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1638716757

MATHEMATICS **0580/42**

Paper 4 (Extended) **May/June 2023**

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π, use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

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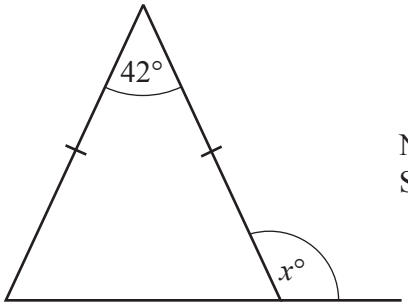
1 **(a)**



NOT TO SCALE

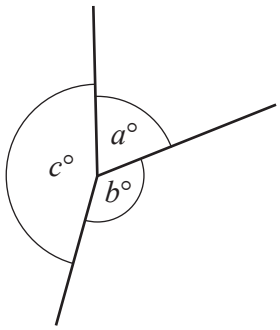
The diagram shows an isosceles triangle with the base extended.

Find the value of x.

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

(b) The diagram shows three lines meeting at a point.
The ratio $a : b : c = 3 : 4 : 5$.

Find the value of c.



NOT TO SCALE

$c =$ ..... [3]

(c) A regular pentagon has an exterior angle, d.
A regular hexagon has an interior angle, h.

Find the fraction $\frac{d}{h}$.
Give your answer in its simplest form.

..... [4]

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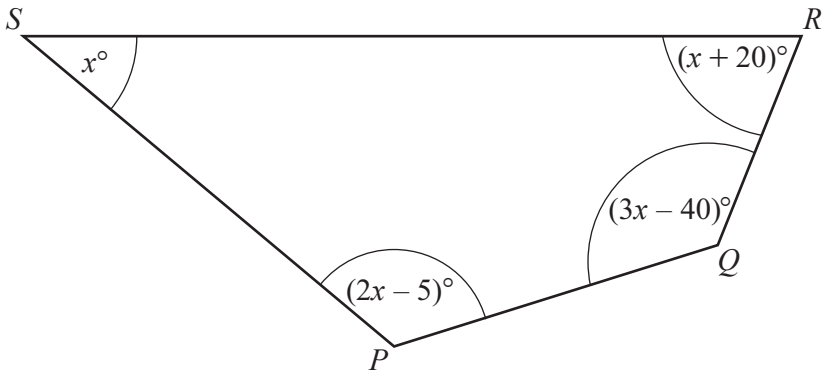
(d)

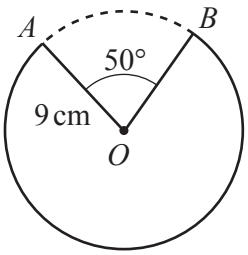


NOT TO SCALE

Show that *PQRS* is a cyclic quadrilateral.

[5]

(e)



NOT TO SCALE

The diagram shows a circle of radius 9 cm, centre *O*.
The minor sector *AOB*, with sector angle 50°, is removed from the circle.

Calculate the length of the major arc *AB*.

..... cm [3]

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2 **(a)** Anil changes \$830 into euros when the exchange rate is 1 euro = \$1.16 .
He spends 500 euros.
He then changes the remaining money back into dollars at the same exchange rate.

Work out how much, in dollars, Anil receives.

\$ ..... [3]

(b) In 2021, Anil earns \$37 000.

(i) He spends \$12 400 on bills in 2021.

Calculate the percentage of his earnings he spends on bills.

..... % [2]

(ii) His earnings of \$37 000 increase by 3.2% in 2022.

Calculate his earnings in 2022.

\$ ..... [2]

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(c) Anil invests \$3500 in an account that pays a rate of 2.4% per year compound interest.

(i) Calculate the total interest earned at the end of 5 years.

\$ ..... [3]

(ii) Find the number of complete years before Anil has at least \$5000 in this account.

..... years [3]

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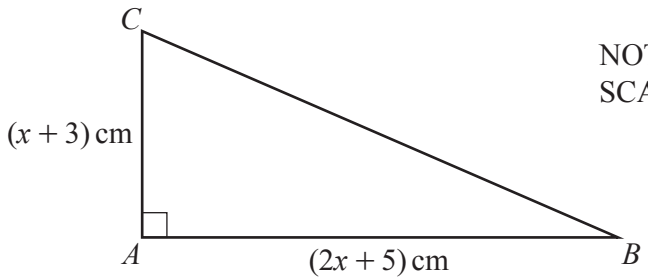
3



The diagram shows a right-angled triangle ABC.

(a) (i) The area of the triangle is $60\,\text{cm}^2$.

Show that $2x^2 + 11x - 105 = 0$.

[3]

(ii) Solve by factorisation.

$$2x^2 + 11x - 105 = 0$$

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

(iii) Calculate angle ACB.

..... [3]

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(b) Triangle *ABC* is similar to triangle *DEF*.
Triangle *DEF* has an area of $93.75\,\text{cm}^2$.

(i) Find the size of the smallest angle of triangle *DEF*.

..... [1]

(ii) Find the length of the shortest side of triangle *DEF*.

..... cm [3]

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4 The table shows information about the heights of 80 children.

Height (h metres)	$1.2 < h \leqslant 1.4$	$1.4 < h \leqslant 1.5$	$1.5 < h \leqslant 1.65$	$1.65 < h \leqslant 1.8$	$1.8 < h \leqslant 1.9$
Frequency	2	13	24	32	9

(a) (i) Write down the interval containing the median.

..... $< h \leqslant$ ..... [1]

(ii) Calculate an estimate of the mean height.

..... m [4]

(b) (i) One of these children is chosen at random.
Calculate the probability that they have a height of 1.4 m or less.

..... [1]

(ii) Two of these children are chosen at random.
Calculate the probability that both children are taller than 1.5 m but only one of them is taller than 1.8 m.

..... [3]

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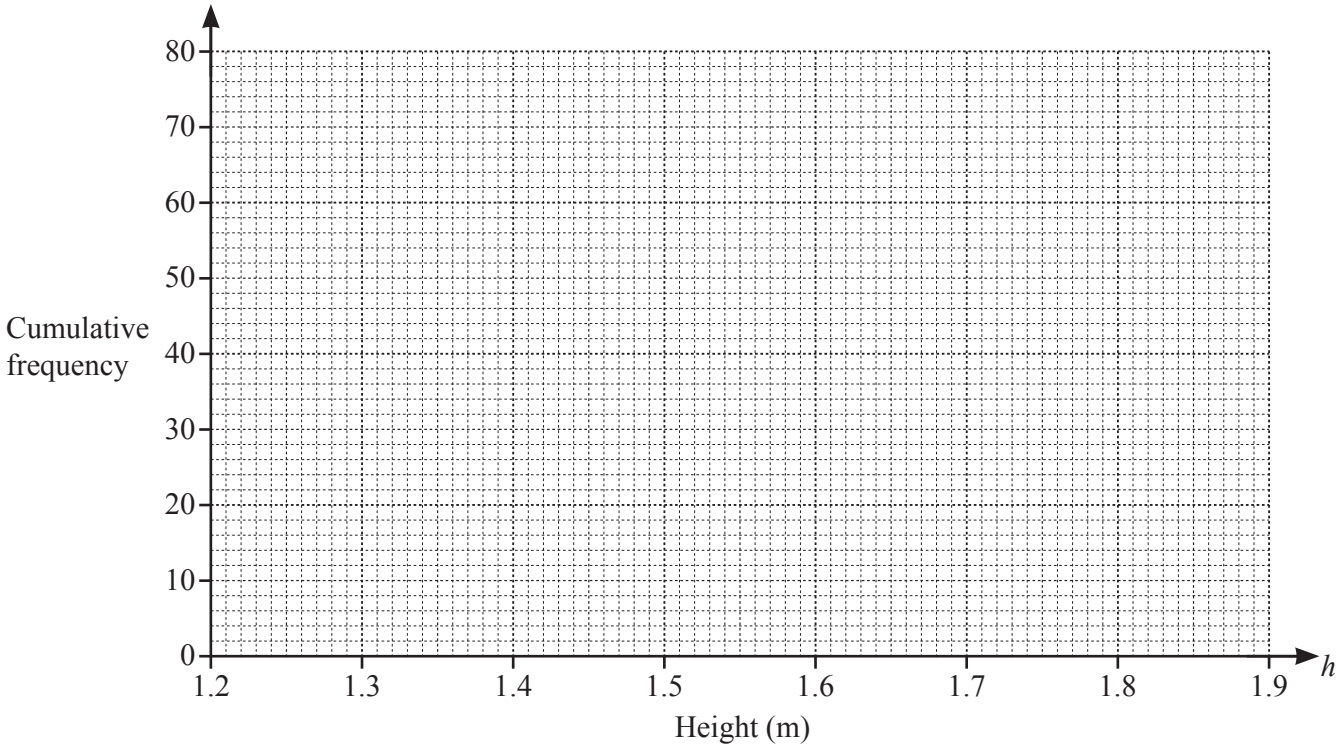
(c) **(i)** Complete the cumulative frequency table for the heights.

Height (h metres)	$h \leqslant 1.4$	$h \leqslant 1.5$	$h \leqslant 1.65$	$h \leqslant 1.8$	$h \leqslant 1.9$
Cumulative frequency	2				

[2]

(ii) On the grid, draw the cumulative frequency diagram.



[3]

(d) Use your diagram to find an estimate of

(i) the interquartile range

..... m [2]

(ii) the 60th percentile.

..... m [2]

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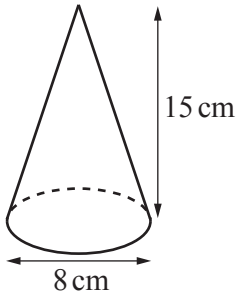
5 (a)



NOT TO SCALE

A cone has base diameter 8 cm and perpendicular height 15 cm.

(i) Calculate the volume of the cone.
[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm^3 [2]

(ii) A label completely covers the curved surface area of the cone.

Calculate the area of the label as a percentage of the **total** surface area of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

..... % [5]

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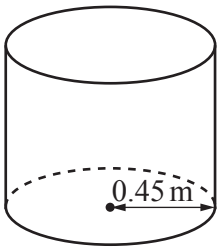
(b)



NOT TO SCALE

An empty cylindrical container has radius 0.45 m.
300 litres of water is poured into the container at a rate of 375 ml per second.

(i) Find the time taken, in minutes and seconds, for all the water to be poured into the container.

..... min ..... s [3]

(ii) Calculate the height of the water in the container.

..... m [3]

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[Turn over

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6 **(a)** A sequence has nth term $\frac{n}{2n+3}$.

(i) Find the first three terms of this sequence.

Give your answers as fractions.

..... , ... , ... [2]

(ii) The kth term of this sequence is $\frac{12}{25}$.

Find the value of k.

$k =$ ..... [2]

(b) Find the nth term of each sequence.

(i) 6, 13, 32, 69, 130, …

..... [2]

(ii) 100, 50, 25, 12.5, 6.25, …

..... [2]

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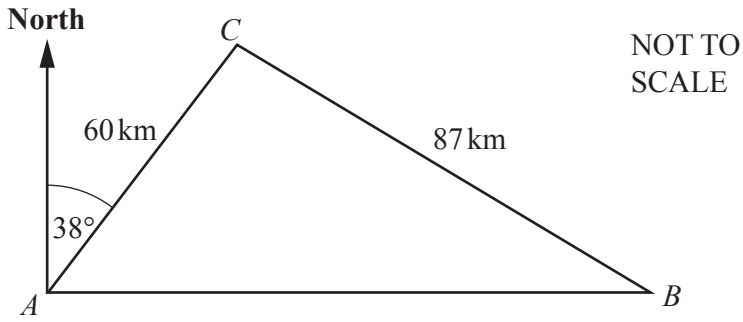
7



The diagram shows the straight roads between town A, town B and town C.
$AC = 60\,\text{km}$, $CB = 87\,\text{km}$ and B is due east of A.
The bearing of C from A is 038°.

(a) Show that angle $ACB = 95.1°$, correct to 1 decimal place.

[5]

(b) Without stopping, a car travels from town A to town C then to town B, before returning directly to town A.
The total time taken for the journey is 3 hours 20 minutes.

Calculate the average speed of the car for this journey.
Give your answer in kilometres per hour.

..... km/h [6]

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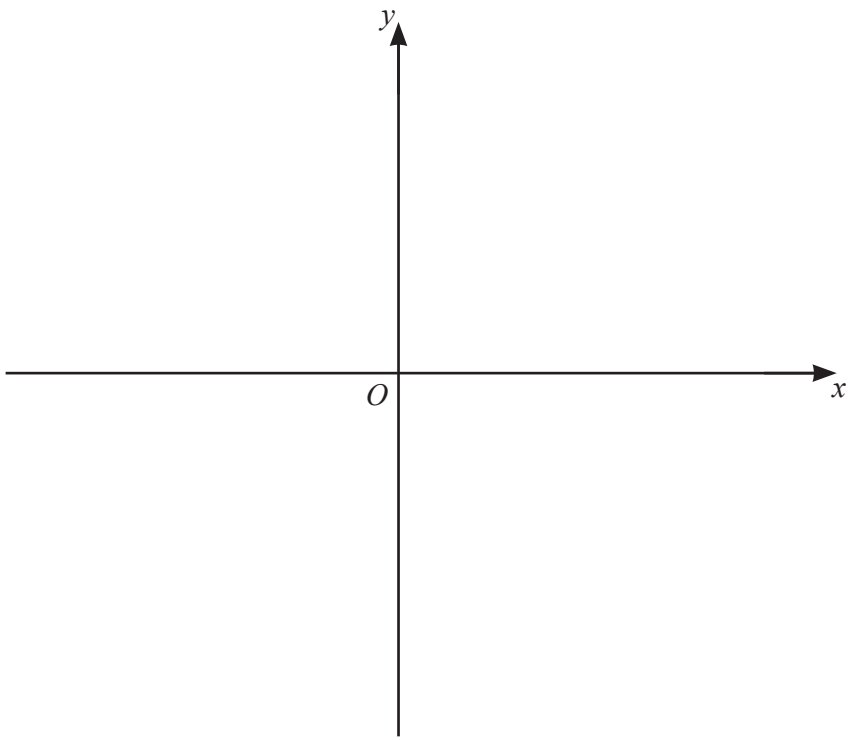
8 **(a)** **(i)** Show that the equation $y = (x-4)(x+1)(x-2)$ can be written as $y = x^3 - 5x^2 + 2x + 8$.

[2]

(ii) On the diagram, sketch the graph of $y = x^3 - 5x^2 + 2x + 8$, indicating the values where the graph crosses the axes.



[4]

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(b) The graph of $y = x^3 - 5x^2 + 2x + 8$ has two tangents with a gradient of 10.

Find the equations of these two tangents.
You must show all your working and give your answers in the form $y = mx + c$.

$y =$ .....

$y =$ ..... [7]

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9 **(a)** Simplify.

(i) $(3x^2y^4)^3$

..... [2]

(ii) $\left(\frac{16}{x^{16}y^8}\right)^{-\frac{3}{2}}$

..... [3]

(b) **(i)** Factorise.

$x^2 - 9$

..... [1]

(ii) Simplify.

$$\frac{x^2 - 9}{2xy - 6y + 5x - 15}$$

..... [3]

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(c) Solve the simultaneous equations.
You must show all your working and give your answers correct to 2 decimal places.

$$2x + y = 7$$
$$y = 5x^2 + 2x - 13$$

$x =$ ..... , $y =$ .....

$x =$ ..... , $y =$ ..... [6]

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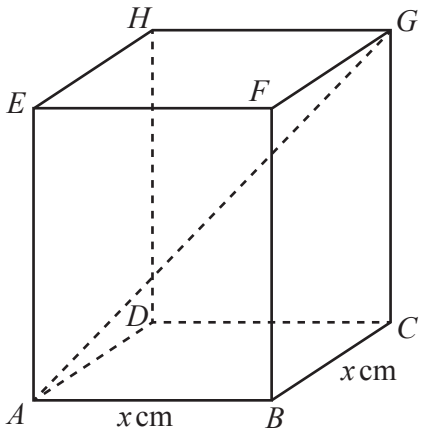
10 (a)



NOT TO SCALE

ABCDEFGH is a cuboid with a square base of side x cm.
$CG = 20$ cm and $AG = 28$ cm.

Calculate the value of x.

$x =$ ..... [4]

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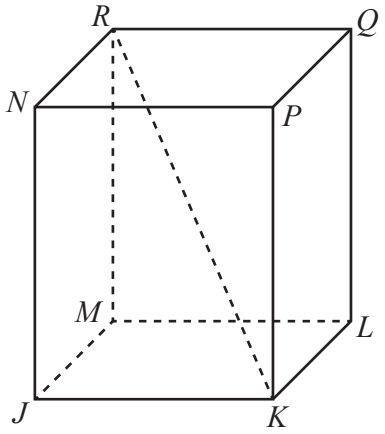
(b)



NOT TO SCALE

The diagram shows a different cuboid $JKLMNPQR$.
$MR = 30$ cm correct to the nearest centimetre.
$KR = 37$ cm correct to the nearest centimetre.

Calculate the lower bound of the angle between KR and the base $JKLM$ of the cuboid.

..... [4]

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