Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

7920029899

MATHEMATICS **0580/41**

Paper 4 (Extended) **October/November 2022**

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.

DC (LK/CGW) 302726/3

1 **(a)** Calculate the volume of

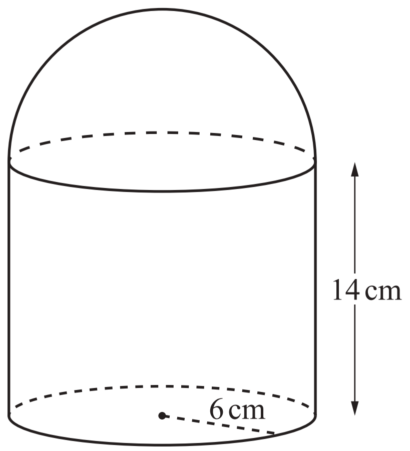
(i) a solid cylinder with radius 6 cm and height 14 cm,

.... cm^3 [2]

(ii) a solid hemisphere with radius 6 cm.
[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

.... cm^3 [2]

(b)



NOT TO SCALE

The cylinder and hemisphere in **part (a)** are joined to form the solid in the diagram.
The solid is made of steel and 1 cm^3 of steel has a mass of 7.85 g.

(i) Show that 1 cm^3 of steel has a mass of 0.007 85 kg.

[1]

(ii) Calculate the total mass of the solid.

.... kg [2]

(c) $2000\,\text{cm}^3$ of iron is melted down and some of it is used to make 50 spheres with radius 2 cm.

(i) Calculate the percentage of iron that is left over.
[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

.... % [3]

(ii) The iron left over is then made into a cube.

Calculate the length of an edge of the cube.

.... cm [1]

(d) A solid cone has radius $3R$ cm and slant height $9R$ cm.
A solid cylinder has radius x cm and height $7x$ cm.
The **total** surface area of the cone is equal to the **total** surface area of the cylinder.

Given that $R = kx$, find the value of k.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

$k =$ .... [4]

2 **(a)** Write

(i) 2994.99 correct to the nearest 10,

.... [1]

(ii) 0.983 correct to 1 decimal place,

.... [1]

(iii) 2090 correct to 2 significant figures.

.... [1]

(b) Write down a prime number between 90 and 100.

.... [1]

(c) Write 2^{-6} as a fraction.

.... [1]

(d) Write 0.007 01 in standard form.

.... [1]

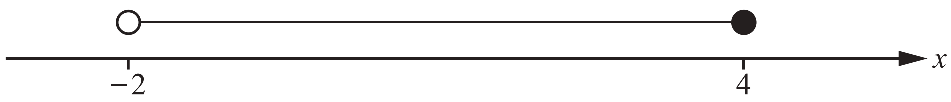
(e) Simplify $1.5 \times 10^{x} + 1.5 \times 10^{x-1}$ giving your answer in standard form.

.... [2]

(f) Write $0.3\dot{7}$ as a fraction.
You must show all your working.

.... [2]

3 **(a)**



Write down the inequality shown by the number line.

.... [1]

(b) $-3 \leqslant 2x+3 < 9$

(i) Solve the inequality.

.... [3]

(ii) Write down all the integer values of x that satisfy the inequality.

.... [2]

(c) Solve the equations.

(i) $3(3-x)-\frac{2(x+2)}{5}=1$

$x =$ .... [4]

(ii) $\frac{5}{x+3}=\frac{3}{x+5}$

$x =$ .... [3]

4 **(a)** **(i)** Zak invests \$500 at a rate of 2% per year simple interest.

Calculate the value of Zak's investment at the end of 5 years.

\$ .... [3]

(ii) Yasmin invests \$500 at a rate of 1.8% per year compound interest.

Calculate the value of Yasmin's investment at the end of 5 years.

\$ .... [2]

(iii) Zak and Yasmin continue with these investments.

How many **more complete** years is it before the value of Yasmin's investment is greater than the value of Zak's investment?

.... [3]

(b) Xavier buys a car for \$2500.
The value of the car decreases exponentially at a rate of 10% each year.

Calculate the value of Xavier's car at the end of 5 years.
Give your answer correct to the nearest dollar.

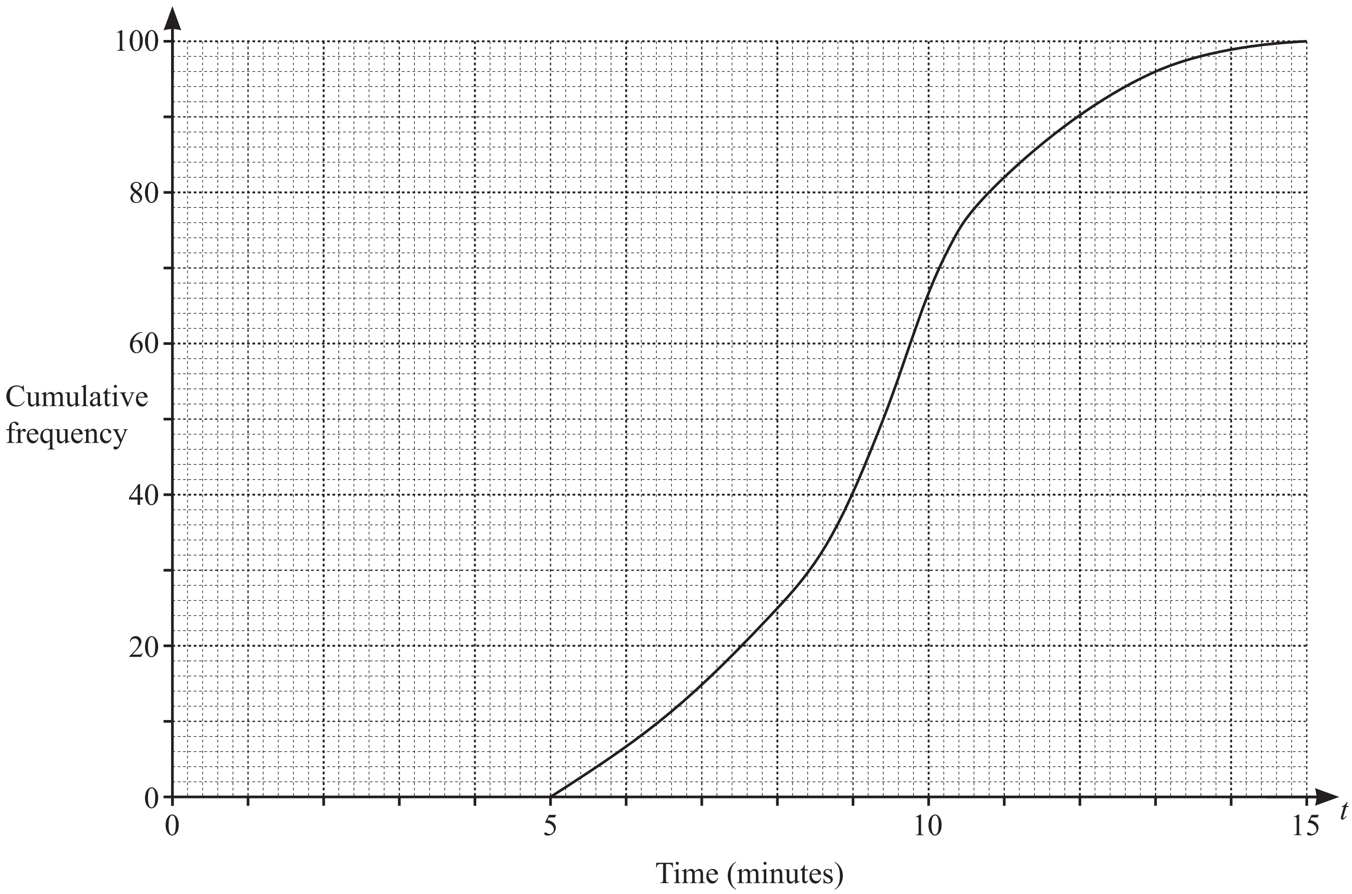
\$ .... [3]

(c) The number of a certain type of bacteria increases exponentially at a rate of r% each day.
After 22 days, the number of this bacteria has doubled.

Find the value of r.

$r =$ .... [3]

5 **(a)** 100 students each record the time, t minutes, taken to eat a pizza.
The cumulative frequency diagram shows the results.



Find an estimate of

(i) the median,

.... min [1]

(ii) the interquartile range,

.... min [2]

(iii) the number of students taking more than 11 minutes to eat a pizza.

.... [2]

(b) 150 students each record how far they can throw a tennis ball.
The table shows the results.

Distance (d metres)	$0 < d \leqslant 20$	$20 < d \leqslant 30$	$30 < d \leqslant 35$	$35 < d \leqslant 45$	$45 < d \leqslant 60$
Frequency	4	38	40	53	15

(i) Calculate an estimate of the mean.

.... m [4]

(ii) A histogram is drawn to show this information.
The height of the bar representing $30 < d \leqslant 35$ is 12 cm.

Calculate the height of each of the other bars.

Distance (d metres)	Frequency	Height of bar (cm)
$0 < d \leqslant 20$	4	
$20 < d \leqslant 30$	38	
$30 < d \leqslant 35$	40	12
$35 < d \leqslant 45$	53	
$45 < d \leqslant 60$	15	

[3]

(iii) Two students are chosen at random.

Find the probability that they both threw the ball more than 45 m.

.... [2]

6 **(a)** $\mathbf{p} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -1 \\ 1 \end{pmatrix}$

Find

(i) $3\mathbf{q}$,

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(ii) $\mathbf{p} - \mathbf{q}$,

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(iii) $|\mathbf{p}|$.

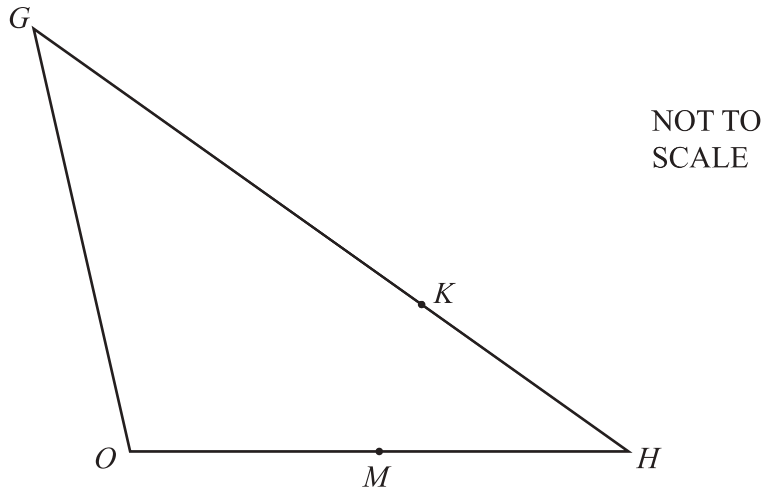
.... [2]

(b) B is the point (2, 7) and $\overrightarrow{AB} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}$.

Find the coordinates of A.

(...................... , ...) [2]

(c)



In triangle OGH, M is the midpoint of OH and K divides GH in the ratio 5 : 2.
$\overrightarrow{OG} = \mathbf{g}$ and $\overrightarrow{OH} = \mathbf{h}$.

Find $\overrightarrow{MK}$ in terms of $\mathbf{g}$ and $\mathbf{h}$.
Give your answer in its simplest form.

$\overrightarrow{MK} =$ .... [4]

7 $\mathrm{f}(x) = 10 - x$ $\mathrm{g}(x) = \dfrac{2}{x},\ x \neq 0$ $\mathrm{h}(x) = 2^x$ $\mathrm{j}(x) = 5 - 2x$

(a) **(i)** Find $\mathrm{g}\left(\frac{1}{2}\right)$.

.... [1]

(ii) Find $\mathrm{hg}\left(\frac{1}{2}\right)$.

.... [1]

(b) Find x when $\mathrm{f}(x) = 7$.

$x =$ .... [1]

(c) Find x when $\mathrm{g}(x) = \mathrm{h}(3)$.

$x =$ .... [2]

(d) Find $\mathrm{j}^{-1}(x)$.

$\mathrm{j}^{-1}(x) =$ .... [2]

(e) Write $\mathrm{f}(x) + \mathrm{g}(x) + 1$ as a single fraction in its simplest form.

.... [3]

(f) $\left(\mathrm{f}(x)\right)^2 - \mathrm{ff}(x) = ax^2 + bx + c$

Find the values of a, b and c.

$a =$ ....

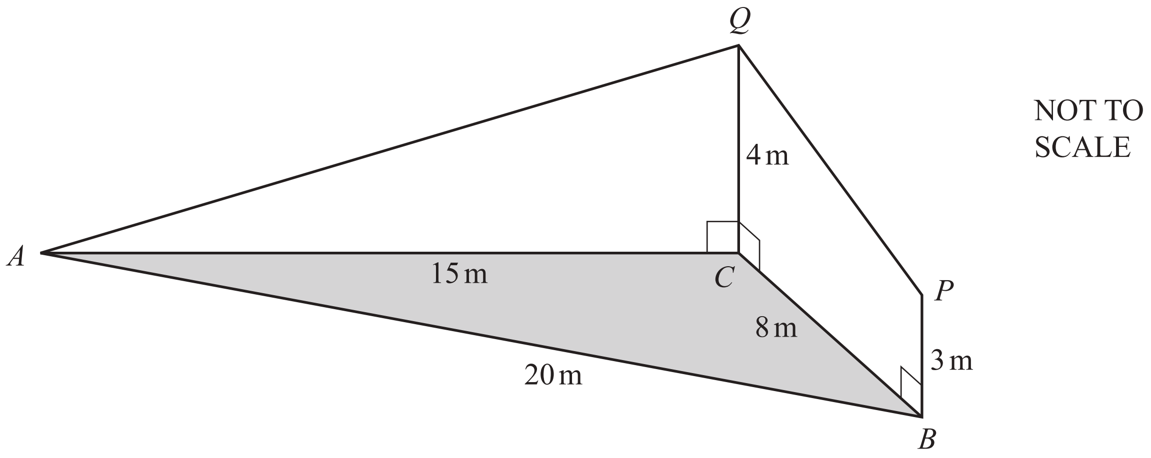
$b =$ ....

c = ... [4]

(g) Find x when $\mathrm{h}^{-1}(x) = 10$.

$x =$ .... [2]

8



The diagram shows triangle ABC on horizontal ground.
$AC = 15\,\text{m}$, $BC = 8\,\text{m}$ and $AB = 20\,\text{m}$.

BP and CQ are vertical poles of different heights.
$BP = 3\,\text{m}$ and $CQ = 4\,\text{m}$.
AQ and PQ are straight wires.

(a) Show that angle $ACB = 117.5°$, correct to 1 decimal place.

[4]

(b) Calculate the area of triangle ABC.

.... m^2 [2]

(c) Calculate the length of *AQ*.

.... m [2]

(d) Calculate the angle of elevation of *Q* from *P*.

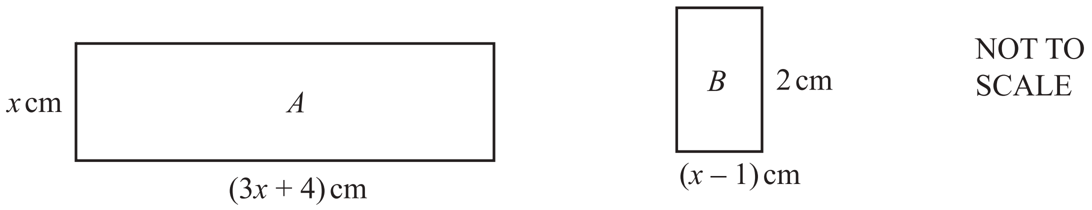
.... [3]

(e) Another straight wire connects *A* to the midpoint of *PQ*.

Calculate the angle between this wire and the horizontal ground.

.... [5]

9 (a)



The total of the areas of rectangles A and B is $20\,\text{cm}^2$.

(i) Show that $3x^2 + 6x - 22 = 0$.

[2]

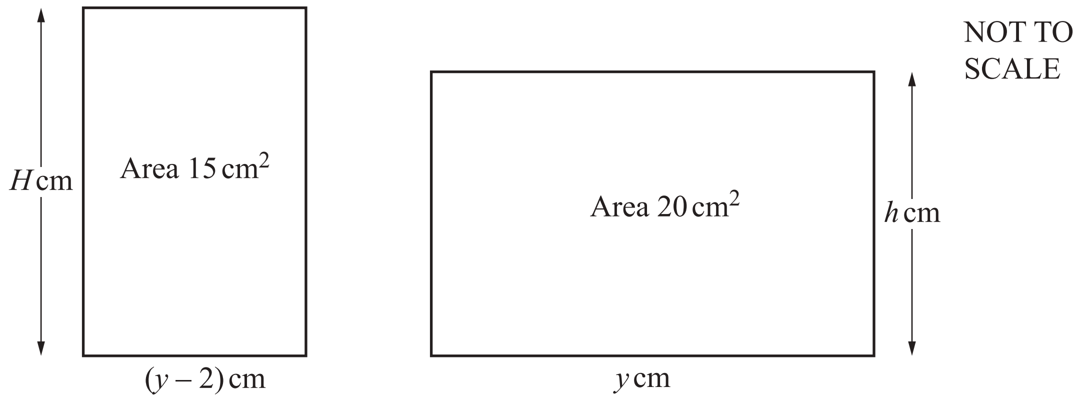
(ii) Solve the equation $3x^2 + 6x - 22 = 0$, giving your answers correct to 4 significant figures.
You must show all your working.

x = ... or x = ... [4]

(iii) Find the perimeter of rectangle B.

.... cm [1]

(b)

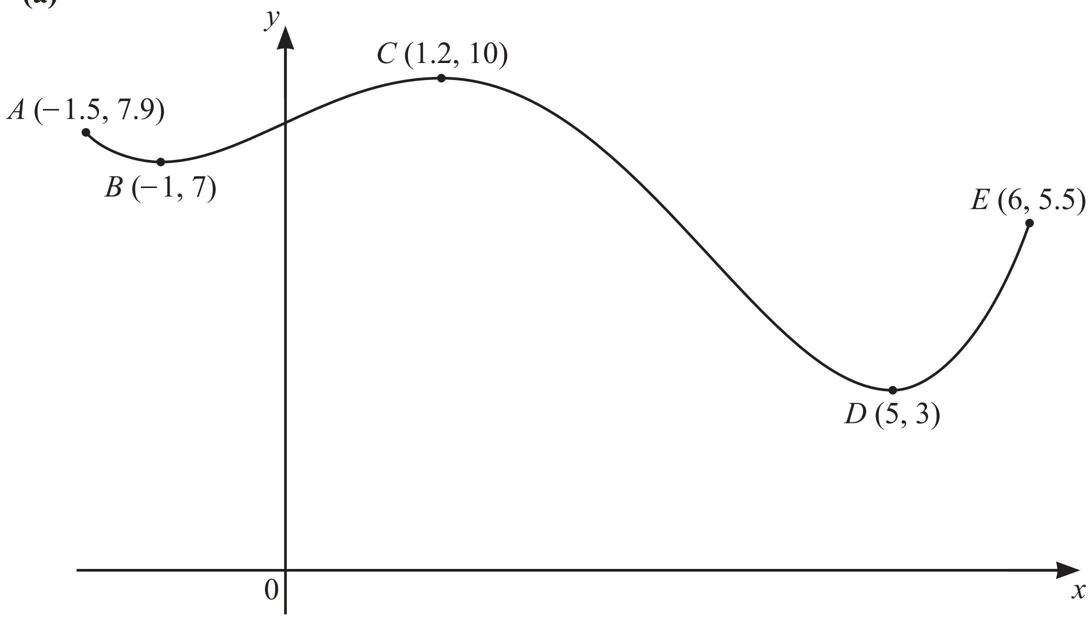


The diagram shows two rectangles where $H - h = 1$.

By forming a quadratic equation and factorising, find the value of y.

$y =$ .... [7]

10 (a)



NOT TO SCALE

The diagram shows a sketch of the graph of $y = \mathrm{f}(x)$ for $-1.5 \leqslant x \leqslant 6$.
The coordinates of five points on the graph of $y = \mathrm{f}(x)$ are shown on the diagram.

(i) $\mathrm{f}(x) = k$ has two solutions in the interval $-1.5 \leqslant x \leqslant 6$.

Write down a possible integer value of *k*.

$k =$ .... [1]

(ii) $\mathrm{f}(x) = j$ has no solutions in the interval $-1.5 \leqslant x \leqslant 6$ when $j < a$ or $j > b$.

Find the maximum value of *a* and the minimum value of *b*.

$a =$ ....

$b =$ .... [2]

(b) Find the coordinates of the two stationary points on the graph of $y = x^6 - 6x^5$.
You must show all your working.

(.................... , ...)

(.................... , ...) [5]