Formula Sheet On Mensuration

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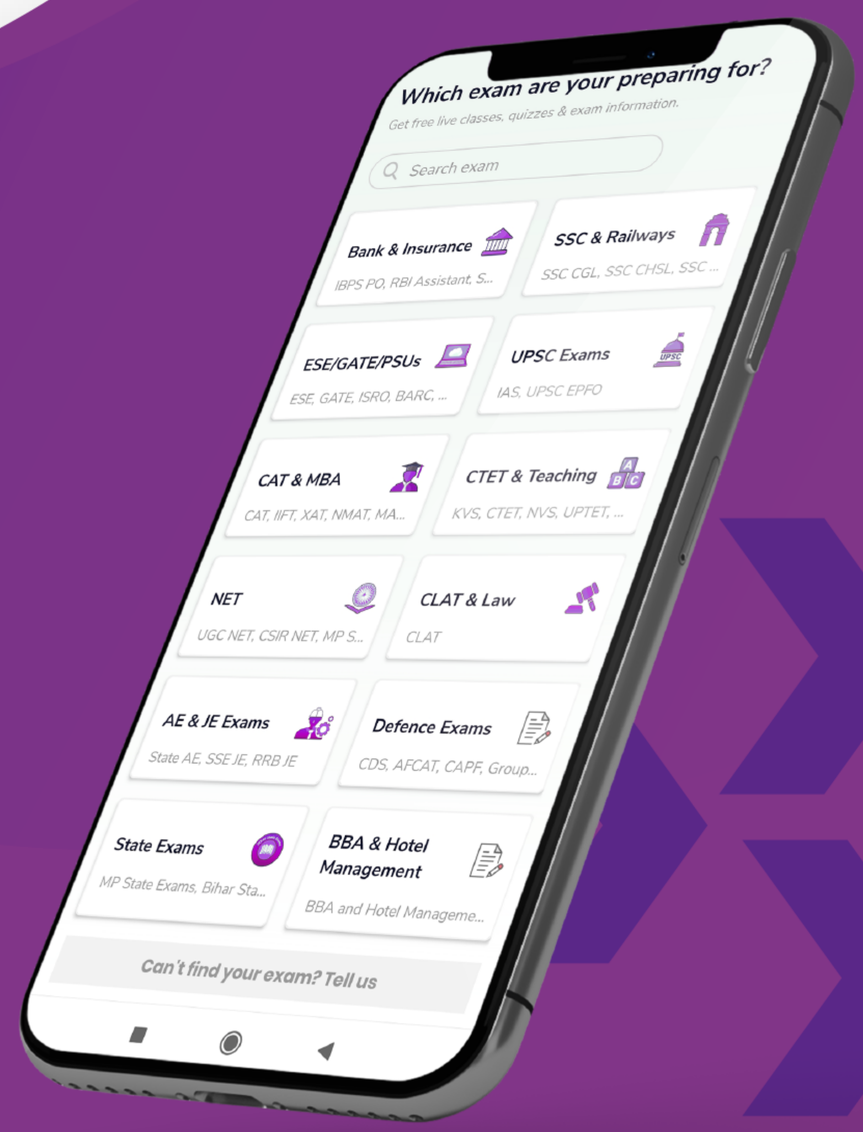

TRIANGLES

(a) When base (b) and height (h) perpendicular to that base are given.

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{b} b \cdot h$$

(b) When lengths of all three sides are given a, b and c

$$\text{Area} = \sqrt{S(S-a)(S-b)(S-c)} \text{ where, } S = \frac{a+b+c}{2} = \text{semi perimeter of the triangle}$$

This is called Heron's Formula.

(c) If the lengths of three medians of a triangle ABC are p, q, r units, then:

$$\text{Area} = \frac{4}{3}\sqrt{S_m(S_m-p)(S_m-q)(S_m-r)}$$

$$\text{Where, } S_m = \frac{p+q+r}{2}$$

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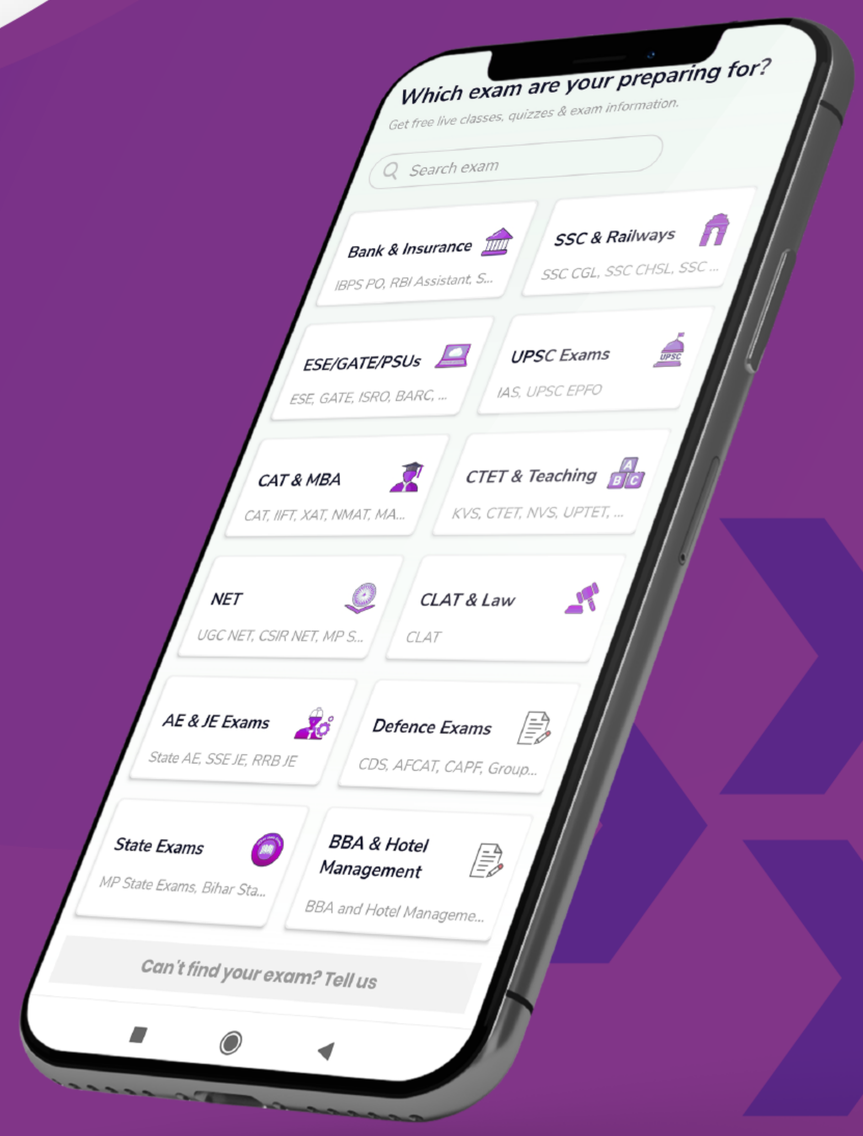


QUADRILATERALS

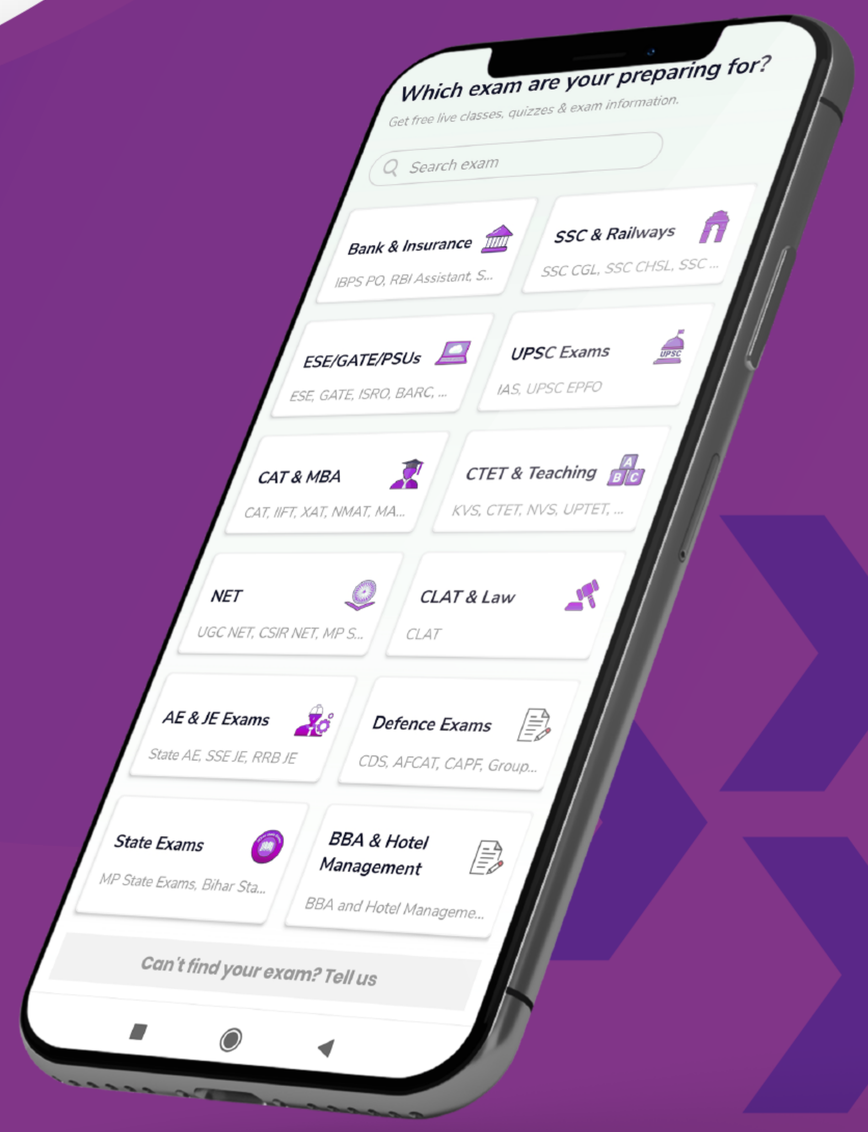
(i) For any quadrilateral in general,

(a) $\angle A + \angle B + \angle C + \angle D = 360°$

(b) Area of the Quadrilateral = $\frac{1}{2}\times$ (one diagonal) × (sum of perpendicular to it from opposite vertex)

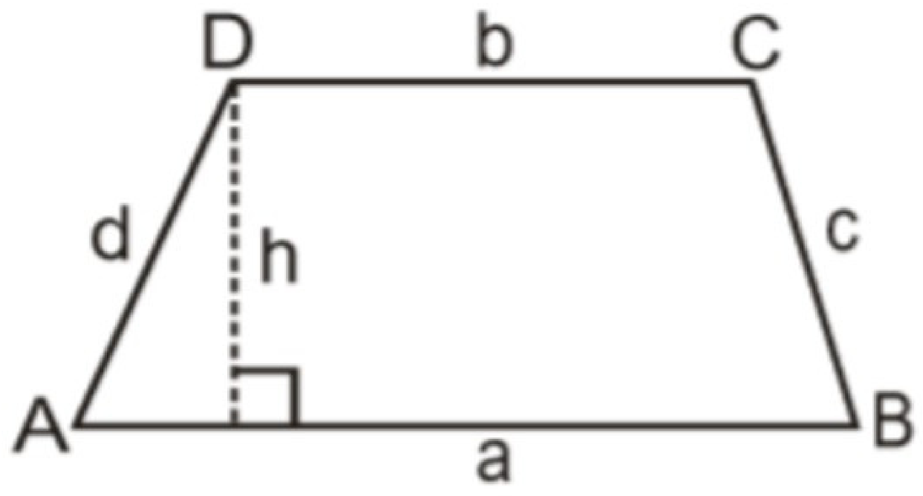
$$=\frac{1}{2}\times(AC)\times(h_1+h_2)$$

(c) Perimeter = a + b + c + d.



Trapezium

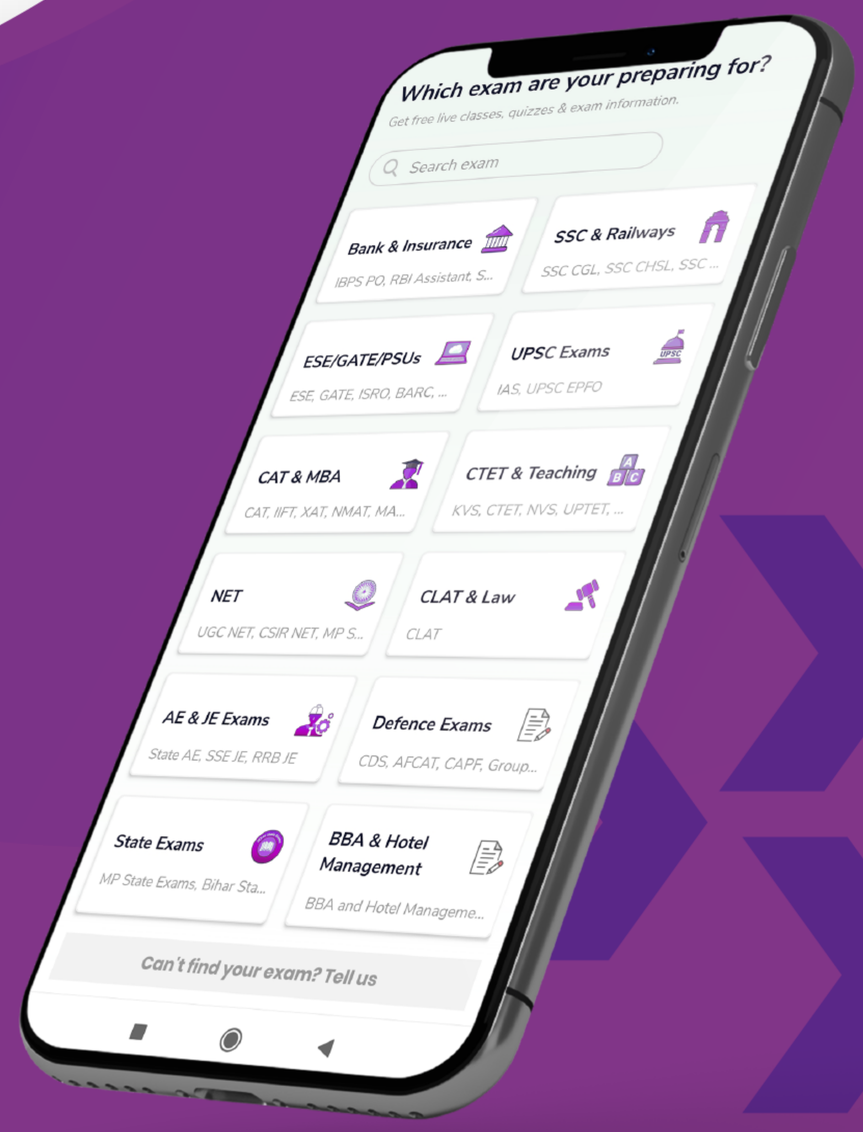
(iii) Trapezium: A quadrilateral where any two opposite sides are parallel is a Trapezium.



(a) Area of a trapezium $=\frac{1}{2}\times$ (sum of parallel sides) × (perpendicular distance between them)

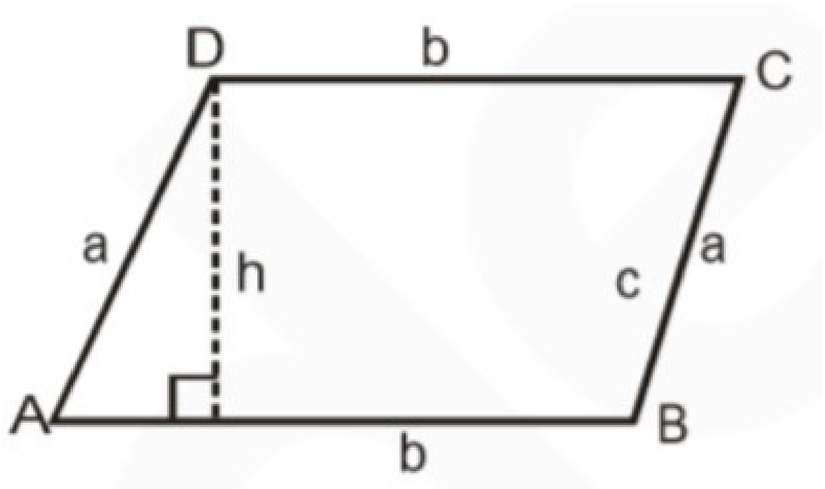
$=\frac{1}{2}(a+b)\times h$

(b) Perimeter (P) = a + b + c + d



Parallelogram

(iv) Parallelogram: A parallelogram is a quadrilateral whose opposite sides are equal and parallel.

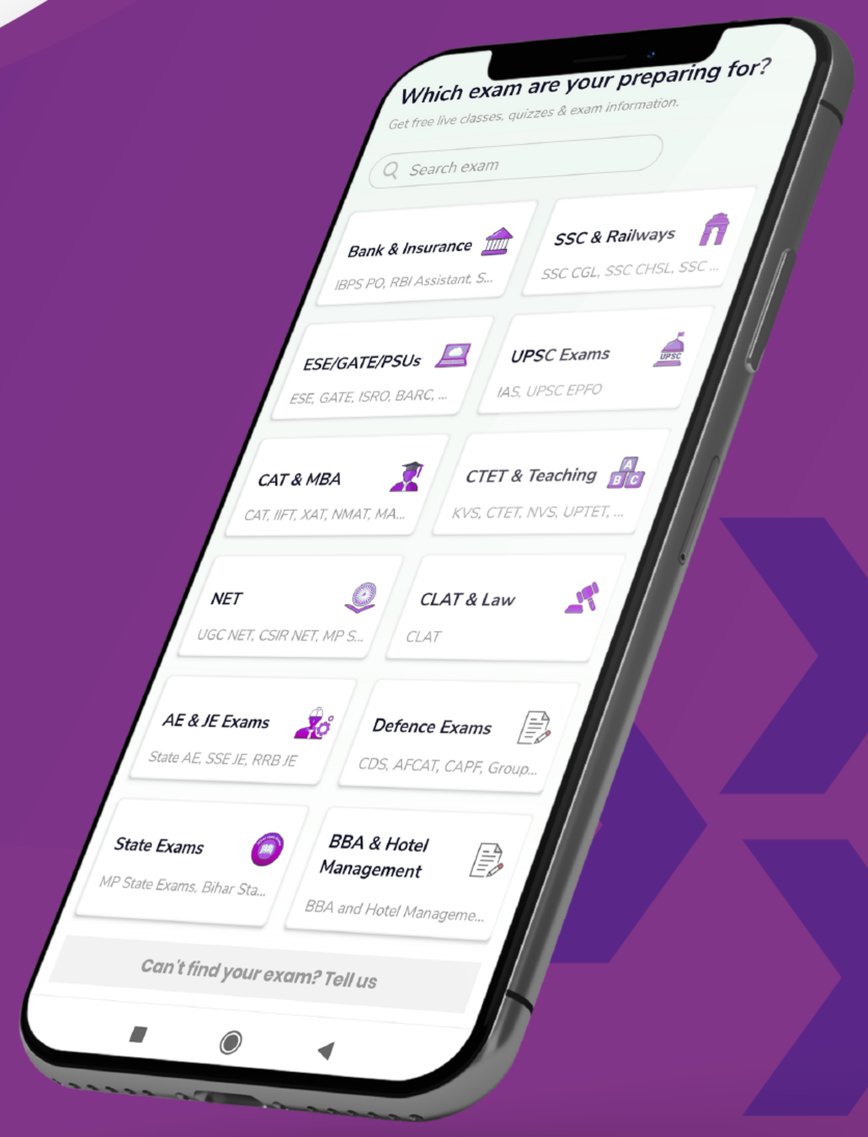


(a) Area = base × height

(b) Area = Product of two sides × sin of the angle between two adjacent sides = ab sinθ

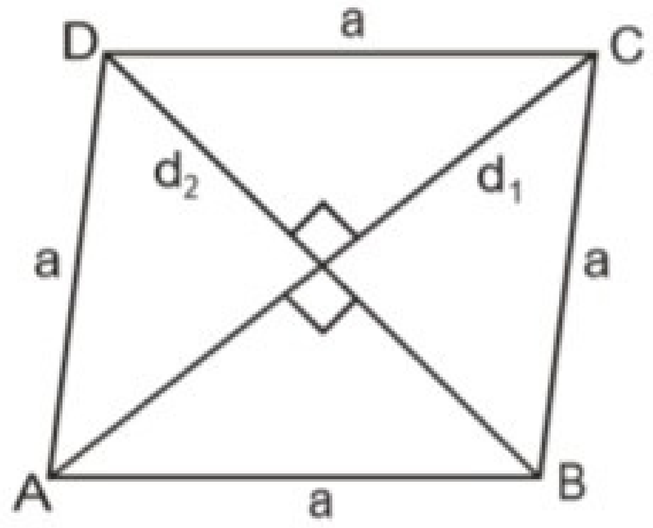
(c) Perimeter 2(a + b)

(d) $d_1^2 + d_2^2 = 2(a^2 + b^2)$ (d_1, d_2 = length of diagonals)



Rhombus

(v) Rhombus: It is a parallelogram whose all four sides are equal



(a) Diagonals of a Rhombus bisect each other at 90°

(b) Area = $\frac{1}{2}\times$ product of the diagonals

(c) Perimeter = 4 × side of the rhombus

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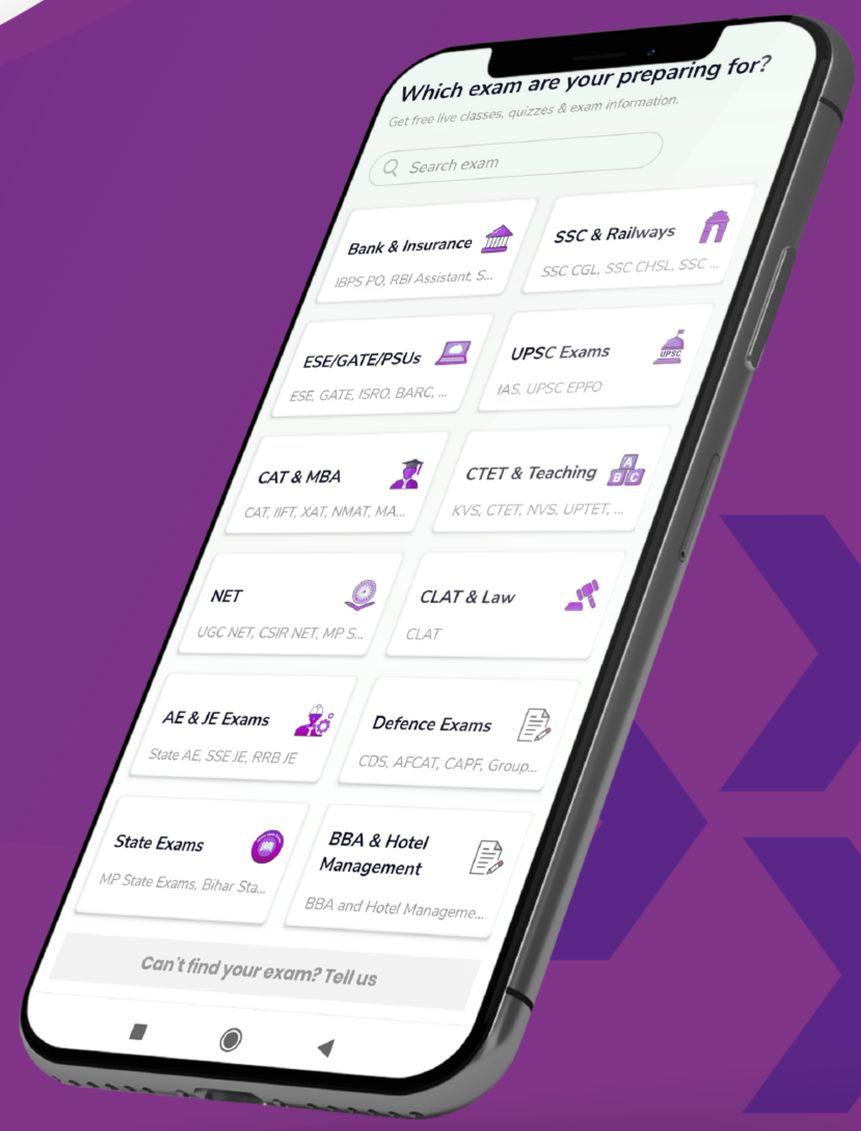
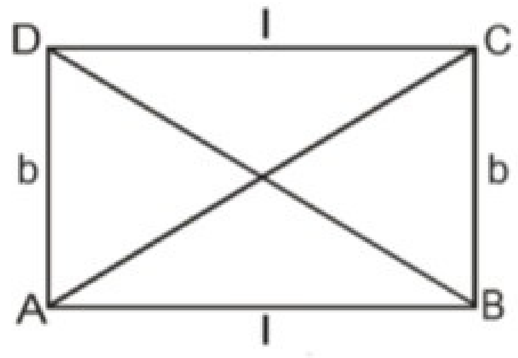


Rectangle



(a) Area = Length × Breadth

(b) Perimeter = 2(l + b), where l and b are the length and the breadth of the rectangle respectively

(c) Diagonals area equal and bisect each other.

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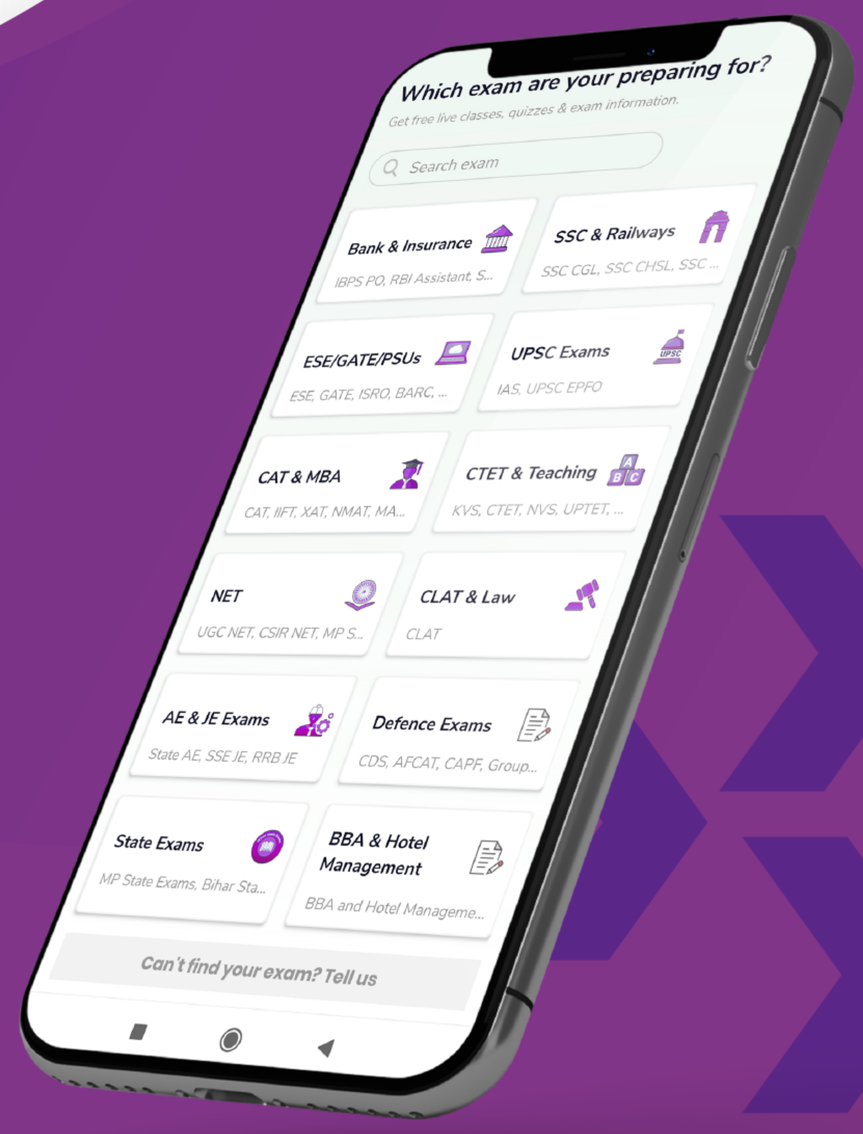
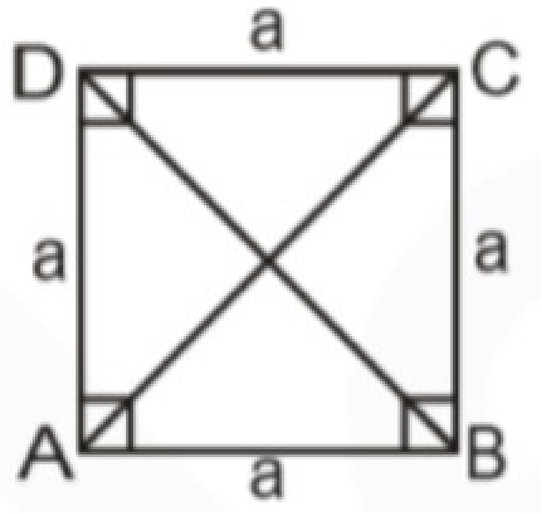


SQUARE

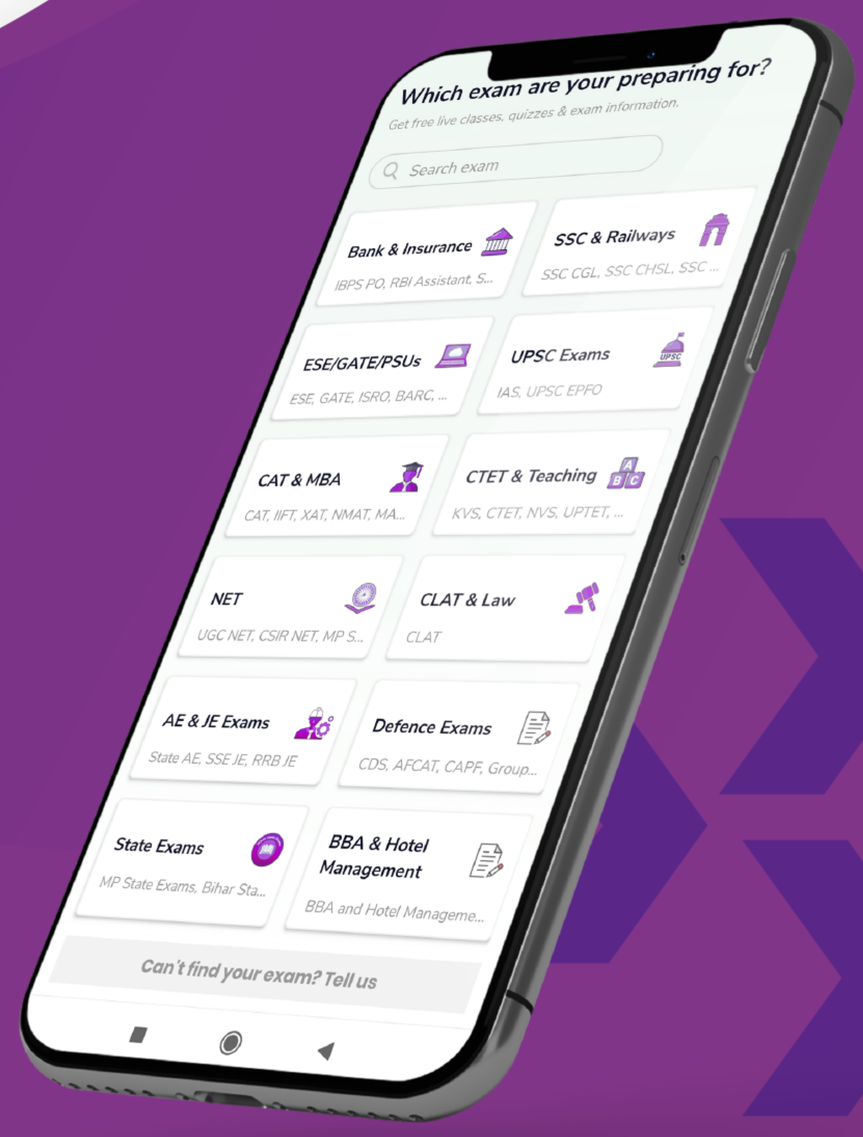


All four sides of a square are equal and all four vertex angles are equal to 90°,

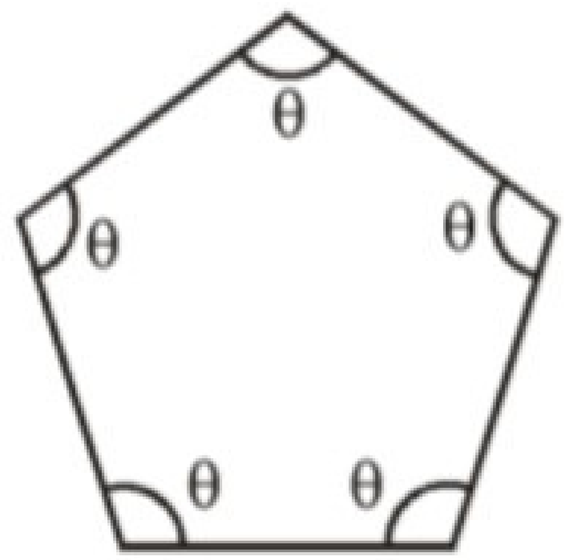
(a) Area = (side)2

(b) Area = $\frac{1}{2} \times (\text{Diagonal})^2$ (where diagonal = $\sqrt{2} \times$ side)

(c) Perimeter = 4 × side



POLYGONS

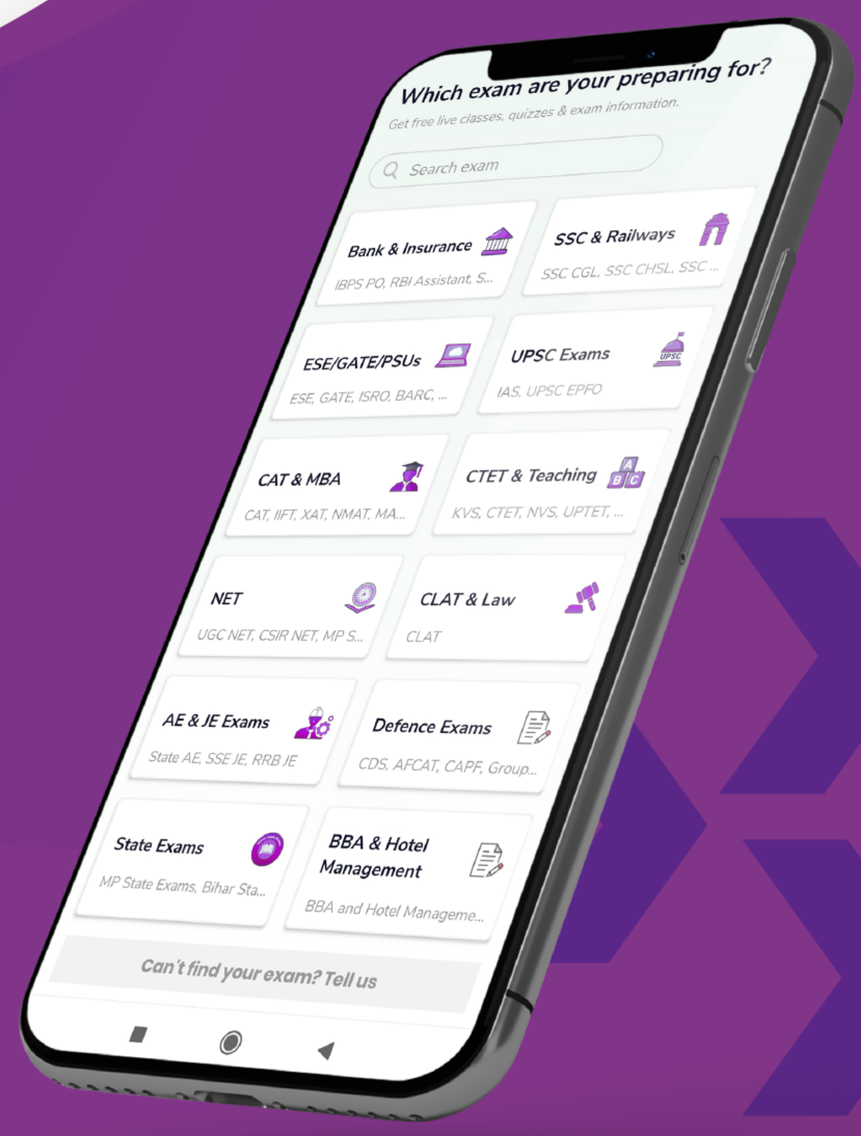


All the interior angles of a regular polygon area equal.

For a regular polygon:

(i) Sum of exterior angles = 360°

(ii) Sum of interior angles (n – 2) × 180°



(iv) Each interior angle

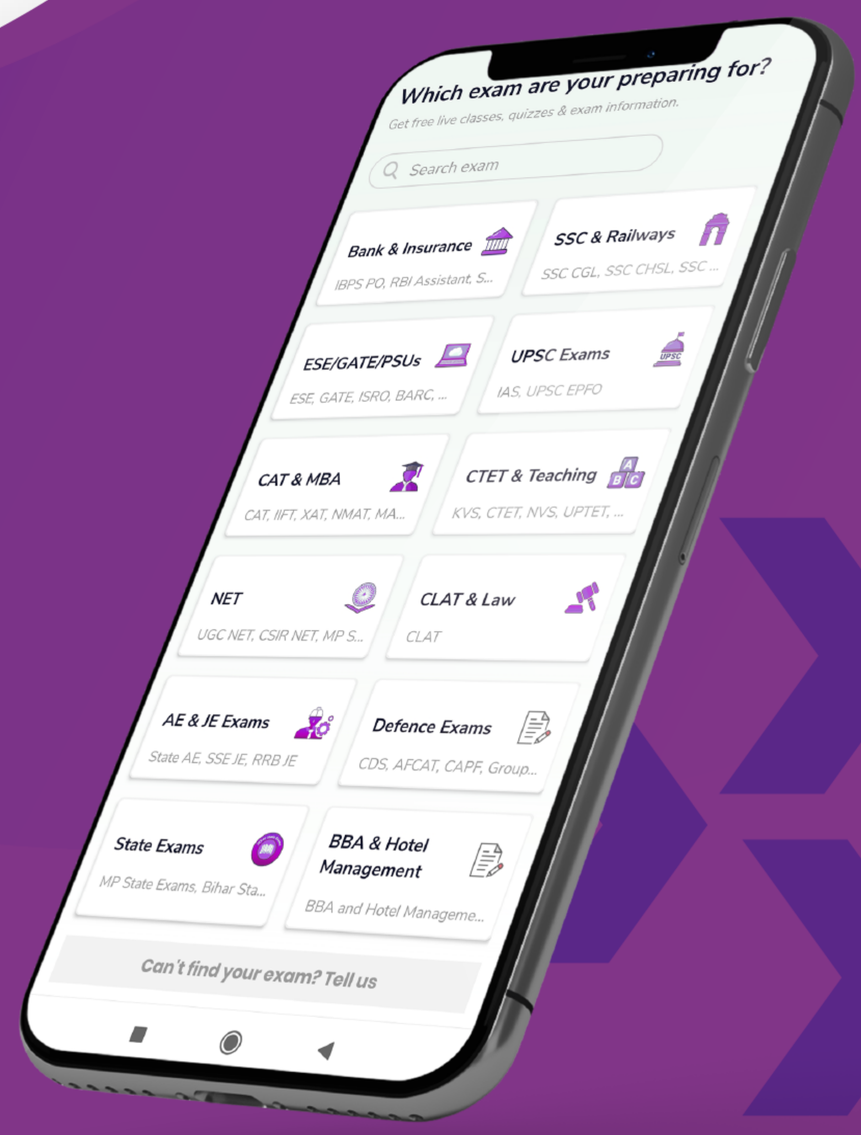
(vii) Area of a regular polygon = $\frac{1}{2}\times$ (Perimeter) × (Perpendicular distance from the centre of the polygon to any side)

(Centre of a regular polygon is equidistant from all its sides)

Area of regular Hexagon = 6 × (Area of equilateral triangle of side a)

Since regular Hexagon is made of 6 equilateral triangle when its vertex are joined to centre $=6\times\frac{\sqrt{3}}{4}a^2=\frac{3\sqrt{3}}{2}a^2$

Regular octagon: Area = $2(\sqrt{2}+1)(\text{side})^2$



Circles

(i) Area of circle = πr^2, where is the radius of the circle

(ii) Circumference of a circle = $2\pi r$

Room: If we have a room of length l, breadth b and height h, then,

Area of four walls of the room = $2h(l + b)$

Area of four walls and floor = $2h(l + b) + lb$

Area of floor, roof and four walls = $2h(l + b) + 2lb$

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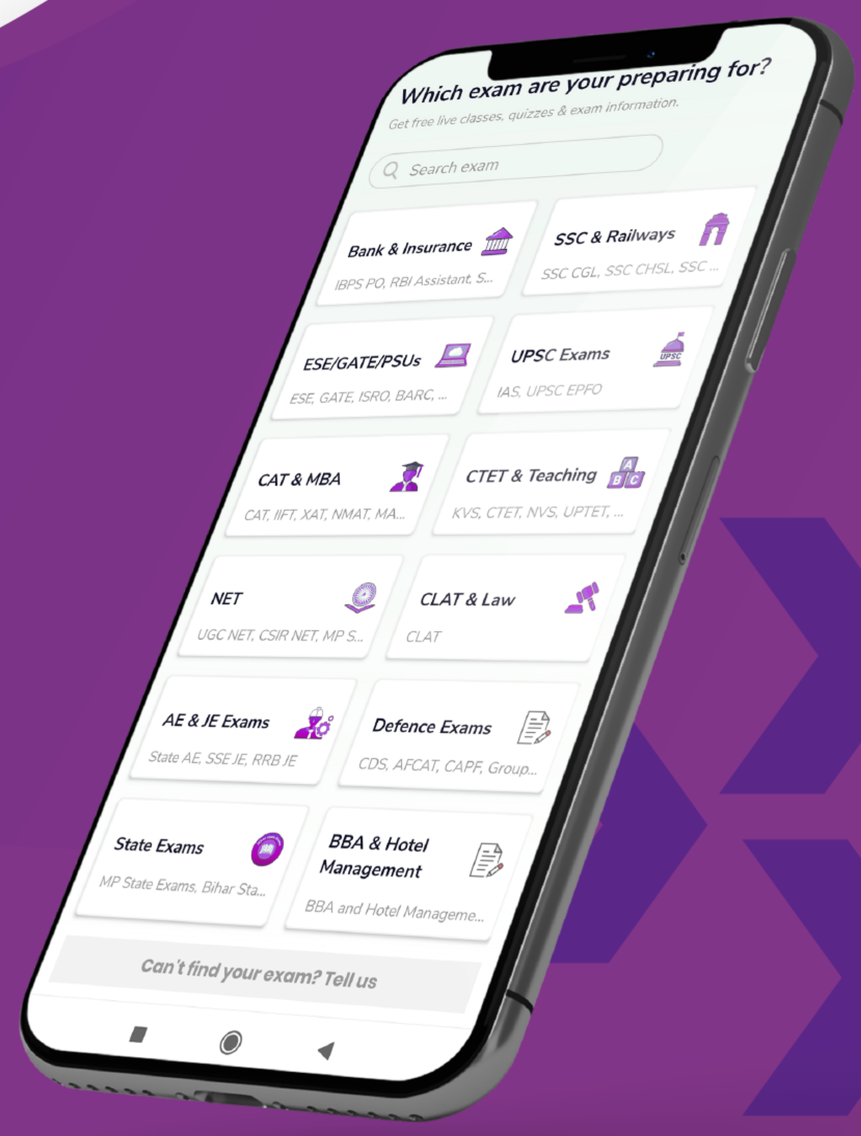
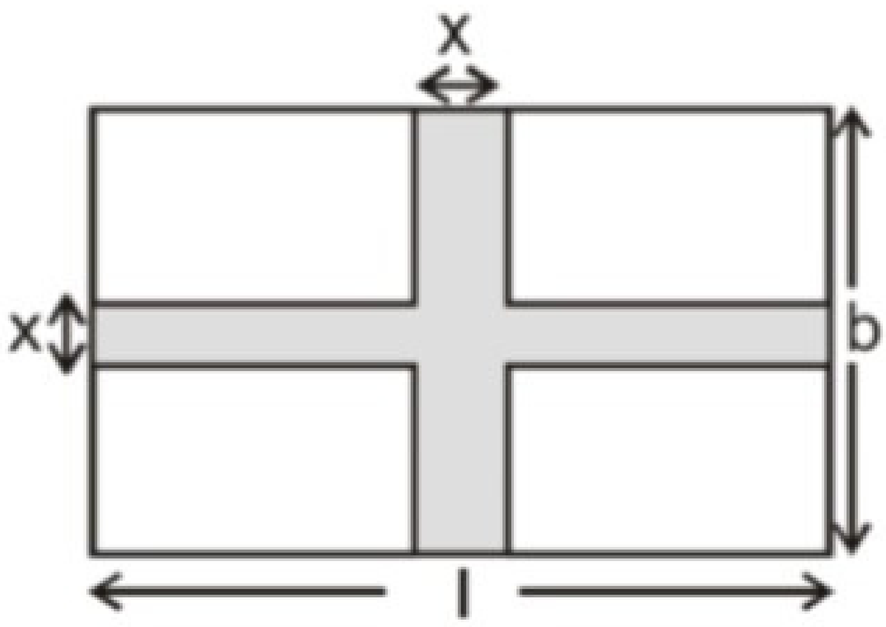


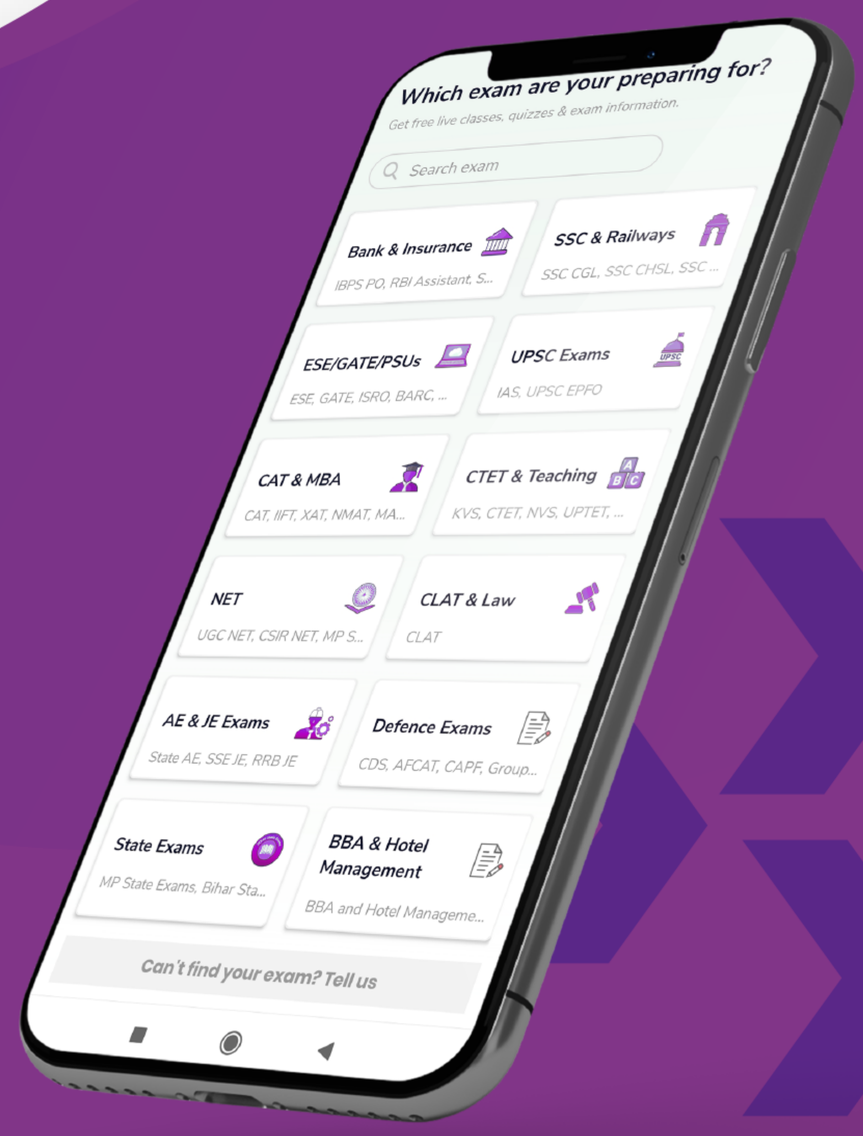
Pathway Across the rectangle

Pathway Across the rectangle

Area of path = (l + b – x)x

Perimeter of path = 2(l + b) – 4x = 2(l + b – 2x)



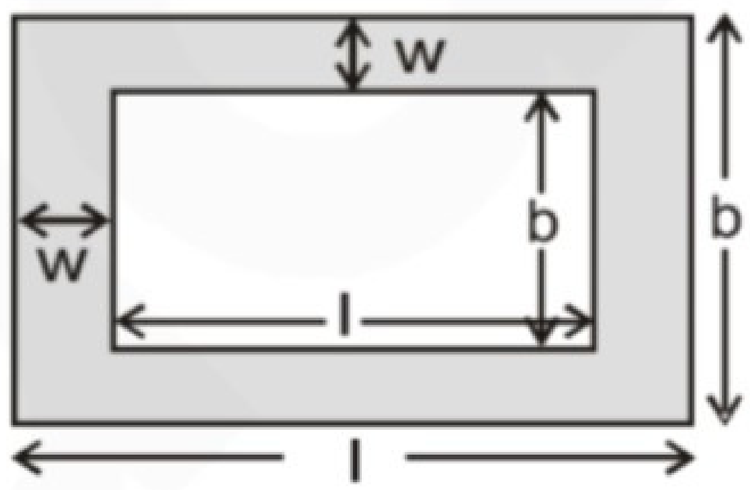


Pathways around a rectangular space:

Outer pathways:

(i) Area = (l + b + 2w)2w

(ii) Perimeter = outer perimeter + inner perimeter = 2 (l + b) + 2(l + b + 4w) = 4(l + b + 2w)



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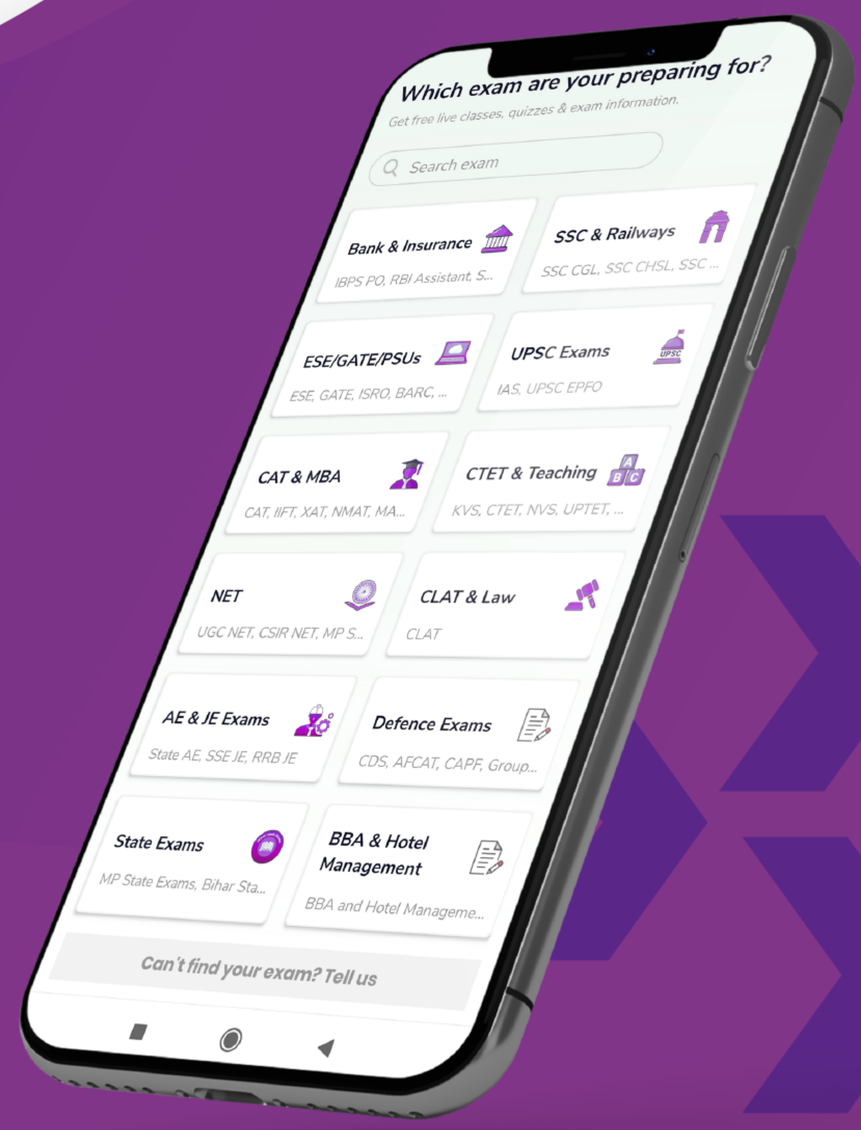
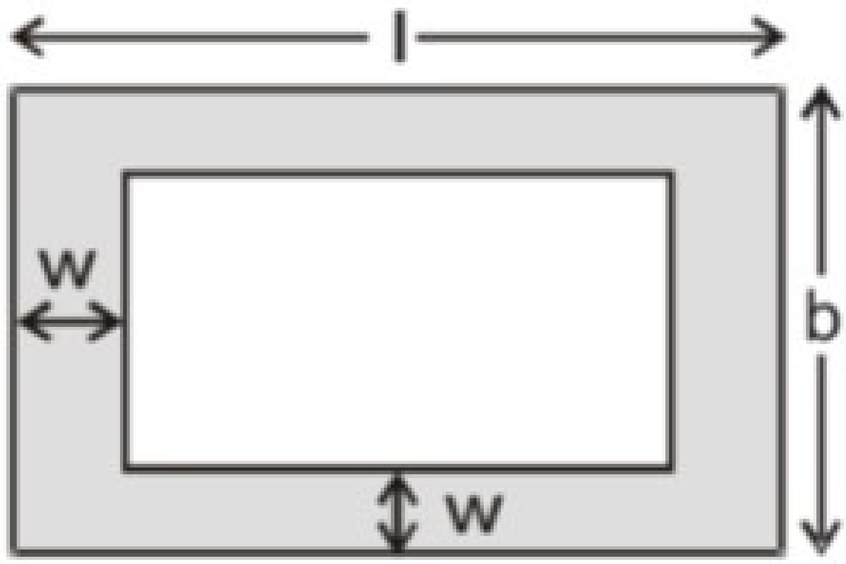


Inner Pathways:

Area of the path = (l + b + 2w)2w

Perimeter = 2(l + b) + 2(l + b – 4w) = 4(l + b – 2w)



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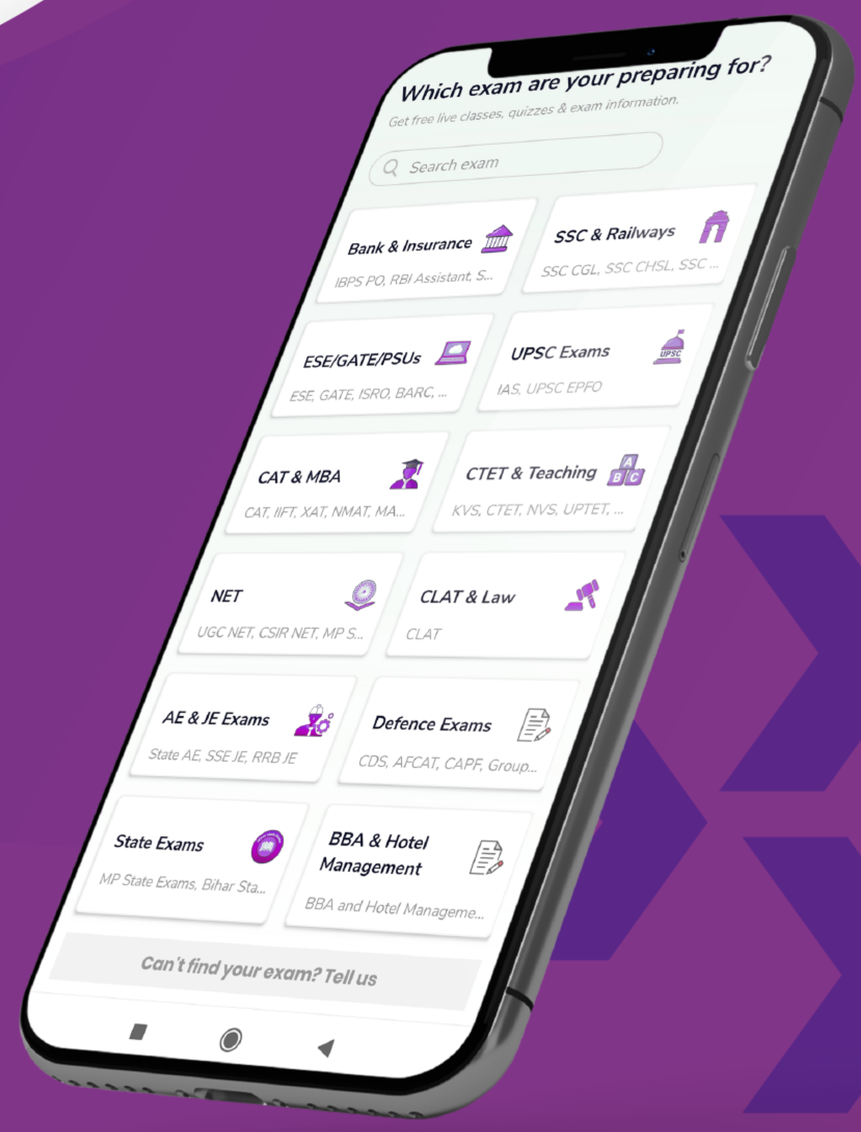

CUBOID

If l, b, and h represent Length, Breadth, and Height of the cuboid respectively.

- Total surface area of cuboid = $\mathbf{2(lb + bh + lh)}$
- Length of diagonal of cuboid= $\sqrt{l^2 + b^2 + h^2}$
- Volume of cuboid = $\mathbf{l} \times \mathbf{b} \times h$
- If area of faces of cuboid are x, y and z then volume of cuboid = $\sqrt{xyz}$

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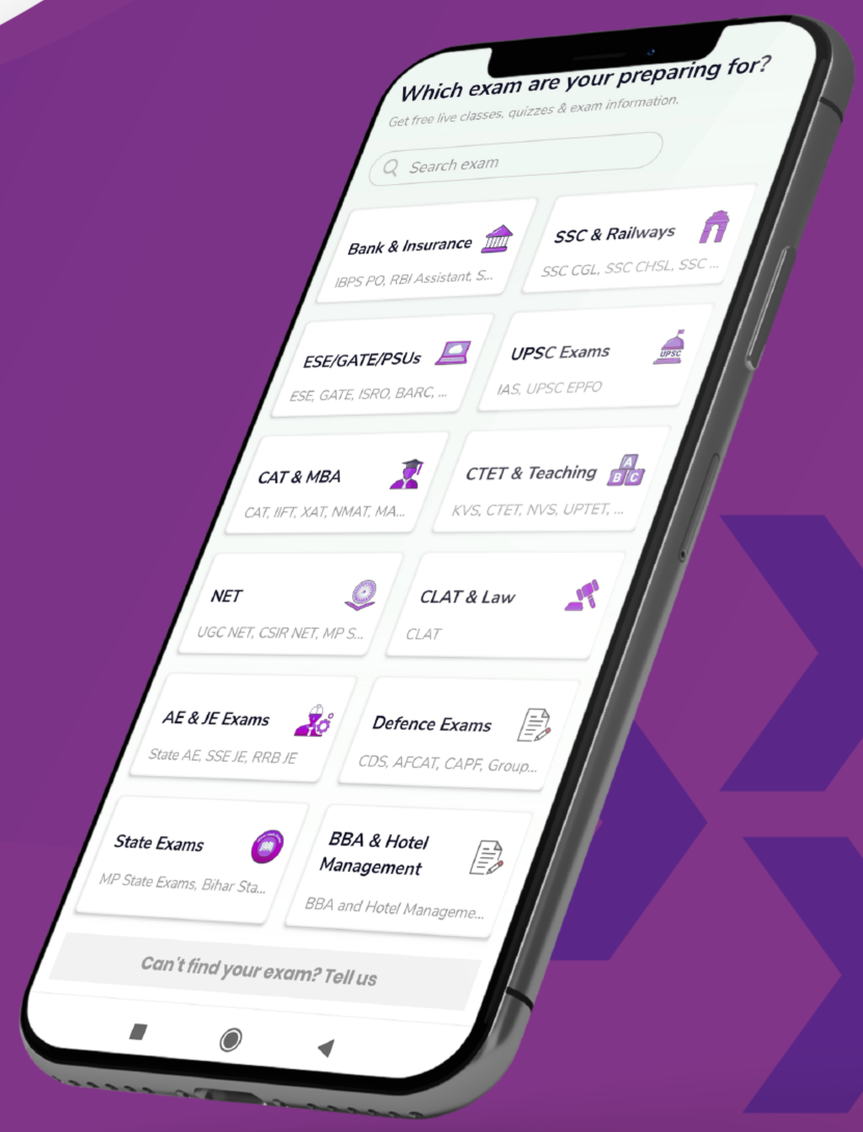
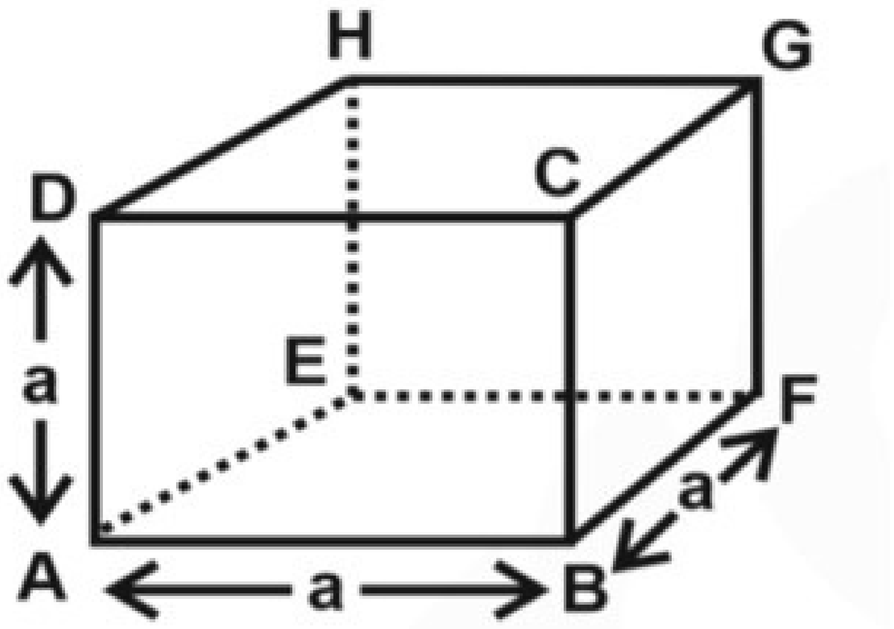


CUBE



- Volume of cube = $(\textbf{Side})^3 = \mathbf{a}^3$
- Total surface area of cube = $\mathbf{6} \times (\textbf{Side})^2 = \mathbf{6a}^2$
- Length of Leading Diagonal of Cube = $\sqrt{3} \times \text{side} = a\sqrt{3}$

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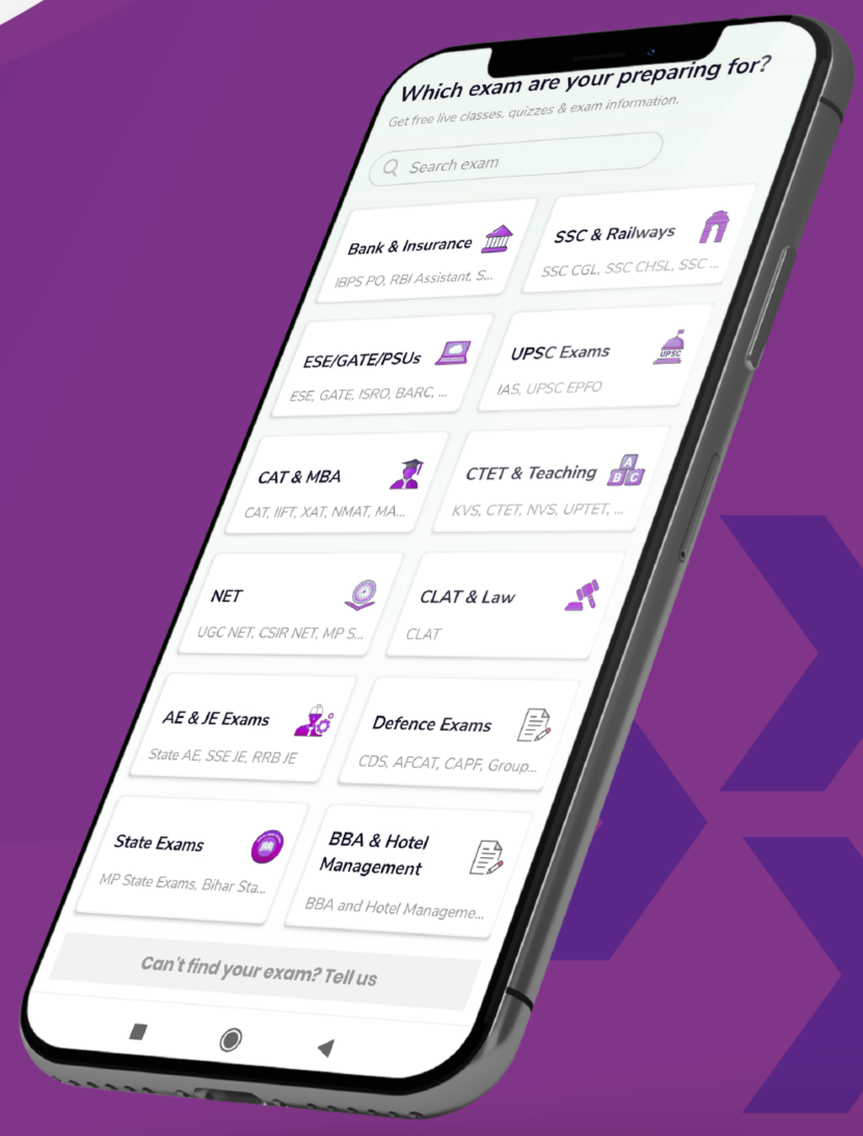
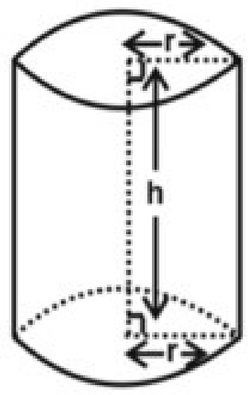
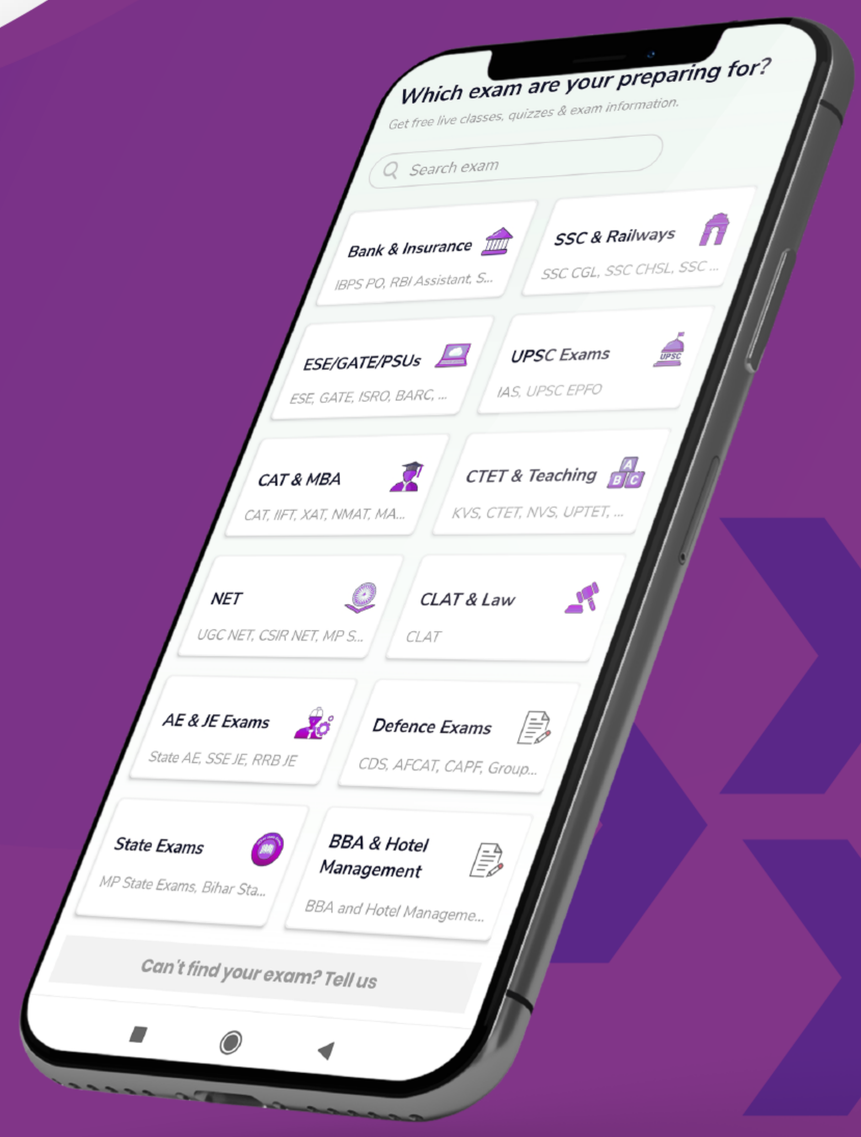


CYLINDER

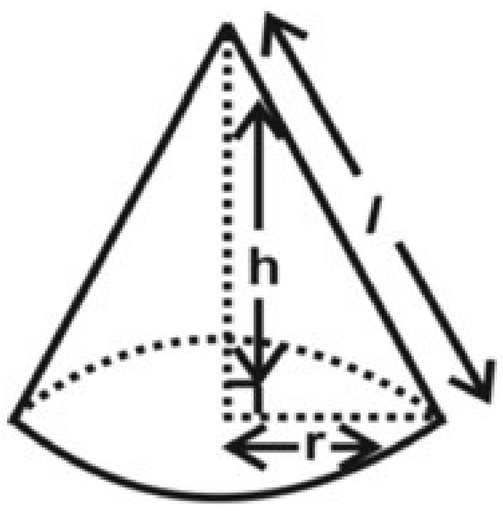


If, r and h represent radius of the base of the cylinder and Height of the cylinder respectively.

- Curved surface area of a cylinder = $2\pi rh$
- Total surface area of a cylinder = $2\pi r(r + h)$
- Volume of a cylinder = $\pi r^2 h$



CONE



If, r, h and l represent radius of the base of the cone, Height of the cone, and Slant height of the cuboid respectively.

- Slant height of a cone = $\mathbf{l} = \sqrt{h^2 + r^2}$
- Curved surface area of a cone ($\mathbf{C.S.A.}$) = $\boldsymbol{\pi} \times \mathbf{r} \times 1$
- Total surface area of a cone ($\mathbf{T.S.A.}$) = $\boldsymbol{\pi} \times \mathbf{r} \times (\mathbf{r} + 1)$
- Volume of right circular cone $= \frac{1}{3} \times \pi r^2 h$

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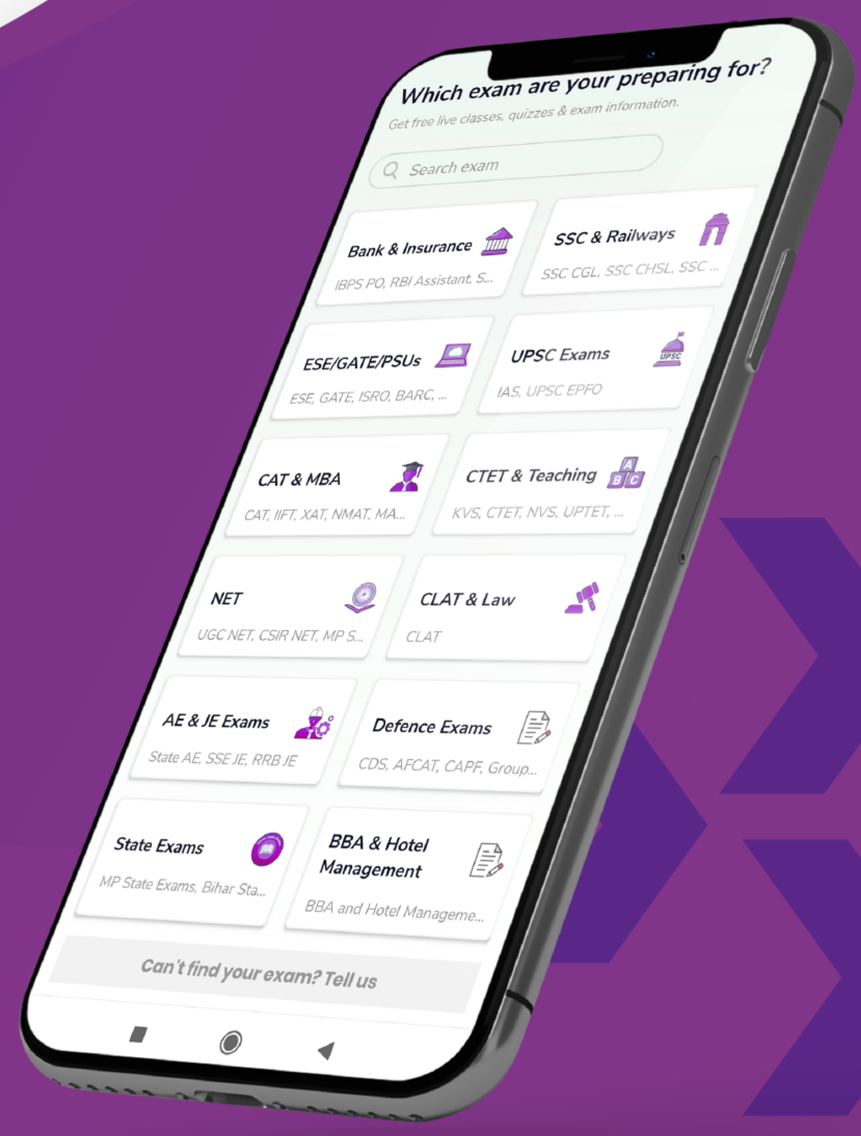
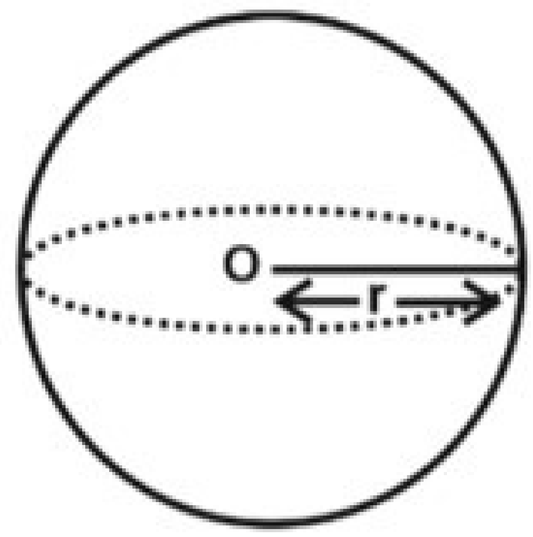


SPHERE



- Surface area of a sphere = $\mathbf{4\pi r\ 2} = \mathbf{\pi d}^2$
- Volume of a sphere = $\left(\frac{4}{3}\right)\pi r^3$

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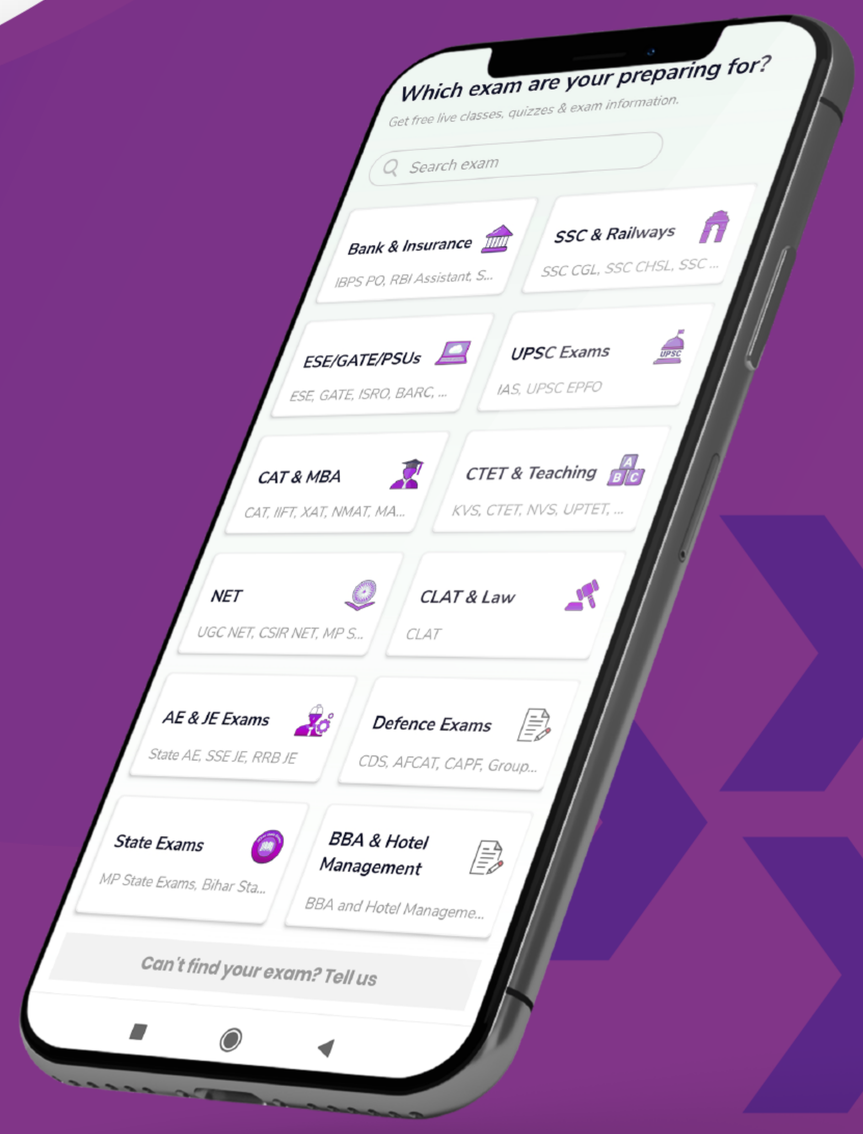
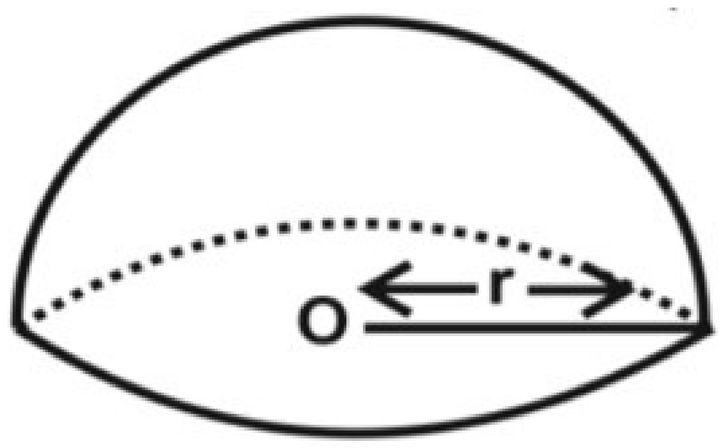
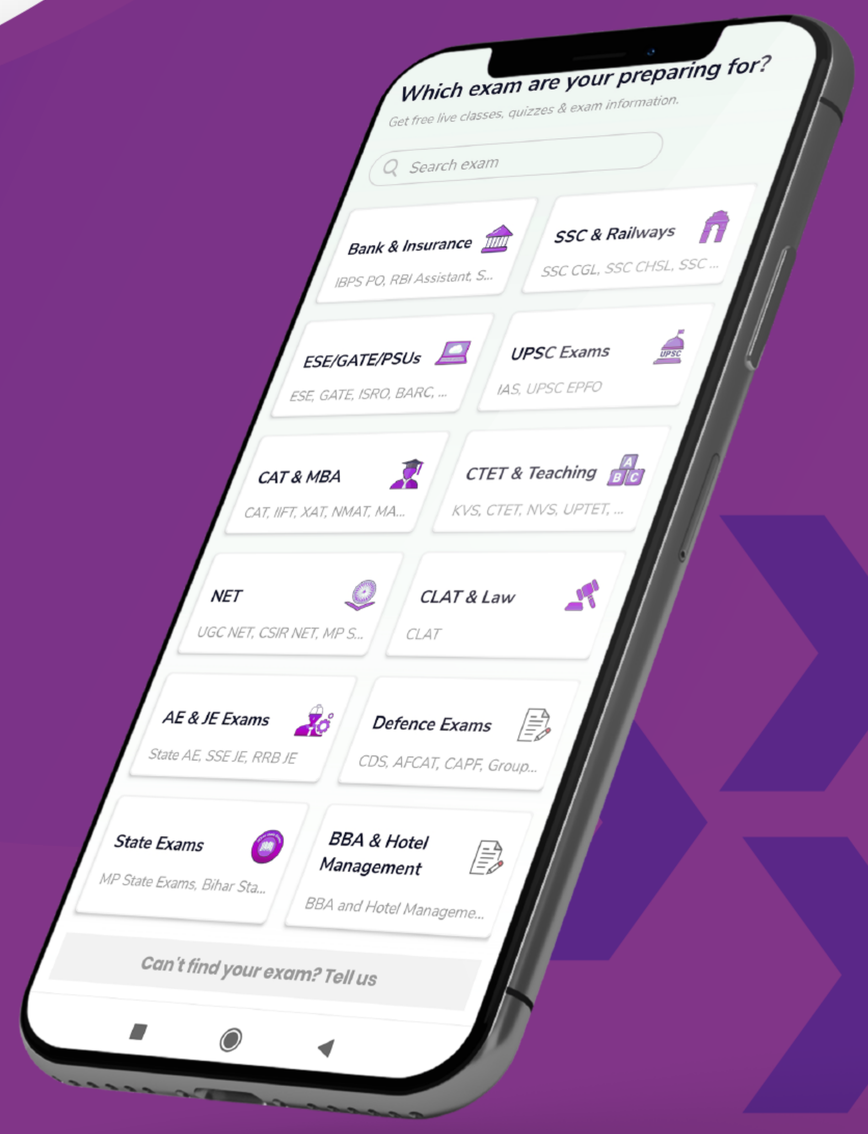


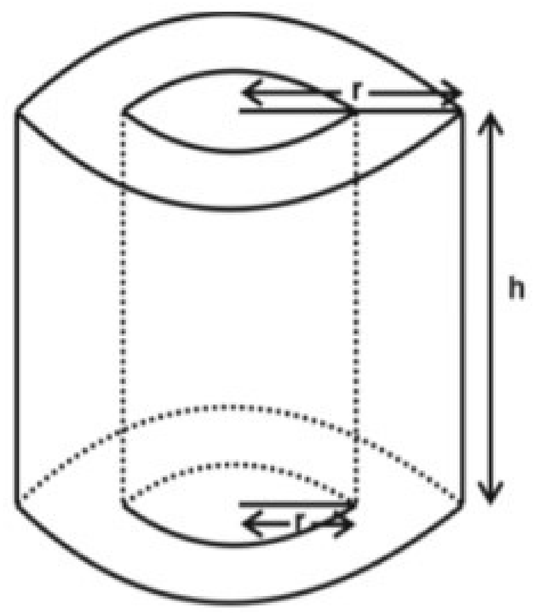
HEMISPHERE



- Volume of a hemisphere = $\left(\frac{2}{3}\right)\pi r^3$
- Curved surface area of a hemisphere = $\mathbf{2\pi r^2}$
- Total surface area of a hemisphere = $\mathbf{3\pi r^2}$



HOLLOW CYLINDER



If R, r and h represent Outer radius of cylinder, Inner radius of cylinder and Height of hollow cylinder respectively.

- Volume of hollow cylinder = $\pi(R^2 - r^2)h$

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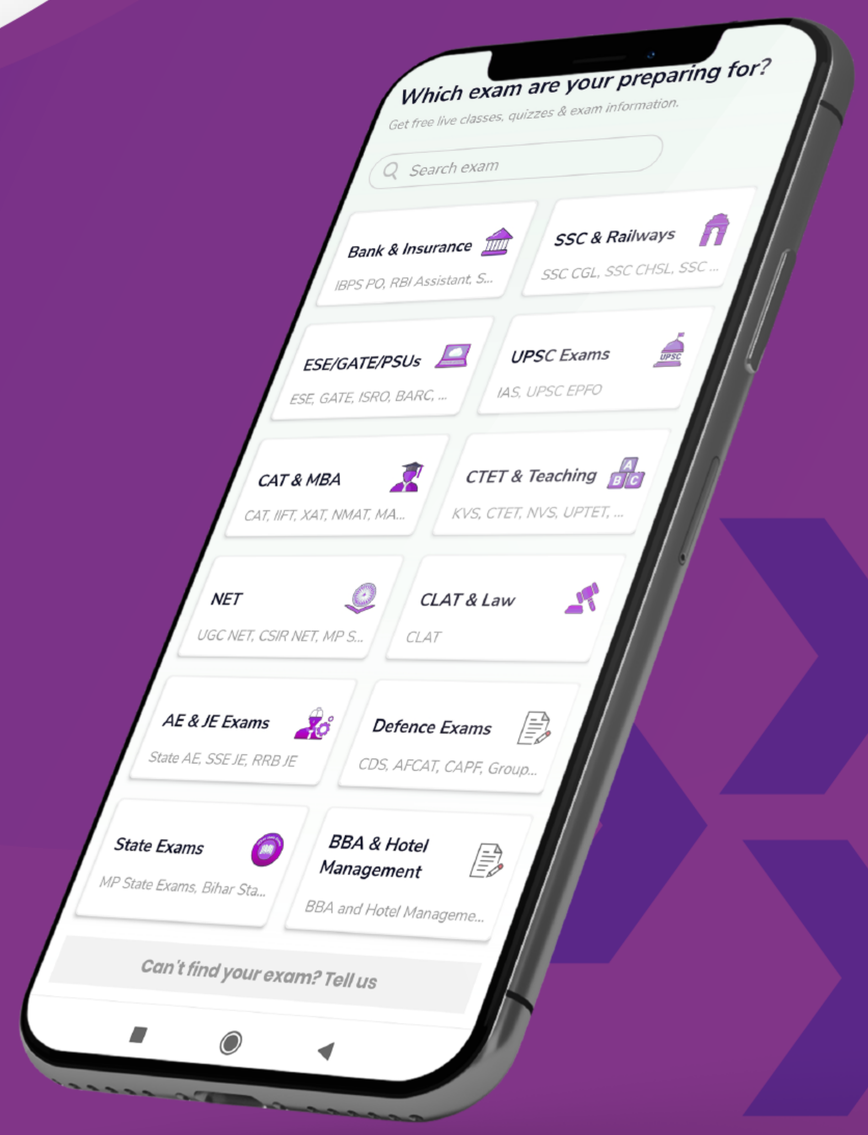
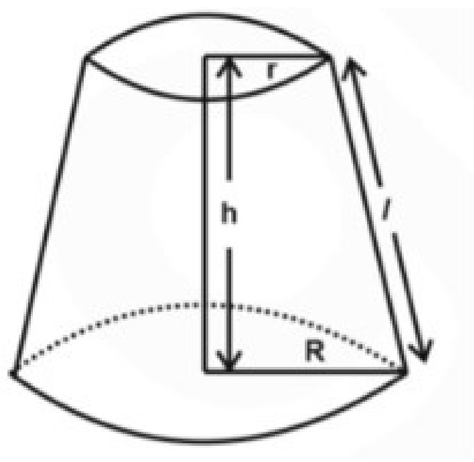


FRUSTUM OF A CONE

If, R, r, h and l represent radius of the base of the frustum, radius of the top of the frustum, height of the frustum, and slant height respectively.

- Slant height of the frustum $= 1 = \sqrt{h^2 + (R - r)^2}$
- Curved surface area of frustum = $\pi(R + r)1$
- Total surface area of frustum = $\pi(R + r)l + \pi(R^2 + r^2)$
- Volume of the frustum = $\left(\frac{1}{3}\right)\pi h(R^2 + r^2 + Rr)$



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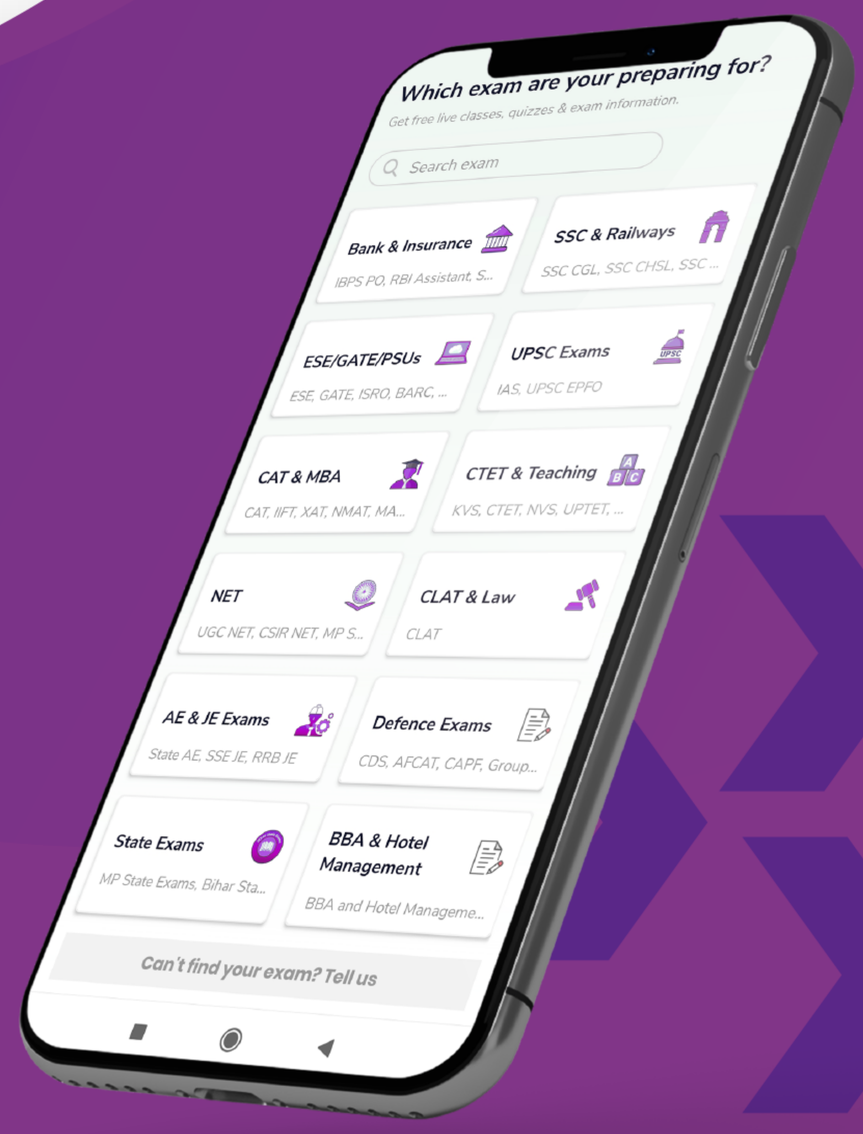
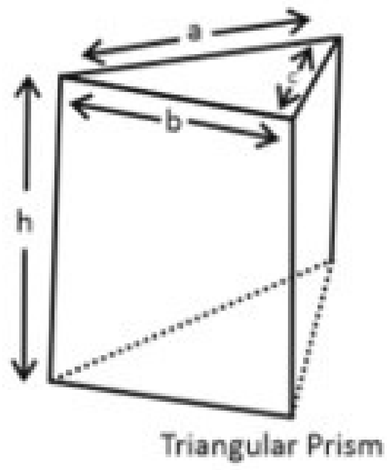


PRISM



Triangular Prism

- Volume of prism = Base area × height
- Lateral surface area of prism = perimeter of base × height
- Total surface area of prism = Lateral surface area + (2 × base area)

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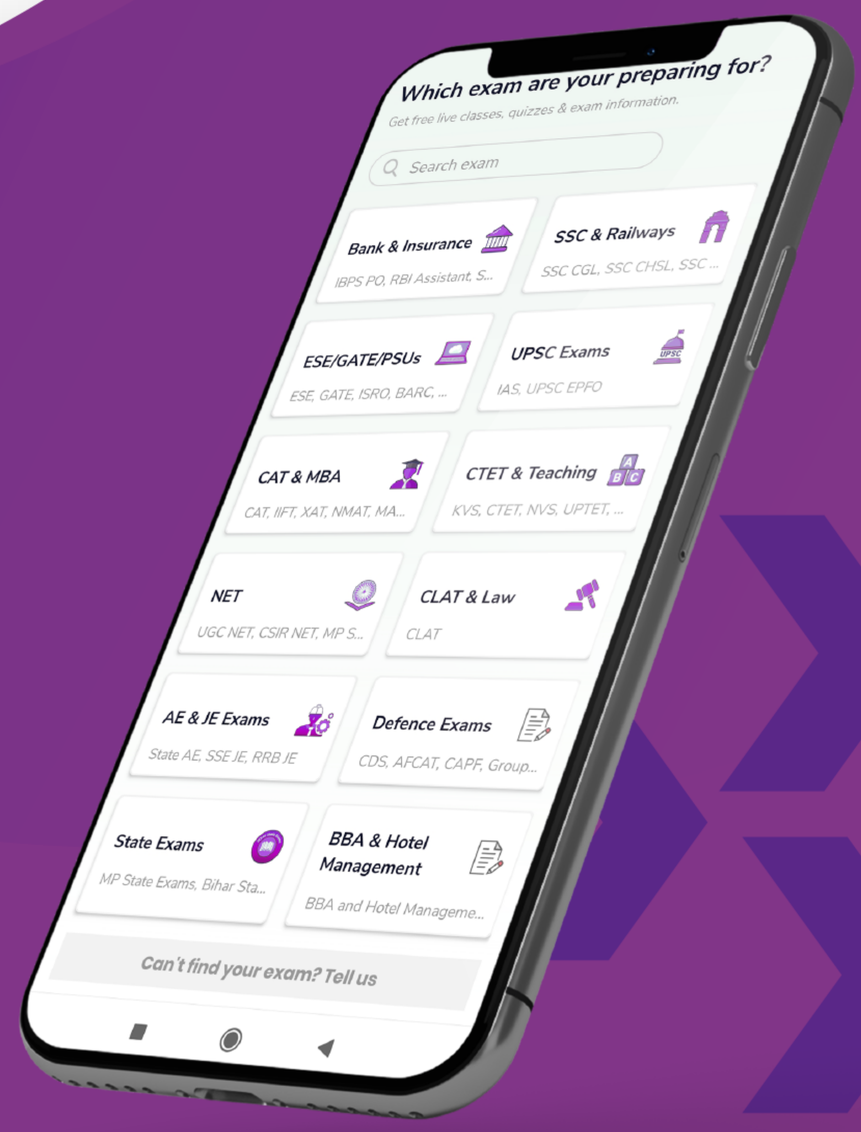

PYRAMID

- Total surface area of pyramid =

$$\textbf{base area} + (\textbf{number of side} \times \frac{1}{2} \times \textbf{slant height} \times \textbf{base length})$$

- Volume of pyramid = $\left(\frac{1}{3}\right) \times \textbf{area of base} \times \textbf{heigh}$

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