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**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

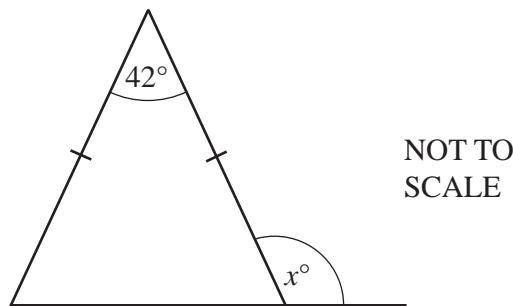
INSTRUCTIONS

- 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.

1 (a)


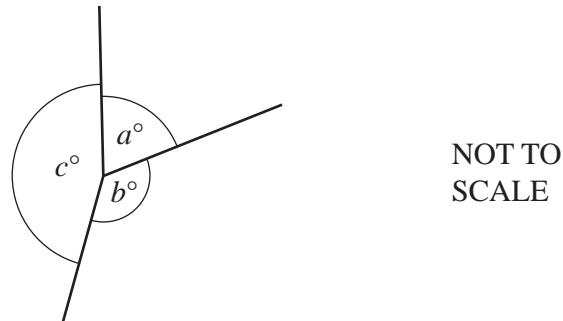
The diagram shows an isosceles triangle with the base extended.

Find the value of x .

$$x = \dots \quad [3]$$

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

Find the value of c .



$$c = \dots \quad [3]$$

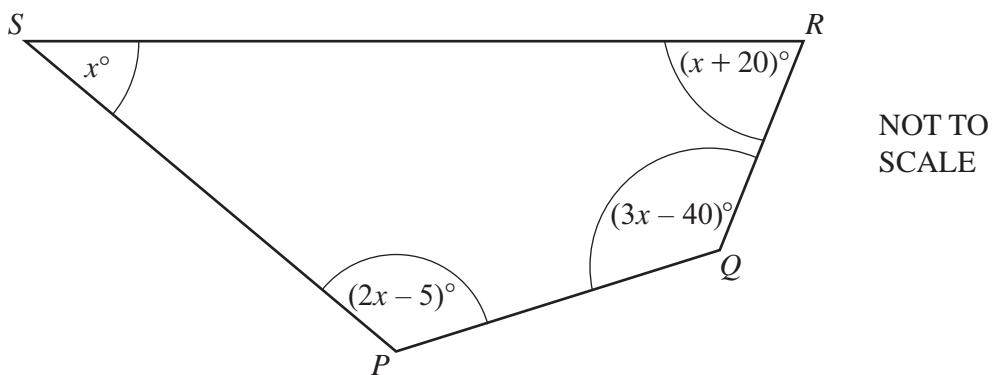
- (c)** A regular pentagon has an exterior angle, d .
 A regular hexagon has an interior angle, h .

Find the fraction $\frac{d}{h}$.

Give your answer in its simplest form.

$$\dots \quad [4]$$

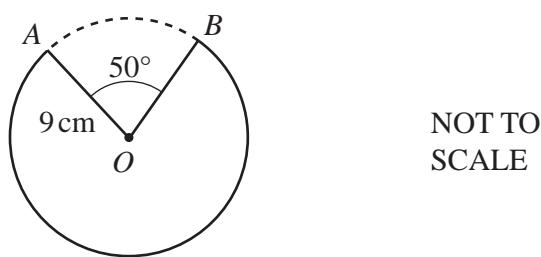
(d)



Show that $PQRS$ is a cyclic quadrilateral.

[5]

(e)



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]

- 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]

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

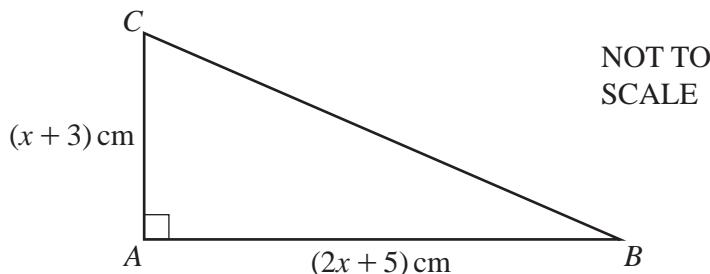
(i) Calculate the total interest earned at the end of 5 years.

\$ [3]

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

..... years [3]

3



The diagram shows a right-angled triangle ABC .

- (a) (i)** The area of the triangle is 60 cm^2 .

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

[3]

- (ii)** Solve by factorisation.

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

$$x = \dots \text{ or } x = \dots \quad [3]$$

- (iii)** Calculate angle ACB .

$$\dots \quad [3]$$

- (b) Triangle ABC is similar to triangle DEF .
Triangle DEF has an area of 93.75 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]

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

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

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

..... $< h \leq$ [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.

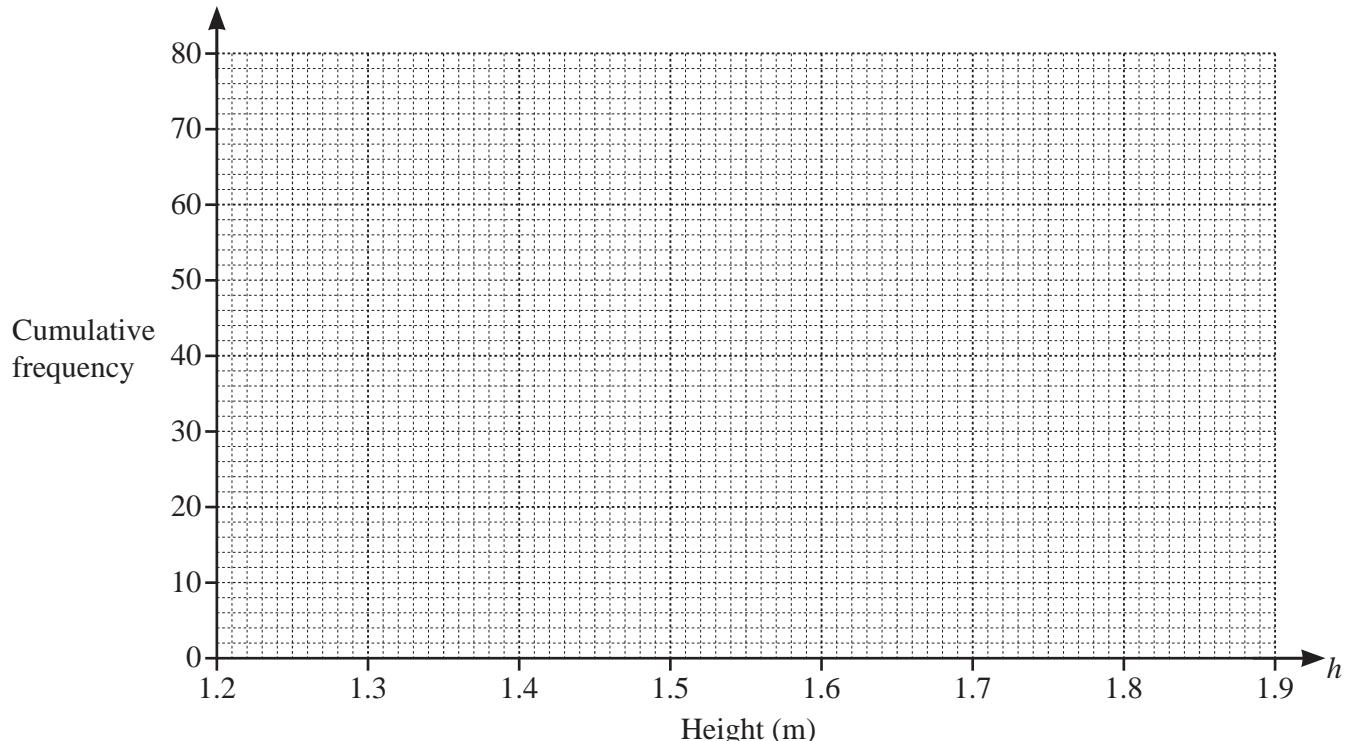
..... [3]

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

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

[2]

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



[3]

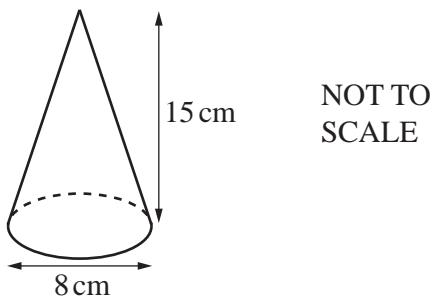
- (d) Use your diagram to find an estimate of

- (i) the interquartile range

..... m [2]

- (ii) the 60th percentile.

..... m [2]

5 (a)


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]

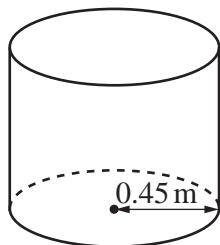
- (ii)** A label completely covers the curved surface area of the cone.

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]

(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]

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

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

Give your answers as fractions.

.....,, [2]

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

Find the value of k .

$k =$ [2]

(b) Find the n th term of each sequence.

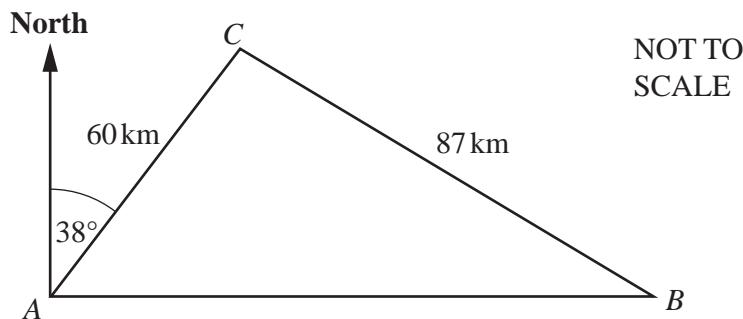
(i) 6, 13, 32, 69, 130, ...

..... [2]

(ii) 100, 50, 25, 12.5, 6.25, ...

..... [2]

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 $ACB = 95.1^\circ$, 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.

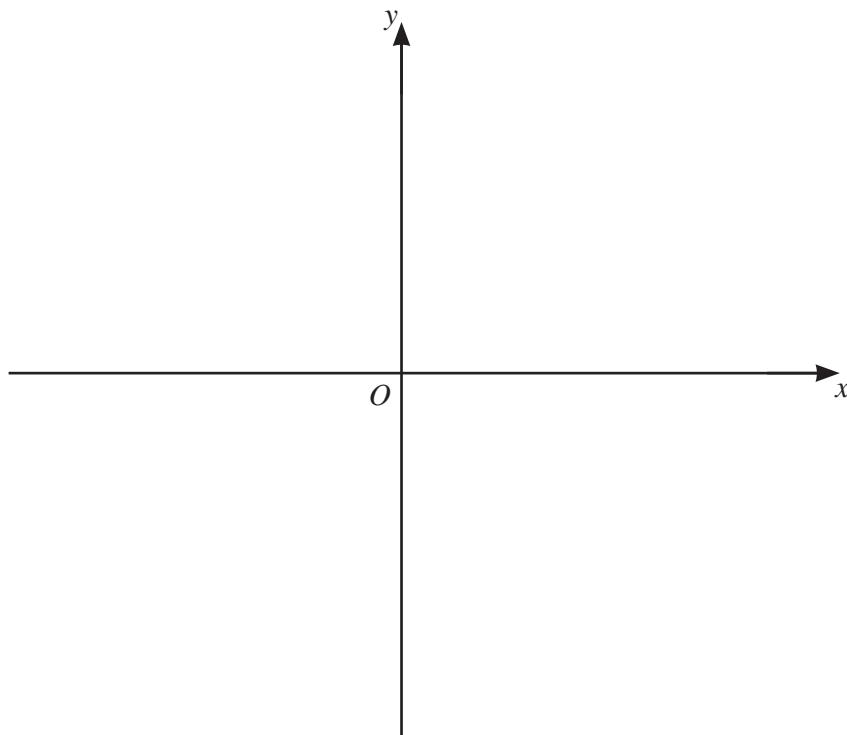
Give your answer in kilometres per hour.

..... km/h [6]

- 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]

(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 $y = mx + c$.

$$y = \dots$$

$$y = \dots [7]$$

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]

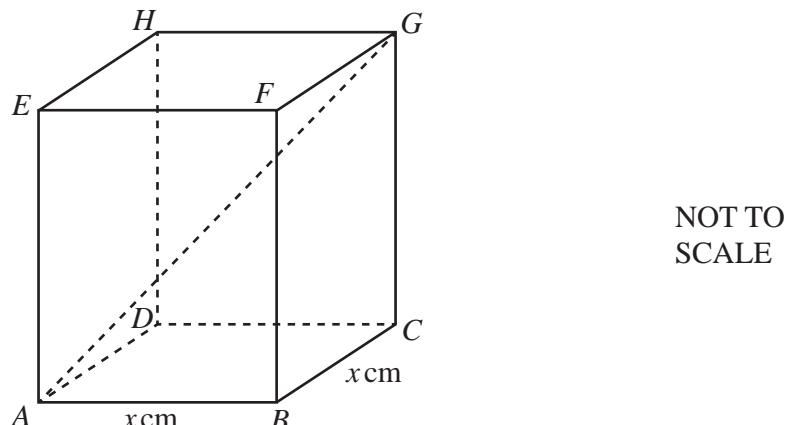
- (c) Solve the simultaneous equations.

You must show all your working and give your answers correct to 2 decimal places.

$$\begin{aligned}2x + y &= 7 \\y &= 5x^2 + 2x - 13\end{aligned}$$

$$x = \dots, y = \dots$$

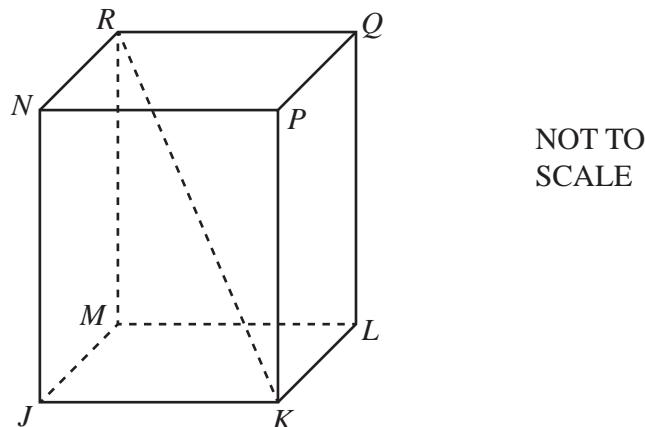
$$x = \dots, y = \dots [6]$$

10 (a)


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

Calculate the value of x .

$$x = \dots \quad [4]$$

(b)


The diagram shows a different cuboid $JKLMNPQR$.

$MR = 30\text{ cm}$ correct to the nearest centimetre.

$KR = 37\text{ cm}$ 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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