# 4.14 Cylinders: 2-hour Pack

EDEXCEL 1MA1 · Calculator allowed · about 120 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

## Formulae You May Need

*Revision Library formulae reminder, styled on Edexcel 1MA1 formulae-sheet conventions; wording is original.*

Volume of a cylinder = pi x r^2 x h

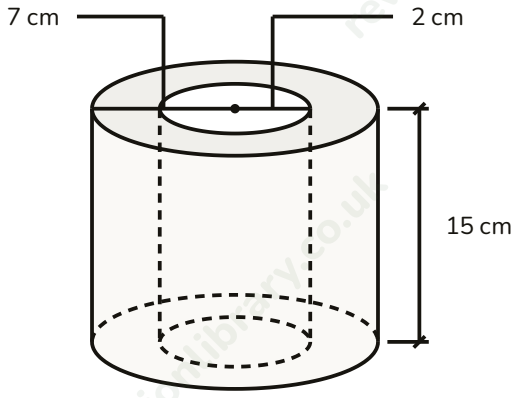
Curved surface area of a cylinder = 2 x pi x r x h

Total surface area of a cylinder = 2 x pi x r x h + 2 x pi x r^2 = 2 x pi x r x (h + r)

The cylinder volume formula follows from prism volume = cross-sectional area x length and circle area = pi x r^2. Derive surface areas from the curved surface and the required circular ends.

**1** A metal pipe is a hollow cylinder of length 15 cm. The outer radius is 7 cm and the inner radius is 2 cm.
Work out the volume of metal used. Give your answer in terms of π.

Diagram NOT accurately drawn

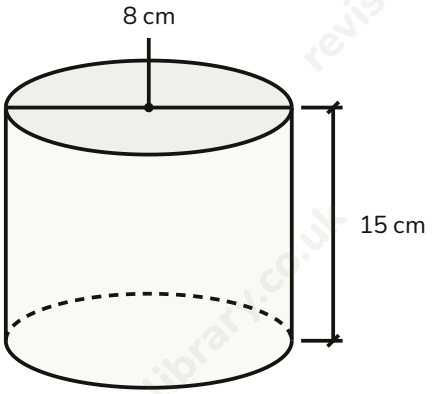



**(Total for Question 1 is 4 marks)**


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**2** A cylindrical candle has diameter 8 cm and height 15 cm.
Work out the total surface area of the candle. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

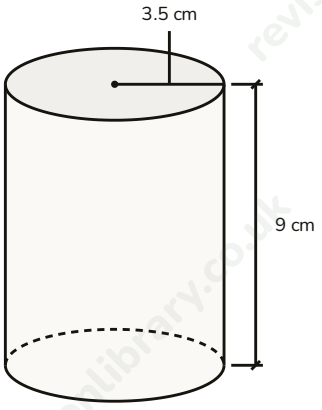



**(Total for Question 2 is 3 marks)**

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**3** A cylindrical candle has radius 3.5 cm and height 9 cm. Calculate the volume of wax needed to make the candle. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

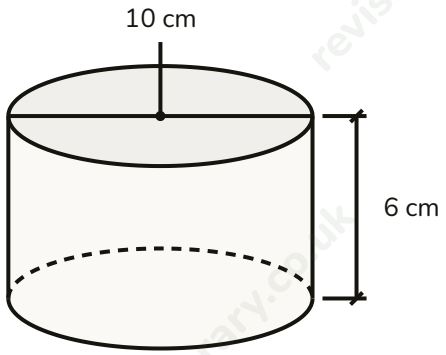



**(Total for Question 3 is 2 marks)**


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**4** A cylinder has diameter 10 cm and height 6 cm. Calculate the volume of the cylinder. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

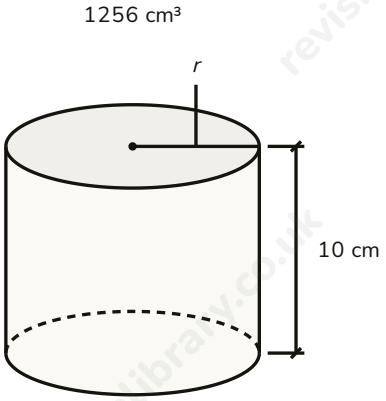



**(Total for Question 4 is 2 marks)**


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**5** A cylinder has height 10 cm and volume 1256 cm³. Work out the radius of the cylinder. Give your answer to 1 decimal place.

Diagram NOT accurately drawn

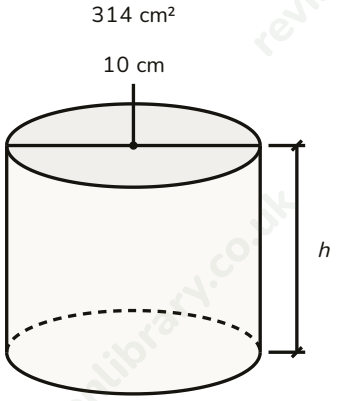



**(Total for Question 5 is 3 marks)**

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**6** A cylinder has diameter 10 cm. The total surface area of the cylinder is 314 cm². Work out the height of the cylinder.

Diagram NOT accurately drawn

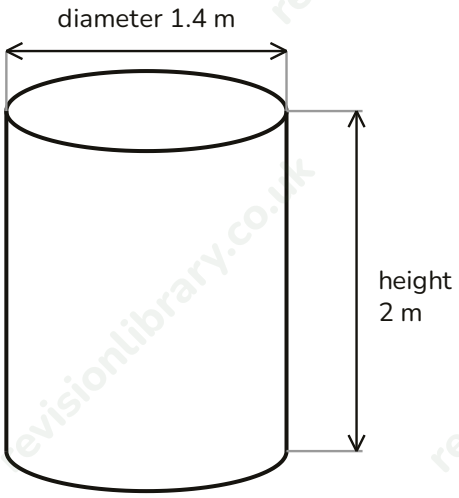



**(Total for Question 6 is 3 marks)**


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**7** A cylindrical drum has diameter 1.4 m and height 2 m. Only the curved surface of the drum is to be painted. 1 litre of paint covers 6 m². Paint is sold only in 1 litre tins costing £12.50 each. Work out the total cost of the paint needed to paint the drum.

Diagram NOT accurately drawn

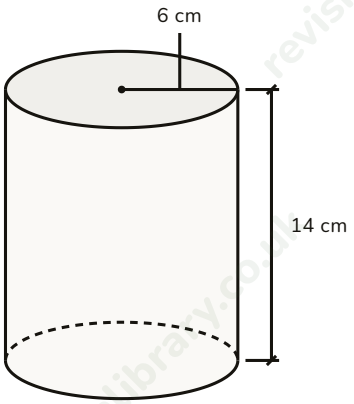



**(Total for Question 7 is 4 marks)**


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**8** A cylinder has radius 6 cm and height 14 cm. Calculate the total surface area of the cylinder. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

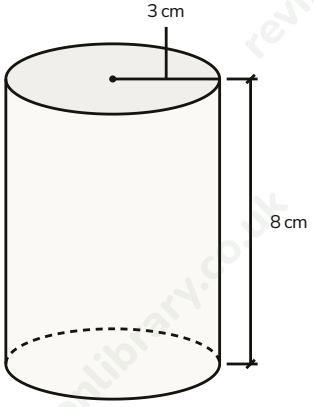



**(Total for Question 8 is 3 marks)**

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**9** A cylinder has radius 3 cm and height 8 cm. Calculate the curved surface area of the cylinder. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

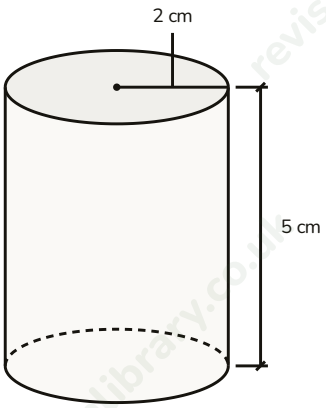



**(Total for Question 9 is 2 marks)**


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**10** A cylinder has radius 2 cm and height 5 cm. Calculate the total surface area of the cylinder (the curved surface plus the two circular ends). Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

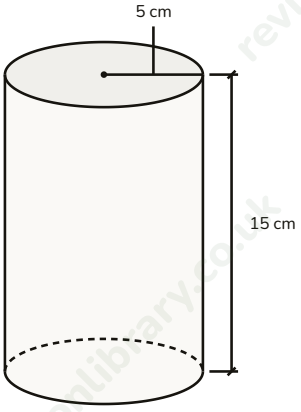



**(Total for Question 10 is 3 marks)**

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**11** A cylindrical tin has radius 5 cm and height 15 cm. Work out the volume of the tin. Give your answer in litres, correct to 3 significant figures (1000 $cm^3$ = 1 litre).

Diagram NOT accurately drawn

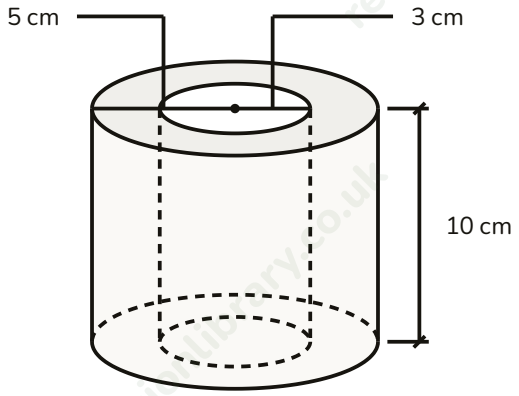



**(Total for Question 11 is 3 marks)**


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**12** A hollow tube has outer radius 5 cm, inner radius 3 cm and height 10 cm. Work out the total curved surface area (sum of the inner and outer curved surfaces) of the tube. Give your answer in terms of π.

Diagram NOT accurately drawn

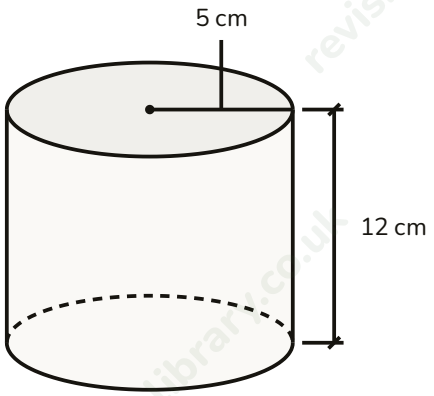



**(Total for Question 12 is 3 marks)**


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**13** Calculate the total surface area of a closed cylinder with radius 5 cm and height 12 cm. Give your answer in terms of π.

Diagram NOT accurately drawn

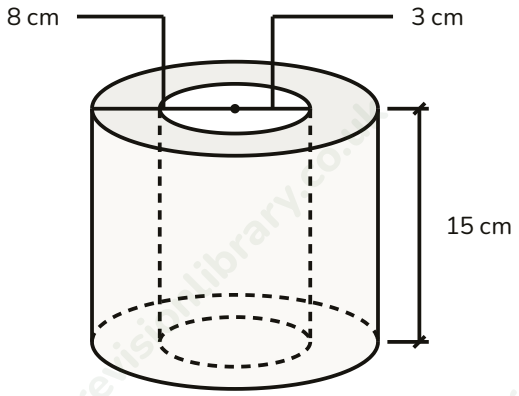



**(Total for Question 13 is 3 marks)**

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**14** A metal rod is made by drilling a cylindrical hole through the centre of a solid cylinder. The original cylinder has radius 8 cm and height 15 cm. The hole is a cylinder of radius 3 cm drilled along the full height. Work out the volume of metal remaining, giving your answer in terms of π.

Diagram NOT accurately drawn




**(Total for Question 14 is 3 marks)**

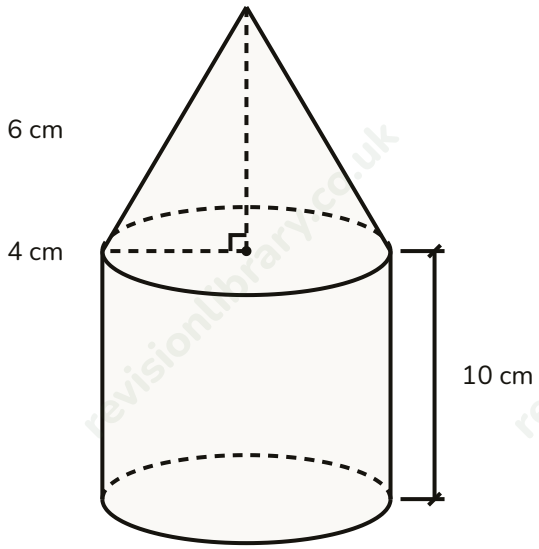

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**15** A composite solid is made from a cylinder of radius 4 cm and height 10 cm, with a cone of the same radius and height 6 cm attached on top.

The volume of a cone = $(1/3) \times \pi \times r^2 \times h$.

Work out the total volume of the solid. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

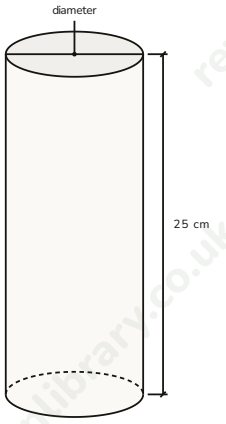



**(Total for Question 15 is 4 marks)**


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**16** A cylinder has volume 2000 cm³ and height 25 cm. Work out the diameter of the cylinder. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

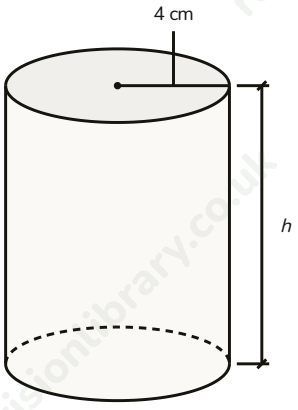



**(Total for Question 16 is 3 marks)**

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**17** A cylinder has volume 500 cm³ and radius 4 cm. Rearrange $V = \pi \times r^2 \times h$ to make h the subject, then work out the height of the cylinder. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

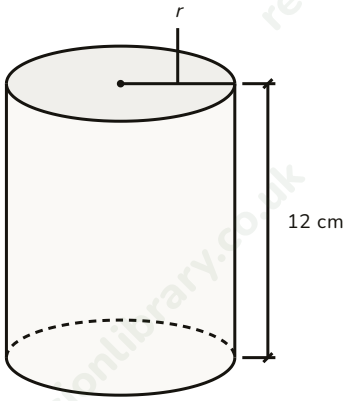



**(Total for Question 17 is 3 marks)**


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**18** A cylinder has volume 942 cm³ (to the nearest whole number) and height 12 cm. Rearrange $V = \pi \times r^2 \times h$ to make r the subject, then work out the radius of the cylinder. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

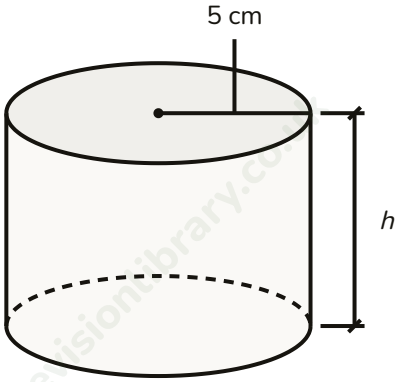



**(Total for Question 18 is 3 marks)**

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**19** A cylinder has curved surface area 220 cm² and radius 5 cm. Rearrange $CSA = 2 \times \pi \times r \times h$ to make h the subject, then work out the height of the cylinder. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

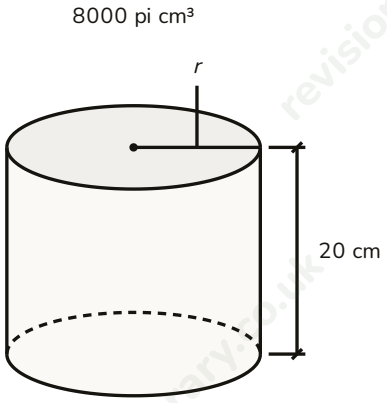



**(Total for Question 19 is 3 marks)**


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**20** A cylinder has height 20 cm and volume 8000 π $cm^3$. Work out the radius of the cylinder.

Diagram NOT accurately drawn

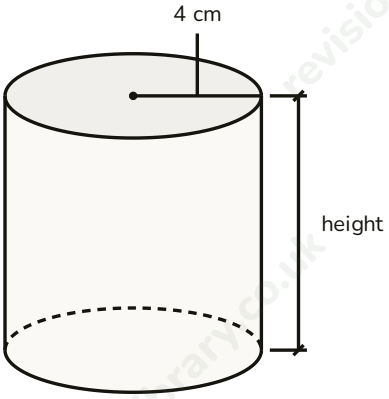



**(Total for Question 20 is 3 marks)**

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**21** A cylinder has total surface area 300 $cm^2$ and radius 4 cm. Work out the height of the cylinder. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

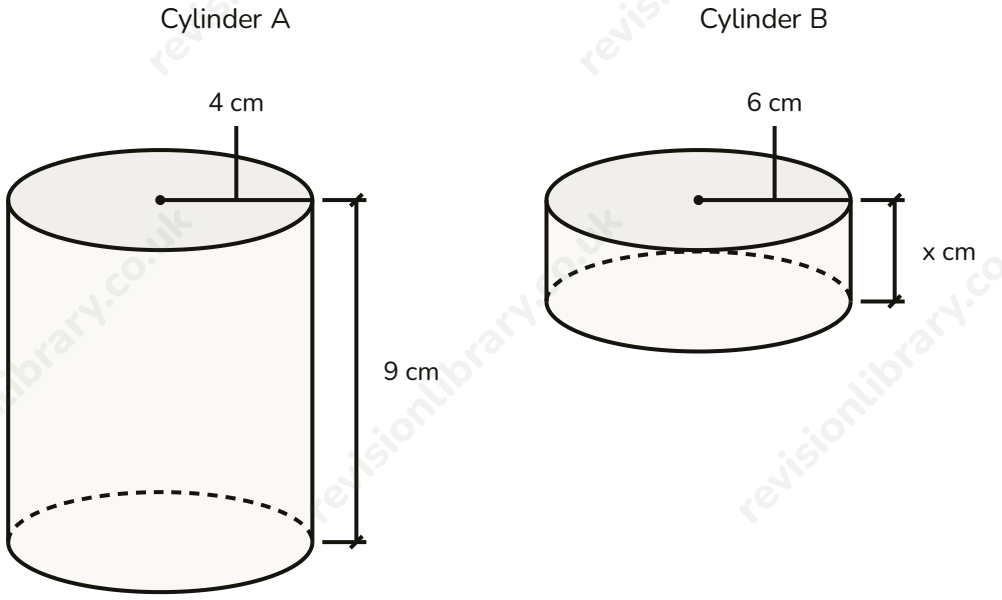



**(Total for Question 21 is 3 marks)**


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**22** Cylinder A has radius 4 cm and height 9 cm. Cylinder B has radius 6 cm and height x cm. Cylinder A and Cylinder B have the same volume. Work out the value of x.

Diagram NOT accurately drawn

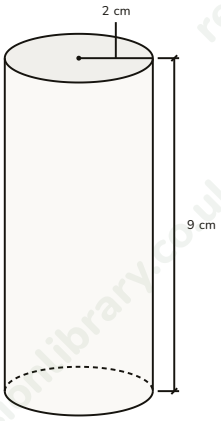



**(Total for Question 22 is 3 marks)**


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**23** Priya, a silversmith, melts down a solid cylindrical silver bar of radius 2 cm and height 9 cm. She recasts all of the silver into 6 identical smaller solid cylinders, each of radius 1 cm. Work out the height of each smaller cylinder.

Diagram NOT accurately drawn

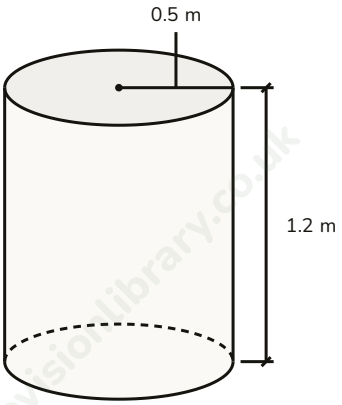



**(Total for Question 23 is 4 marks)**


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**24** Leon needs to paint 10 identical cylindrical oil drums for use as planters. Each drum has radius 0.5 m and height 1.2 m, and needs painting all over (the curved surface and both circular ends). One tin of paint covers 4 m² and costs £6.50. Tins cannot be shared between jobs, so Leon must buy whole tins. Work out the total cost of the paint Leon needs to buy.

Diagram NOT accurately drawn

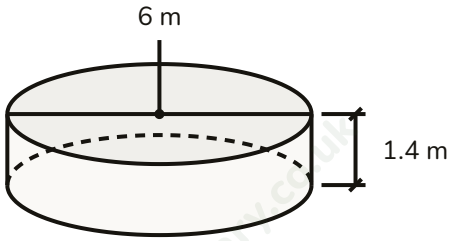



**(Total for Question 24 is 5 marks)**


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**25** Mr Jankowski is filling a cylindrical paddling pool in his garden. The pool has diameter 6 m and he fills it to a depth of 1.4 m. Water flows from his hose at a rate of 500 litres per minute. Work out how long it will take to fill the pool to this depth, giving your answer to the nearest minute.

Diagram NOT accurately drawn



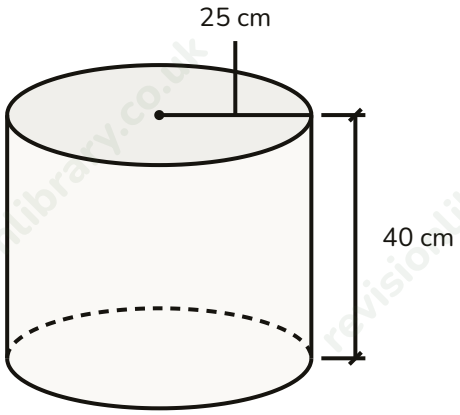

**(Total for Question 25 is 5 marks)**


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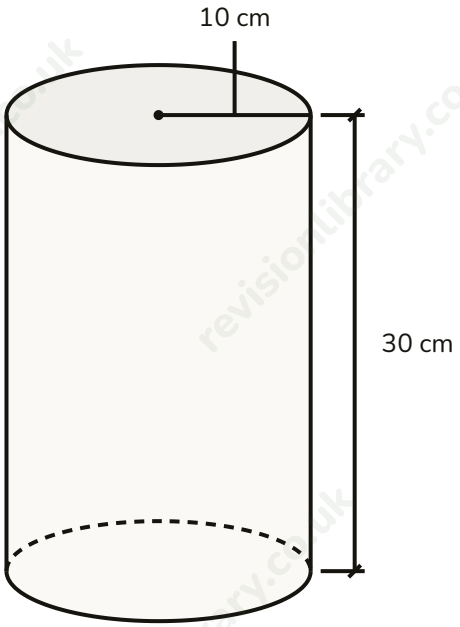
**26** Declan's cylindrical water butt has radius 25 cm and currently holds water to a depth of 40 cm. He uses a cylindrical bucket of radius 10 cm and height 30 cm to empty the butt, filling the bucket completely each time. Work out the greatest number of full buckets Declan can fill, and work out how much water (in litres, to 3 significant figures) is left in the butt afterwards.

Diagram NOT accurately drawn

Water in butt




Water in full bucket

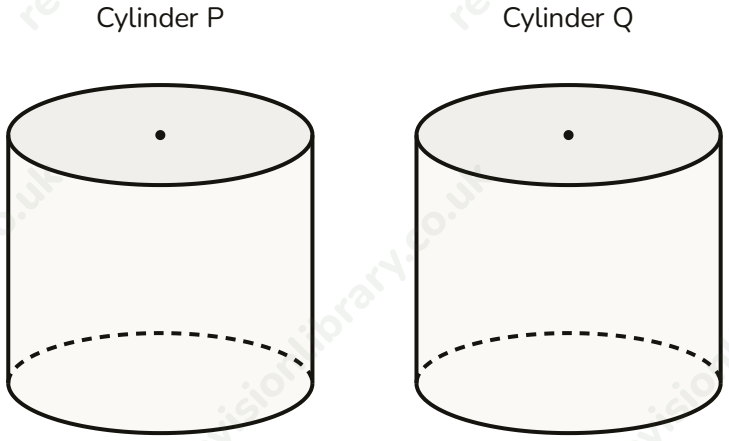



**(Total for Question 26 is 5 marks)**


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**27** Two similar cylinders, cylinder P and cylinder Q, have volumes in the ratio 8:27 (P smaller, Q larger). The curved surface area of cylinder P is 40pi $cm^2$. Work out the curved surface area of cylinder Q.

Diagram NOT accurately drawn




**(Total for Question 27 is 4 marks)**


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# Mark scheme · 4.14 Cylinders: 2-hour Pack

## Question 1

| | |
|---|---|
| outer volume $\pi \times 7^2 \times 15$ | **M1** |
| inner volume $\pi \times 2^2 \times 15$ | **M1** |
| subtracts | **M1** |
| $675\ \pi\ cm^3$ | **A1** |

**Answer: $675\ \pi\ cm^3$**

## Question 2

| | |
|---|---|
| radius 4 identified, curved surface area $2 \times \pi \times 4 \times 15$ (= 120pi) oe | **M1** |
| + $2 \times \pi \times 4^2$ (= 32pi) for the two circular ends oe | **M1** |
| awrt 477.5 (units $cm^2$) | **A1** |

**Answer: 477.5 $cm^2$ (1 d.p.)**

## Question 3

| | |
|---|---|
| correct substitution into $V = \pi \times r^2 \times h$, e.g. $\pi \times 3.5^2 \times 9$ (oe) | **M1** |
| awrt 346 $cm^3$ (cao) | **A1** |

**Answer: 346 $cm^3$ (3 s.f.)**

## Question 4

| | |
|---|---|
| radius = 5 identified and correct substitution into $V = \pi \times r^2 \times h$, e.g. $\pi \times 5^2 \times 6$ (oe) | **M1** |
| awrt 471 $cm^3$ (cao) | **A1** |

**Answer: 471 $cm^3$ (3 s.f.)**

## Question 5

| | |
|---|---|
| use $V = \pi * r^2 * h$ so $r^2 = V / (\pi * h)$ and substitute V = 1256, h = 10 | **M1** |
| calculate $r^2 = 1256 / (\pi * 10) = 125.6 / \pi = 39.98$ (2 d.p.) | **M1** |
| 6.3 cm awrt ($r = \sqrt{125.6 / \&\pi;} = 6.3229...$ so 6.3 to 1 d.p.) | **A1** |

**Answer: 6.3 cm**

## Question 6

| | |
|---|---|
| use $TSA = 2 * \pi * r * (r + h)$ with r = 5, so $314 = 2 * \pi * 5 * (5 + h) \Rightarrow 314 = 10pi(5 + h)$ | **M1** |
| solve h = 314 / (10pi) - 5 = 4.995 cm (3 d.p.), about 5.0 cm | **M1** |
| 4.995 cm, about 5.0 cm; accept 4.99 to 5.0 cm | **A1** |

**Answer: 5 cm**

## Question 7

| | |
|---|---|
| radius 0.7 m identified, $CSA = 2 \times \pi \times 0.7 \times 2$ oe (= 2.8pi) | **M1** |
| litres needed = their CSA / 6 oe (= awrt 1.47) | **M1** |
| rounds up to 2 whole tins needed (since only whole tins can be bought) | **B1** |
| £25.00 cao (= 2 x 12.50) | **A1** |

**Answer: £25.00**

## Question 8

| | |
|---|---|
| curved surface area = $2 \times \pi \times 6 \times 14$ (= 168pi) (oe) | **M1** |
| area of the two circular ends = $2 \times \pi \times 6^2$ (= 72pi) (oe) | **M1** |
| awrt 754 $cm^2$ (cao) | **A1** |

**Answer: 754 $cm^2$ (3 s.f.)**

## Question 9

| | |
|---|---|
| correct substitution into $CSA = 2 \times \pi \times r \times h$, e.g. $2 \times \pi \times 3 \times 8$ (oe) | **M1** |
| awrt 151 $cm^2$ (cao) | **A1** |

**Answer: 151 $cm^2$ (3 s.f.)**

## Question 10

| | |
|---|---|
| curved surface area = $2 \times \pi \times 2 \times 5$ (= 20pi) (oe) | **M1** |
| area of the two circular ends = $2 \times \pi \times 2^2$ (= 8pi) (oe) | **M1** |
| awrt 88.0 $cm^2$ (cao) | **A1** |

**Answer: 88.0 $cm^2$ (3 s.f.)**

## Question 11

| | |
|---|---|
| correct substitution into $V = \pi \times r^2 \times h$, e.g. $\pi \times 5^2 \times 15$ (oe) | **M1** |
| dividing their volume in $cm^3$ by 1000 (ft) | **M1** |
| awrt 1.18 litres (cao) | **A1** |

**Answer: 1.18 litres (3 s.f.)**

## Question 12

| | |
|---|---|
| use curved surface areas: $2pi * R * h + 2pi * r * h = 2pi * (R + r) * h$ | **M1** |
| substitute R = 5, r = 3, h = 10 to get $2pi * (5 + 3) * 10 = 160pi$ | **M1** |
| 160pi $cm^2$ cao | **A1** |

**Answer: 160pi $cm^2$**

## Question 13

| | |
|---|---|
| calculate curved surface area $2 * \pi * r * h = 2 * \pi * 5 * 12 = 120\ \pi$ | **M1** |
| calculate area of two bases $2 * \pi * r^2 = 2 * \pi * 25 = 50\ \pi$ | **M1** |
| $170\ \pi\ cm^2$ cao | **A1** |

**Answer: $170\ \pi\ cm^2$**

## Question 14

| | |
|---|---|
| volume of original cylinder $\pi * 8^2 * 15 = 960\ \pi$ | **M1** |
| volume of drilled cylinder $\pi * 3^2 * 15 = 135\ \pi$ | **M1** |
| remaining volume = $960\ \pi - 135\ \pi = 825\ \pi\ cm^3$ cao | **A1** |

**Answer: $825\ \pi\ cm^3$**

## Question 15

| | |
|---|---|
| volume of cylinder = $\pi \times 4^2 \times 10$ oe (= 160pi) | **M1** |
| volume of cone = $(1/3) \times \pi \times 4^2 \times 6$ oe (= 32pi) | **M1** |
| total = their cylinder + their cone oe (= 192pi) | **M1** |
| awrt 603 (units $cm^3$) | **A1** |

**Answer: 603 $cm^3$ (3 s.f.)**

## Question 16

| | |
|---|---|
| $r = \sqrt{V / (\&\pi; \times h)}$ stated or used, oe | **M1** |
| correct substitution and doubling to find the diameter, e.g. $2 \times \sqrt{2000 / (\&\pi; \times 25)}$ (oe) | **M1** |
| awrt 10.1 cm (cao) | **A1** |

**Answer: diameter = 10.1 cm (3 s.f.)**


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## Question 17

| | |
|---|---|
| $h = V / (\pi \times r^2)$ stated or used, oe | **M1** |
| correct substitution, e.g. $500 / (\pi \times 4^2)$ (oe) | **M1** |
| awrt 9.95 cm (cao) | **A1** |

**Answer: h = 9.95 cm (3 s.f.)**

## Question 18

| | |
|---|---|
| $r = \sqrt{V / (\&\pi; \times h)}$ stated or used, oe | **M1** |
| correct substitution, e.g. $\sqrt{942 / (\&\pi; \times 12)}$ (oe) | **M1** |
| awrt 5.0 cm (cao) | **A1** |

**Answer: r = 5.0 cm (1 d.p.)**

## Question 19

| | |
|---|---|
| $h = CSA / (2 \times \pi \times r)$ stated or used, oe | **M1** |
| correct substitution, e.g. $220 / (2 \times \pi \times 5)$ (oe) | **M1** |
| awrt 7.00 cm (cao) | **A1** |

**Answer: h = 7.00 cm (3 s.f.)**

## Question 20

| | |
|---|---|
| use $V = \pi * r^2 * h$ and rearrange to $r^2 = V / (\pi * h)$ | **M1** |
| substitute $V = 8000\pi$ and $h = 20$ to get $r^2 = 8000 / 20 = 400$ | **M1** |
| r = 20 cm cao | **A1** |

**Answer: 20 cm**

## Question 21

| | |
|---|---|
| $(h + r) = TSA / (2 \times \pi \times r)$, e.g. $300 / (2 \times \pi \times 4)$ (oe) | **M1** |
| (h + r) = awrt 11.9 (ft) | **M1** |
| awrt 7.94 cm (cao), from subtracting r = 4 from their (h + r) | **A1** |

**Answer: h = 7.94 cm (3 s.f.)**

## Question 22

| | |
|---|---|
| $\pi \times 4^2 \times 9 = \pi \times 6^2 \times x$, oe (equating the two volumes) | **M1** |
| 144 = 36x, or equivalent correct simplification | **M1** |
| x = 4 cao | **A1** |

**Answer: x = 4**

## Question 23

| | |
|---|---|
| volume of original bar = $\pi \times 2^2 \times 9$ (= 36pi) (oe) | **M1** |
| volume of one small cylinder = $\pi \times 1^2 \times h$, oe, in terms of h | **M1** |
| $6 \times \pi \times 1^2 \times h = 36\text{pi}$, oe (equating total volume of 6 small cylinders to original volume) | **M1** |
| h = 6 cm cao | **A1** |

**Answer: h = 6 cm**

## Question 24

| | |
|---|---|
| correct substitution into $TSA = 2 \times \pi \times r \times (h + r)$, e.g. $2 \times \pi \times 0.5 \times 1.7$ (oe) | **M1** |
| TSA of one drum = awrt 5.34 m² (cao) | **A1** |
| multiplying their TSA by 10 (ft) | **M1** |
| dividing their total area by 4 and rounding up to a whole number of tins (ft) | **M1** |
| £91 cao (from 14 tins x £6.50) | **A1** |

**Answer: £91**

## Question 25

| | |
|---|---|
| radius = 3 m identified | **M1** |
| correct substitution into $V = \pi \times r^2 \times h$, e.g. $\pi \times 3^2 \times 1.4$ (oe) | **M1** |
| converting their volume in $m^3$ to litres, using 1 m³ = 1000 litres (ft) | **M1** |
| dividing their volume in litres by 500 (ft) | **M1** |
| 79 minutes cao (accept awrt 79 minutes, or equivalent statement such as 1 hour 19 minutes) | **A1** |

**Answer: 79 minutes (awrt), i.e. 1 hour 19 minutes**

## Question 26

| | |
|---|---|
| volume of water in butt = $\pi \times 25^2 \times 40$ (= 25000pi) (oe) | **M1** |
| volume of bucket = $\pi \times 10^2 \times 30$ (= 3000pi) (oe) | **M1** |
| dividing their two volumes and rounding down to a whole number of buckets (ft) | **M1** |
| 8 full buckets cao | **A1** |
| awrt 3.14 litres remaining (cao) | **A1** |

**Answer: 8 full buckets; awrt 3.14 litres remain**

## Question 27

| | |
|---|---|
| linear scale factor = cube root(8/27) = 2/3, oe | **M1** |
| area scale factor = $(2/3)^2 = 4/9$, oe | **M1** |
| setting up 40pi / (4/9) or equivalent correct method to scale the given area up to cylinder Q | **M1** |
| 90pi $cm^2$ (oe, accept awrt 283 cm²), cao | **A1** |

**Answer: 90pi $cm^2$ (awrt 283 $cm^2$)**


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