Student Name

Mathematics Stage 5 Core

AREA AND SURFACE AREA

Book 3 Solve problems involving surface areas of cylinders and related composite solids

Version: 260207

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OVERVIEW

SYLLABUS CONTENT

MA5-ARE-C-01 solves problems involving the surface area of right prisms and practical problems involving the area of composite shapes and solids

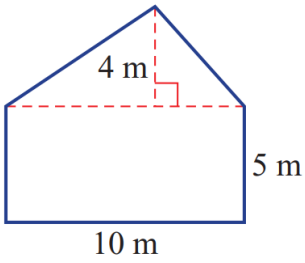
Solve problems involving surface areas of cylinders and related composite solids

- Solve problems involving surface areas of cylinders and related composite solids

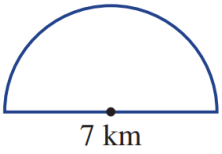
REVIEW OF PRIOR KNOWLEDGE

1 Calculate the area of these shapes.

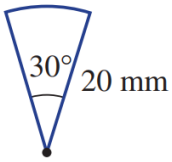
a



b



c



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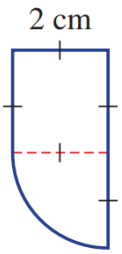
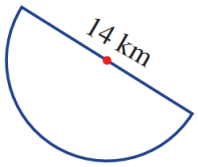


2 Calculate the perimeter of these sectors.

a



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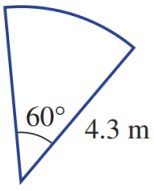

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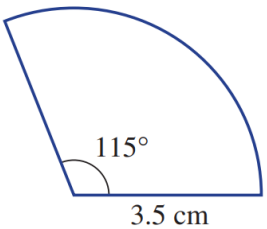
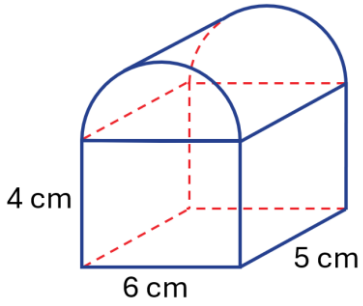


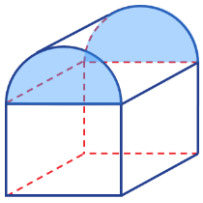
SURFACE AREA OF COMPOSITE PRISMS

- A **composite prism** has a base made of joined shapes.
- To find its surface area, it is helpful to picture all its faces.

Example Calculate surface area of composite solids.

Calculate the surface area of this solid, rounded to 2 decimal places.

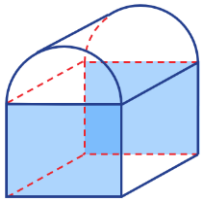




base semicircles

$\left(\frac{1}{2} \times \pi(3)^2\right) \times 2$

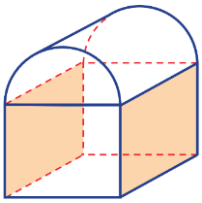
$= 28.2743 \ldots$



base rectangles

$(4 \times 6) \times 2$

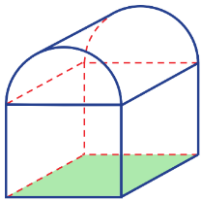
$= 48$



side rectangles

$(4 \times 5) \times 2$

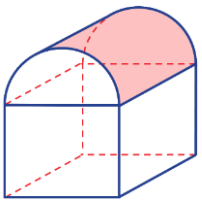
$= 40$



bottom rectangle

6×5

$= 30$



top surface (rectangle)

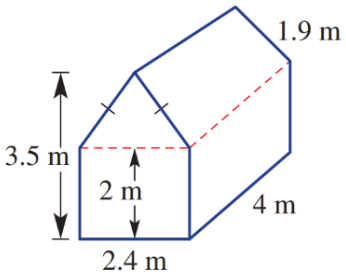
$\frac{1}{2} \times 2\pi(3)(5)$

$= 47.1238 \ldots$

Total surface area $= 28.2743 + 48 + 40 + 30 + 47.1238$

$= 193.40 \text{ cm}^2$

Calculate the surface area of this composite solid. Round to 2 d.p.



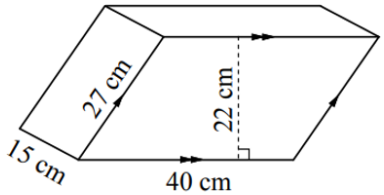
base triangles | base rectangles | side rectangles | top rectangles | bottom rectangle

Total surface area:

54 m^2

1 Find the surface area of these solids. Round to 2 d.p.

a



SA = 2 × □ × □ Area of front and back

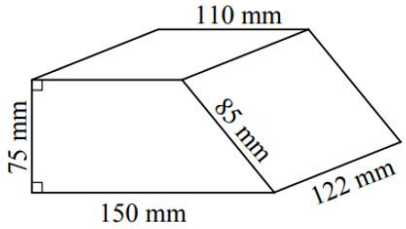
+ 2 × □ × □ Area of top and base

+ 2 × □ × □ Area of left and right sides

SA =

3770 cm²

b



SA = □ × □ + □ × □

Area of top Area of base

+ □ × □ + □ × □

Area of LHS face Area of slanted face

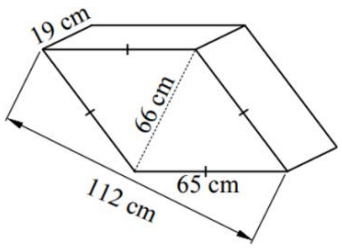
+ 2 × ½ × (□ + □) × □

Area of the front and back faces (trapezia)

SA =

70 740 mm²

c



SA = 2 × ½ × □ × □

Front and Rear faces (Rhombi)

+ 4 × □ × □

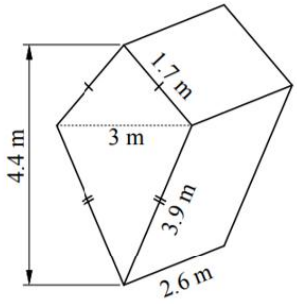
Four sides

SA =

12 332 cm²

2 Find the surface area of these solids.
Set your working out neatly to show that you have considered every face of the solid.

a



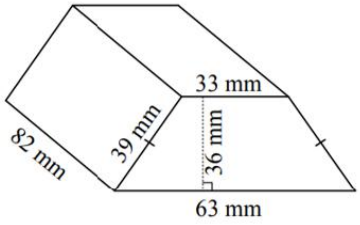
Front & Back: $\left(\frac{3 \times 4.4}{2}\right) \times 2$

Top two: $(1.7 \times 2.6) \times 2$

Bottom two: $(3.9 \times 2.6) \times 2$

Total: 42.32 m²

b



Front & Back: $\left(\frac{36}{2}(33 + 63)\right) \times 2$

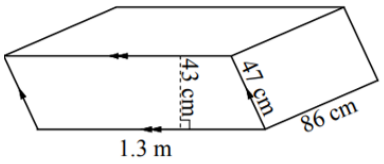
Left & Right: $(39 \times 82) \times 2$

Top: 33×82

Bottom: 63×82

Total: 17 724 mm²

c Answer in m²



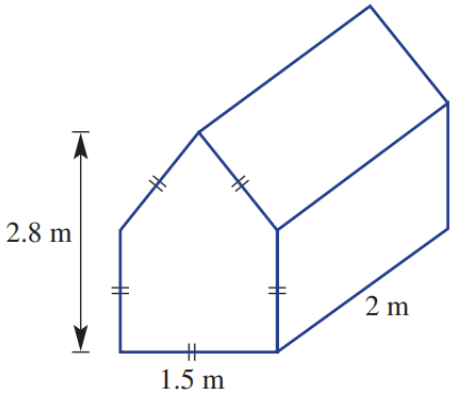
Front & Back: $(1.3 \times 0.43) \times 2$

Left & Right: $(1.3 \times 0.86) \times 2$

Top & Bottom: $(0.47 \times 0.86) \times 2$

Total: 4.1624 m²

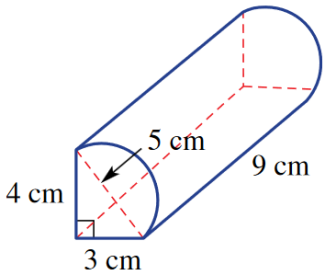
3 The floor, sides and roof of this tent are made from canvas at a cost of \$5 per square metre. The tent's dimensions are shown in the diagram. What is the cost of the canvas for the tent?



Surface area = 21.45 m²

Cost: \$42.90

4 Find the surface area of this composite prism to 2 d.p.



Front & back: $2\left(\frac{4\times3}{2}+\frac{\pi(2.5)^2}{2}\right)$

Left: 4×9

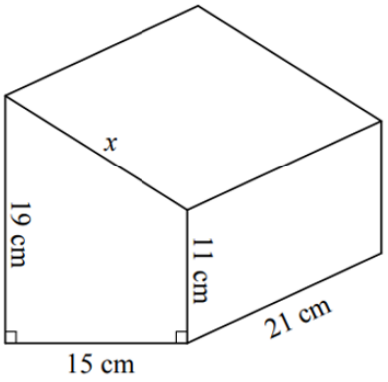
Bottom: 3×9

Right: $\frac{2\pi(2.5)(9)}{2}$

Total: 165.32 cm²

5 Find the surface area of these solids.
First calculate the missing length using Pythagoras' Theorem.

a



$x = 17$ cm

Front & Back $\frac{15}{2}(19+11)\times 2$

Left: 15×19

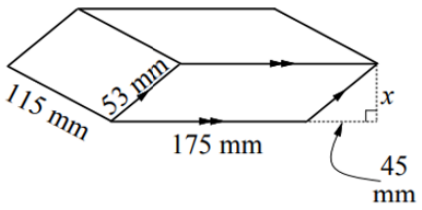
Right: 11×21

Top: 17×21

Bottom: 15×21

$SA = 1752$ cm²

b



$x = 28$ mm

Front & Back $(175 \times 28) \times 2$

Left & Right: $(115 \times 53) \times 2$

Top & Bottom: $(115 \times 175) \times 2$

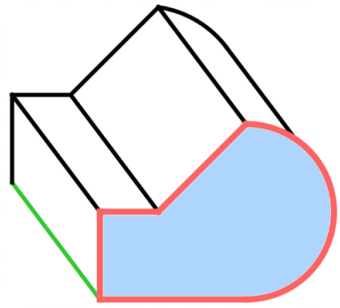
$SA = 62\,240$ mm²

6 The formula for calculating any solid with *uniform cross-section* is:

Surface Area of any Solid with Uniform Cross-Section

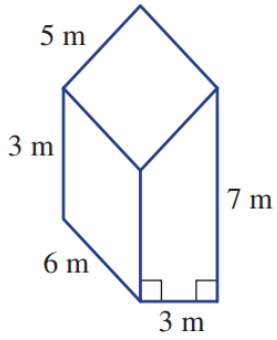
$$SA = 2B + ph$$

B: base area; p: base perimeter; h: height of prism



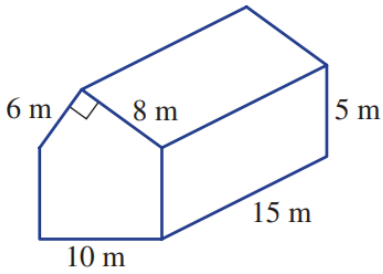
Calculate the surface area of these solids using the formula. Answer to 1 d.p. where needed.

a



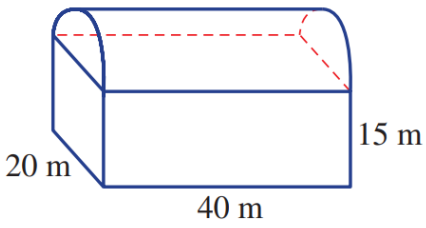
138 m²

b



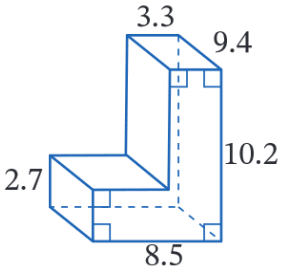
658 m²

c



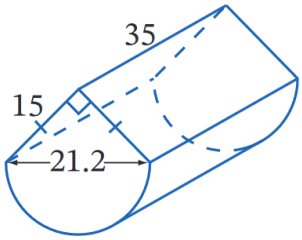
4170.8 m²

d



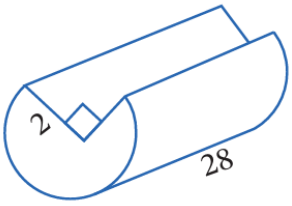
447.0 cm²

e



2793.5 cm²

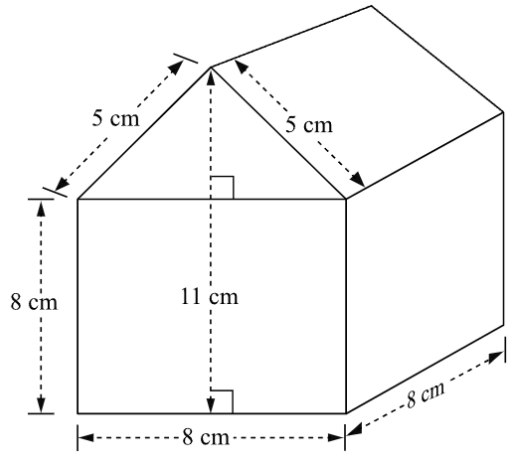
f



394.7 cm²

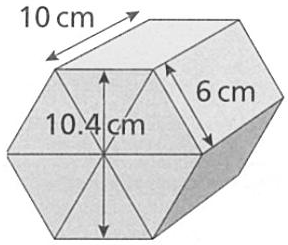
7 **2020 HSC Standard 2 Band 4**

Calculate the surface area of the composite solid.



424 cm²

8 Amina cuts a regular hexagonal prism into six, identical triangular prisms.
Work out the surface area of each triangular prism rounded to 1 decimal place.



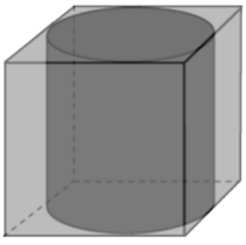
The triangular faces are equilateral.

Area of triangles: $\frac{5.2\times6}{2}\times 2$

Area of rectangular faces: $(6\times 10)\times 3$

Total SA: 211.2 cm²

9 A cube with surface area 216 square centimetres has a cylinder perfectly enclosed inside.
What is the surface area of the cylinder? Answer correct to 2 decimal places.



Find cube side length: $6x^2 = 216$

$x = 6$ cm

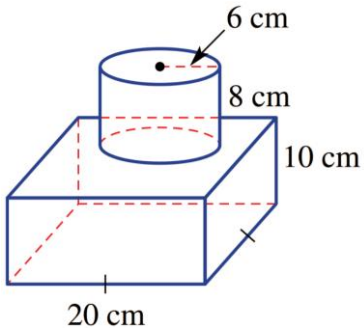
SA of cylinder $= 2\pi(3)^2 + 2\pi(3)(6) = 169.65$ cm²

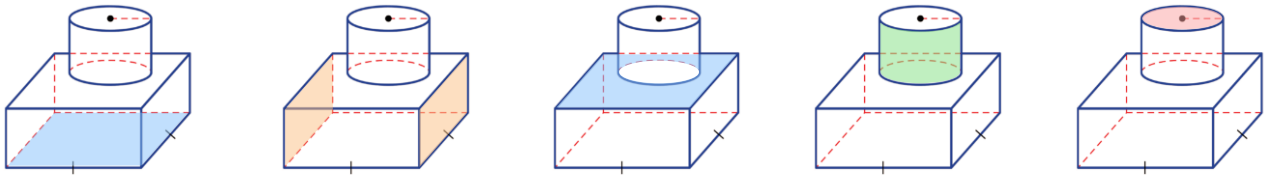
SURFACE AREA OF PRISM COMBINATIONS

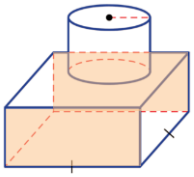
- A **composite solid** is made up of multiple simple solids.
- We calculate the surface area by considering each face and adding them up.
  1. Visualise and write down surfaces.
  2. Calculate area of each surface.
  3. Sum area of each surface.

Example Calculate surface area of a composite prism.

Calculate surface area to 1 d.p.



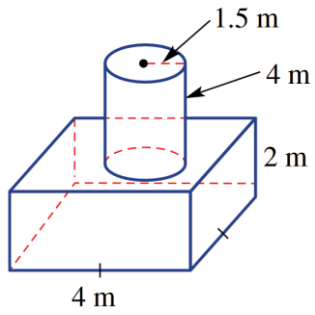




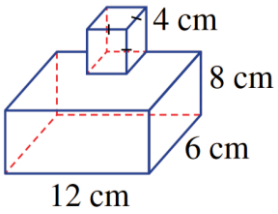
bottom square	side rectangles	top square – circle	curved surface (rectangle)	top circle
20×20	$(10 \times 20) \times 4$	$20 \times 20 - \pi(6)^2$	$2\pi(6)(8)$	$\pi(6)^2$
$= 400$	$= 800$	$= 286.90266 \ldots$	$= 301.59228 \ldots$	$= 113.09733 \ldots$

Total surface area = 1901.6 cm^2

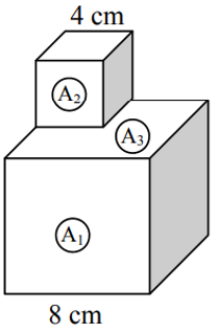
a Show that the surface area of this composite prism is 101.7 m^2.



b Show that the surface area of this composite prism is 496 cm^2.
Note that the base is not a square.



1 Find the surface area of the cube.



Cube with sides 4 cm length sits on top of a cube with sides 8 cm.

$A_1 = \square \times \square =$

$A_2 = \square \times \square =$

$A_3 = = A_1 - A_2$

$= \square - \square =$

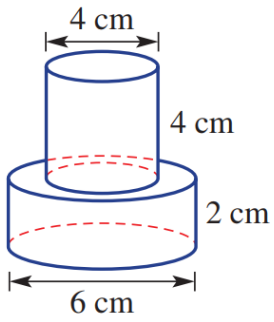
$SA = 5 \times \square + 5 \times \square + \square$

$SA =$

448 cm²

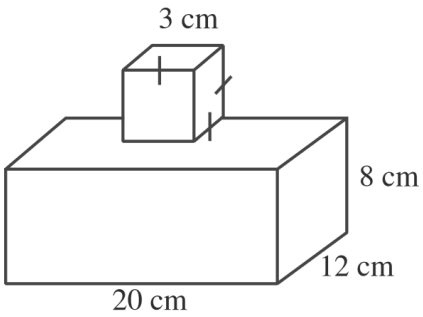
2 Find the surface area of these composite solids. Round to 1 d.p. where appropriate.

a



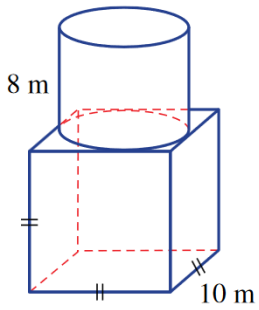
144.5 cm²

b



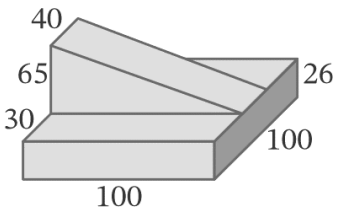
1028 cm²

c



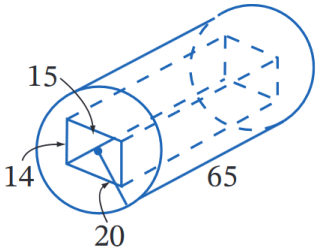
851.3 m²

d All measurements in cm.



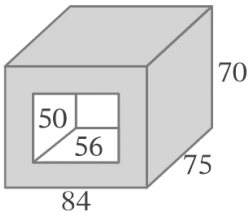
40 270 cm²

e All measurements in cm.



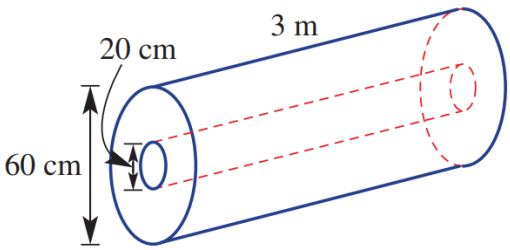
14 031.4 cm²

f All measurements in cm.



45 160 cm²

3 A log with diameter 60 cm is 3 m in length. Its hollow centre is 20 cm in diameter. Find the surface area of the log in cm^2, including the ends and the inside, correct to 1 decimal place.



Circular ends: $[\pi(30^2) - \pi(10^2)] \times 2$

Outside: $2\pi(30)(300)$

Inside: $2\pi(10)(300)$

Total: 80 424.8 cm²