Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Surface area and volume

Time allowed: 1 hour

Subject code **0580**

Mathematics

Questions from Paper 1, Paper 2, Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.
You may use a calculator.

Total marks

/ 50

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.
- Unless a question says otherwise, give answers that are not exact to 3 significant figures, and angles in degrees to 1 decimal place.

Information

- This paper has 10 questions worth 50 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 The volume of a cuboid is $180\,cm^3$.
The base is a square of side length 6 cm.

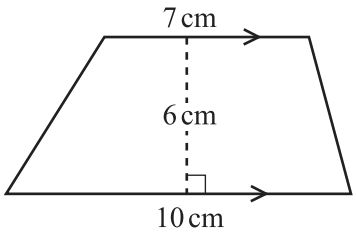
Calculate the height of this cuboid.

..... cm [2]

Volume of cuboids Click for more variations

1	5	**2**	**M1** for $180 \div 6^2$ oe

2



NOT TO SCALE

(a) Calculate the area of the trapezium.

..... cm^2 [2]

(b) The trapezium is the cross section of a prism.
The length of the prism is 12 cm.

Calculate the volume of the prism.
Give the units of your answer.

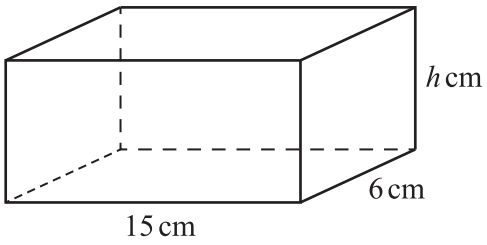
.... [2]

(a) Area (b) Volume Click for more variations

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2 (a)	51	**2**	**M1** for $\frac{1}{2}\times(10+7)\times 6$ oe
(b)	612	**1FT**	**FT** 12 × *their* (a)
	cm^3	**1**	

3



NOT TO SCALE

The total surface area of this cuboid is $369\,\text{cm}^2$.

Work out the value of h.

$h =$ ..... [4]

Surface area Click for more variations

3	4.5	**4**	**M3** for $2(6h+15h)=369-2(6\times15)$ or better or **M2** for $[2](6\times15+6\times h+15\times h)$ oe or **M1** for $[2\times]\,6\times15$ or $[2\times]\,6h$ or $[2\times]\,15h$

4 A solid cylinder has radius 5 cm and height 8 cm.

Calculate the total surface area of the cylinder.

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..... cm^2 [4]

Surface area Click for more variations

4	408 or 408.4 to 408.5	**4**	**M3** for $2\times\pi\times5\times8 + 2\times\pi\times5^2$ oe OR **M1** for $2\times\pi\times5\times8$ **M1** for $[2]\times\pi\times5^2$

5 Find the radius of a hemisphere of volume $80\,\text{cm}^3$.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

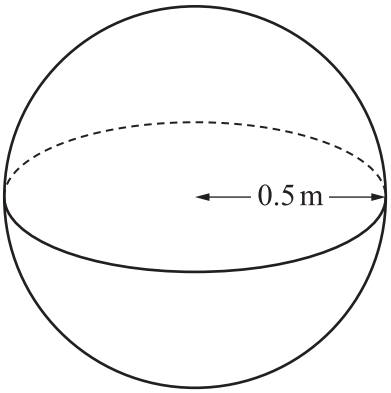
..... cm [3]

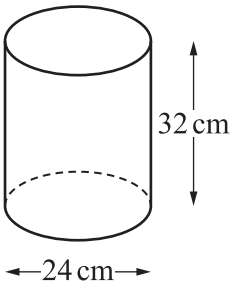
Volume Click for more variations

5	3.37 or 3.367 to 3.368	**3**	**M2** for isolating r^3, e.g. $r^3 = \frac{120}{\pi}$ or **M1** for $\frac{1}{2}\times\frac{4}{3}\times\pi r^3 = 80$ oe If 0 scored **SC1** for answer 2.67 or 2.672 to 2.673...

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6





NOT TO SCALE

The diagram shows a spherical tank with radius 0.5 m and a cylindrical jug with diameter 24 cm and height 32 cm.
The tank is full of water.

Calculate how many times the jug can be completely filled with water from the tank.
[The volume, V, of a sphere with radius r is $\frac{4}{3}\pi r^3$.]

..... [5]

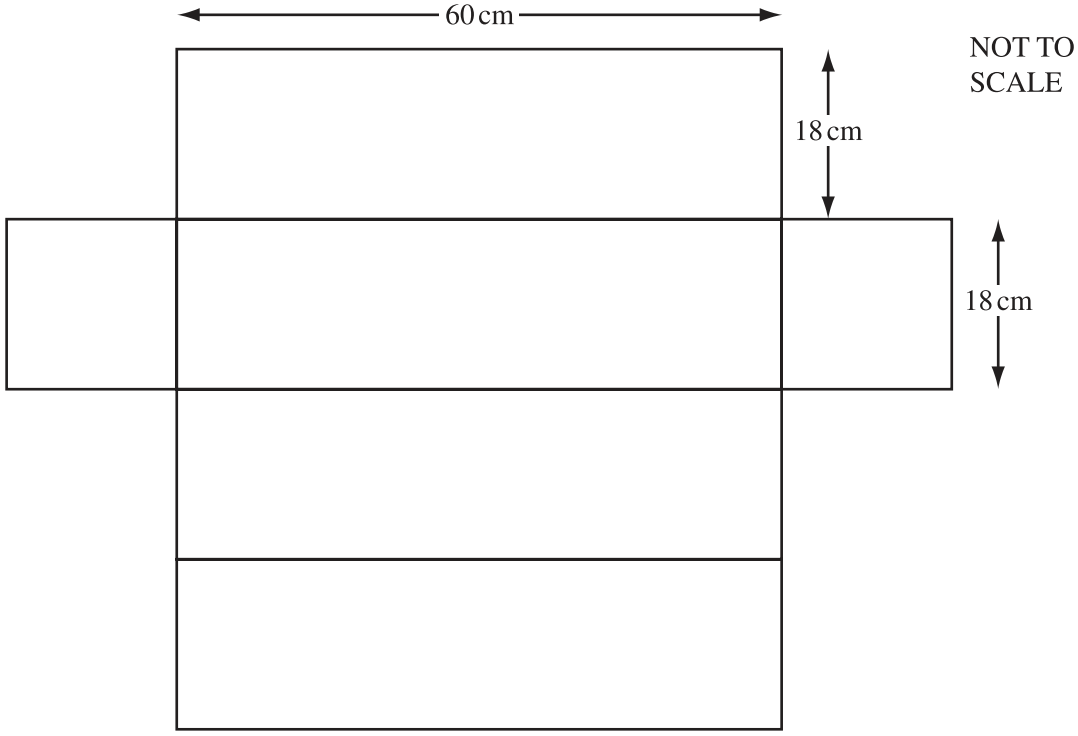
Problem solving with volumes Click for more variations

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6	36	**5**	**B4** for 36.16 to 36.17 or 36.2 or **B1** for 50 or 0.12 and 0.32 **M1** for $\frac{4}{3}\times\pi\times(their50)^3$ or $\frac{4}{3}\times\pi\times 0.5^3$ **M1** for $\pi\times12^2\times32$ or $\pi\times$ *their* $0.12^2\times$ *their* 0.32 **M1** for *their* 523 598 ÷ *their* 14 476 or *their* 0.523 598 ÷ *their* 0.014 476 dep on M1 M1and correct formulae used If **1**,**2**or **3** scored award **SC1** for *their* decimal answer correctly rounded down to the nearest integer

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7



The diagram shows the net of a box.

(a) (i) Calculate the **total** surface area of the box.

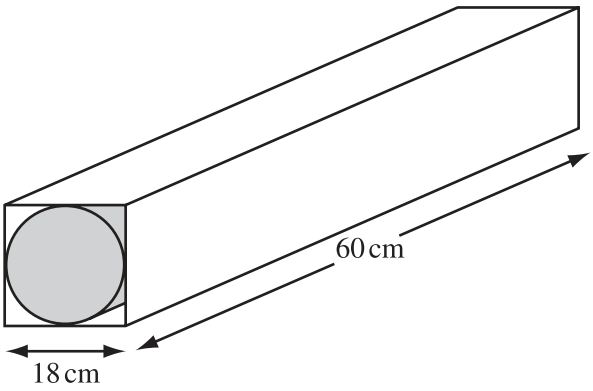
Answer(a)(i) ..... cm^2 [2]

(ii) Calculate the volume of the box.

Answer(a)(ii) ..... cm^3 [2]

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(b) A cylinder with **diameter** 18 cm and length 60 cm just fits inside the box.



NOT TO SCALE

(i) Calculate the volume of the cylinder.

Answer(b)(i) ..... cm^3 [2]

(ii) Find the volume of space outside the cylinder but inside the box.

Answer(b)(ii) ..... cm^3 [1]

(iii) Calculate the curved surface area of the cylinder.

Answer(b)(iii) ..... cm^2 [2]

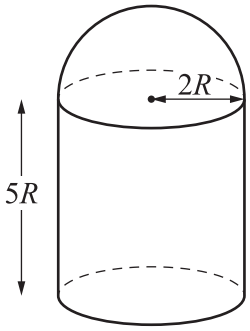
(a)(i) Surface area (a)(ii) Volume of cuboids (b)(i) Volume (b)(ii) Problem solving with volumes
(b)(iii) Surface area Click for more variations

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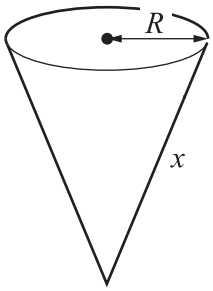
7 (a) (i)	4968 Allow 4970	**2**	**M1** for $4 \times 60 \times 18 + 2 \times 18 \times 18$ oe
(ii)	19440 Allow 19400	**2**	**M1** for $18 \times 18 \times 60$
(b) (i)	15260 to 15271 or 15300	**2**	**M1** for $\pi \times 9 \times 9 \times 60$ or 4860π If **M0**, **SC1** for answer of 61000 to 61100
(ii)	4172 or 4170 or 4169 to 4180 or 4140 or 4129 to 4140 or 4100	**1ft**	ft their**(a)(ii)** – their**(b)(i)** provided **(a)(ii)** > **(b)(i)**
(iii)	3391 to 3393.5 or 3390	**2**	**M1** for $2 \times \pi \times 9 \times 60$ or 1080π If **M0**, **SC1** for answer of 6780 to 6790

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8 In this question all measurements are in centimetres.



Solid A



Solid B

NOT TO SCALE

Solid A is made from a cylinder and a hemisphere, both of radius $2R$.
The cylinder has height $5R$.
Solid B is a cone of radius R and sloping edge x.

The **total** surface area of solid A is equal to the **total** surface area of solid B.

Find R in terms of x.

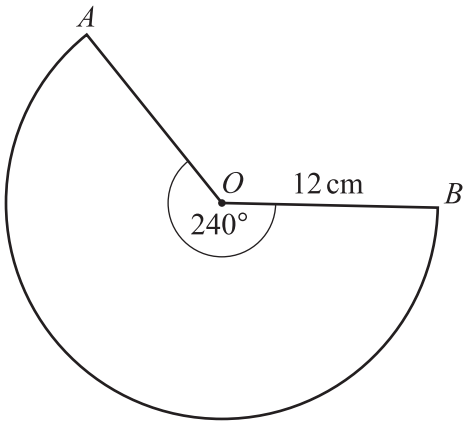
$R =$ ..... [5]

Surface area Click for more variations

8	$[R =] \frac{x}{31}$	**5**	**M1** for $\pi (2R)^2$ oe **M1** for $2 \times \pi \times 2R \times 5R$ oe **M1** for $\frac{4\pi(2R)^2}{2}$ oe **M1** for $\pi \times R \times x + \pi \times R^2$ oe

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9



NOT TO SCALE

The diagram shows a major sector, AOB, of a circle.
The sector angle is 240° and the radius is 12 cm.

(a) Show that the length of the major arc AB is 16π cm.

[1]

(b) OA is joined to OB to form a cone.

Work out the volume of the cone.

Give your answer in the form $\frac{\left(a\sqrt{b}\right)\pi}{3}$ where a is an integer and b is a prime number.

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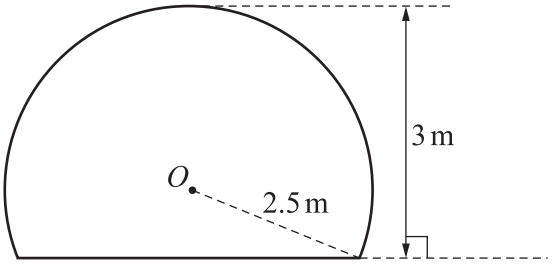
..... cm^3 [6]

(a) Arc length and sector area (b) Volume Click for more variations

9(a)	$\frac{240}{360}\times 2\times\pi\times 12$ oe	**M1**	
9(b)	$\frac{\left(256\sqrt{5}\right)\pi}{3}$ cao	**6**	**B5** for answer $\frac{\left(256\sqrt{5}\right)}{3}$ or $\frac{\left(256\sqrt{5}\right)\pi}{3}$ seen then spoilt or an answer equivalent to $\frac{\left(256\sqrt{5}\right)\pi}{3}$ but not in required form OR **B2** for radius of cone = 8 oe or **M1** for $2\pi r = 16\pi$ **B2** for [height of cone =] $\sqrt{80}$ oe or **M1** for $12^2 =$ *their* $8^2 + h^2$ or better **M1dep** for $\frac{1}{3}\times\pi\times$ *their* $8^2\times$ *their* $\sqrt{80}$ oe dep on attempt at Pythagoras to find height of cone

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10



NOT TO SCALE

The diagram shows the major segment of a circle, centre O, radius 2.5 m.
The segment is the cross section of a tunnel with height 3 m.
The length of the tunnel is 800 m and it has the same cross section throughout its length.

Calculate the volume of the tunnel.

..... m^3 [7]

Adding and subtracting areas Click for more variations

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10	9835 to 9844 nfww	**7**	**B5** for [area of segment =] 12.29 to 12.31 nfww **M1** for 12.29 to 12.31 × 800 **OR** **B2** for angle at centre = 157 or 156.9 or 156.92 to 156.93 or for [reflex angle =] 203 to 203.1 or **M2** for $2 \times \cos^{-1}\left(\frac{3-2.5}{2.5}\right)$ oe or **M1** for $\cos x = \frac{3-2.5}{2.5}$ oe **M2dep** for $\frac{360-their\theta}{360} \times \pi \times 2.5^2$ or **M1dep** for $\frac{[360-]their\,\theta}{360} \times \pi \times 2.5^2$ seen **M1dep** for $\frac{1}{2} \times 2.5 \times 2.5 \times \sin(their\,\theta)$ oe or $2 \times 0.5 \times \sqrt{2.5^2 - 0.5^2} \times 0.5$ oe **M1** for *their* area × 800 leading to answer

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