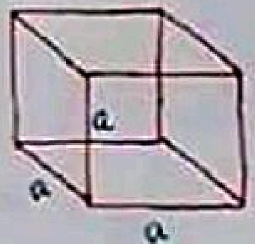
Surface Areas and Volumes

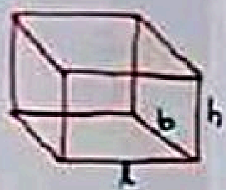
1. Cube

- $T.S.A = 6a^2$
- $C.S.A = 4a^2$
- $Volume = a^3$
- $Diagonal = a\sqrt{3}$



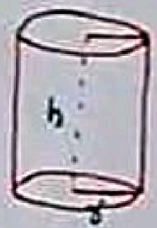
2. Cuboid

- $T.S.A = 2(lb+bh+hl)$
- $C.S.A = 2(l+b)h$
- $Volume = l \times b \times h$
- $Diagonal = \sqrt{l^2+b^2+h^2}$



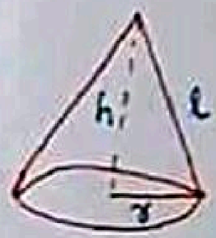
3. Cylinder

- $T.S.A = 2\pi r(h+r)$
- $C.S.A = 2\pi rh$
- $Volume = \pi r^2 h$



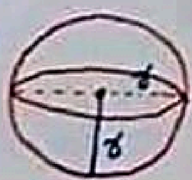
4. Cone

- $T.S.A = \pi r(l+r)$
- $C.S.A = \pi rl$
- $Volume = \frac{1}{3}\pi r^2 h$
- $l = \sqrt{r^2+h^2}$ (slant height)



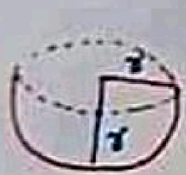
5. Sphere

- $T.S.A = 4\pi r^2$
- $C.S.A = 4\pi r^2$
- $Volume = \frac{4}{3}\pi r^3$

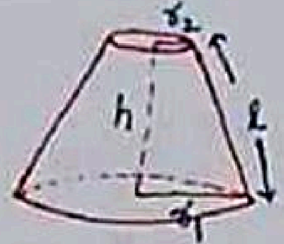


6. Hemisphere

- $T.S.A = 3\pi r^2$
- $C.S.A = 2\pi r^2$
- $Volume = \frac{2}{3}\pi r^3$



7. Frustum of a Cone



- $Volume = \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$
- $T.S.A$ (solid) $= \pi\{r_1^2 + r_2^2 + l(r_1+r_2)\}$
- $C.S.A = \pi l(r_1+r_2)$
- slant height $(l) = \sqrt{h^2+(r_1-r_2)^2}$
- T.S.A. of bucket (Top is open) $= \pi l(r_1+r_2) + \pi r_1^2$

Regular Polygon

- No of diagonal $= \frac{n(n-3)}{2}$
- Each exterior $\angle = \left(\frac{360}{n}\right)^\circ$
- Each interior $\angle = 180 -$ exterior
- Angle of R-Poly $= \frac{(n-2)}{n} \times 180$
- Perimeter $= n \cdot a$
- Area of R-Hexagon $= 6 \times \frac{\sqrt{3}}{4} a^2$
- Area $= \frac{\text{Total cost}}{\text{Per unit cost}}$
- Length of carpet $= \frac{\text{Total cost}}{\text{Per unit cost}}$

In Convex Polygon:

- Sum of all exterior angles $= 360^\circ$
- Sum of all interior angle $= (n-2) \times 180^\circ$

★ Sum of all exterior angles of any poly. $= 360^\circ$

TRIGONOMETRY

- $\sin(A+B) = \sin A\cdot\cos B + \cos A\cdot\sin B$
- $\sin(A-B) = \sin A\cdot\cos B - \cos A\cdot\sin B$
- $\cos(A+B) = \cos A\cdot\cos B - \sin A\,\sin B$
- $\cos(A-B) = \cos A\cdot\cos B + \sin A\cdot\sin B$
- $\tan(A+B) = \dfrac{\tan A + \tan B}{1-\tan A\tan B}$
- $\tan(A-B) = \dfrac{\tan A - \tan B}{1+\tan A\cdot\tan B}$
- $\cot(A+B) = \dfrac{\cot B\cot A - 1}{\cot B + \cot A}$
- $\cot(A-B) = \dfrac{\cot B\cdot\cot A + 1}{\cot B - \cot A}$
- $\sin C + \sin D = 2\cdot\sin\left(\frac{C+D}{2}\right)\cdot\cos\left(\frac{C-D}{2}\right)$
- $\sin C - \sin D = 2\cos\left(\frac{C+D}{2}\right)\cdot\sin\left(\frac{C-D}{2}\right)$
- $\cos C + \cos D = 2\cos\left(\frac{C+D}{2}\right)\cdot\cos\left(\frac{C-D}{2}\right)$
- $\cos C - \cos D = -2\sin\left(\frac{C+D}{2}\right)\cdot\sin\left(\frac{C-D}{2}\right)$
  $= 2\sin\left(\frac{C+D}{2}\right)\cdot\sin\left(\frac{D-C}{2}\right)$
- $\sin 2x = 2\sin x\cdot\cos x = \dfrac{2\tan x}{1+\tan^2 x}$
- $\cos 2x = \cos^2 x - \sin^2 x = 2\cos^2 x - 1$
  $= 1 - 2\sin^2 x = \dfrac{1-\tan^2 x}{1+\tan^2 x}$
- $\tan 2x = \dfrac{2\tan x}{1-\tan^2 x}$
- $\sin 3x = 3\sin x - 4\sin^3 x$
- $\cos 3x = 4\cos^3 x - 3\cos x$
- $\tan 3x = \dfrac{3\tan x - \tan^3 x}{1-3\tan^2 x}$
- $a\sin x + b\cos x \longrightarrow$ Max. Value $= +\sqrt{a^2+b^2}$
  Min. Value $= -\sqrt{a^2+b^2}$

- odd $f(x) \Rightarrow f(-x) = -f(x)$
- Even $f(x) \Rightarrow f(-x) = +f(x)$

$\cos(-x) = \cos x$	$\sec(-x) = \sec x$
$\sin(-x) = -\sin x$	$\operatorname{cosec}(-x) = -\operatorname{cosec} x$
$\tan(-x) = -\tan x$	$\cot(-x) = -\cot x$

- $2\sin A\cdot\cos B = \sin(A+B) + \sin(A-B)$
- $2\cos A\cdot\sin B = \sin(A+B) - \sin(A-B)$
- $2\cos A\cdot\cos B = \cos(A+B) + \cos(A-B)$
- $-2\sin A\cdot\sin B = \cos(A+B) - \cos(A-B)$
- $\sin(A+B)\cdot\sin(A-B) = \sin^2 A - \sin^2 B$
- $\cos(A+B)\cdot\cos(A-B) = \cos^2 A - \sin^2 B$

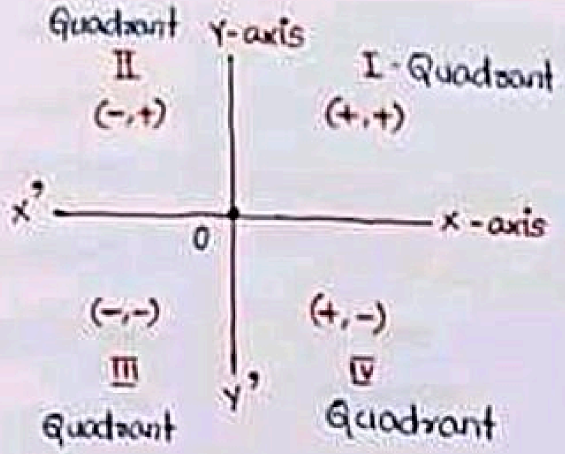
$\sin^2\theta + \cos^2\theta = 1$	$1+\cos 2x = 2\cos^2 x$
$\sec^2\theta - \tan^2\theta = 1$	$1-\cos 2x = 2\sin^2 x$
$\operatorname{cosec}^2\theta - \cot^2\theta = 1$	$\tan x = \dfrac{1-\cos 2x}{\sin 2x}$

*General Solution of trigonometry

- $\sin x = 0 \Rightarrow x = n\pi$
- $\cos x = 0 \Rightarrow x = (2n+1)\pi/2$
- $\tan x = 0 \Rightarrow x = n\pi$
- $\sin x = \sin y \Rightarrow x = n\pi + (-1)^n\cdot y$
- $\cos x = \cos y \Rightarrow x = 2n\pi \pm y$
- $\tan x = \tan y \Rightarrow x = n\pi + y$
- $\left.\begin{aligned}\sin^2 x &= \sin^2 y\\ \cos^2 x &= \cos^2 y\\ \tan^2 x &= \tan^2 y\end{aligned}\right\} \Rightarrow x = n\pi \pm y$

$\boxed{n \in \mathbb{Z}}$

Coordinate Geometry



- Coordinate of origin ⇒ (0,0)
- Cordinate on x-axis ⇒ $(x,0)$
- Cordinate on Y-axis ⇒ $(0,y)$
- Equation of x-axis ⇒ $y=0$
- Equation of Y-axis ⇒ $x=0$
- Equation of Line passing through origin ⇒ $y=x$
- General equation of Line ⇒ $y=mx+c$
- x-axis = x-coordinate = Abscissa
- Y-axis = Y-coordinate = ordinate
- Distance formula $=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
- Distance from origin $=\sqrt{x^2+y^2}$
- section formula internal $=\left(\dfrac{m_1x_2+m_2x_1}{m_1+m_2}, \dfrac{m_1y_2+m_2y_1}{m_1+m_2}\right)$
- External $=\left(\dfrac{m_1x_2-m_2x_1}{m_1-m_2}, \dfrac{m_1y_2-m_2y_1}{m_1-m_2}\right)$
- Mid-Point formula $=\left(\dfrac{x_1+x_2}{2}, \dfrac{y_1+y_2}{2}\right)$
- Area of $\Delta = \frac{1}{2}\left|x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)\right|$

$$= \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$$

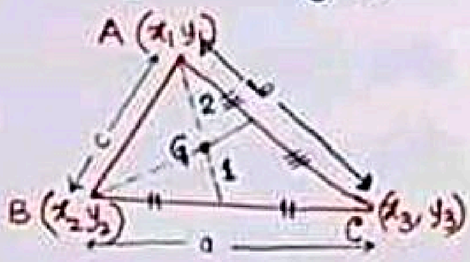
- If points $(x_1y_1), (x_2y_2), (x_3y_3)$ are collinear then

$$\Rightarrow \frac{1}{2}\left|x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)\right| = 0$$

$$\Rightarrow \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = 0$$

- Centroid of a triangle

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



- Centroid devide the median into 2:1
- Mid-points of diagonal of paralleogram coincide each other
- Distance from circumcentre to the vertex is same.
- Coordinate of in-centre

$$\left(\frac{ax_1+bx_2+cx_3}{a+b+c}, \frac{ay_1+by_2+cy_3}{a+b+c}\right)$$

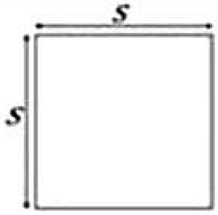
- Median divides the 3rd side into two equal part.
-

GEOMETRY

SHAPES AND SOLIDS

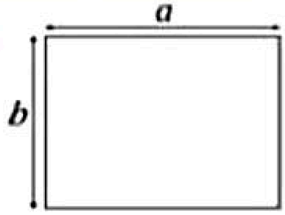
SQUARE

$P = 4s$
$A = s^2$



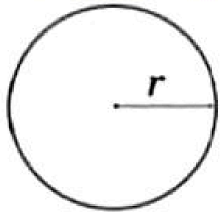
RECTANGLE

$P = 2a + 2b$
$A = ab$



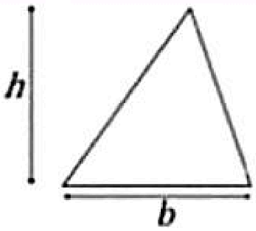
CIRCLE

$P = 2\pi r$
$A = \pi r^2$



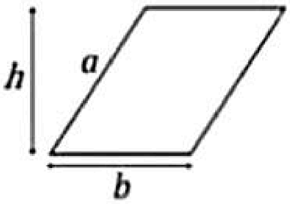
TRIANGLE

$P = a + b + c$
$A = \frac{1}{2}bh$



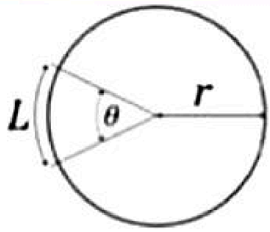
PARALLELOGRAM

$P = 2a + 2b$
$A = bh$



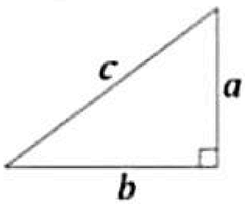
CIRCULAR SECTOR

$L = \pi r \frac{\theta}{180^\circ}$
$A = \pi r^2 \frac{\theta}{360^\circ}$



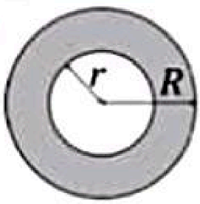
PYTHAGOREAN THEOREM

$a^2 + b^2 = c^2$
$c = \sqrt{a^2 + b^2}$



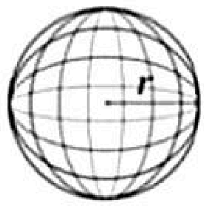
CIRCULAR RING

$A = \pi(R^2 - r^2)$



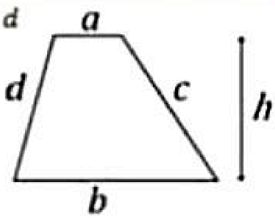
SPHERE

$S = 4\pi r^2$
$V = \frac{4\pi r^3}{3}$



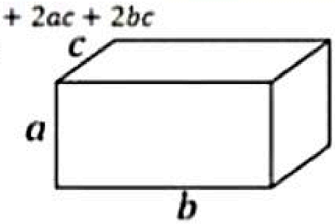
TRAPEZOID

$P = a + b + c + d$
$A = h\frac{a + b}{2}$



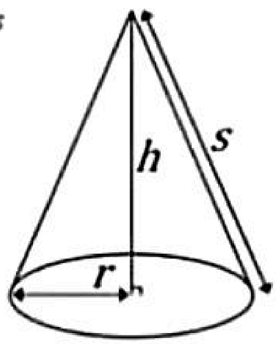
RECTANGULAR BOX

$A = 2ab + 2ac + 2bc$
$V = abc$



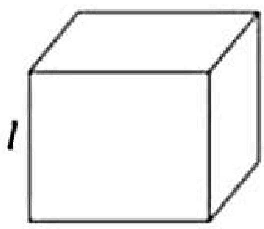
RIGHT CIRCULAR CONE

$A = \pi r^2 + \pi rs$
$s = \sqrt{r^2 + h^2}$
$V = \frac{1}{3}\pi r^2 h$



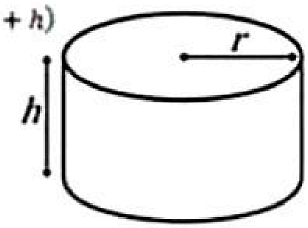
CUBE

$A = 6l^2$
$V = l^3$



CYLINDER

$A = 2\pi r(r + h)$
$V = \pi r^2 h$



FRUSTUM OF A CONE

$V = \frac{1}{3}\pi h(r^2 + rR + R^2)$