

(119) Area of a paralleogram $= bh$.

(120) Area of Rhombus $= \frac{1}{2}d_1 d_2$

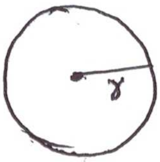
(121) Area of qudrilateral $= \frac{1}{2}d(h_1+h_2)$

(122) Area of Scalin $\Delta^{le} = \sqrt{s(s-a)(s-b)(s-c)}$

Where $s = \frac{a+b+c}{2}$

(123) Area of trapezium $= \frac{1}{2}h(a+b)$

Circle:



(124) Diameter $= 2r$.

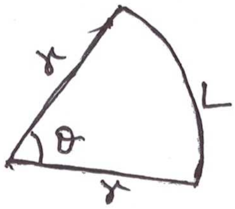
(125) Perimeter $= 2\pi r = \pi d$.

(126) Area $= \pi r^2 = \frac{\pi d^2}{4}$

(127) Area of the circular path $= R - r$.

(128) Area of the circular path $= \pi(R^2 - r^2)$

Sector



(129) Perimeter $= 2r + L$

(130) Length of the arc of the sector $= \frac{\theta}{360} \times 2\pi r$.

(131) Area of the sector $= \frac{\theta}{360} \times \pi r^2$

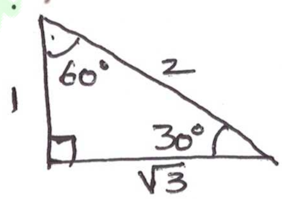
(132) Area of the sector when L is given $= \frac{Lr}{2}$.

(133) Area of Regular hexagon $= \frac{6\sqrt{3}}{4} a^2$.

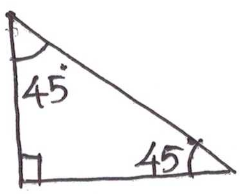
(134) Perimeter of Regular hexagon $= 6a$.

Ratio formulae:

(135) In a right angled Δle if the angles are in the ratio $30^\circ : 60^\circ : 90^\circ$, then the sides are in the ratio $1 : \sqrt{3} : 2$



(136) In a right angled Δle if the angles are in the ratio $45^\circ : 45^\circ : 90^\circ$ then the sides are in the ratio $1 : 1 : \sqrt{2}$.



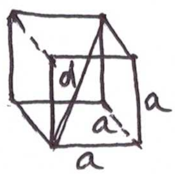
Surface area and Volume [3D objects]

(137) Volume of Prism (V) = Base Area × height = (B.A) × h.

(138) Surface Area of Prism (SA) = Base Perimeter × height = (BP) × h.

(139) Total surface Area of the Prism (TSA) = S.A + 2 (B.A)

Cube:

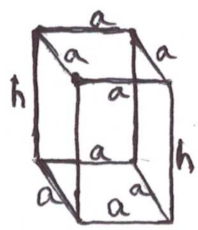


(140) Volume = a^3.

(141) S.A = $4a^2$.

(142) TSA = $6a^2$. (143) diagonal = $a\sqrt{3}$.

Square Prism.

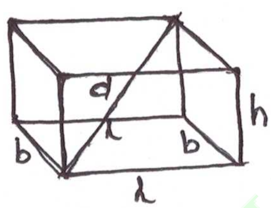


(144) volume = a^2h

(145) S.A = $4ah$

(146) TSA = $2a^2 + 4ah$.

Cuboid.



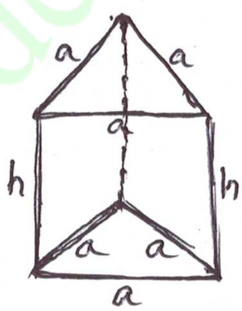
(147) Volume = lbh.

(148) S.A = $2(lh+bh)$

(149) TSA = $2(lb+bh+lh)$

(150) diagonal = $\sqrt{l^2+b^2+h^2}$

Equilatral Triangular Prism:

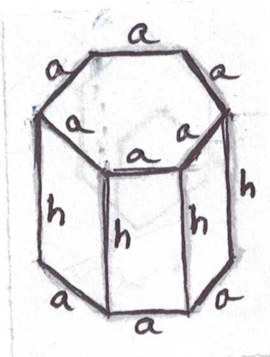


(151) volume = $\frac{\sqrt{3}}{4}a^2h$.

(152) S.A = $3ah$.

(153) TSA = $3ah + \frac{2\sqrt{3}}{4}a^2$

Hexagonal Prism:

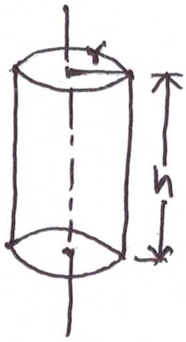


(154) Volume = $\frac{6\sqrt{3}}{4}a^2h$.

(155) S.A = $6ah$.

(156) TSA = $6ah + 3\sqrt{3}\,a^2$

Cylinder:

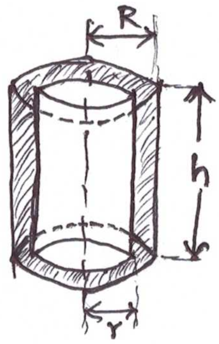


(157) Volume $= \pi r^2 h$.

(158) S.A $= 2\pi r h$.

(159) TSA $= 2\pi r(r+h)$

Hollow cylinder

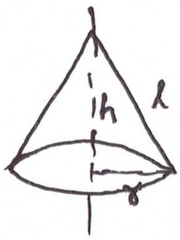


(160) Volume $= \pi h(R^2 - r^2)$

(161) S.A $= 2\pi h(R+r)$

(162) TSA $= 2\pi(R+r)(R-r+h)$

Cone:



(163) Volume $= \frac{1}{3}\pi r^2 h$.

(164) SA $= \pi r l$

(165) TSA $= \pi r(r+l)$

(166) Slant height $(l) = \sqrt{r^2 + h^2}$.

Sphere:

(167) Volume $= \frac{4}{3}\pi r^3$.

(168) S.A $= 4\pi r^2$

Hemisphere:

(169) Volume $= \frac{2}{3}\pi r^3$.

(170) SA $= 2\pi r^2$.

(171) TSA $= 3\pi r^2$.

Conversion:

172) 100cm = 1m : 173) 10dm = 1m ; 174) 1000m = 1km.

175) $1000\,cm^3 = 1$ litre ; 176) 1000 litre $= 1\,m^3$.

Probability.

176) Experiment: A description of an incident is called experiment.

177) Event: Each possible outcome from an experiment.

178) Sure event: An event which occurs surely. The probability is one.

179) Impossible event: An event which does not occur surely. The Probability is zero.

180) Mutually exclusive events: Two or more events are said to be mutually exclusive events, if the occurance of one event depends on the occurance of other events.

181) Independent events: Two or more events are said to be indepen-dent events, if the occurrance of one event does not depend on the occurance of the other events.

182) Equally likely events: Two or more events are said to be equally likely events if they are mutually exclusive events and the probability of each event are the same.

183) All equally likely events are mutually exclusive events but all mutually exclusive events may not be equally likely events.

184) Sample space [S]: Set of all possible outcomes from an experiment.

185) Sample point [n(S)]: The total possible outcomes from an experiment.

186) Probability of any event(E) = $P(E) = \frac{n(E)}{n(S)}$ where n(E) is the no of favorable events and n(S) is the sample point.

187) Probability value: $0 \leq P(E) \leq 1$.

188) Probability theorem: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

189) for mutually exclusive events, $P(A \cup B) = P(A) + P(B)$ & $P(A \cap B) = 0$.

190) for Independent events: $P(A \cap B) = P(A) \times P(B)$

191) Prob. of Success + Prob. failure = 1.

$$P(S) + P(S') = 1.$$

192) $\sum_{i=1}^{n} P_i = 1$

Statistics:

193) 3 measures of central values are mean, median and mode.

194) Arithimatic mean $(\bar{x}) = \frac{\sum_{i=1}^{n} f_i x_i}{N.}$ where f is the frequency and x is the variable; $N = \sum_{i=1}^{n} f_i$.

195) Assumed mean method: $\bar{x} = A + \frac{1}{N} \sum_{i=1}^{n} f_i d_i$

where $d_i = x_i - A$, $N = \sum_{i=1}^{n} f_i$ and A = Assumed variable.

196) Median $= l + \left[\frac{\frac{N}{2} - (c.f)}{f}\right] \times h.$

where l is the lower limit of the median class.

f = frequency of the median class: $c.f$ = cumulative frequency.

$N = \sum_{i=1}^{n} f_i$ ∴ h = width of the class interval.

197) Mode $= l + \left[\frac{f - f_1}{2f - f_1 - f_2}\right] \times h.$ where

l = lower limit of the modal class.

f = frequency " " "

f_1 = frequency of the class preceding the modal class.

f_2 = " " " following " " "

h = width of the class interval.

198) Mode = 3 median − 2 mean.