



SSC FOUNDATION



सम्यान 1.0 बैच

MATHS

MENSURATION-3D

PYRAMID & TETRAHEDRON

CONCEPT FORMULAS & TRICKS



ⓁIVE 11:00 AM-BY SHASHI SIR

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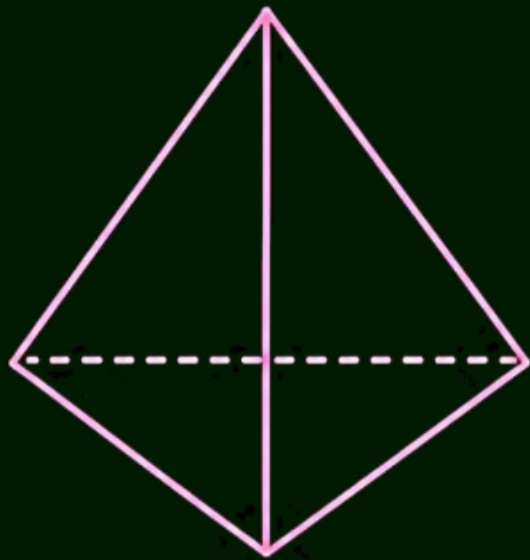
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Pyramid and Tetrahedron

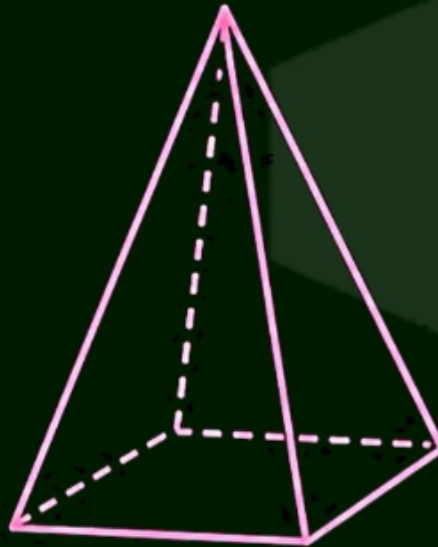
Pyramid / पिरामिड

A pyramid is a 3D figure built with a base of a polygon and triangular faces all connected together.

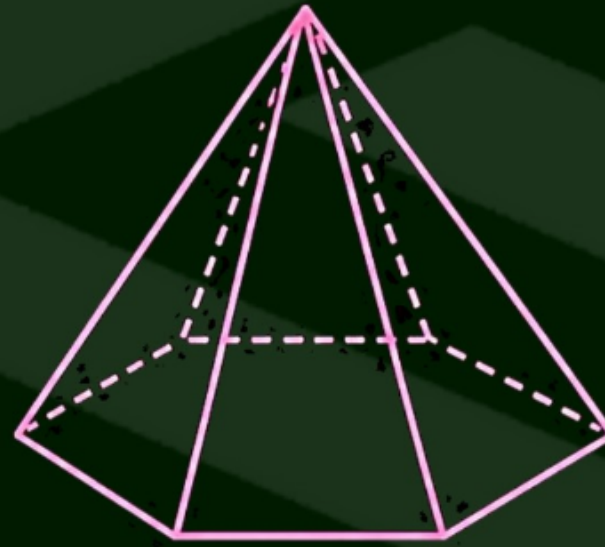
पिरामिड एक 3D आकृति है जो एक बहुभुज के आधार और सभी त्रिकोणीय फलकों को एक साथ जोड़कर बनाई जाती है।



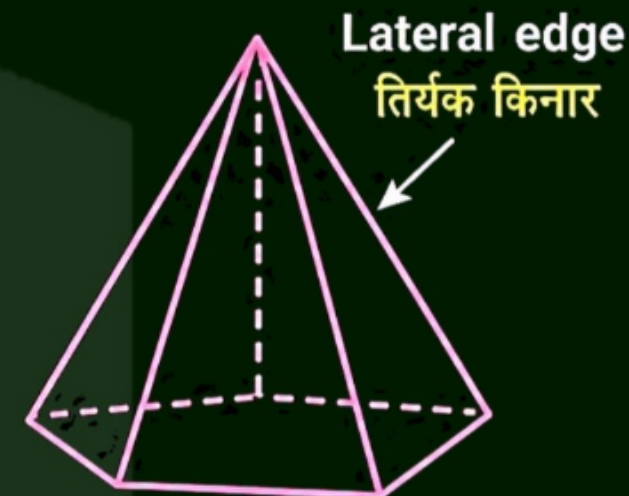
**Triangular
Pyramid**



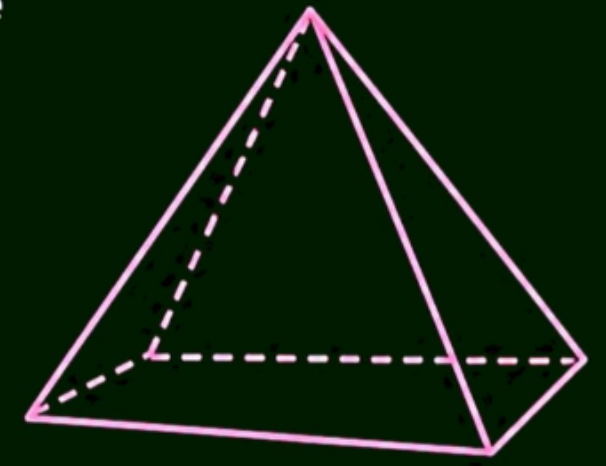
**Square
Pyramid**



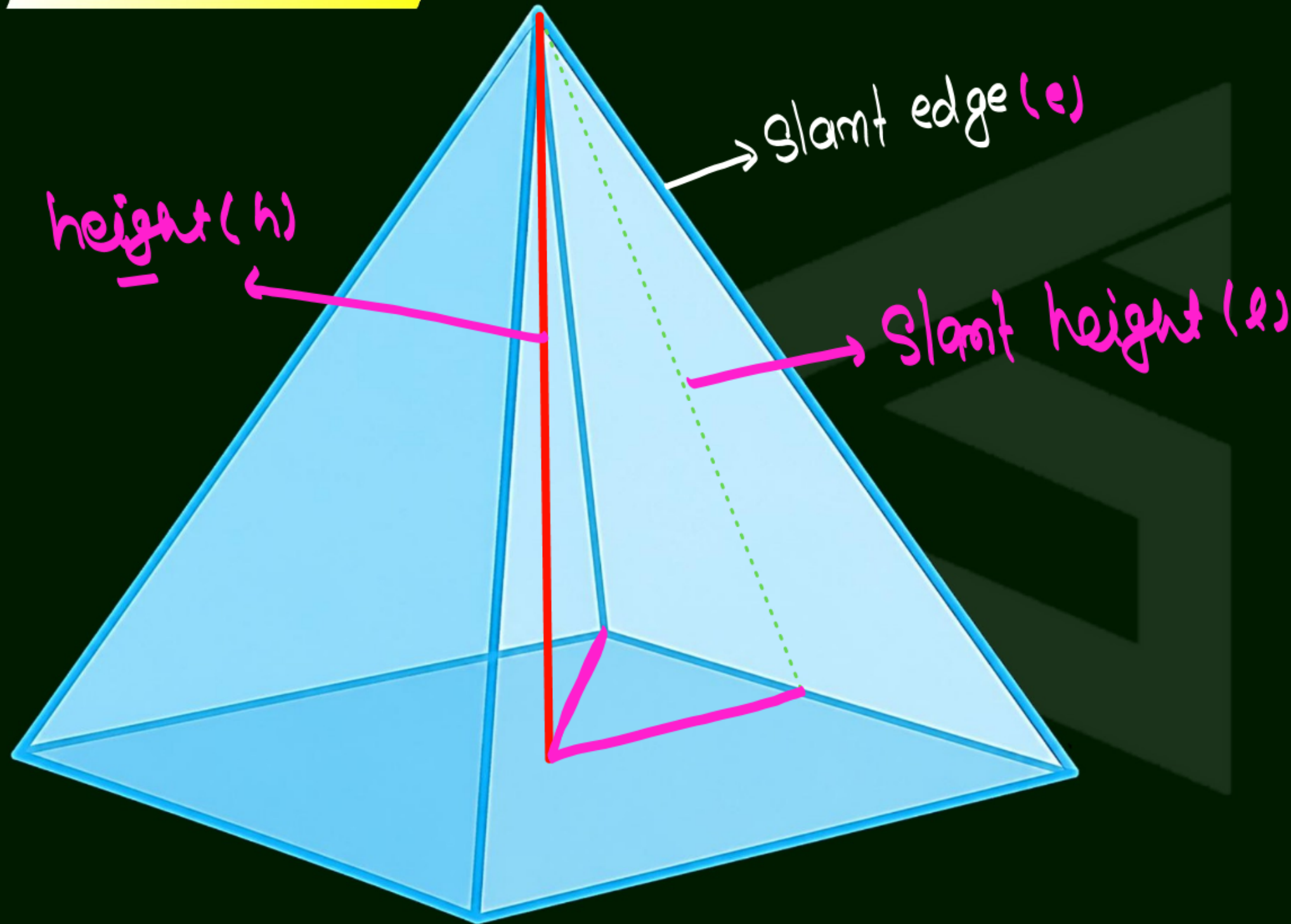
**Hexagonal
Pyramid**



**Rectangular
Pyramid**



**Pentagonal
Pyramid**



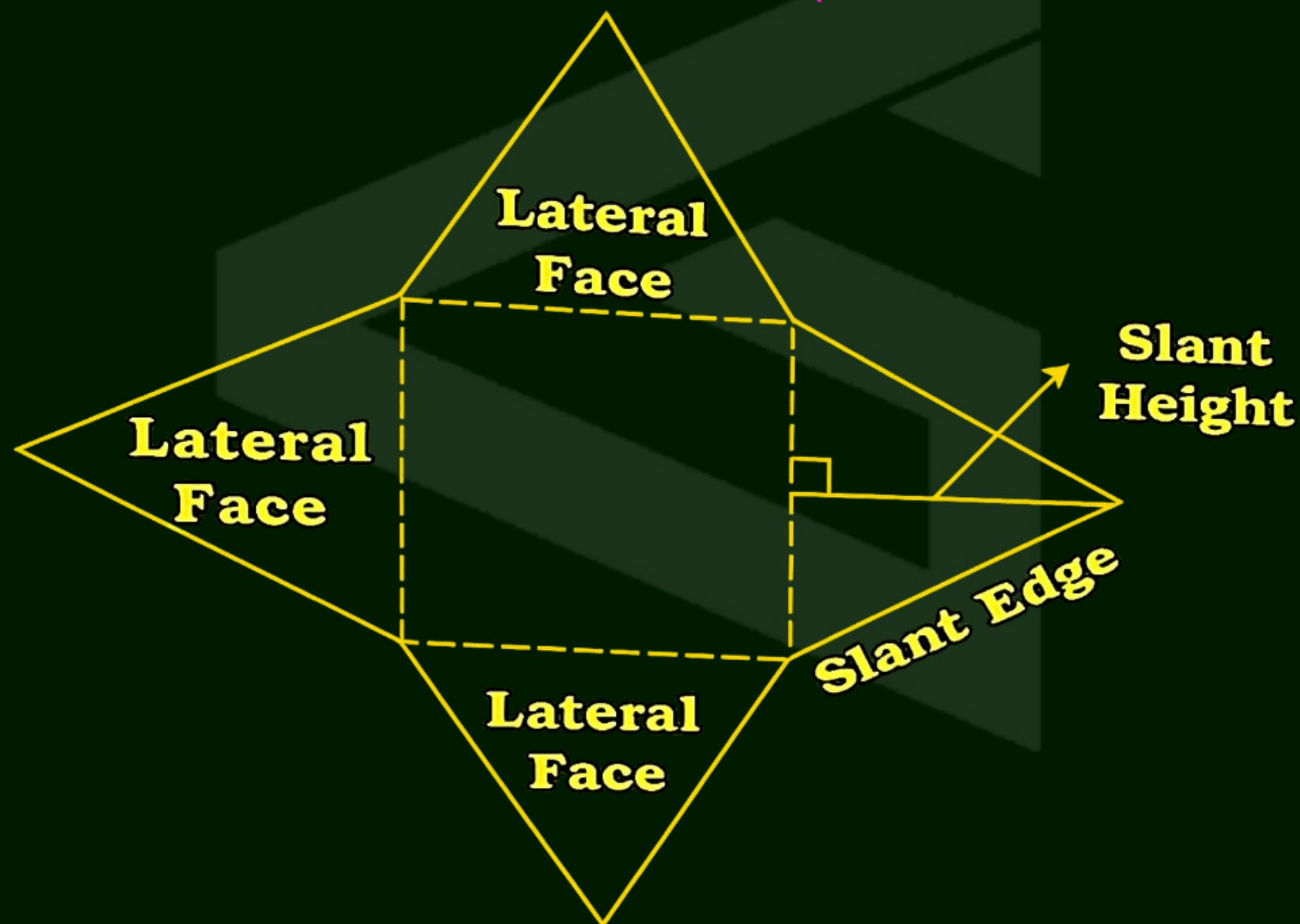
$$V = \frac{1}{3} \times \text{Area of base} \times h$$

$$C.S.A = \frac{1}{2} \times \text{Per. of base} \times l$$

$$T.S.A = C.S.A + \text{Area of base}$$

$$\text{Volume} = \frac{1}{3} \times \text{Base Area} \times \text{height}$$

$$\text{CSA/LSA} = \frac{1}{2} \times \text{Base perimeter} \times \text{Slant height}, \text{ TSA} = \text{LSA} + \text{Base Area}$$



Prism Pyramid
 Base = Base
 h = h

$$V = \text{Base Area} \times h : V = \frac{1}{3} \times \text{Base Area} \times h$$

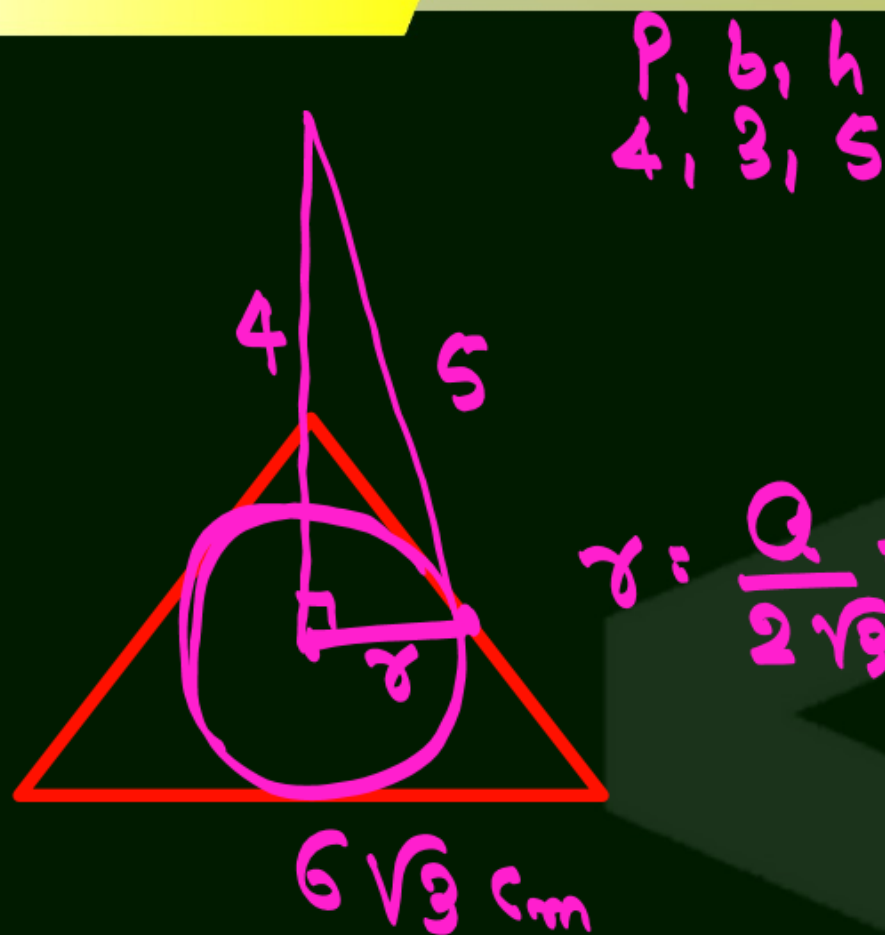
$$V_1 : V_2 \\ 3 : 1$$

1. A prism and a pyramid have the same base and the same height. Find the ratio of the volume of the prism and the pyramid?

एक प्रिज्म और एक पिरामिड का आधार समान और ऊंचाई समान है। प्रिज्म और पिरामिड के आयतन का अनुपात ज्ञात कीजिये ?

- (a) 2:3
 (b) 3:1
 (c) 1:3
 (d) 3:2

Core
S. height



P, b, h
4, 3, 5

$$r = \frac{Q}{2\sqrt{3}} = \frac{6\sqrt{3}}{2\sqrt{3}} = 3$$

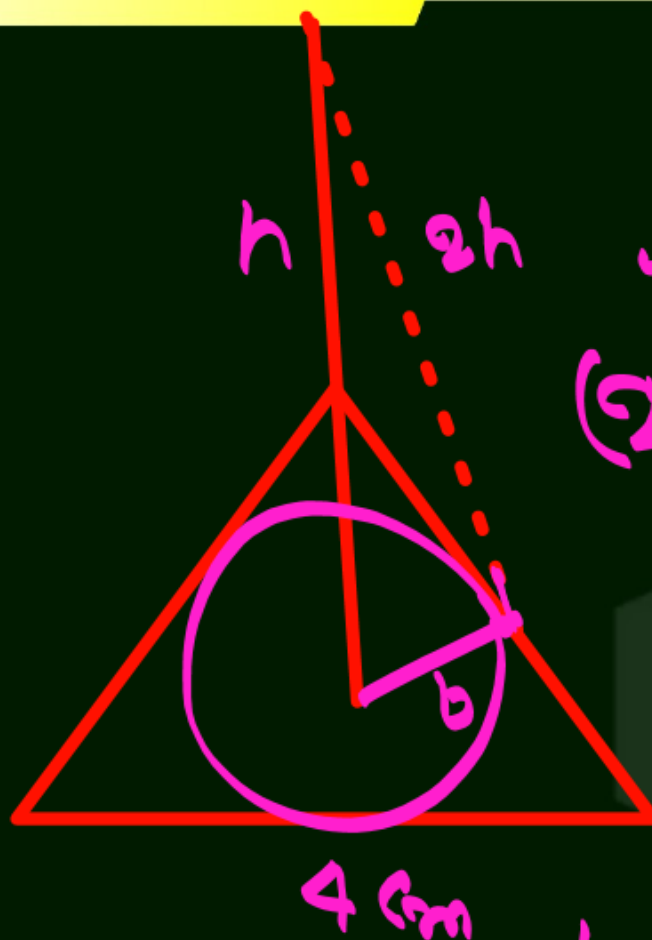
2. Find the volume of pyramid which is based on a equilateral Δ of side $6\sqrt{3}$ cm. If its slant height is 5 cm?

किसी पिरामिड का $6\sqrt{3}$ cm आधार भुजा की एक समबाहु त्रिभुज है। यदि इसकी तिर्यक ऊंचाई 5 cm है तो आयतन ज्ञात करो।

- (a) $36\sqrt{3} \text{ cm}^3$
(b) 72 cm^3
(c) $466\sqrt{3} \text{ cm}^3$
(d) 65 cm^3

$$V = \frac{1}{3} \times \frac{\sqrt{3}}{4} \times (6\sqrt{3})^2 \times 4$$

$$= \frac{1}{3} \times \sqrt{3} \times 36 \times 3 = 36\sqrt{3} \text{ cm}^3$$



$$\begin{aligned} 2^2 &= h^2 + b^2 \\ (2h)^2 - h^2 &= \frac{4}{3} \\ 3h^2 &= \frac{4}{3} \\ h^2 &= \frac{4}{9} \\ h &= \frac{2}{3} \end{aligned}$$

3. The base of a pyramid is an equilateral triangle with a side length of 4 cm. Its slant height is twice its height. Find the volume.

किसी पिरामिड का आधार एक समबाहु त्रिभुज है जिसकी भुजा 4 cm है। इसकी तिर्यक ऊंचाई इसकी ऊंचाई का दुगुना है। आयतन ज्ञात करो।

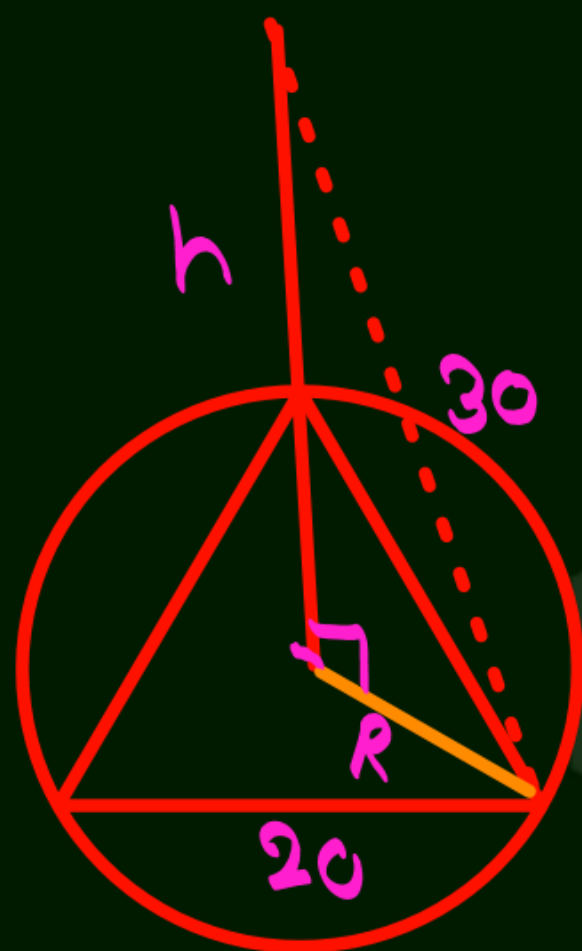
(a) 7cm^3

(b) 9cm^3

(c) $\frac{8\sqrt{3}}{9}\text{cm}^3$

(d) 15cm^3

$$\begin{aligned} V &= \frac{\sqrt{3}}{4} \times 4^2 \times \frac{2}{3} \\ &= \frac{8}{\sqrt{3}} = \frac{8\sqrt{3}}{3}\text{cm}^3 \end{aligned}$$



$$R = \frac{20\sqrt{3}}{2}$$

$$h^2 = 30^2 - \left(\frac{20\sqrt{3}}{2}\right)^2$$

$$h = \sqrt{900 - \frac{400 \times 3}{3}} = \sqrt{\frac{2800}{3}} = 10\sqrt{\frac{28}{3}}$$

4. The base of right pyramid is an equilateral triangle, each side of which is 20 cm. Each slant edge is 30 cm. The vertical height (in cm) of the pyramid is:

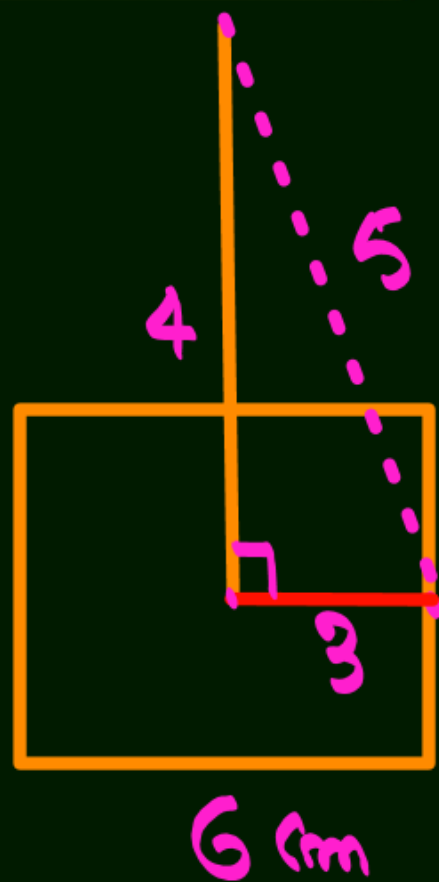
एक लंब पिरामिड का आधार एक ऐसा समबाहु त्रिभुज है, जिसकी प्रत्येक भुजा की लंबाई 20 सेमी. है। प्रत्येक तिर्यक कोर 30 सेमी. है। पिरामिड की ऊर्ध्वाधर ऊँचाई (सेमी. में) कितनी होगी?

(a) $10\sqrt{3}$

☒ (b) $10\sqrt{\frac{23}{3}}$

(c) $5\sqrt{\frac{23}{3}}$

(d) $5\sqrt{3}$



5. Find the volume of pyramid which is based on a square of side 6 cm and its slant height is 5 cm?

किसी पिरामिड का आयतन ज्ञात करें कि जिसका आधार 6 cm भुजा वाला एक वर्ग है और इसकी तिर्यक ऊंचाई 5 cm है।

(a) 53 cm³ ✗

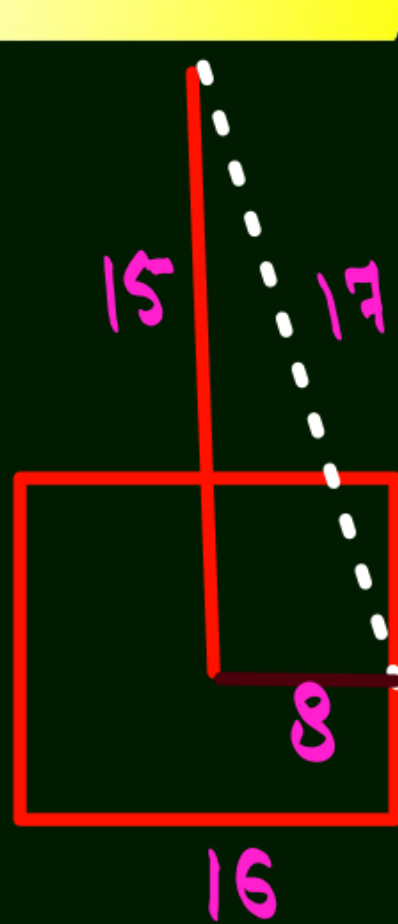
(b) 46 cm³ ✗

(c) 41 cm³ ✗

(d) 48 cm³ ✓

$$V = \frac{1}{3} \times 6 \times 6 \times 4$$

$$= 48 \text{ cm}^3$$



$$8, 15, 17$$

$$l = 17$$

$$h = 15$$

$$T.S.A = C.S.A + A_{\text{base}}$$

$$= \frac{1}{2} \times 4 \times 16 \times 17 + 16^2$$

$$= 32 \times 17 + 256$$

$$= 544 + 256 = 800 \text{ cm}^2$$

6. Find the total surface area of a pyramid of height 15 cm which is based on a square of side 16 cm?

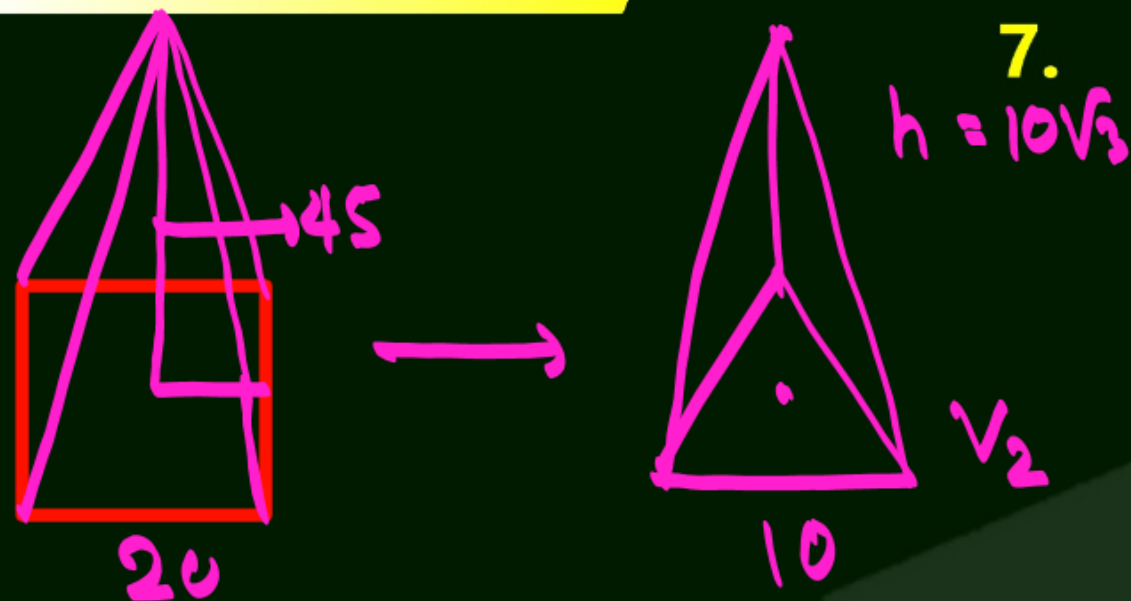
किसी पिरामिड का कुल पृष्ठीय क्षेत्रफल ज्ञात करें जिसकी ऊंचाई 15 cm और आधार 16 cm भुजा का एक वर्ग है।

(a) 800 cm^2

(b) 750 cm^2

(c) 900 cm^2

(d) 850 cm^2



$$V = n \times V_2$$

$$n = \frac{20^2 \times 20 \times 45}{\frac{\sqrt{3}}{4} \times 10^2 \times 10\sqrt{3}}$$

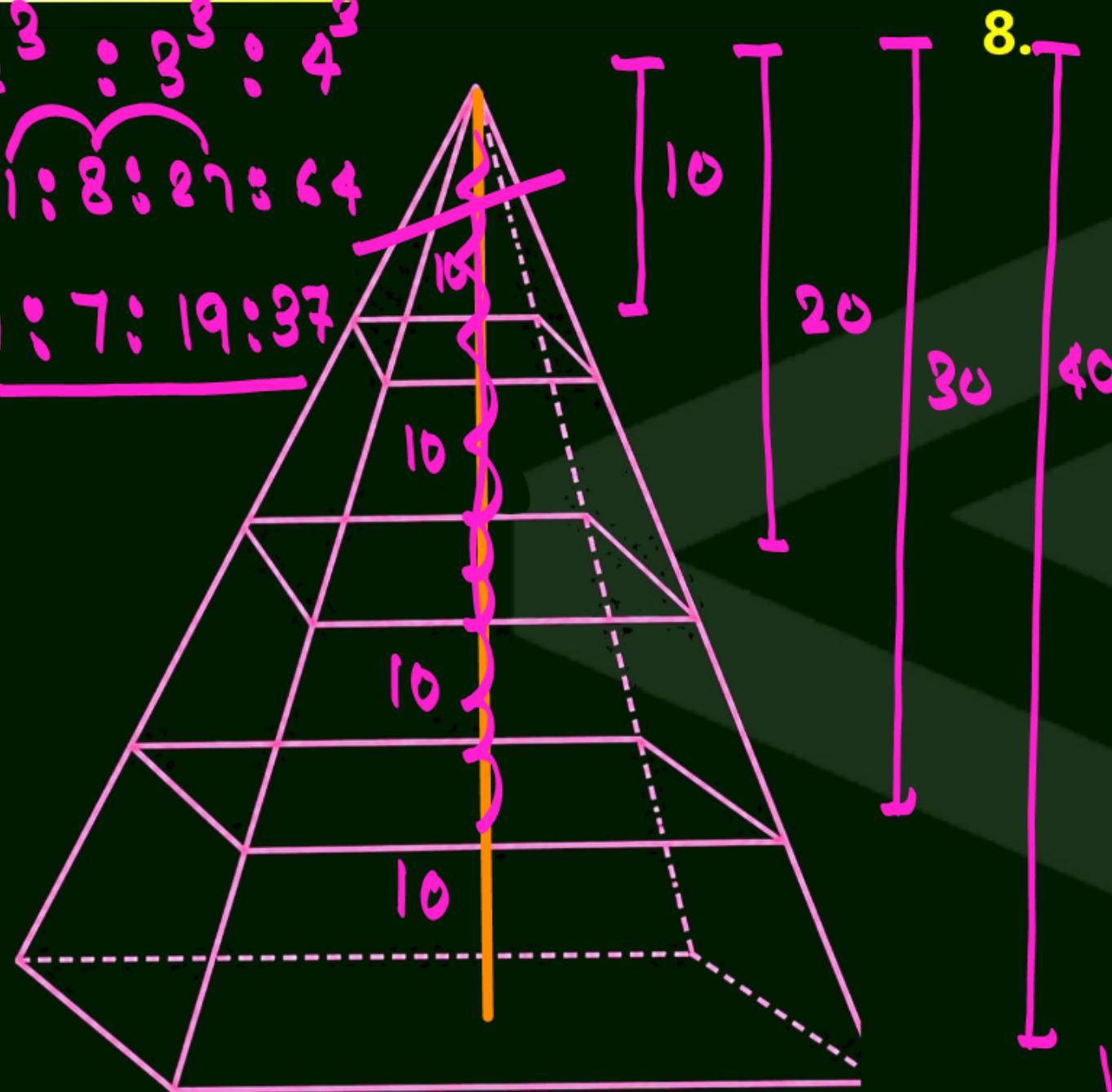
$$= \frac{4 \times 4 \times 45}{10 \times 3} = 24$$

A square pyramid has a base side length of 20 cm and a height of 45 cm. This pyramid is melted down to form new pyramids with equilateral triangular bases, each having a side length of 10 cm and a height of $10\sqrt{3}$ cm. Determine the total number of pyramids formed in this manner.

एक वर्गाकार पिरामिड के ऊंचाई का आधार की भुजा 20 सेमी. और ऊंचाई 45 सेमी. है, पिरामिड को पिघलाकर समबाहु त्रिभुज आधार वाले पिरामिड बनाए गए हैं, जिनकी भुजा 10 सेमी. है और ऊंचाई $10\sqrt{3}$ सेमी. है। इस प्रकार बने पिरामिडों की कुल संख्या ज्ञात करें।

- (a) 24
(b) 28
(c) 20
(d) 27

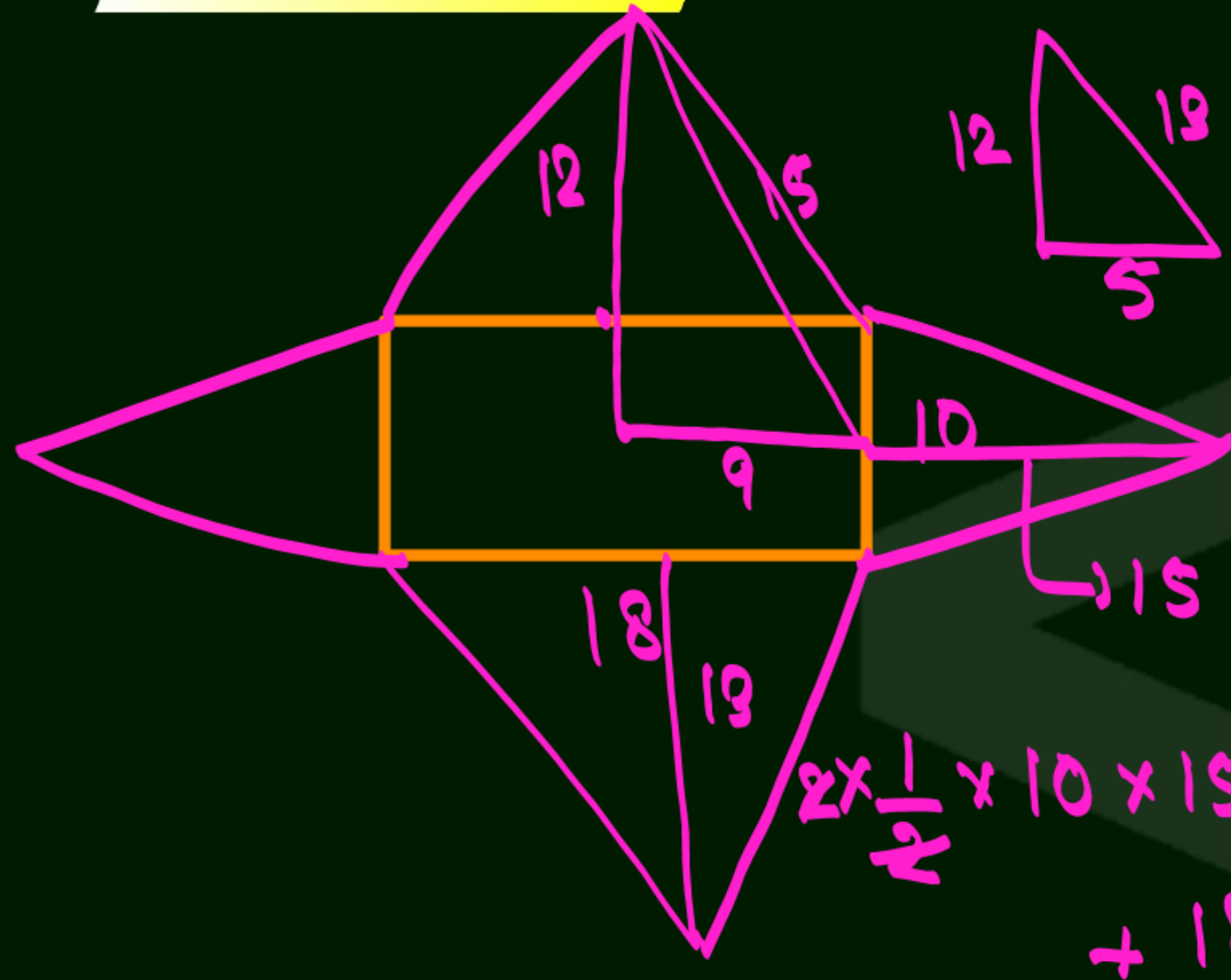
$V = 1^3 : 2^3 : 3^3 : 4^3$
 Pyramid $V = 1 : 8 : 27 : 64$
Cut part $V = 1 : 7 : 19 : 37$



8. A right pyramid has a square base with side of base 12 cm and the height of pyramid is 40 cm. The pyramid is cut in four parts of equal heights by three planes parallel to its base. What is the ratio of the volume of four parts?

एक वर्गाकार आधार वाले पिरामिड जिसकी भुजा 12 सेमी. और पिरामिड की ऊंचाई 40 सेमी. है। पिरामिड को इसके आधार के समान्तर 3 काट द्वारा 4 बराबर ऊंचाई वाले भागों में काटा गया है, तब इनके आयतनों का अनुपात क्या है?

- (a) 1:8:27:70
- (b) 1:7:19:47
- (c) 1:8:27:64
- ✓ (d) 1:7:19:37



9. Find the total surface area of a pyramid which is based on a rectangle of length 18 cm, breadth 10 cm & height 12 cm?

किसी पिरामिड का आधार एक आयत है जिसकी लंबाई व चौड़ाई 18 cm व 10 cm है। यदि पिरामिड की ऊंचाई 12 cm हो तो कुल पृष्ठीय क्षेत्रफल ज्ञात करो।

(a) 524cm^2

(b) 636cm^2

(c) 575cm^2

(d) 564cm^2

$$2 \times \frac{1}{2} \times 10 \times 15 + \frac{1}{2} \times 2 \times 18 \times 15 + 18 \times 10$$

$$150 + 234 + 180 = 564\text{cm}^2$$

H.W

10. Find the volume of a pyramid which is based on a regular hexagon of side $2\sqrt{3}$ cm and height of pyramid is 15 cm?

किसी पिरामिड का आयतन ज्ञात करो जिसका आधार $2\sqrt{3}$ सेमी भुजा वाला एक षट्भुज है और पिरामिड की ऊंचाई 15 cm है।

(a) $73\sqrt{3} \text{ cm}^3$

(b) $99\sqrt{3} \text{ cm}^3$

(c) $90\sqrt{3} \text{ cm}^3$

(d) $79\sqrt{3} \text{ cm}^3$

If slant edge is equal to side of Base, then it is tetrahedron.
जब पिरामिड के चारों पृष्ठ एक समान हो या अगर तिर्यक कोर आधार की भुजा के बराबर हो।

$$\text{Volume/आयतन} = \frac{1}{3} \times \text{Base area} \times \text{Height} =$$

$$\frac{1}{3} \times \frac{\sqrt{3}}{4} a^2 \times \frac{\sqrt{2}}{\sqrt{3}} a = \frac{\sqrt{2}}{12} a^3$$

$$\text{Lateral surface area / पार्श्व सतह का क्षेत्रफल} = \frac{1}{2} \times B.P. \times$$

Slant height

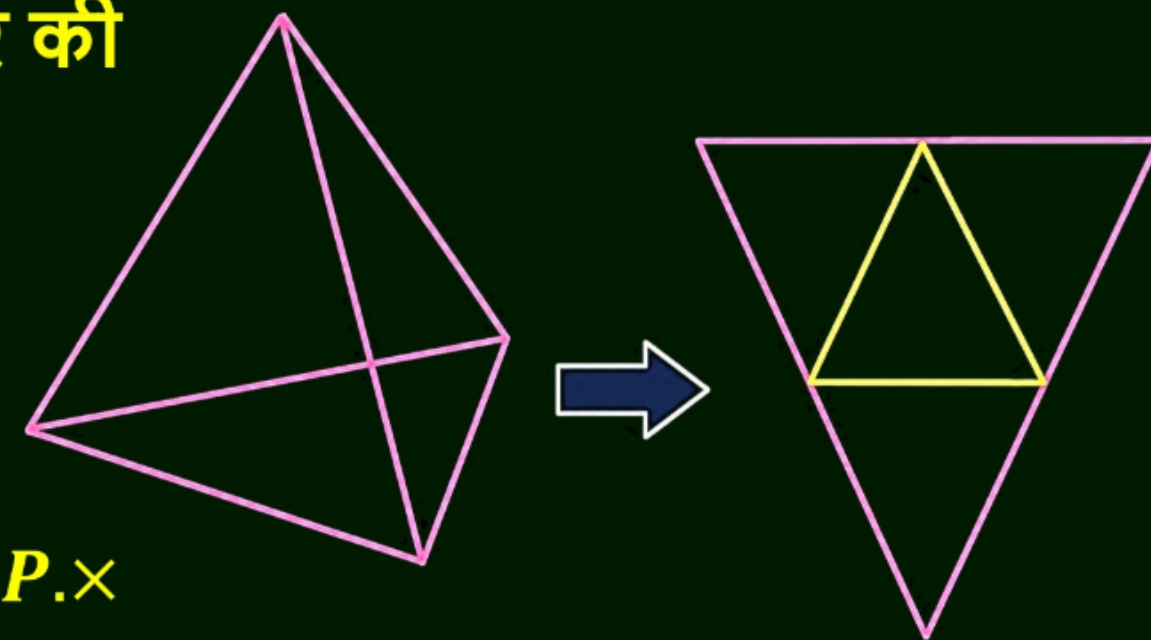
$$= \frac{1}{2} \times 3a \frac{\sqrt{3}}{2} a = 3 \times \frac{\sqrt{3}}{4} a^2$$

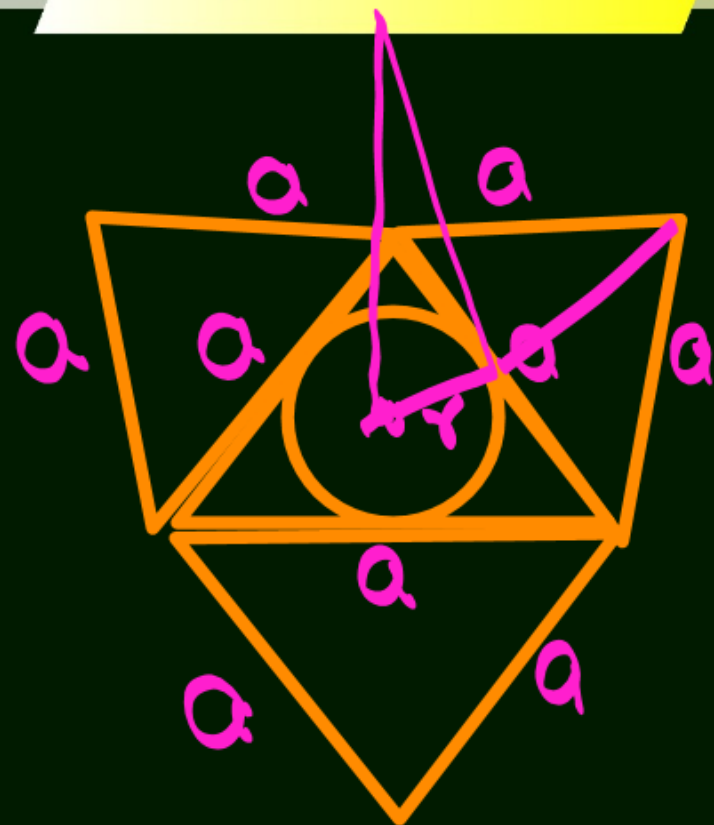
$$= 3 \times \text{area of equilateral } \Delta$$

$$\text{Lateral surface area / पार्श्व सतह का क्षेत्रफल} = \text{LSA} + \text{Base area}$$

$$= 4 \times \frac{\sqrt{3}}{4} a^2 = 4 \times \text{area of equilateral } \Delta$$

$$a = \text{side of equilateral } \Delta$$





Side = slant edge

$$a = a$$

$$l = \frac{\sqrt{3}}{2} \times a$$

$$r = \frac{a}{2\sqrt{3}}$$

$$h = \sqrt{l^2 - r^2}$$

$$h = \sqrt{\frac{3}{4}a^2 - \frac{a^2}{12}} = \frac{2\sqrt{2}a}{2\sqrt{3}} = \sqrt{\frac{2}{3}}a$$

$$V = \frac{1}{3} \times \frac{\sqrt{3}}{4} \times a^2 \times \frac{\sqrt{2}}{\sqrt{3}} \times a = \frac{a^3}{6\sqrt{2}} = \frac{\sqrt{2}a^3}{12}$$

Tetrahedron (सममितीकृत)

$$C.S.A = \frac{1}{2} \times P \times l$$

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

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

$$T.S.A = \frac{3\sqrt{3}}{4} a^2 + \frac{\sqrt{3}}{4} a^2$$

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

$$= \sqrt{3} a^2$$

$$V = \frac{a^3}{6\sqrt{2}} = \frac{\cancel{12} \times 12 \times 12}{8 \times \cancel{12}} = 144\sqrt{2}$$

11. If the length of each side of a regular tetrahedron is 12 cm, then the volume of the tetrahedron is?

किसी समचतुष्फलक की प्रत्येक भुजा 12 सेमी. है। समचतुष्फलक का आयतन ज्ञात करें?

- (a) $144\sqrt{2} \text{ cm}^3$
- (b) $72\sqrt{2} \text{ cm}^3$
- (c) $8\sqrt{2} \text{ cm}^3$
- (d) $64\sqrt{2} \text{ cm}^3$

$$V = \frac{Q^3}{6\sqrt{2}} \rightarrow Q \rightarrow T.S.A = \sqrt{3}Q^2$$

$$\frac{Q^3}{6\sqrt{2}} = 18\sqrt{2}$$

$$Q^3 = 18 \times 6 \times 2$$

$$Q^3 = 216$$

$$Q = 6$$

$$T.S.A = 6^2\sqrt{3} = 36\sqrt{3}$$

12. The volume of a tetrahedron is $18\sqrt{2}$ then find its total surface area?

समचतुष्फलक का आयतन $18\sqrt{2}$ है तब उसका कुल पृष्ठ क्षेत्रफल ज्ञात करें?

(a) $18\sqrt{3}$

(b) $37\sqrt{3}$

☒ (c) $36\sqrt{3}$

(d) $45\sqrt{3}$



13. Find the TSA of a tetrahedron whose height is $4\sqrt{2}$ cm.

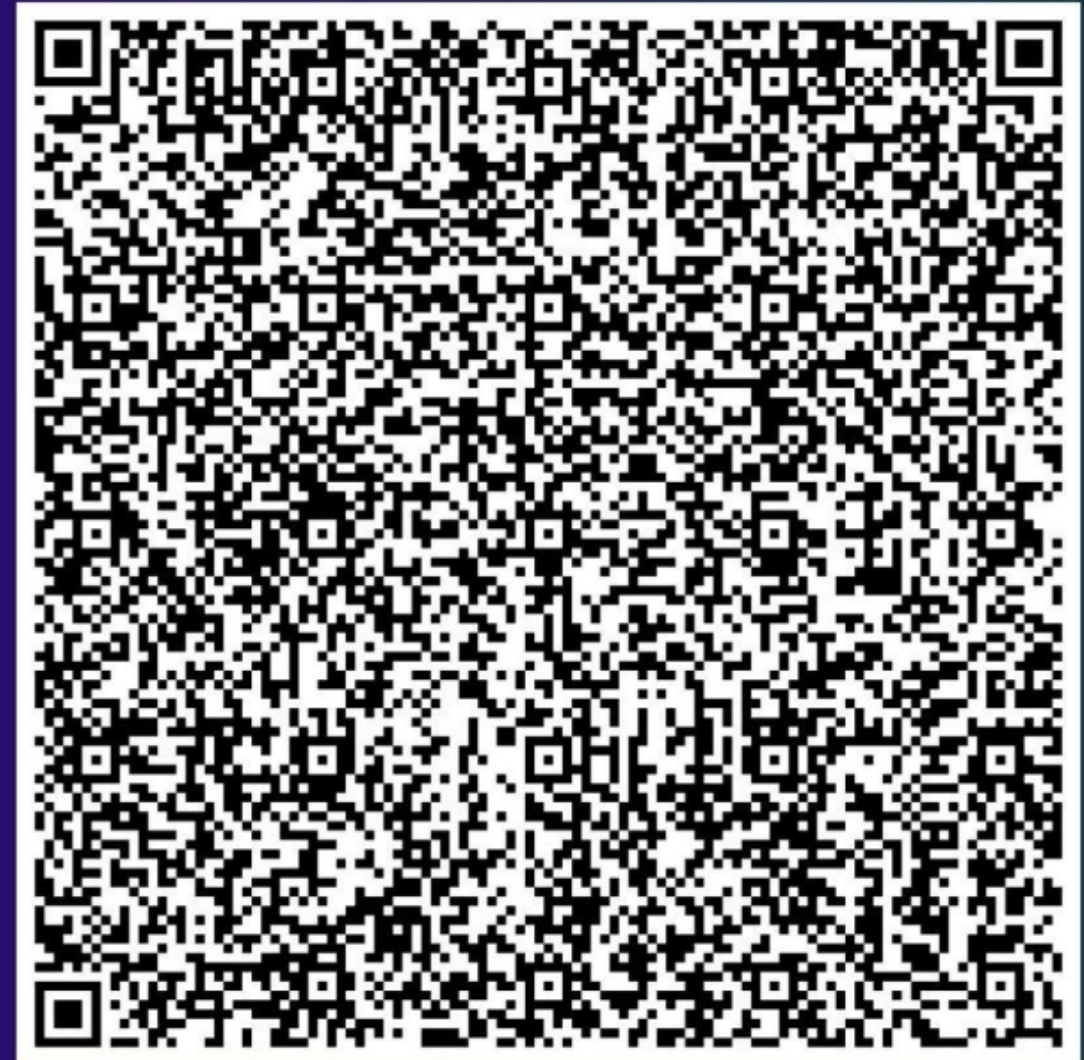
उस समचतुष्फलक का TSA कितना होगा यदि इसकी ऊंचाई $4\sqrt{2}$ सेमी. है?

- (a) $42\sqrt{3}cm^2$
- (b) $48\sqrt{3}cm^2$
- (c) $32\sqrt{3}cm^2$
- (d) $36\sqrt{3}cm^2$

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The End
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