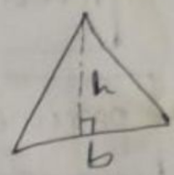
~: MENSURATION :~

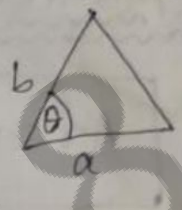
Triangle :→

→ for any Δ, $\boxed{\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}}$



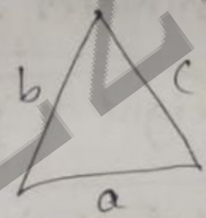
→ when two sides and corresponding one angle is given then,

$$\boxed{\text{Area} = \frac{1}{2} \times a \times b \times \sin\theta}.$$



Scalene triangle :→

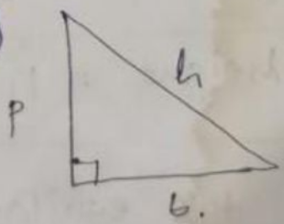
$$\boxed{\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}}$$



where, $\boxed{s = \frac{(a+b+c)}{2}}$ called semiperimeter.

so, $\boxed{\text{perimeter} = (a+b+c) = 2s}.$

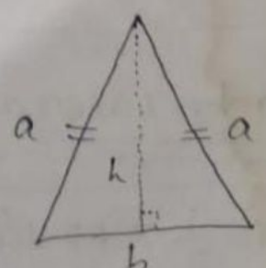
Right angled Δ :→



$$\boxed{\text{Area} = \frac{1}{2} \times p \times b}$$

$$\boxed{\text{perimeter} = p+b+h}$$

Isoceles Δ :→

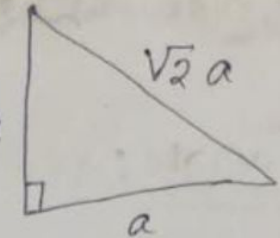


$$\boxed{\text{Area} = \frac{b}{4}\sqrt{4a^2-b^2}}$$

$$\boxed{\text{Height} = \frac{1}{2}\sqrt{4a^2-b^2}}$$

$$\boxed{\text{perimeter} = 2a+b}.$$

Isoceles right angled Δ :→

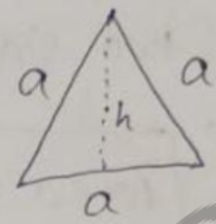


$$\boxed{Area = \frac{1}{2} a^2}$$

$$\boxed{perimeter = (2+\sqrt{2})a}$$ $$\boxed{Area = \frac{p^2}{4}(3-2\sqrt{2})}$$

(where p = perimeter)

Equilateral Δ :→



$$\boxed{Area = \frac{\sqrt{3}}{4} a^2}$$

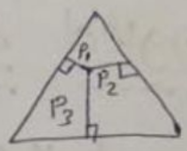
$$\boxed{perimeter = 3a}$$ $$\boxed{Area = \frac{1}{2} \times a \times h}$$

$$\boxed{Height = \frac{\sqrt{3}}{2} a}$$

→ If height is given then, $\boxed{Area = \frac{h^2}{\sqrt{3}}}$

→ For equilateral Δ, if three perpendiculars are drawn from any point inside the Δ then

$$\boxed{height = P_1 + P_2 + P_3}$$



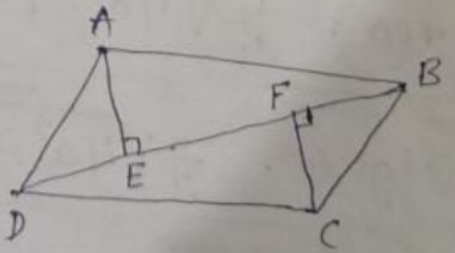
→ For two equilateral Δs,

$$\boxed{\frac{A_1}{A_2} = \left(\frac{a_1}{a_2}\right)^2 = \left(\frac{h_1}{h_2}\right)^2 = \left(\frac{P_1}{P_2}\right)^2}$$

where,
h → height.
P → perimeter
a → side of Δ.

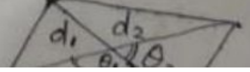
(1) Quadrilateral :→ *

$$\boxed{Area = \frac{1}{2} \times BD \times (CF + AE)}$$

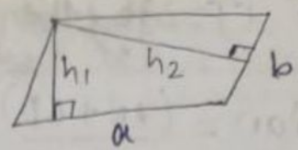


$$\boxed{Area = \frac{1}{2} d_1 d_2 \sin\theta_1 \quad \text{or} = \frac{1}{2} d_1 d_2 \sin\theta_2}$$

$\theta_1 + \theta_2 = 180$

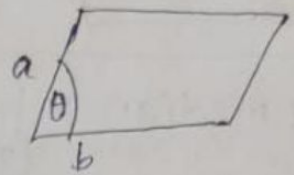


(3) Parallelogram :→



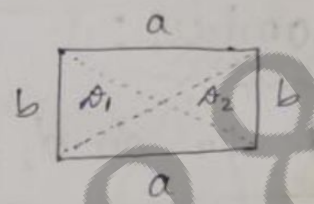
$$\boxed{\text{Area} = a \times h_1 = b \times h_2}$$

$$\boxed{\text{perimeter} = 2(a+b)}$$



$$\boxed{\text{Area} = ab \sin\theta}$$

(4) Rectangle :→

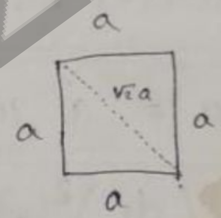


$$\boxed{\text{Area} = a \times b}$$

$$\boxed{\text{perimeter} = 2(a+b)}$$

$$\boxed{D_1 = D_2 = \sqrt{a^2+b^2}}$$

(4) Square :→



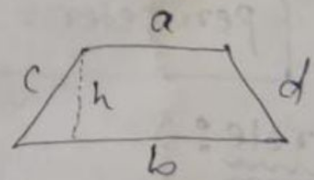
$$\boxed{\text{Area} = a^2}$$

$$\boxed{\text{Perimeter} = 4a}$$

$$\boxed{D_1 = D_2 = \sqrt{2}a}$$

$$\boxed{\text{Area} = \frac{(\text{diagonal})^2}{2}}$$

(8) Trapezium :→

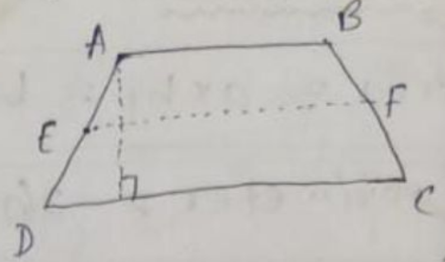


$$\boxed{\text{Area} = \frac{1}{2} h (a+b)}$$

$$\boxed{\text{Area} = \frac{a+b}{l}\sqrt{s(s-c)(s-d)(s-l)}}$$

where, $\boxed{l = (b-a)}$ & $\boxed{s = \frac{c+d+l}{2}}$

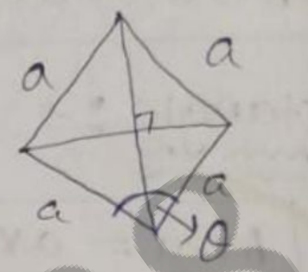
→ when EF is the median of the trapezium, then



$$\boxed{\text{median} = \frac{(AB + CD)}{2}}$$

$$\boxed{\text{Area} = \text{median} \times \underset{(\text{Total})}{\text{height}}}$$

④ Rhombus :→



→ $d_1 \perp r$ on d_2.

$$\boxed{\text{Area} = \frac{1}{2} \times d_1 \times d_2} \; (d_1 \perp d_2)$$

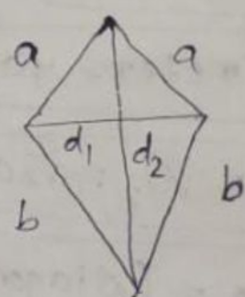
$$\boxed{\text{perimeter} = 4a}$$

$$\boxed{\text{Area} = a^2 \sin\theta} \; \left(\text{Not } \tfrac{1}{2}a^2 \sin\theta\right)$$

$$\boxed{a^2 = \left(\frac{d_1}{2}\right)^2 + \left(\frac{d_2}{2}\right)^2}$$

Subhrajit Khandual

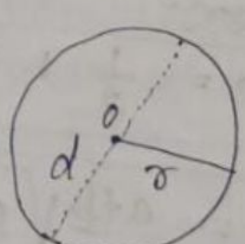
Kite :→



$$\boxed{\text{Area} = \frac{1}{2} \times d_1 \times d_2} \; (d_1 \perp d_2)$$

$$\boxed{\text{perimeter} = 2(a+b)}$$

Circle :→



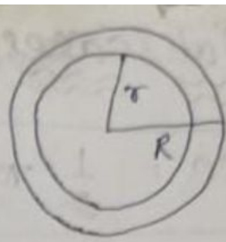
$$\boxed{d = 2r}$$

$$\boxed{\text{Area} = \pi r^2 = \frac{\pi}{4} d^2}$$

$$\boxed{\text{circumferrence} = 2\pi r = \pi d}$$

$$\boxed{\text{Total distance} = n \times 2\pi r}$$

Ring :→



$$\boxed{\text{Area} = \pi(R^2 - r^2)}$$

$$\boxed{\text{Area} = \pi(R+r)(R-r)}$$

$$\boxed{\text{width} = (R-r) = \frac{7}{44} \times \text{difference of circumferrence.}}$$

Sector :→

$$\boxed{\text{Area} = \frac{\theta}{360} \times \pi r^2}$$

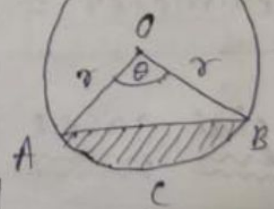
Subrakit Sir

$$\boxed{\text{circumferrence} = \frac{\theta}{360} \times 2\pi r = l}$$

$$\boxed{\theta^c = \frac{l}{r}} \qquad \boxed{\text{perimeter} = (l + 2r)}$$

$$\boxed{\text{Area} = \frac{l \times r}{2}} \rightarrow \left(\sim \frac{1}{2} r^2 \theta\right)$$

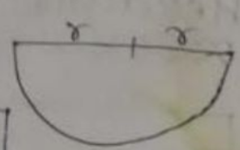
Segment :→



$$\boxed{\text{Area of segment ACB (minor segment)} = r^2\left(\frac{\pi\theta}{360} - \frac{\sin\theta}{2}\right)}$$

$$\boxed{\text{perimeter} = 2r\left[\frac{\pi\theta}{360} + \sin\left(\frac{\theta}{2}\right)\right]}$$

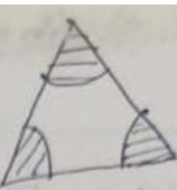
Semicircle :→



$$\boxed{\text{perimeter} = (\pi r + 2r) = \frac{36}{7} r = (\pi r + d)}$$

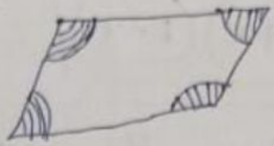
$$\boxed{\text{Area} = \frac{\pi r^2}{2}}$$

Special cases :→

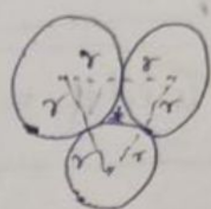


① $\boxed{\text{Area} = \frac{1}{2}\pi r^2}$

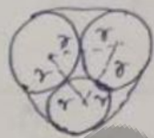
② $\boxed{\text{Area} = \pi r^2}$



③ $\boxed{\text{included Area}(*) = r^2\left(\sqrt{3} - \frac{\pi}{2}\right)}$



④ $\boxed{\text{circumferrence} = 6r + 2\pi r}$



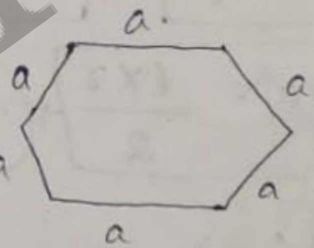
⑤ $\boxed{\text{circumferrence} = 12r + 2\pi r}$

* Radius are same

Hexagon :→ (Subrasit sir)

$\boxed{\text{Area} = 6 \times \frac{\sqrt{3}}{4} a^2 = \frac{3\sqrt{3}}{2} a^2}$

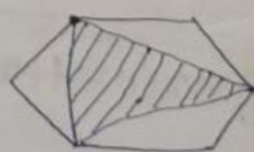
$\boxed{\text{perimeter} = 6a}$



Special cases :→

① $\boxed{\text{Area of shaded portion} = 4 \times \frac{\sqrt{3}}{4} a^2 = \sqrt{3}\, a^2}$

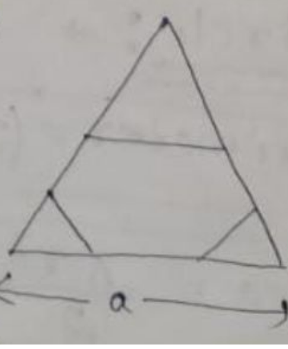
② $\boxed{\text{Area of shaded portion} = 3 \times \frac{\sqrt{3}}{4} a^2 = \frac{3\sqrt{3}}{4} a^2}$



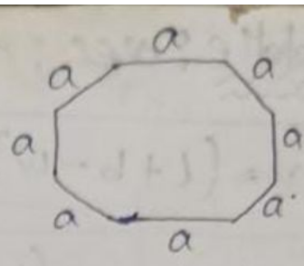
③ Hexagon from an equilateral Δ,

$\boxed{\text{Area} = \frac{\sqrt{3}}{6} a^2 = \frac{a^2}{2\sqrt{3}}}$ $\left(\frac{2}{3} \times \text{Area of } \Delta\right)$

$a \rightarrow$ side of the triangle.



Octagon :→

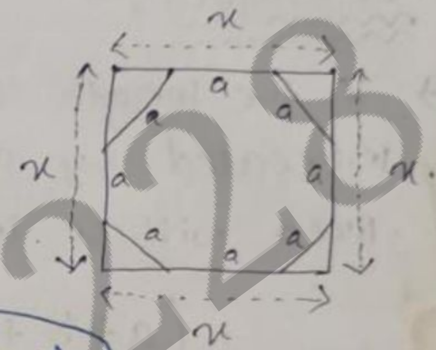


$$\boxed{\text{Area} = 2(\sqrt{2}+1)a^2}$$

$$\boxed{\text{perimeter} = 8a}$$

Special cases :→

Regular octagon from a square,



$$\boxed{\text{Area} = 2(\sqrt{2}-1)x^2}$$

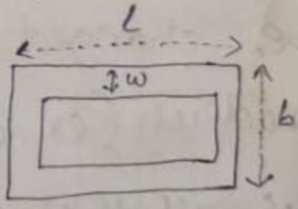
where, x = side of square
a = side of octagon

$$\boxed{a = x(\sqrt{2}-1)}$$

Subrati sir

Area of path inside the rectangular path :→

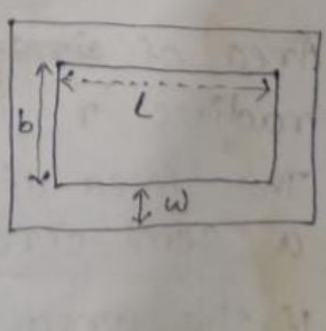
① inner :→



$$\boxed{\text{Area} = 2w(l+b-2w)}$$

$$\boxed{\begin{array}{l}\text{perimeter} = 2(l+b)\ (\text{outer}) \\ \text{Perimeter} = 2(l+b-4w)\ (\text{inner})\end{array}}$$

② outer :→

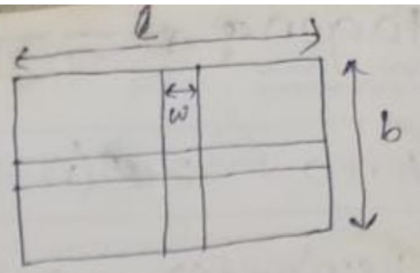


$$\boxed{\text{Area} = (l+b+2w)\,2w}$$

$$\boxed{\text{perimeter} = 2(l+b)\ (\text{inner})}$$

$$\boxed{\text{Perimeter} = 2(l+b+4w)\ (\text{outer})}$$

③ Middle:→



$$\boxed{\text{Area} = (l+b-w)w}$$

$$\boxed{\begin{aligned}\text{perimeter} &= 2(l+b) - 4w \\ \text{or} &= 2(l+b-2w)\end{aligned}}$$

Techniques:→ Subrasit Sir

→ If the length and breadth of a rectangle are increased by a% and b% respectively then Area will be increased by

$$\left(a + b + \frac{ab}{100}\right)\%.$$ (Applying successive formula)

→ If all the increasing sides of any two-dimensional figures are changes by a% then its area will be changed by $\left(2a + \frac{a^2}{100}\right)\%$, in place of circle radius (or diameter) is increased in places of sides.

→ If all the measuring sides of any two-dimensionals figures are changes (increased or decreased) by a% then the perimeter also changes by a%. In case of circle such changes takes place because of the change in radius or diameter.

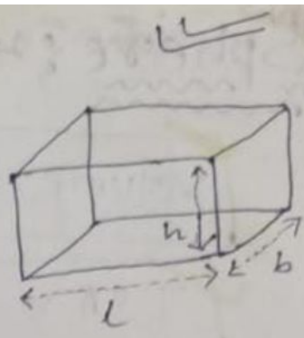
→ Area of ~~circle~~ a square inscribed in a circle of radius 'r' is '$2r^2$'.

→ The Area of the largest triangle inscribed in a semi-circle of radius r is 'r^2'.

→ If the area of square is 'a' sq unit then the area of the circle formed by the same perimeter is given by $\frac{4a}{\pi}$ sq unit.

→ $\boxed{F + V = E + 2.}$ where, (F → faces, E → Edges, V → vertices)

$$\boxed{\text{Volume} = \text{Base Area} \times \text{height}.}$$



Cuboid :→

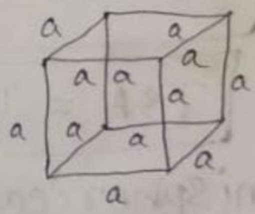
$$\boxed{\text{volume} = lb \times h = lbh.}$$

$$\boxed{\begin{array}{l}\text{LSA} \\ \text{or} \\ \text{Area of four walls}\end{array} = 2(lh+bh) = 2h(l+b)}$$

$$\boxed{\begin{aligned}\text{TSA} &= 2lb + 2lh + 2bh \\ &= 2(lb + lh + bh)\end{aligned}}$$

$$\boxed{\text{Diagonals} = \sqrt{l^2 + b^2 + h^2}}$$

$$\boxed{\begin{array}{l}\text{Area of three} \\ \text{adjacent surfaces}\end{array} = lb \times bh \times lh = l^2 b^2 h^2 = (\text{volume})^2}$$



Cube :→

$$\boxed{\text{volume} = a^3}$$

$$\boxed{\text{LSA} = 4a^2} \quad \boxed{\text{TSA} = 6a^2}$$

$$\boxed{\text{Diagonals} = \sqrt{3}a.}$$

$$\boxed{\begin{array}{l}\text{No of} \\ \text{cube}\end{array} = \left(\frac{\text{side of bigger cube}}{\text{side of smaller cube}}\right)^3}$$

For two cubes, $(\text{volume})^2 = (\text{surface area})^3$

$$\boxed{\left(\frac{V_1}{V_2}\right)^2 = \left(\frac{S_1}{S_2}\right)^3} \quad \boxed{\text{or}} \quad \boxed{\left(\frac{V_1}{V_2}\right) = \left(\frac{S_1}{S_2}\right)^{3/2}}$$

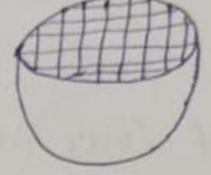
where, ($(V_1, V_2) \to$ volume, and (S_1, S_2) = Surface Area)

Sphere :→

$$\boxed{\text{volume} = \frac{4}{3}\pi r^3}$$

$$\boxed{TSA = 4\pi r^2}$$

Hemisphere :→

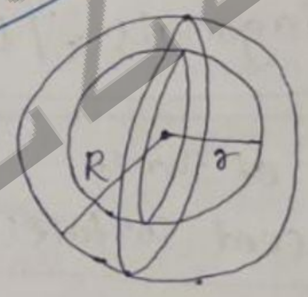


$$\boxed{\text{volume} = \frac{2}{3}\pi r^3}$$

$$\boxed{CSA \text{ or } LSA = 2\pi r^2}$$

$$\boxed{TSA = 3\pi r^2}$$

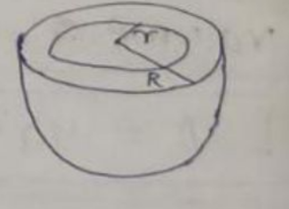
Spherical shell :→



$$\boxed{\text{volume} = \frac{4}{3}\pi(R^3 - r^3)}$$

$$\boxed{TSA = 4\pi(R^2 + r^2)}$$

Hemispherical shell (HOLLOW) :→



$$\boxed{\text{volume} = \frac{2}{3}\pi(R^3 - r^3)}$$

$$\boxed{TSA = 3\pi R^2 + \pi r^2}$$ ✓

Cube	Sphere
side → 'n' times increased	Radius → 'n' times increased.
volume → n^3 times increased	volume → n^3 times increased
Surface Area → n^2 times increased	Surface Area → n^2 times increased.

Cylinder: → (Right circular)

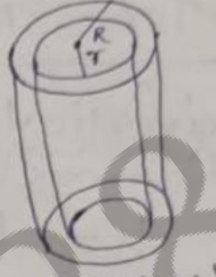
$\boxed{\text{volume} = \pi r^2 h.}$

$\boxed{LSA/CSA = 2\pi r h}$

$\boxed{TSA = 2\pi r h + 2\pi r^2 = 2\pi r(h+r)}$

Cylindrical shell: →

Subrajit Khandual



(HOLLOW)

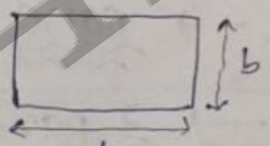
$\boxed{\text{volume} = \pi h(R^2 - r^2)}$

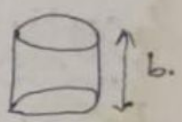
$\boxed{CSA = 2\pi h(R+r)}$

$\boxed{TSA = 2\pi(R+r)(h+R-r)}$ or $\boxed{2\pi h(R+r) + 2\pi(R^2-r^2)}$

Folding of paper sheet to cylinder: →

Ⓐ Along length: →





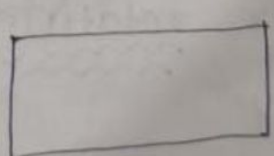
$l = 2\pi r.$

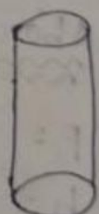
$l = 2\pi r$

$b = \text{height}, \; R = \dfrac{l}{2\pi}.$

$\text{volume} = \pi R^2 h = \pi \times \dfrac{l^2}{4\pi^2} \times b = \dfrac{l^2 b}{4\pi}.$

Ⓑ Along breadth: →





$l = \text{height}.$

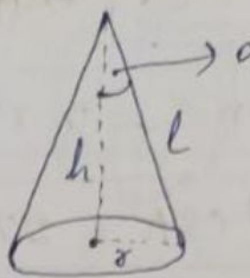
$b = 2\pi r \Rightarrow r = \dfrac{b}{2\pi}.$

$\text{volume} = \pi r^2 h = \pi \times \dfrac{b^2}{4\pi^2} \times l = \dfrac{l b^2}{4\pi}.$

Ratio: →.

$$\boxed{\frac{V_{Al}}{V_{Ab}} = \frac{l}{b}}$$

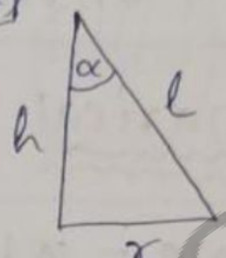
Cone (Right circular) :→



$\boxed{\text{volume} = \frac{1}{3}\pi r^2 h}$ ($\sim \frac{1}{3} \times$ Base Area $\times \perp r$ height)

$\boxed{CSA = \pi r L}$ → ($\frac{1}{2} \times$ perimeter $\times$ slant height)

$\boxed{TSA = \pi r(l+r)}$



Semivertical angle (α) :→

$h = l\cos\alpha$

$r = l\sin\alpha$

$\boxed{h^2 + r^2 = l^2}$

l → slant height
h → ⊥r height.
α → semi vertical angle.

$\boxed{\text{volume of cylinder} = 3\times \text{volume of cone}}$

cylinder → cone

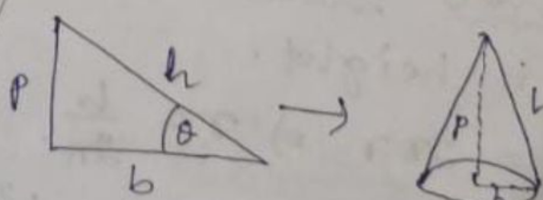
wastage →	$\frac{2}{3}$ part
Remain →	$\frac{1}{3}$ part.

→ maximum volume of a cone that can be inscribed in a sphere is $\frac{32}{81}\pi r^3$

Rotation of right angled Δ to form cone :→

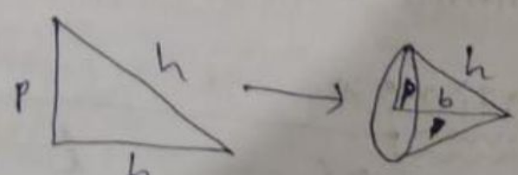
(A) About ⊥r rotating :→

p = height
b = radius
h = slant height



$\boxed{\text{volume} = \frac{1}{3}\pi b^2 p}$

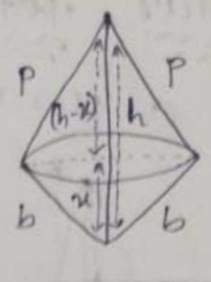
(B) About base rotating :→



$\boxed{\text{volume} = \frac{1}{3}\pi p^2 b}$

p → radius
b → height
h → slant height

(c) About hypotenuse rotating :→



$$\cancel{\text{volume} = \frac{1}{3}\pi\left(\frac{p\times b}{h}\right)^2 \times h}$$

$$\cancel{\boxed{\text{volume} = \frac{1}{3}\pi\,\frac{p^2 b^2}{h}}}$$

$$\boxed{\text{radius} = \frac{p\times b}{h}}$$

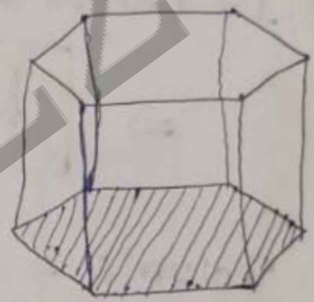
Prism :→ ($\approx$ cylinder)

$$\boxed{\text{volume} = \text{Base Area} \times \text{height}}$$

$$\boxed{LSA = \text{height} \times (\text{perimeter of base})}$$

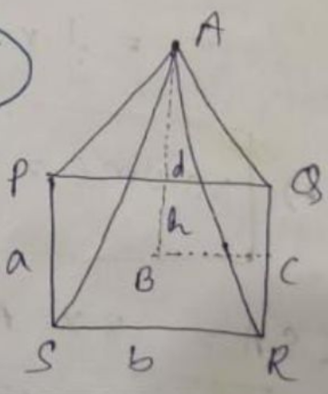
$$\boxed{LSA = h \times (a+b+c)} \quad \{ \triangle 3 \}$$

$$\boxed{LSA = h \times (a+b+c+d+e+f)} \quad \{ 6 \}$$



$$\boxed{TSA = LSA + 2\times \text{Area of Base}}$$

Pyramid :→ ($\cong$ cone) Subrasit Sir



$AB \rightarrow$ perpendicular height (h)

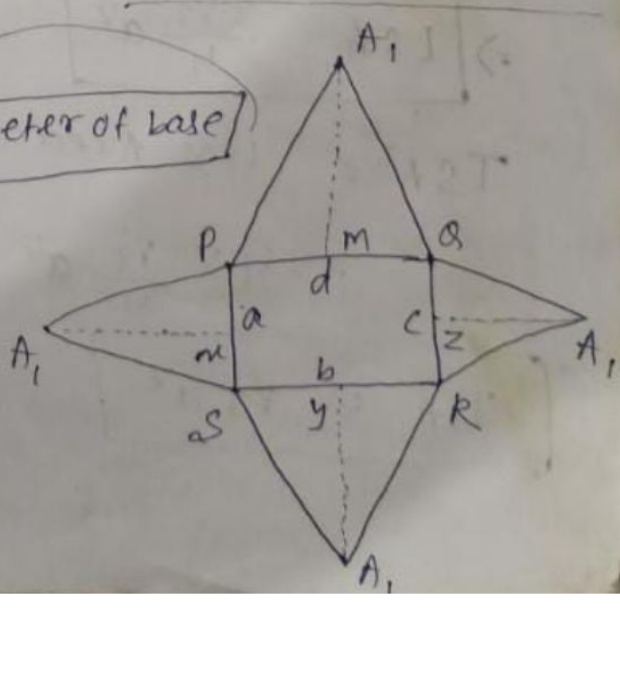
$A_1x = A_1y = A_1z = A_1m$ = slant height (l)

$$\boxed{\text{volume} = \frac{1}{3}\times \text{Base Area} \times \perp r \text{ height}}$$

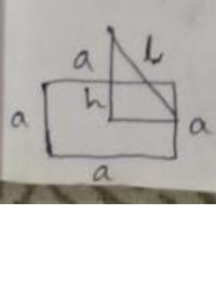
$$\boxed{LSA = \frac{1}{2}\times l \times (a+b+c+d)}$$

$$\boxed{LSA = \frac{1}{2}\times \text{Slant height} \times \text{perimeter of base}}$$

$$\boxed{TSA = LSA + \text{Area of Base}}$$



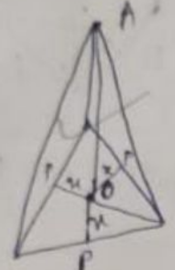
→ If base is square then,



$$\boxed{h^2 + \left(\frac{a}{2}\right)^2 = l^2}$$

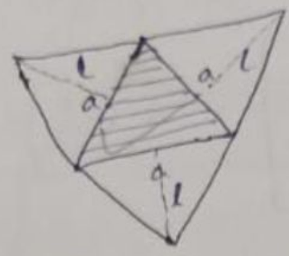
Regular tetrahedron : → ($\cong$ cone)

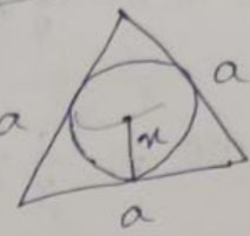
→ It's a pyramid whose surface is equilateral Δ.



$\boxed{OP = x}$

$\boxed{AO = h}$





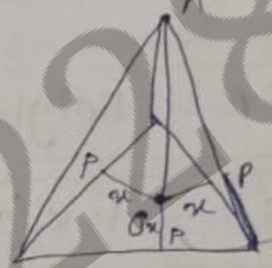
$$\boxed{x = \frac{a}{2\sqrt{3}}}$$

Height of equilat. Δ → $\boxed{l = \frac{\sqrt{3}}{2} a}$ $\boxed{x = \frac{a}{2\sqrt{3}}}$

Subrasit Sir

$\perp$r height $(h) = \sqrt{l^2 - x^2}$

$$\Rightarrow \boxed{h = a\sqrt{\frac{2}{3}}}$$



$\boxed{OP = x}$

$\boxed{AO = h}$

volume $= \frac{1}{3} \times$ Base Area $\times$ $\perp$r height

$= \frac{1}{3} \times \frac{\sqrt{3}}{4} a^2 \times a\sqrt{\frac{2}{3}}$

$\Rightarrow \boxed{\text{volume} = \frac{a^3}{6\sqrt{2}}} \left(= \frac{\sqrt{2}}{12} a^3 \right)$

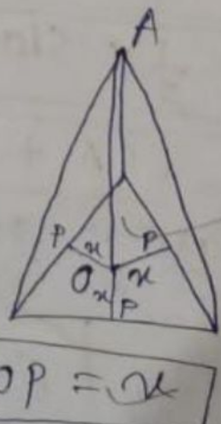
LSA $= 3 \times$ Area of equilateral Δ.

$\Rightarrow \boxed{LSA = \frac{3\sqrt{3}}{4} a^2}$

TSA $=$ $4 \times$ Area of equilateral Δ

$= 4 \times \frac{\sqrt{3}}{4} a^2$

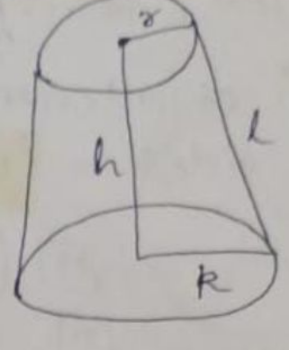
$\boxed{TSA = \sqrt{3}\, a^2}$



$\boxed{OP = x}$

$\boxed{AO = h}$

Frustom :→ ($\cong$ cone)

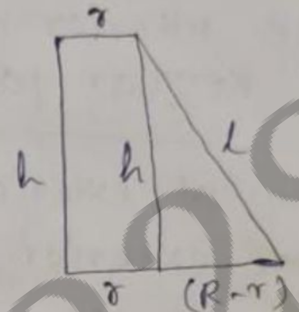


$$\boxed{\text{volume} = \frac{\pi h}{3}\left(R^2 + r^2 + Rr\right)}$$

$$\boxed{CSA = \pi l (R + r)}$$

$$\boxed{TSA = CSA + \pi\left(R^2 + r^2\right)}$$

$$\boxed{L^2 = h^2 + (R - r)^2}$$



Extra :→

$$\boxed{\text{largest side} = \frac{\text{volume}}{\text{smallest Area}}}$$

$$\boxed{h = \frac{\text{volume of body sinked}}{\text{Base Area}}}$$

Techniques :→ (Subrajit Sir)

→ If length, breadth and height of a cuboid are increased by $x\%$, $y\%$ and $z\%$ respectively then its volume increased by

$$\left[x + y + z + \frac{xy + yz + xz}{100} + \frac{xyz}{(100)^2}\right]\% \quad \left[\text{Apply successive formula}\right]$$

→ If side of a cube is increased by $x\%$ then its volume increased by

$$\left[\left(1 + \frac{x}{100}\right)^3 - 1\right] \times 100\ \% \quad \left(\text{Apply successive formula}\right)$$

→ If height of cylinder is changed by $x\%$ and radius remains the same then the volume changes by $x\%$.

→ If radius of cylinder is changed by $x\%$ and height remains unchanged then the volume changed by,

$$\left(2x + \frac{x^2}{100}\right)\% \quad \left(\text{Apply successive formula}\right).$$

: Angle :

→ Sum of interior angle of any polygon of 'n' sides = $(n-2)\,180$ or $\boxed{180 \times n - 360^\circ}$

or $(2n-4)\,90^\circ$

or $(2n-4) \times$ Right angles.

→ $\boxed{\text{one interior angle of Regular polygon} = \dfrac{(n-2)\,180}{n}}$

→ Sum of exterior angle of any polygon = 360°

→ one exterior angle of regular polygon = $\dfrac{360}{n}$.

→ $\boxed{n = \dfrac{360}{\text{one exterior angle}}}$

Subrasit Sir

→ $\boxed{\text{No of Diagonals of polygon} = \dfrac{n(n-3)}{2}}$

---

1. Sum of interior angles of any polygon = $(n-2)\,180^\circ$.
2. ↳ one interior angle = $\dfrac{(n-2)}{n} \times 180^\circ$. *
3. Sum of exterior angle of any polygon = 360°.
   ↳ one exterior angle of any polygon = $\dfrac{360}{n}$ *
5. No of Diagonals of polygon = $\dfrac{n(n-3)}{2}$.