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

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Areas and volumes of similar shapes

Time allowed: 40 minutes

Subject code **0580**

Mathematics

Paper 2 (Extended)

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

/ 33

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 33 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 Hans draws a plan of a field using a scale of 1 centimetre to represent 15 metres.
The actual area of the field is 10 800 m^2.

Calculate the area of the field on the plan.

Answer ..... cm^2 [2]

Similar areas and volumes Click for more variations

1		48	**2**	**M1** for 15^2 or $\left(\frac{1}{15}\right)^2$ or $\frac{1}{15^2}$ or $\sqrt{10800}$ or $\frac{1}{\sqrt{10800}}$

2 On a map with scale 1 : 25 000, the area of a lake is 33.6 square centimetres.

Calculate the actual area of the lake, giving your answer in square kilometres.

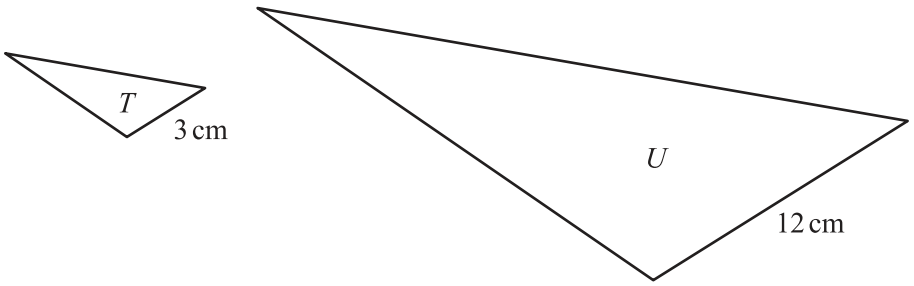
..... km^2 [2]

Similar areas and volumes Click for more variations

2	2.1	**2**	**M1** for $\frac{33.6 \times 25000^2}{100000^2}$ oe or answer figs 21

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3



NOT TO SCALE

The diagram shows two mathematically similar triangles, T and U.
Two corresponding side lengths are 3 cm and 12 cm.
The area of triangle T is 5 cm^2.

Find the area of triangle U.

..... cm^2 [2]

Similar areas and volumes Click for more variations

3	80	**2**	**M1** for $\left(\frac{12}{3}\right)^2$ or $\left(\frac{3}{12}\right)^2$ oe or $\frac{3^2}{5}=\frac{12^2}{A}$ oe

4 Two cups are mathematically similar.
The larger cup has capacity 0.5 litres and height 8 cm.
The smaller cup has capacity 0.25 litres.

Find the height of the smaller cup.

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..... cm [3]

Similar areas and volumes Click for more variations

4	6.35 or 6.349 to 6.350	**3**	**M2** for $\frac{8}{h} = \sqrt[3]{\frac{0.5}{0.25}}$ oe or **M1** for $\left(\frac{8}{h}\right)^3 = \frac{0.5}{0.25}$ oe or for $\sqrt[3]{\frac{0.5}{0.25}}$ or $\sqrt[3]{\frac{0.25}{0.5}}$ oe

5 Two solids are mathematically similar and have volumes $81\,\text{cm}^3$ and $24\,\text{cm}^3$.
The surface area of the smaller solid is $44\,\text{cm}^2$.

Calculate the surface area of the larger solid.

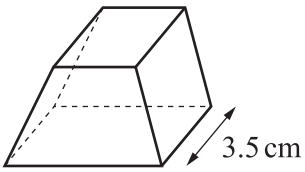
..... cm^2 [3]

Similar areas and volumes Click for more variations

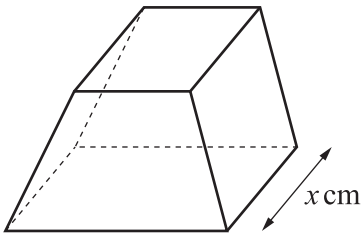
5	99	**3**	**M2** for $44 \times \left(\frac{81}{24}\right)^{\frac{2}{3}}$ oe or **M1** for $\left(\frac{81}{24}\right)^{\frac{1}{3}}$ oe or $\left(\frac{24}{81}\right)^{\frac{1}{3}}$ oe or $\left(\frac{44}{Area}\right)^3 = \left(\frac{24}{81}\right)^2$ oe

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6



Small box



Large box

NOT TO SCALE

The small box is mathematically similar to the large box.
The volume of the large box is 72.8% greater than the volume of the small box.
The small box has length 3.5 cm and the large box has length x cm.

Calculate the value of x.

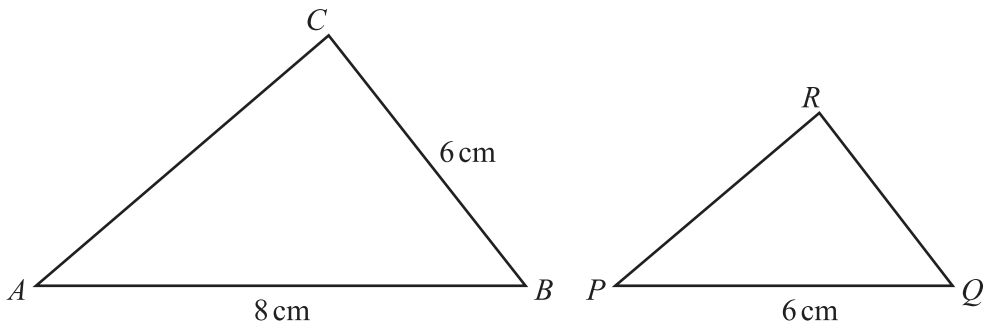
$x =$ ..... [3]

Similar areas and volumes Click for more variations

6	4.2 oe	**3**	**M2** for $\sqrt[3]{1+\frac{72.8}{100}}\times 3.5$ oe or **M1** for $\frac{\sqrt[3]{172.8}}{\sqrt[3]{100}}$ oe or $\frac{\sqrt[3]{100}}{\sqrt[3]{172.8}}$ oe or $\frac{x^3}{3.5^3}=\frac{172.8}{100}$ oe

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7



Triangle ABC is mathematically similar to triangle PQR.

(a) Calculate QR.

$QR =$ ..... cm [2]

(b) The two triangles are the cross-sections of two mathematically similar prisms.
The volume of the larger prism is $320\,\text{cm}^3$.

Calculate the volume of the smaller prism.

..... cm^3 [2]

(a) Similar lengths (b) Similar areas and volumes Click for more variations

7(a)	4.5 oe	**2**	**M1** for $\frac{8}{6}=\frac{6}{QR}$ oe or better
7(b)	135	**2**	**M1** for $\left(\frac{6}{8}\right)^3$ or $\left(\frac{8}{6}\right)^3$ or $\left(\frac{\textit{their}4.5}{6}\right)^3$ oe

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8 Two solid steel statues are mathematically similar.
The smaller statue has height 12 cm and the larger statue has height 15 cm.
The larger statue has a mass 2.5 kg.
The density of steel is 8 g/cm^3.

Calculate the volume of the smaller statue.
[Density = mass ÷ volume.]

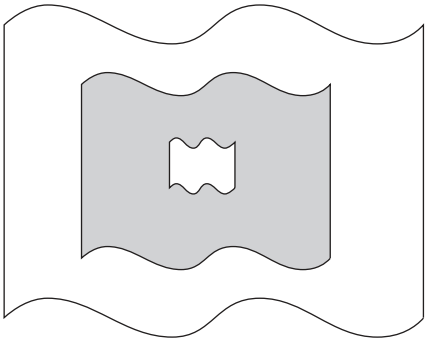
..... cm^3 [4]

Similar areas and volumes Click for more variations

8	160	**4**	**M3** for $V \div \frac{2500}{8} = \frac{12^3}{15^3}$ oe or for answer figs 16 from $\frac{figs25}{8} \times \frac{12^3}{15^3}$ or **B2** for 1.28 [kg] OR **M1** for 2500 ÷ 8 oe or 312.5 seen **M1** for $\left(\frac{12}{15}\right)^3$ or $\left(\frac{15}{12}\right)^3$ oe

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9



NOT TO SCALE

The diagram shows three shapes that are mathematically similar.
The heights of the shapes are in the ratio small : medium : large = 1 : 5 : 8.

Find the ratio shaded area : total unshaded area.
Give your answer in its simplest form.

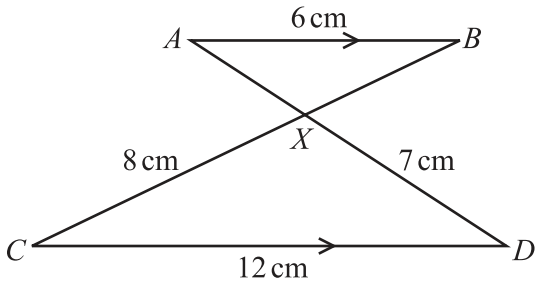
..... : ..... [4]

Similar areas and volumes Click for more variations

9	3 : 5 nfww	**4**	**M3** for $5^2 - 1$ oe and $8^2 - 5^2 + 1$ oe or **M2** for $5^2 - 1$ oe or $8^2 - 5^2 + 1$ oe or **M1** for 5^2 oe or 8^2 oe seen

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10



NOT TO SCALE

In the diagram, AB is parallel to CD.
AD and BC intersect at X.
$AB = 6\,\text{cm}$, $CD = 12\,\text{cm}$, $CX = 8\,\text{cm}$ and $DX = 7\,\text{cm}$.

(a) Complete the statement.

Triangle ABX is ..... to triangle DCX. [1]

(b) Work out the length of BX.

$BX =$ ..... cm [2]

(c) The area of triangle DCX is $26.906\,\text{cm}^2$.

Use this value to find the area of

(i) triangle ABX,

..... cm^2 [2]

(ii) triangle ACX.

..... cm^2 [1]

(a) Similarity (b) Similar lengths (c)(i) Similar areas and volumes (c)(ii) Similar areas and volumes

Click for more variations

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10(a)	Similar	**1**	
10(b)	4	**2**	**M1** for $\frac{12}{6}=\frac{8}{BX}$ oe or better If **0** scored **SC1** for answer 3.5
10(c)(i)	6.7265 or 6.73 or 6.726 to 6.727	**2**	**M1** for scale factor 2^2 or $\left(\frac{1}{2}\right)^2$ oe soi
10(c)(ii)	13.453 or 13.5 or 13.45 to 13.46	**1**	**FT** *their* **(c)(i)** $\times 2$

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