Topic Test: Further Applications of Area and Volume

Remember: these are HSC-type questions.

Time allowed: 40 minutes **Total marks:** 25

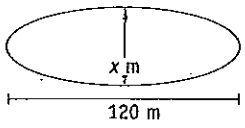
Part A (Suggested time: 15 minutes)

Choose the correct answer (A, B, C or D) for each question. One mark each

1 The surface area of a sphere with diameter 8 cm is closest to:

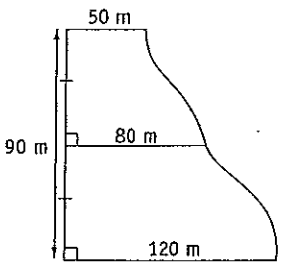
A 201 cm^2 B 268 cm^2
C 804 cm^2 D 2147 cm^2

2 The area of the ellipse is 7540 m^2, to the nearest square metre. What is the value of x?



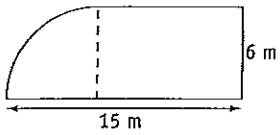
A 20 B 40
C 60 D 80

3 Use Simpson's rule to approximate the area shown in the diagram.



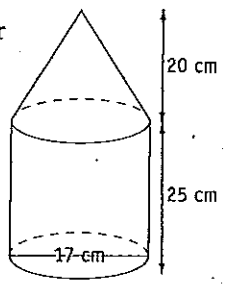
A 3750 m^2
B 7350 m^2
C 1.47 ha
D 1.96 ha

4 Find the area (to the nearest square metre) of the figure, which is made up of a rectangle and quadrant.



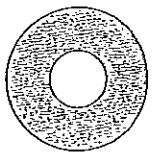
A 118 m^2
B 100 m^2
C 82 m^2
D there is not enough information to find the area

5 This shape is made up of a cylinder and cone. What is the volume to the nearest cubic centimetre?



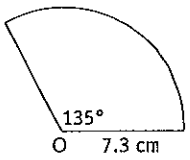
A 4161 cm^3
B 28 751 cm^3
C 7188 cm^3
D 10 214 cm^3

6 The shaded area is between two circles with common centre. The diameter of the smaller circle is 4 m, while the radius of the larger circle is 8 m. Find the shaded area, giving the answer to the nearest square metre.



A 197 m^2 B 51 m^2
C 151 m^2 D 188 m^2

7 The diagram shows a sector of a circle, centre O. The area of the sector, in square centimetres correct to one decimal place, is:



A 62.8 cm^2 B 17.2 cm^2
C 125.6 cm^2 D 41.9 cm^2

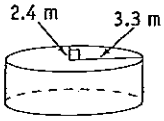
8 Donna measures the radius of a sphere to be 9 cm. If the actual radius is 9.6 cm, by approximately how much is Donna's calculation of the volume too small?

A 0.9 cm^3 B 4.5 cm^3
C 140 cm^3 D 652 cm^3

9 The area of a quadrant is 272 m^2, to the nearest square metre. What is its approximate radius?

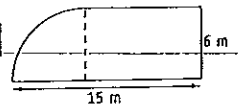
A 4.7 m B 18.6 m
C 13.2 m D 21 m

10 A hole in the ground is 2 metres deep and has an elliptical cross-section as shown in the diagram. If the ground was level before the hole was dug, approximately what amount of earth has been removed?



A 16 m^3 B 50 m^3
C 63 m^3 D 200 m^3

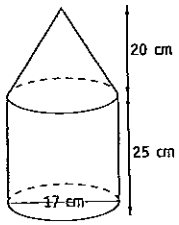
4



Radius of quadrant = width of rectangle
= 6 m
Length of rectangle = 15 m − 6 m
= 9 m

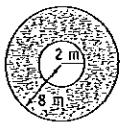
$A = lb + \frac{1}{4}\pi r^2$
$= 9 \times 6 + \frac{1}{4} \times \pi \times 6^2$
$= 82.274\,333\,88\ldots$
$= 82$ (nearest unit)
The area of the figure, to the nearest square metre, is 82 m^2. C

5



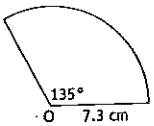
$r = 8.5$
$V = \pi r^2 H + \frac{1}{3}\pi r^2 h$
$= \pi \times 8.5^2 \times 25 + \frac{1}{3} \times \pi \times 8.5^2 \times 20$
$= 7187.702\,192\ldots$
$= 7188$ (nearest unit)
The volume is 7188 cm^3, to the nearest cubic centimetre. C

6



$A = \pi(R^2 - r^2)$
$= \pi \times (8^2 - 2^2)$
$= 188.495\,5592\ldots$
$= 188$ (nearest unit)
The shaded area is 188 m^2, to the nearest square metre. D

7



$A = \frac{\theta}{360}\pi r^2$
$= \frac{135}{360} \times \pi \times 7.3^2$
$= 62.780\,802\,19\ldots$
$= 62.8$ (1 d.p.)
The area of the sector is 62.8 cm^2, correct to one decimal place. A

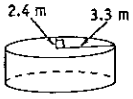
8

$V = \frac{4}{3}\pi r^3$
If $r = 9$, $V = \frac{4}{3} \times \pi \times 9^3$
$= 3053.628\,059\ldots$
$= 3054$ (nearest unit)
If $r = 9.6$, $V = \frac{4}{3} \times \pi \times 9.6^3$
$= 3705.973\,491\ldots$
$= 3706$ (nearest unit)
Difference $= 3706 - 3054$
$= 652$
The volume is approximately 652 cm^3 too small. D

9

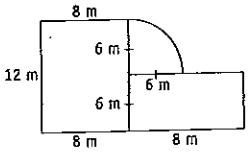
$A = \frac{1}{4}\pi r^2$
$272 = \frac{1}{4} \times \pi \times r^2$
$r^2 = 272 \div \left(\frac{1}{4} \times \pi\right)$
$= 346.321\,1562\ldots$
$r = \sqrt{346.321\,1562\ldots}\ (r > 0)$
$= 18.609\,705\,97\ldots$
The radius is approximately 18.6 m. B

10



$V = Ah$
$= \pi \times 3.3 \times 2.4 \times 2$
$= 49.762\,827\,63\ldots$
$= 50$ (nearest unit)
The amount of earth removed is approximately 50 m^3. B

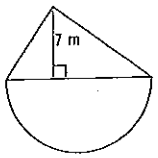
11



a Total area
= area of 2 rectangles
+ area of quadrant
$A = 12 \times 8 + 8 \times 6 + \frac{1}{4} \times \pi \times 6^2$ ✓
$= 172.2743339\ldots$
$= 172$ (nearest unit)
The area to be concreted is 172 m^2, to the nearest square metre. ✓

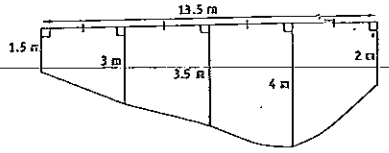
b Volume $= 172\text{ m}^2 \times 0.15\text{ m}$
$= 25.8\text{ m}^3$ ✓
Cost $= 25.8 \times \$200$
$= \$5160$ ✓

12



Triangle:
$A = \frac{1}{2}bh$
$56 = \frac{1}{2} \times b \times 7$
$56 = 3.5b$
$b = 16$ [$56 \div 3.5$] ✓
Diameter of semi-circle is 16 m.
$r = 8$
Semi-circle:
$A = \frac{1}{2}\pi r^2$
$= \frac{1}{2} \times \pi \times 8^2$
$= 100.530\,9649\ldots$
$= 100.5$ (1 d.p.) ✓
Total area $\approx 56\text{ m}^2 + 100.5\text{ m}^2$
$= 156.5\text{ m}^2$ ✓

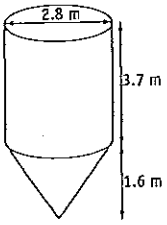
13



a $h = 13.5 \div 4$
$= 3.375$
$A \approx \frac{h}{3}(d_f + 4d_m + d_l)$
$+ \frac{h}{3}(d_f + 4d_m + d_l)$
$= \frac{3.375}{3} \times (1.5 + 4 \times 3 + 3.5)$
$+ \frac{3.375}{3}(3.5 + 4 \times 4 + 2)$ ✓
$= 43.3125$
The approximate area of the cross-section is 43.3125 m^2. ✓

b $V = Ah$
$= 43.3125 \times 25$
$= 1082.8125$
The volume is approximately 1082.8125 m^3. ✓
Volume in litres
$= 1082.8125 \times 1000\text{ L}$
$= 1\,082\,812.5\text{ L}$
$= 1.082\,8125\text{ ML}$
The approximate volume is 1.1 ML, to one decimal place. ✓

14



a $r = 1.4$
$V = \pi r^2 H + \frac{1}{3}\pi r^2 h$
$= \pi \times 1.4^2 \times 3.7$
$+ \frac{1}{3} \times \pi \times 1.4^2 \times 1.6$ ✓
$= 26.066\,841\,44\ldots$
$= 26.1$ (1 d.p.)
The volume of the silo is 26.1 m^3, to one decimal place. ✓

b Eight feed bins:
$V = 8 \times 0.56$
$= 4.48$
The volume of the eight bins is 4.48 m^3. ✓
Number of times filled
$= 26.0668\ldots \div 4.48$
$= 5.818\,491\,394\ldots$
The bins can be filled five times from the silo. ✓

Solutions

Topic Test p135

1 Diameter is 8 cm. $\therefore r = 4$

$A = 4\pi r^2$

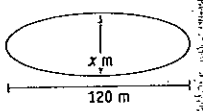
$= 4 \times \pi \times 4^2$

$= 201.061\,9298\ldots$

The surface area is 201 cm^2, to the nearest square centimetre. A

2 $a = \frac{120}{2}$

$= 60$



$b = \frac{x}{2}$

$A = \pi ab$

$7540 = \pi \times 60 \times \frac{x}{2}$

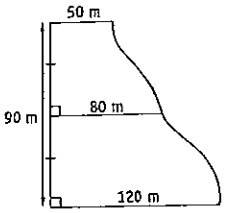
$7540 = 30\pi x$

$x = 7540 \div 30\pi$

$= 80.001\,884\,73\ldots$

$x = 80$ D

3



$h = 90 \div 2$

$= 45$

$A \approx \frac{h}{3}(d_f + 4d_m + d_l)$

$= \frac{45}{3}(50 + 4 \times 80 + 120)$

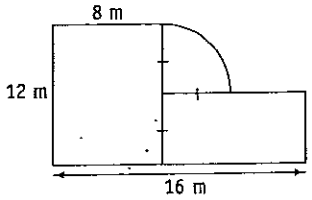
$= 7350$

The area of the land is approximately 7350 m^2. B

Part B (Suggested time: 25 minutes)

Show all working. **15 marks**

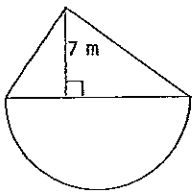
11 The diagram shows the floor of a shed and part of a driveway that needs to be concreted.



a Explain why the total area to be concreted is 172 m^2, to the nearest square metre. 2 marks

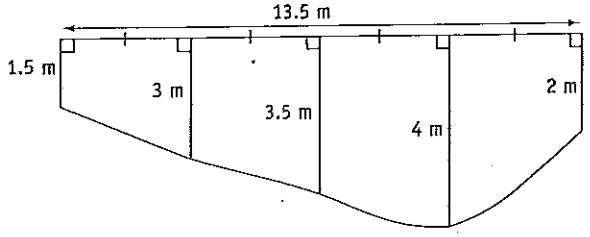
b Find the total cost of the concrete required if it is to be laid to a depth of 15 cm and it costs $200 per cubic metre. 2 marks

12 The figure in the diagram consists of a triangle and semi-circle.



If the area of the triangle is 56 m^2, find the area of the figure. 3 marks

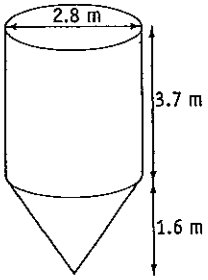
13 An artificial lake has a constant vertical cross-section as shown in the diagram.



a Use Simpson's rule to approximate the area of the cross-section. 2 marks

b If the lake is 25 m long, find the volume of water in the lake. Give the answer in megalitres, to one decimal place. (1 m^3 = 1000 L) 2 marks

14 On a farm, a silo is used for storing grain bought to feed cattle. The silo is made up of a cylinder and cone as shown in the diagram.



a Find the volume of the silo. 2 marks

b If the grain is transferred from the silo to a set of eight feed bins, each with volume 0.56 m^3, how many times can the set of feed bins be filled from a full silo. 2 marks

Go to p 288 for **Quick Answers**
or to pp 328–9 for **Worked Solutions**