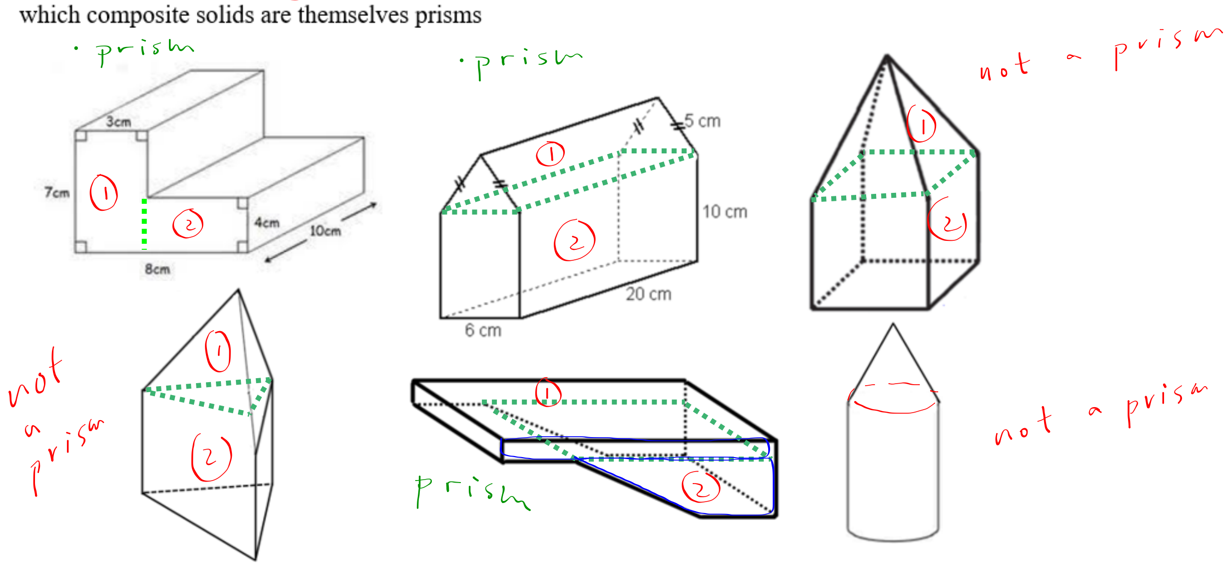
Lesson 12: Volume and Areas of Composite Solids AND full-level tasks

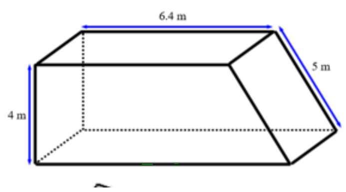
April 12 2024

#1 #2

Warm-up: Decompose/break up the following solids into simpler prisms or pyramids. State which composite solids are themselves prisms



1



prism

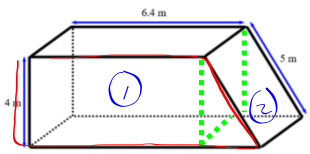
$V_T = V_1 + V_2$

short cut:

$V_T = A_B \times h$

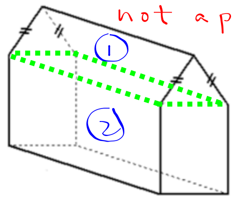
$V_T = V_1 + V_2$

1

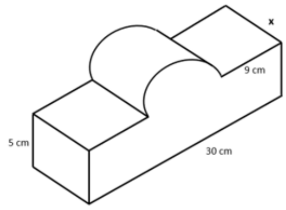


not a prism

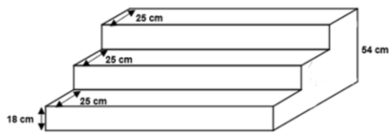
2



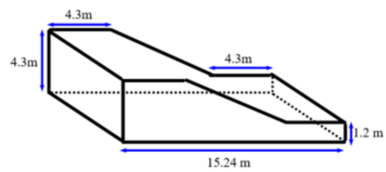
3



4



5



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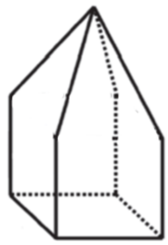
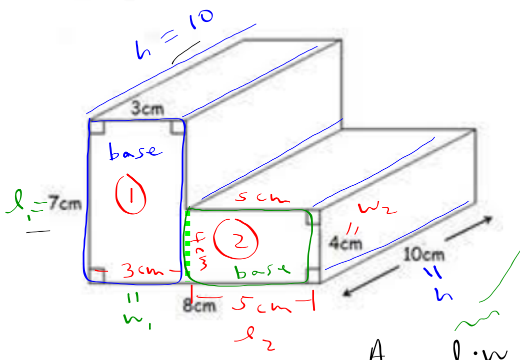


Find Volumes of Composite Solids

1.1.1 Example

Consider the following composite solid. Determine its volume.

tips: · break-up the solid:
· label sides (w more measurements)



$A_{B_1} = l \cdot w$

tool

$V_T = V_1 + V_2$

$V_1 = A_B \times h$ $\qquad$ $V_2 = A_B \times h$

$V_1 = l \cdot w \cdot h$ $\qquad$ $V_2 = l \cdot w \cdot h$

$V_1 = 7 \cdot 3 \cdot 10$ $\qquad$ $V_2 = 5 \cdot 4 \cdot 10$

$V_1 = 210\ cm^3$ $\qquad$ $V_2 = 200\ cm^3$

$V_T = V_1 + V_2$

$V_T = 210 + 200$

$V_T = 410\ cm^3$

You do:

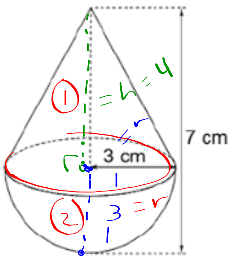
1.1.2

1.1.3

1.1.4

1.1.2 Example

Consider the following container. If its base is a hemisphere, determine its capacity in *L*.



$V_T = V_① + V_②$

pyramid

$V_① = \frac{A_{B_1} \times h}{3}$

$A_{B_①} = \pi r^2$

$V_1 = \frac{\pi r^2 \times h}{3}$

$V_1 = \frac{\pi (3)^2 \times 4}{3}$

$V_1 = 12\pi$

$V_1 \approx 37.7 \text{ cm}^2$

$V_② = \frac{2\pi r^3}{3}$

$V_② = \frac{2\pi (3)^3}{3}$

$V_② = 18\pi$

$V_② \approx 56.55 \text{ cm}^3$

$V_T = V_① + V_②$

$V_T = 12\pi + 18\pi$

$V_T = 30\pi \text{ cm}^3$

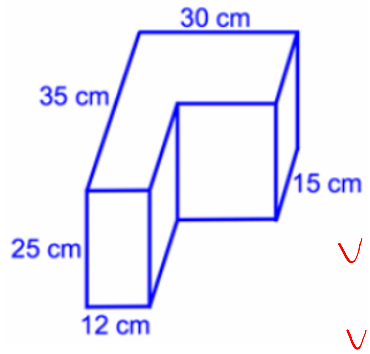
$V_T \approx 94.25 \text{ cm}^3$

$= 94.25 \text{ mL} \div 10 \div 10 \div 10$

$V_T = 0.09425 \text{ L}$

You do : and start 1.2.1 → ans: 98.02 cm²

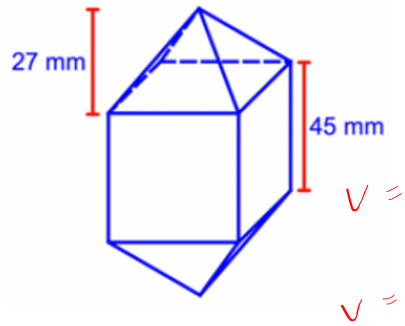
1.1.3 Practice: Consider the following composite solid. Determine its capacity in *L*.



$V = 17250\ cm^3$

$V = 17.25\ L$

1.1.4 Practice: Consider the following composite solid composed of a cube and two identical pyramids. Determine its capacity in *mL*.



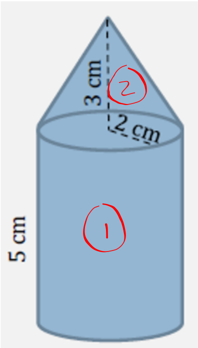
$V = 127575\ mm^3$

$V = 127.575\ mL$

Finding the Area of Composite Solids

(pas évident)

1.2.1 Example: Consider the following composite solid. Determine its total surface area.



e.x. $A_T \cong 98.02\,cm^2$

$A_T = A_{T\,cylinder} + A_{T\,cone}$ No

$A_T = A_{L\,cone} + A_{T\,cylinder} - A_B$ Yes!

or

$A_T = A_{L\,cone} + A_{L\,cylinder} + A_B$ Yes!

$A_T = A_{L\,cone} + A_{L\,cylinder} + \underline{A_B}$

$A_{L\,py} = P_B \times \frac{a}{2}$

$A_L = 2\pi r \times \frac{a}{2}$

$A_L = 2\pi(2) \times \frac{3.6}{2}$

$A_L \cong \underline{22.6195}\,cm^2$

$A_{L\,pr.} = P_B \times h$

$A_{L\,cy} = 2\pi r \times h$

$A_L = 2\pi(2) \times 5$

$A_L = \underline{20\pi}$

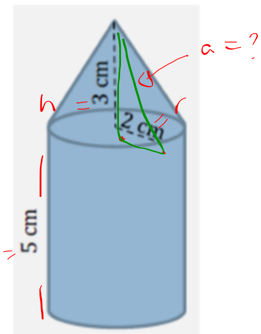
$A_L \approx 62.8319\,cm^2$

$A_B = \pi r^2$

$A_B = \pi\, 2^2$

$A_B = 4\pi$

$A_B = 12.566\,cm^2$



a = 3 ... = a = c

2 = b

$c^2 = a^2 + b^2$

$c^2 = 3^2 + 2^2$

$c = \sqrt{(3^2 + 2^2)}$

$c = 3.6\,cm$ = apothem

You do: 1.2.3

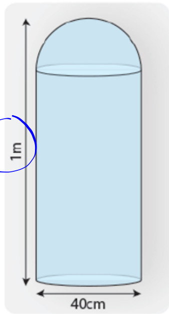
$A_T = A_L + A_L + A_B$

$A_T = 98.02\,cm^2$

You do

1.2.3 Practice: The following composite solid is composed of a cylinder and half a sphere. Determine its total surface area in cm^2.

convert



A total = 4400 pie cm squared

or

A total = 13 823.008 cm squared

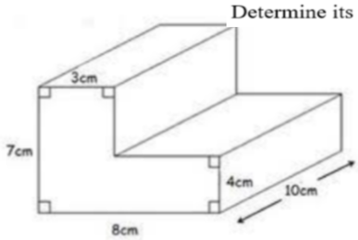
~~$A_T = 4000\pi \text{ cm}^2$~~

~~– or –~~

~~$A_T = 12566.37 \text{ cm}^2$~~

Bonus :

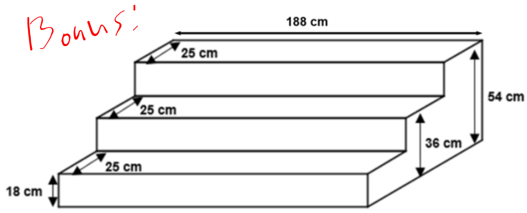
1.2.2 Example: Consider the following composite solid. Determine its total surface area.



$A_T = 382 \text{ cm}^2$

1.2.4 Practice: Consider the following composite solid. Determine its total surface area.

Bonus:



$A_T = 53904 \text{ cm}^2$

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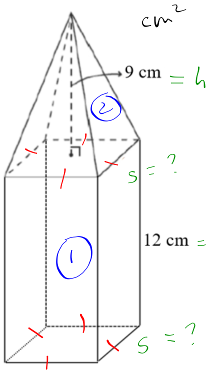
TASK: material on roof.

2.1.1 Example: An architect is making a shed whose roof he will shingle with 2.5 bags of shingles. The shed is represented in the diagram below which pictures a pyramid whose base is the same as that of the prism. Their bases have congruent sides. The total capacity of the shed is 60 000 dm^3. If each bag covers 12 m^2 and contains 28 shingles, will the ~~3.5~~ 2.5 bags be enough to shingle the roof?

mm, cm², ③ = V



Tips: · label diagram w̄ info from sentences.
· take notes. ⊗ find unknown values

$V_T = 60\ 000\ mm^3$

Want
(i) Area we need to cover

(ii) area/amount we have.

2.5 bags × 12 cm²/bag

30 cm² of shingles

· find s !

· w̄ what tool/equation? (based on given info)

tool

stuff to sub in:

$V_T = V① + V②$

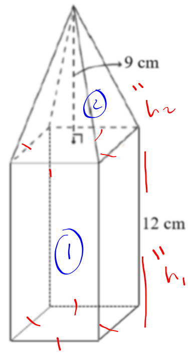
$V① = A_B \times h$

$A_B = s^2$

$V① = s^2 \times h$

$V② = \dfrac{A_B \times h}{3}$

$V② = \dfrac{s^2 \times h}{3}$



$V_T = s^2 \times h_1 + \dfrac{s^2 \times h_2}{3}$

$V_T = s^2 \times 12 + \dfrac{s^2 \times \cancel{9}^{3}}{\cancel{3}}$ · sub · simplify

$V_T = 12s^2 + 3s^2$

$V_T = 15s^2$

$V = 60\ 000\ mm^3 \div 10^3$

$V = 60\ cm^3$

$h_1 = 12\ cm$

$h_2 = 9\ cm$

$\dfrac{60}{15} = \dfrac{\cancel{15} \cdot s^2}{\cancel{15}}$

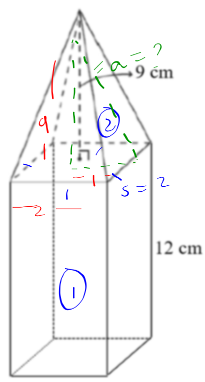
solve for s w̄ o.o.

BEDMAS

$\sqrt{4} = \sqrt{s^2}$

$s = 2\ cm$

2.1.1 Example: An architect is making a shed whose roof he will shingle with 2.5 bags of shingles. The shed is represented in the diagram below which pictures a pyramid whose base is the same as that of the prism. Their bases have congruent sides. The total capacity of the shed is 60 000 ~~dm^3~~. If each bag covers 12 ~~m^2~~ cm and contains 28 shingles, will the ~~3.5~~ 2.5 bags be enough to shingle the roof?



we have 30 cm² of shingle

WANT: A_L of pyramid

INFO $s = 2\ cm$ ✓

$a = ?$

TOOL:

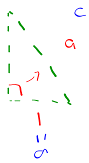
$A_L = P_B \times \dfrac{a}{2}$

want → tool: $c^2 = a^2 + b^2$

$A_L = 4s \times \dfrac{a}{2}$

$P = s + s + s + s$

$P = 4s$



$c^2 = 1^2 + 9^2$

$c = \sqrt{(1^2 + 9^2)}$

$c \cong 9.06\ cm$

$A_L = 4(2) \times \dfrac{9.06}{2}$

$A_L = 36.22\ cm^2$ → we need

$30\ cm^2$ → we have

∴ No he won't have enough, since $36.22\ cm^2 > 30\ cm^2$

You do : exit ticket (2.1.2) and more tasks 2.1.3/2.1.4

Exit Ticket:

2.1.2 Practice: The architect is now making a smaller shed whose exterior walls and roof he plans to paint with 4 cans of paint. The shed is represented in the diagram below which pictures a pyramid on top of a cube. The height of the pyramid is congruent to each side length of the cube. The total capacity of the smaller shed is 13.5 dm^3. If each can of paint cost \$22.50 and covers 1.5 dm^2, will the 4 cans be enough?

HMWK

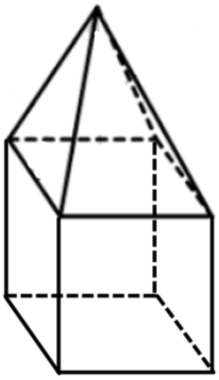
pg 91 #2.22 (great one)

pg 92 #2.24

pg 139 (top)

pg 143-4 #3.26-#3.27

pg 115 (not a))



$s = 2.16$ dm

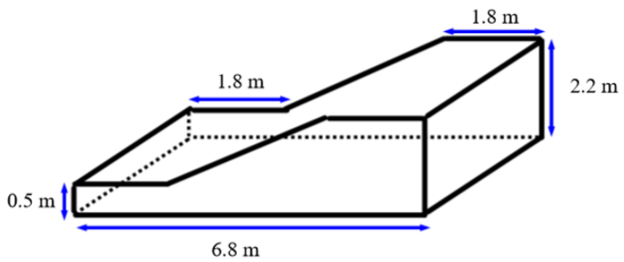
$a = 2.41$ dm

we have: 6 dm^2 of paint

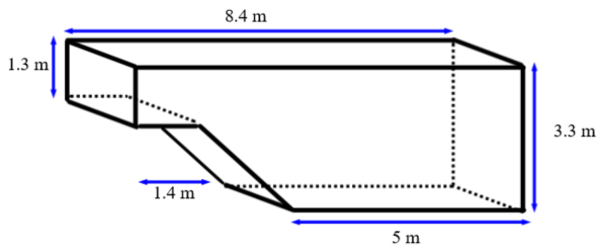
we need: 29.07 dm^2 of paint

∴ No he won't have enough since 29.07 > 6.

2.1.3 Example: The below work of art will be placed in the garden of a museum in a section that measures $7\ m \times 2\ m$. The total amount of space that the work of art takes up is 27.54 kL. Is the garden section big enough to accommodate the structure?



2.1.4 Practice: A water tank holds a maximum capacity of 45 840 litres of water and must be placed in a section of a shed that measures $9\ m \times 4\ m$. Is the section of the shed big enough to accommodate the tank?



Answers:

2.1.3:

- missing measurement in structure: 3m
- therefore, the garden section ($7\ m \times 2\ m$) will NOT be big enough to accommodate the structure

2.1.4:

- missing measurement in water tank: 2m
- therefore, the section in shed $9\ m \times 4\ m$ will be big enough to accommodate the structure