

High School *Mathematics Test 2015*

Year 10

Surface Area and Volume of Other Solids

Calculator
Allowed

Skills and Knowledge Assessed:

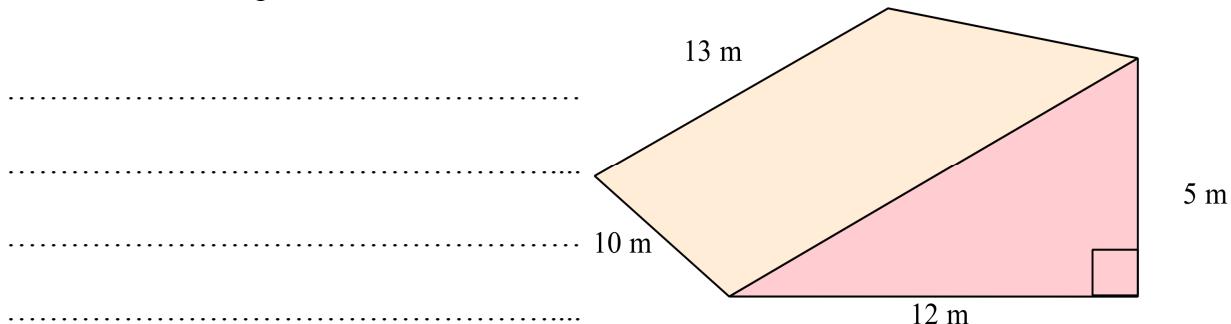
- Solve problems involving surface area and volume of right pyramids, right cones, spheres and related composite solids (ACMMG271)

Name _____

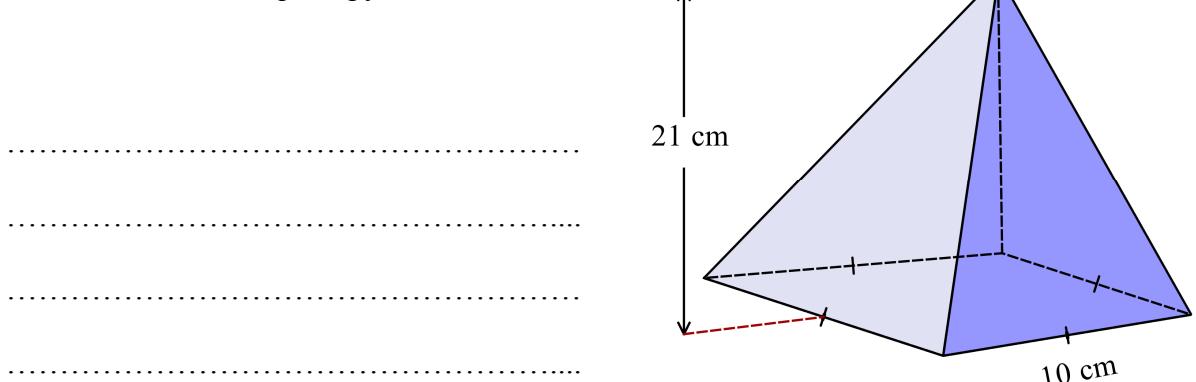
Section 1 Short Answer Section

Write all working and answers in the spaces provided on this test paper.

1. What is the volume of the prism shown?



2. What is the volume of the square pyramid?

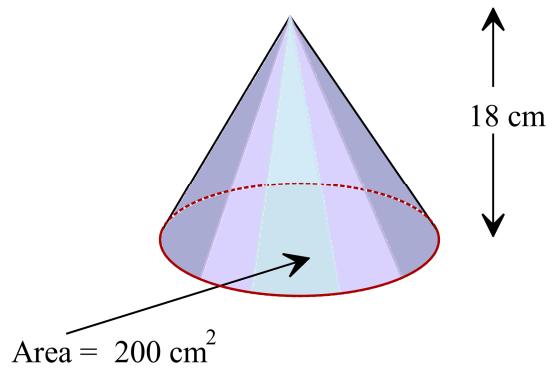


3. A rectangular pyramid has base edges 15 cm and 10 cm and a perpendicular of height 8 cm.
What is its volume?

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4. A cone has a height of 18 cm and the area of its base is 200 cm^2 .
What is its volume?

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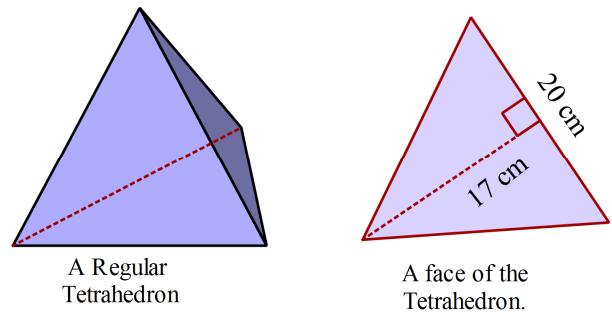
5. An Egyptian pyramid has a square base 120 m long and the slant height of each face is 80 m.
What is the surface area of its exposed faces?

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6. A regular tetrahedron has 4 congruent triangular faces with the dimensions (to the nearest half cm) shown on the diagram.
What is the surface area of the regular tetrahedron?

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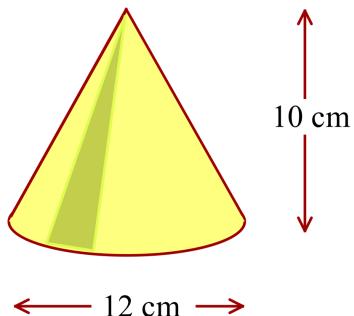
7. Joan wants to make a square pyramid as shown.
Its base measures 30 cm along each side.
She wants the volume to be $12\ 000 \text{ cm}^3$.
What height should she make the pyramid?

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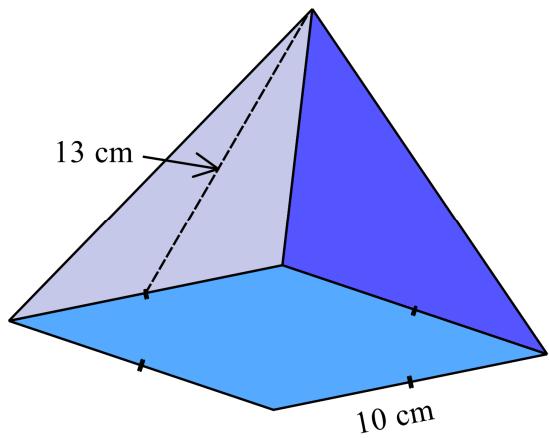
8. What is the volume of this cone?
Answer in terms of π .

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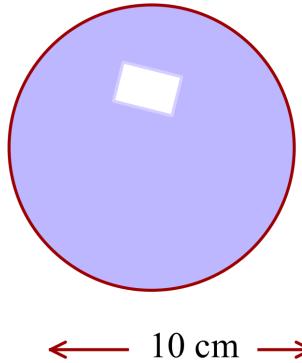
9. What is the surface area of the square pyramid shown?

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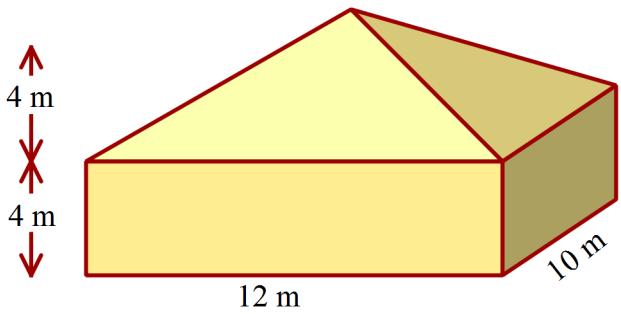
10. What is the surface area of the sphere?
Answer in terms of π .

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11. What is the volume of the building shown?

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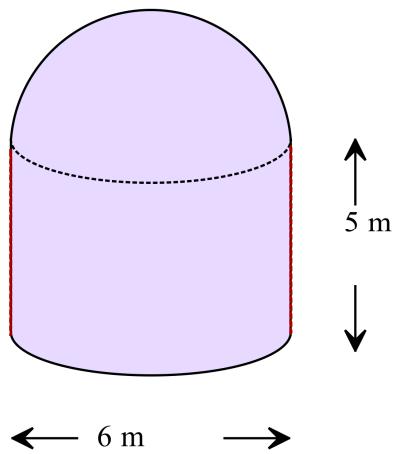
12. The dome on a cathedral in Florence can be approximated by a hemisphere of diameter 44 metres. What is the surface area of the dome (in terms of π)?

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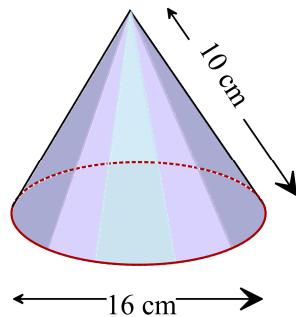
13. The building was designed to house an observatory and has cylindrical walls and a hemispherical roof. Ignoring the thickness of the walls, what is the volume of the building in terms of π ?

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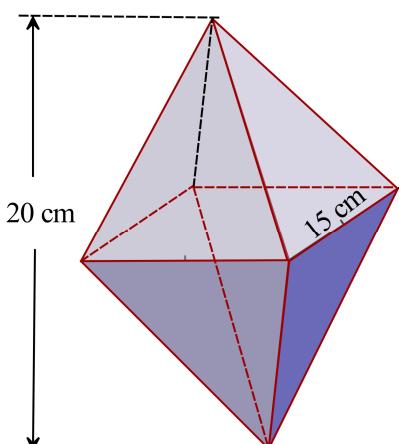
14. What is the surface area of this cone, in terms of π ?

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15. The octahedron shown consists of two identical square pyramids, joined at their bases
What is the volume of the octahedron?

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High School Mathematics Test 2015

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Calculator Allowed

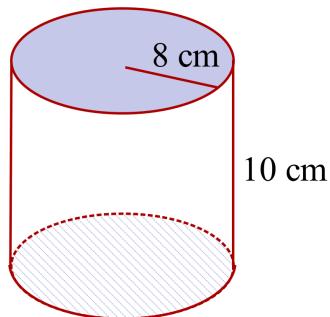
Name _____

Section 2 Multiple Choice Section

Mark all your answers on the accompanying multiple choice answer sheet, not on this test paper. You may do any working out on this test paper. Calculators are allowed for this section.

1. Find the volume of the cylinder shown (to the nearest cm).

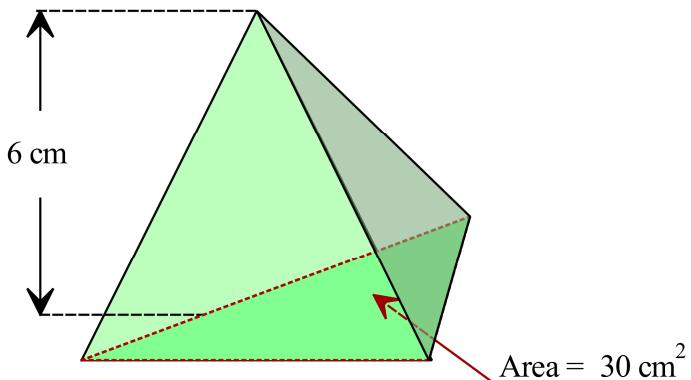
- A. 670 cm^3
- B. $2\,011 \text{ cm}^3$
- C. $2\,145 \text{ cm}^3$
- D. $8\,042 \text{ cm}^3$



2. A triangular pyramid has a perpendicular height of 6 cm and its base has an area of 30 cm^2 .

What is its volume?

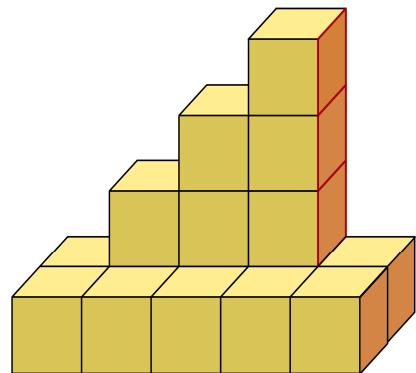
- A. 30 cm^3
- B. 33 cm^3
- C. 60 cm^3
- D. 90 cm^3



3. This solid is made by stacking cubes which measure 5 cm along each edge.

What is the total volume of the solid formed?

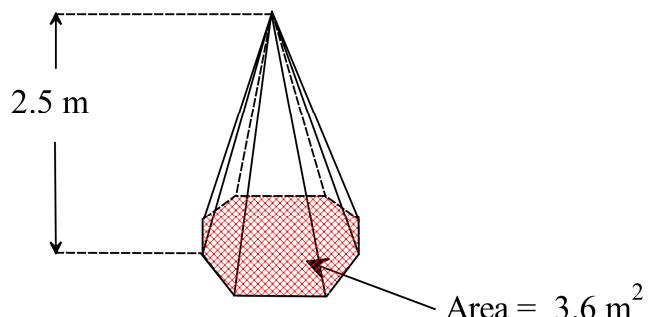
- A. 400 cm^3
- B. 800 cm^3
- C. 1000 cm^3
- D. 2000 cm^3



4. The octagonal pyramid is 2.5 m high and its base has an area of 3.6 m^2 .

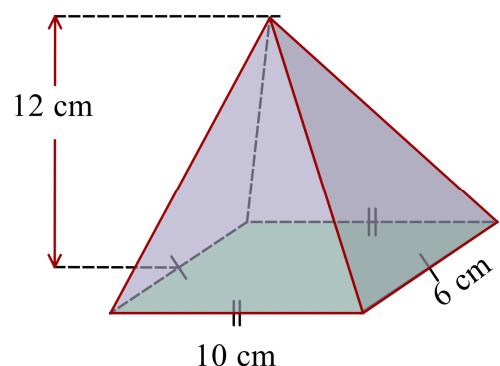
Find its volume.

- A. 3.0 cm^3
- B. 4.5 cm^3
- C. 5.25 cm^3
- D. 9.0 cm^3



5. What is the volume of the rectangular pyramid?

- A. 96 cm^3
- B. 240 cm^3
- C. 360 cm^3
- D. 720 cm^3

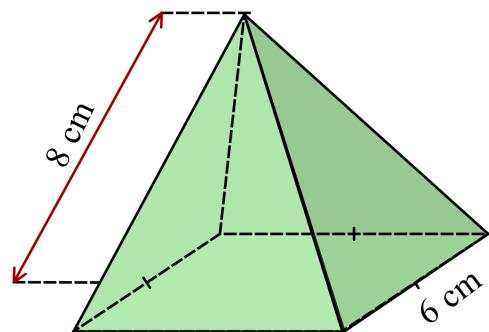


6. What is the volume of a sphere which has a radius of 2.5 metres?

- A. 16 m^3
- B. 49 m^3
- C. 65 m^3
- D. 196 m^3

7. What is the surface area of the square pyramid?

- A. 132 cm^2
- B. 156 cm^2
- C. 264 cm^2
- D. 312 cm^2

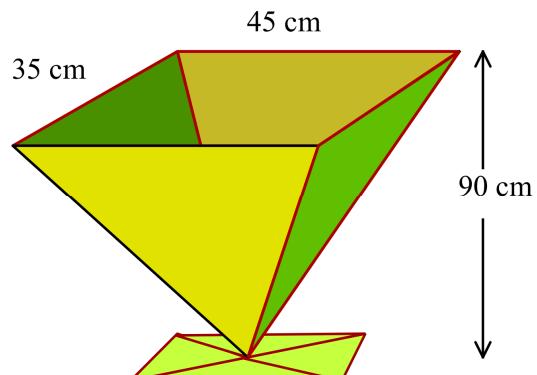


8. A large vase is in the shape of a rectangular pyramid.

How many litres of water can it hold?

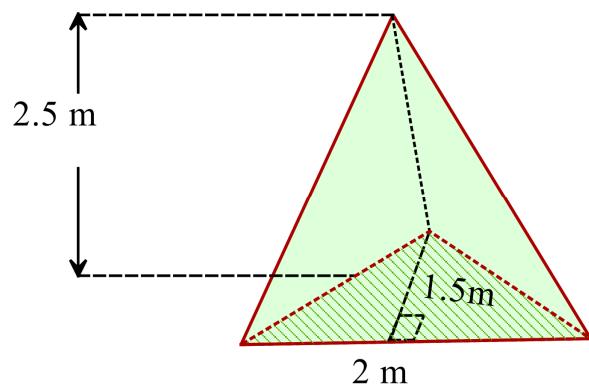
1000 cm^3 holds 1 litre of water.

- A. 3.6 litres
- B. 47.25 litres
- C. 70.88 litres
- D. 141.75 litres



9. Calculate the volume of the triangular prism shown.

- A. 1.25 m^3
- B. 2.5 m^3
- C. 3.75 m^3
- D. 4.375 m^3



10. A globe of the earth is a 20 cm diameter sphere.

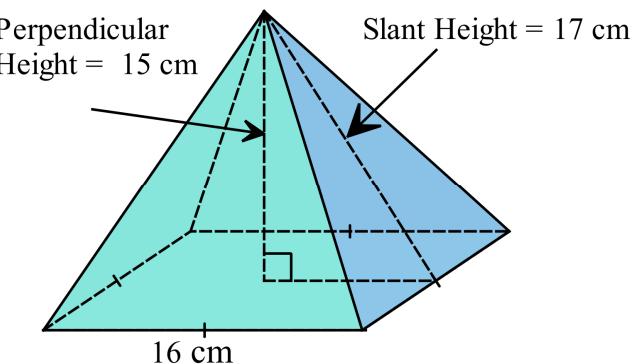
What is the surface area of the globe?

- A. 314 cm^2
- B. 471 cm^2
- C. 628 cm^2
- D. 1257 cm^2



11. What is the surface area of the square pyramid shown?

- A. 672 cm^2
- B. 767 cm^2
- C. 800 cm^2
- D. 1280 cm^2



12. A glasshouse is a geodesic dome, which is approximately the size of a hemisphere with a diameter of 25 metres.

What is the approximate area of glass that would be needed for the glasshouse?

- A. 157 m^2
- B. 981 m^2
- C. 1953 m^2
- D. 1963 m^2



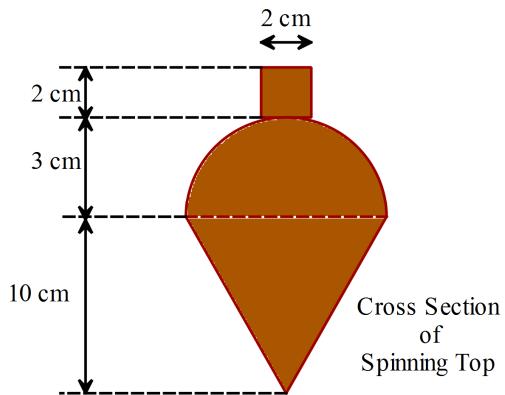
13. The design for a solid wooden spinning top is in the shape of a cone topped by a hemisphere and then a smaller cylinder.



A cross section of the spinning top is shown with its dimensions given.

What is the volume of the spinning top?

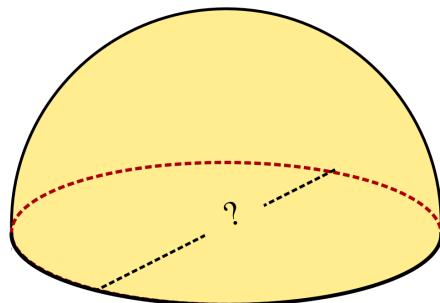
- A. $50\pi \text{ cm}^3$
- B. $56\pi \text{ cm}^3$
- C. $760\pi \text{ cm}^3$
- D. $764\pi \text{ cm}^3$



14. A hemisphere has a volume of 2.5 m^3 .

What is its diameter, to the nearest cm?

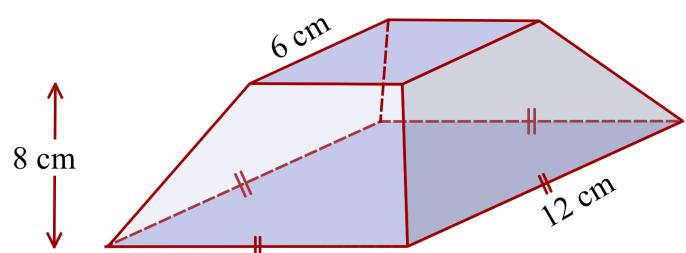
- A. 0.56 m
- B. 1.06 m
- C. 2.12 m
- D. 7.50 m



15. The solid shown is formed by cutting the top 8 cm in height from a square pyramid which originally had a height of 16 cm and a base with sides of 12 cm.

What is the volume of the truncated pyramid?

- A. 96 cm^3
- B. 127 cm^3
- C. 384 cm^3
- D. 672 cm^3



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Name _____

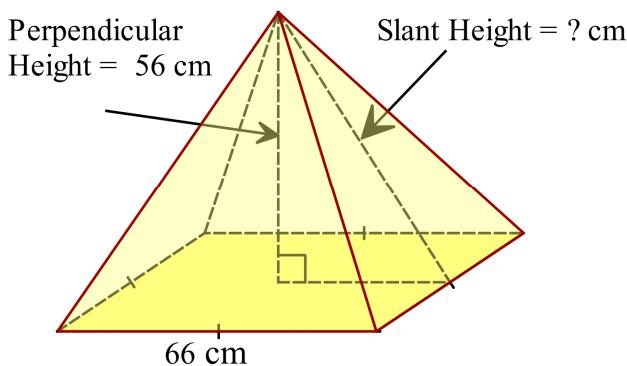
Section 3

Longer Answer Section

Write all working and answers in the spaces provided on this test paper.

Marks

1. The square pyramid below has a base which measures 66 cm and a perpendicular height of 56 cm.



- (a) Calculate the volume of the pyramid.

1

- (b) Calculate the slant height of the pyramid.

1

- (c) Calculate the surface area of the pyramid.

2

High School *Mathematics Test 2015*

Multiple Choice Answer Sheet

Surface Area and Volume of Other Solids

Name _____

Completely fill the response oval representing the most correct answer.

1. A B C D
2. A B C D
3. A B C D
4. A B C D
5. A B C D
6. A B C D
7. A B C D
8. A B C D
9. A B C D
10. A B C D
11. A B C D
12. A B C D
13. A B C D
14. A B C D
15. A B C D

High School Mathematics Test 2015

Year 10

Surface Area and Volume of Other Solids

Non Calculator

Section 1 Short Answer Section

ANSWERS

No.	WORKING	ANSWER
1.	$V = \frac{1}{2} \times 12 \times 5 \times 10$ $= 300 \text{ m}^3$	300 m ³
2.	$V = \frac{1}{3} \times 10 \times 10 \times 21$ $= 100 \times 7$ $= 700 \text{ cm}^3$	700 cm ³
3.	$V = \frac{1}{3} \times 15 \times 10 \times 8$ $= 5 \times 80$ $= 400 \text{ cm}^3$	400 cm ³
4.	$V = \frac{1}{3} \times 200 \times 18$ $= 200 \times 6$ $= 1\,200 \text{ cm}^3$	1 200 cm ³
5.	$SA = 4 \times \frac{1}{2} \times 120 \times 80$ $= 2 \times 9600$ $= 19\,200 \text{ m}^2$	19 200 m ²
6.	$SA = 4 \times \frac{1}{2} \times 20 \times 17$ $= 2 \times 340$ $= 680 \text{ cm}^2$	680 cm ²

7.	$\text{Volume} = \frac{1}{3} \times \text{Area} \times \text{Height}$ $12000 = \frac{1}{3} \times (30 \times 30) \times \text{Height}$ $12000 = 300 \times \text{Height}$ $\text{Height} = \frac{12000}{300}$ $= 40 \text{ cm}$	40 cm
8.	$V = \frac{1}{3} \pi r^2 h$ $= \frac{1}{3} \times \pi \times 6^2 \times 10$ $= 120 \pi \text{ cm}^3$	$120 \pi \text{ cm}^3$
9.	$SA = 4 \times \frac{1}{2} \times 10 \times 13 + 10 \times 10$ $= 260 + 100$ $= 360 \text{ cm}^2$	360 cm^2
10.	$d = 10, \text{ so } r = 5$ $SA = 4\pi r^2$ $= 4 \times \pi \times 5^2$ $= 100\pi \text{ cm}^2$	$100 \pi \text{ cm}^2$
11.	$V = 12 \times 10 \times 4 + \frac{1}{3} \times 12 \times 10 \times 4$ $= 480 + 160$ $= 640 \text{ m}^3$	640 m^3
12.	$d = 44, \text{ so } r = 22$ $SA = \frac{1}{2} \times 4\pi r^2$ $= 2 \times \pi \times 22^2$ $= 968\pi \text{ cm}^2$	$968 \pi \text{ cm}^2$
13.	Radius = 3 $V_{\text{hemisphere}} = \frac{1}{2} \times \frac{4}{3} \pi r^3$ $= \frac{2}{3} \times \pi \times 3^3$ $= 18\pi$ $V_{\text{cylinder}} = \pi r^2 h$ $= \pi \times 3^2 \times 5$ $= 45\pi$ Total Volume = $18\pi + 45\pi$ $= 63\pi \text{ m}^3$	$63\pi \text{ m}^3$

14.	$\begin{aligned} SA &= \pi r^2 + \pi r l \\ &= \pi \times 8^2 + \pi \times 8 \times 10 \\ &= 64\pi + 80\pi \\ &= 144\pi \text{ cm}^2 \end{aligned}$	$144\pi \text{ m}^3$
15.	$\begin{aligned} V &= 2 \times \left(\frac{1}{3} \times 15 \times 15 \times 10 \right) \\ &= 2 \times 5 \times 15 \times 10 \\ &= 10 \times 15 \times 10 \\ &= 1500 \text{ cm}^3 \end{aligned}$	1500 cm^3

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Surface Area and Volume of Other Solids

Calculator Allowed

Section 2 Multiple Choice Section

ANSWERS

No.	WORKING	ANSWER
1.	$ \begin{aligned} V &= \pi r^2 h \\ &= \pi \times 8^2 \times 10 \\ &= 2010.6192 \\ &= 2\,011 \text{ cm}^3 \end{aligned} $	B
2.	$ \begin{aligned} V &= \frac{1}{3} \text{Ah} \\ &= \frac{1}{3} \times 30 \times 6 \\ &= 60 \text{ cm}^3 \end{aligned} $	C
3.	<p>There are 16 cubes, by counting. Each cube measure 5 cm on side so volume of 1 cube = $5 \times 5 \times 5 = 125 \text{ cm}^3$ Volume of solid = $16 \times 125 = 2000 \text{ cm}^3$</p>	D
4.	$ \begin{aligned} V &= \frac{1}{3} \text{Ah} \\ &= \frac{1}{3} \times 3.6 \times 2.5 \\ &= 3 \text{ m}^3 \end{aligned} $	A
5.	$ \begin{aligned} V &= \frac{1}{3} \text{Ah} \\ &= \frac{1}{3} \times 10 \times 6 \times 12 \\ &= 20 \times 12 \\ &= 240 \text{ cm}^3 \end{aligned} $	B
6.	$ \begin{aligned} V &= \frac{4}{3} \pi r^3 \\ &= \frac{4}{3} \times \pi \times 2.5^3 \\ &= 65.4498 \\ &= 65 \text{ m}^3 \end{aligned} $	C

7.	$ \begin{aligned} SA &= 4 \times \frac{1}{2} \times 6 \times 8 + 6 \times 6 \\ &= 96 + 36 \\ &= 132 \text{ cm}^2 \end{aligned} $	A
8.	$ \begin{aligned} V &= \frac{1}{3} Ah \\ &= \frac{1}{3} \times 35 \times 45 \times 90 \\ &= 47250 \text{ cm}^3 \\ &= \frac{47250}{1000} \\ &= 47.25 \text{ litres} \end{aligned} $	B
9.	$ \begin{aligned} A &= \frac{1}{2} \times 2 \times 1.5 = 1.5 \text{ m}^2 \\ V &= \frac{1}{3} Ah \\ &= \frac{1}{3} \times 1.5 \times 2.5 \\ &= 1.25 \text{ m}^3 \end{aligned} $	A
10.	$ \begin{aligned} SA &= 4\pi r^2 \\ &= 4 \times \pi \times 10^2 \\ &= 1256.6370 \\ &= 1257 \text{ cm}^2 \end{aligned} $	D
11.	$ \begin{aligned} SA &= 4 \times \frac{1}{2} \times 16 \times 17 + 16 \times 16 \\ &= 544 + 256 \\ &= 800 \text{ cm}^2 \end{aligned} $	C
12.	$ \begin{aligned} r &= 12.5 \\ SA &= 4\pi r^2 \\ &= 4 \times \pi \times 12.5^2 \\ &= 1963.4954 \\ &= 1963 \text{ cm}^2 \end{aligned} $	D
13.	$ \begin{aligned} V_{\text{Cone}} &= \frac{1}{3} \times \pi \times 3^2 \times 10 = 30\pi \\ V_{\text{Hemisphere}} &= \frac{1}{2} \times \frac{4}{3} \times \pi \times 3^3 = 18\pi \\ V_{\text{Cylinder}} &= \pi \times 1^2 \times 2 = 2\pi \\ V_{\text{Spinner}} &= 30\pi + 18\pi + 8\pi = 50\pi \text{ cm}^3 \end{aligned} $	A

14.	$V = \frac{1}{2} \times \frac{4}{3} \pi r^3$ $2.5 = \frac{2}{3} \times \pi \times r^3$ $7.5 = 2 \times \pi \times r^3$ $\frac{7.5}{2\pi} = r^3$ $r^3 = \frac{1.193662}{3}$ $r = \sqrt[3]{1.193662}$ $= 1.06 \text{ m}$	B
15.	$\text{Volume}_{\text{Entire pyramid}} = \frac{1}{3} \times 12^2 \times 16 = 768$ $\text{Volume}_{\text{Section cut off pyramid}} = \frac{1}{3} \times 6^2 \times 8 = 96$ $\text{Volume}_{\text{Truncated pyramid}} = 768 - 96 = 672 \text{ cm}^3$	D

High School Mathematics Test 2015

Multiple Choice Answer Sheet

Surface Area and Volume of Other Solids

Name _____ ANSWERS

Completely fill the response oval representing the most correct answer.

1. A B C D
2. A B C D
3. A B C D
4. A B C D
5. A B C D
6. A B C D
7. A B C D
8. A B C D
9. A B C D
10. A B C D
11. A B C D
12. A B C D
13. A B C D
14. A B C D
15. A B C D

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Surface Area and Volume of Other Solids

Calculator Allowed

Section 3 Longer Answer Section

ANSWERS

Marks

1.

$$\begin{aligned} \text{(a)} \quad V &= \frac{1}{3} \times 66 \times 66 \times 56 \\ &= 81\,312 \text{ cm}^3 \end{aligned}$$

1

$$\begin{aligned} \text{(b)} \quad h^2 &= 33^2 + 56^2 \\ &= 4225 \\ h &= \sqrt{4225} = 65 \end{aligned}$$

1

$$\begin{aligned} \text{(c)} \quad SA &= 4 \times \frac{1}{2} \times 66 \times 65 + 66 \times 66 \\ &= 12\,936 \text{ cm}^2 \end{aligned}$$

2