



# Cambridge IGCSE™ (9–1)

CANDIDATE  
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**MATHEMATICS**

**0980/41**

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  $\pi$ , 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) Calculate the volume of

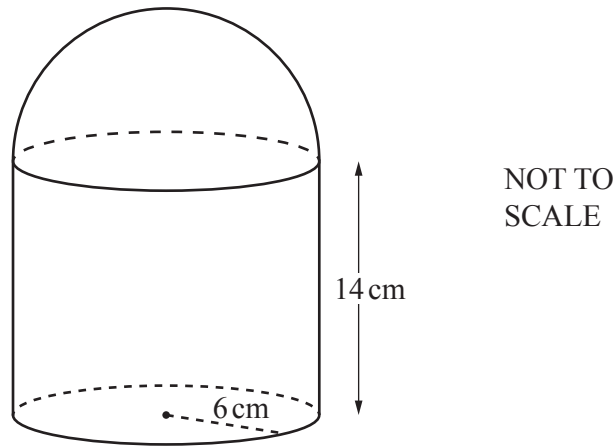
(i) a solid cylinder with radius 6 cm and height 14 cm,

..... cm<sup>3</sup> [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<sup>3</sup> [2]

(b)



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<sup>3</sup> of steel has a mass of 7.85 g.

(i) Show that 1 cm<sup>3</sup> of steel has a mass of 0.00785 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  $A = \pi rl$ .]

$k =$  ..... [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 0.00701 in standard form.

..... [1]

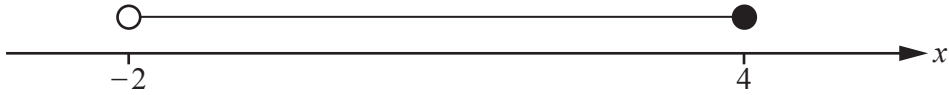
(e) Simplify  $1.5 \times 10^x + 1.5 \times 10^{x-1}$  giving your answer in standard form.

..... [2]

(f) Write  $0.\dot{3}\dot{7}$  as a fraction.  
You must show all your working.

..... [2]

3 (a)



Write down the inequality shown by the number line.

..... [1]

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

(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.

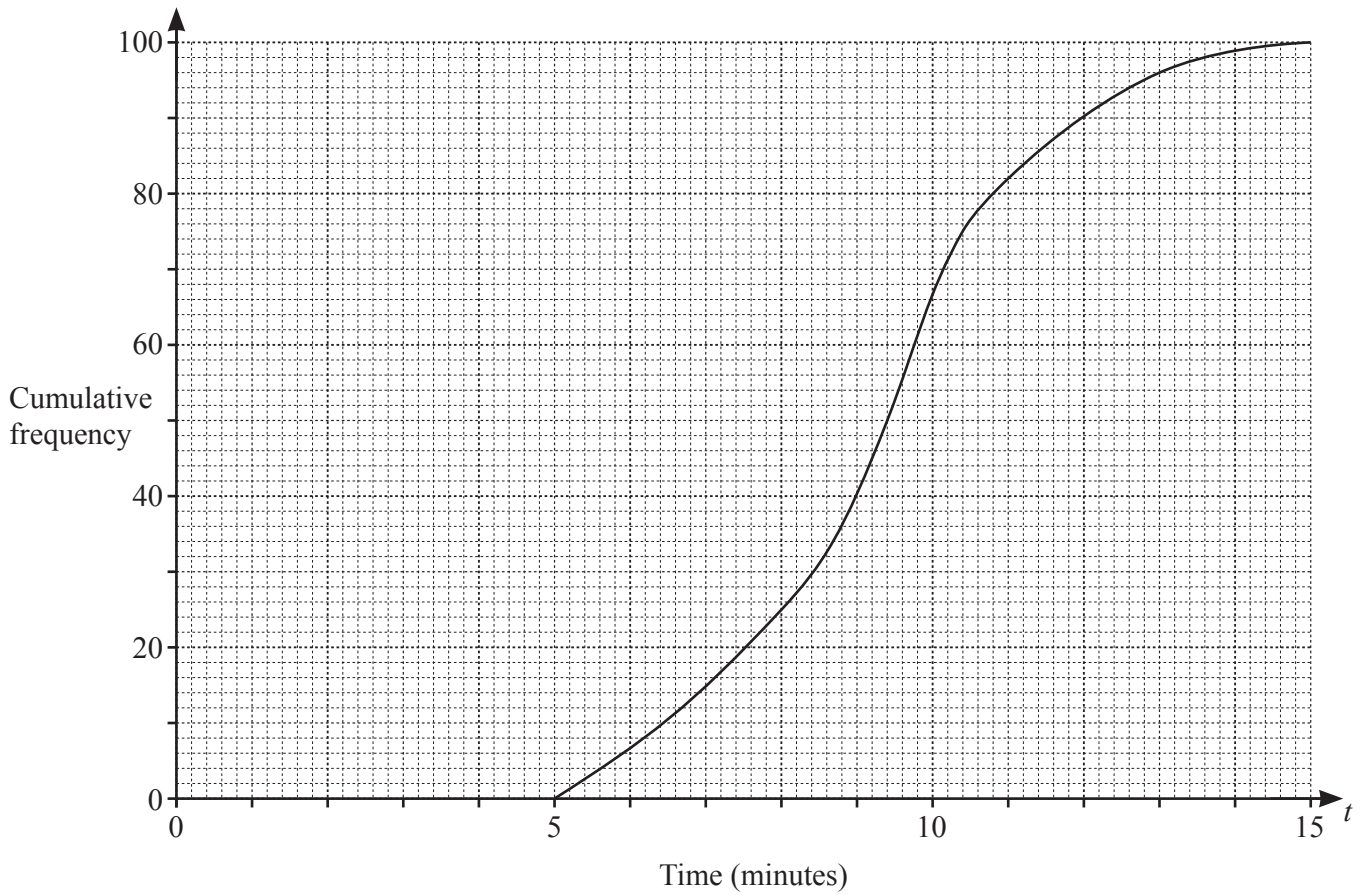
\$ ..... [3]

- (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)	$0 < d \leq 20$	$20 < d \leq 30$	$30 < d \leq 35$	$35 < d \leq 45$	$45 < d \leq 60$
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  $30 < d \leq 35$  is 12 cm.

Calculate the height of each of the other bars.

Distance ( $d$ metres)	Frequency	Height of bar (cm)
$0 < d \leq 20$	4	
$20 < d \leq 30$	38	
$30 < d \leq 35$	40	12
$35 < d \leq 45$	53	
$45 < d \leq 60$	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)  $3\mathbf{q}$ ,

$$\left( \begin{array}{c} \phantom{0} \\ \phantom{0} \end{array} \right) \quad [1]$$

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

$$\left( \begin{array}{c} \phantom{0} \\ \phantom{0} \end{array} \right) \quad [1]$$

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

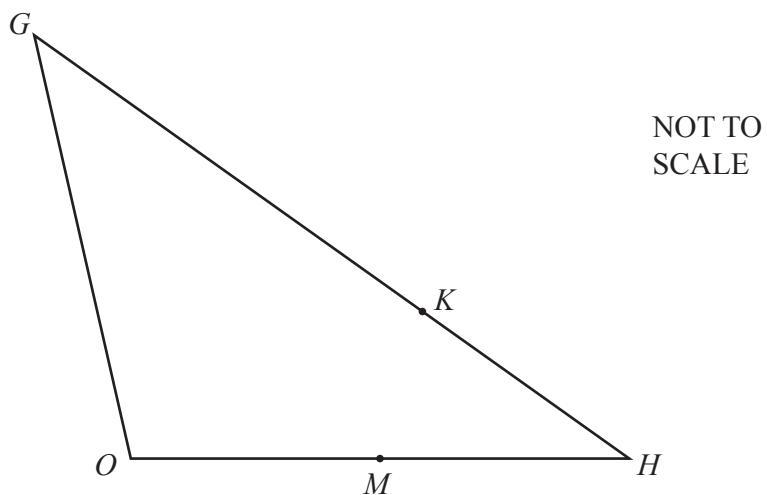
..... [2]

(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  $5 : 2$ .

$\vec{OG} = \mathbf{g}$  and  $\vec{OH} = \mathbf{h}$ .

Find  $\vec{MK}$  in terms of  $\mathbf{g}$  and  $\mathbf{h}$ .

Give your answer in its simplest form.

$\vec{MK} = \dots\dots\dots$  [4]

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

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

..... [1]

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

..... [1]

(b) Find  $x$  when  $f(x) = 7$ .

$x =$  ..... [1]

(c) Find  $x$  when  $g(x) = h(3)$ .

$x =$  ..... [2]

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

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

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

..... [3]

(f)  $(f(x))^2 - ff(x) = ax^2 + bx + c$

Find the values of  $a$ ,  $b$  and  $c$ .

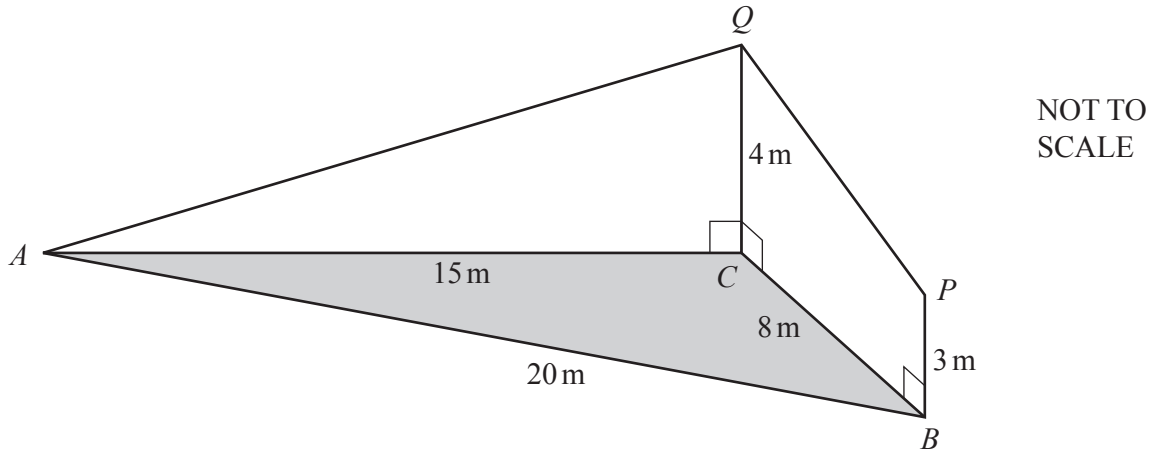
$a = \dots\dots\dots$

$b = \dots\dots\dots$

$c = \dots\dots\dots$  [4]

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

$x = \dots\dots\dots$  [2]



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  $ACB = 117.5^\circ$ , correct to 1 decimal place.

[4]

(b) Calculate the area of triangle  $ABC$ .

.....  $\text{m}^2$  [2]

(c) Calculate the length of  $AQ$ .

..... m [2]

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

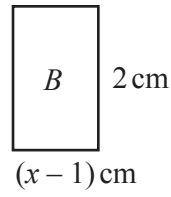
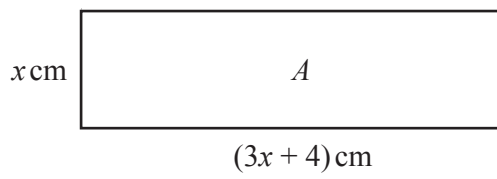
..... [3]

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

Calculate the angle between this wire and the horizontal ground.

..... [5]

9 (a)



NOT TO SCALE

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.

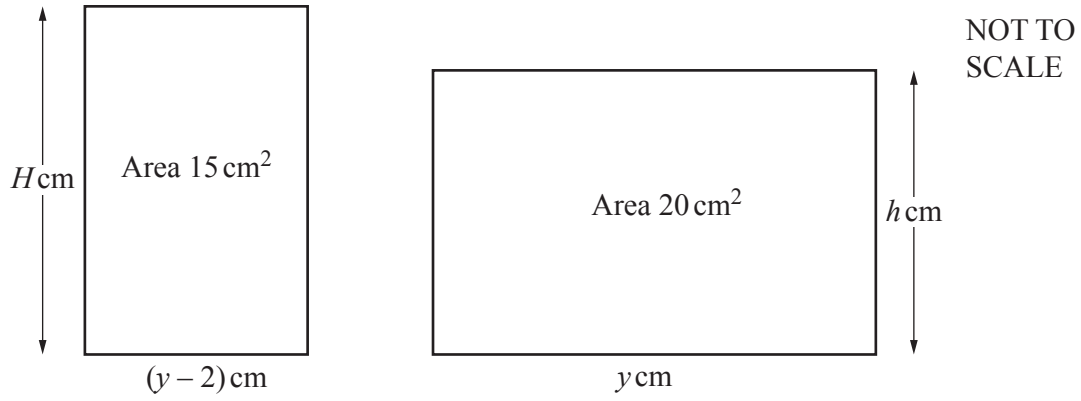
$x = \dots\dots\dots$  or  $x = \dots\dots\dots$  [4]

(iii) Find the perimeter of rectangle *B*.

$\dots\dots\dots \text{ cm}$  [1]



(b)

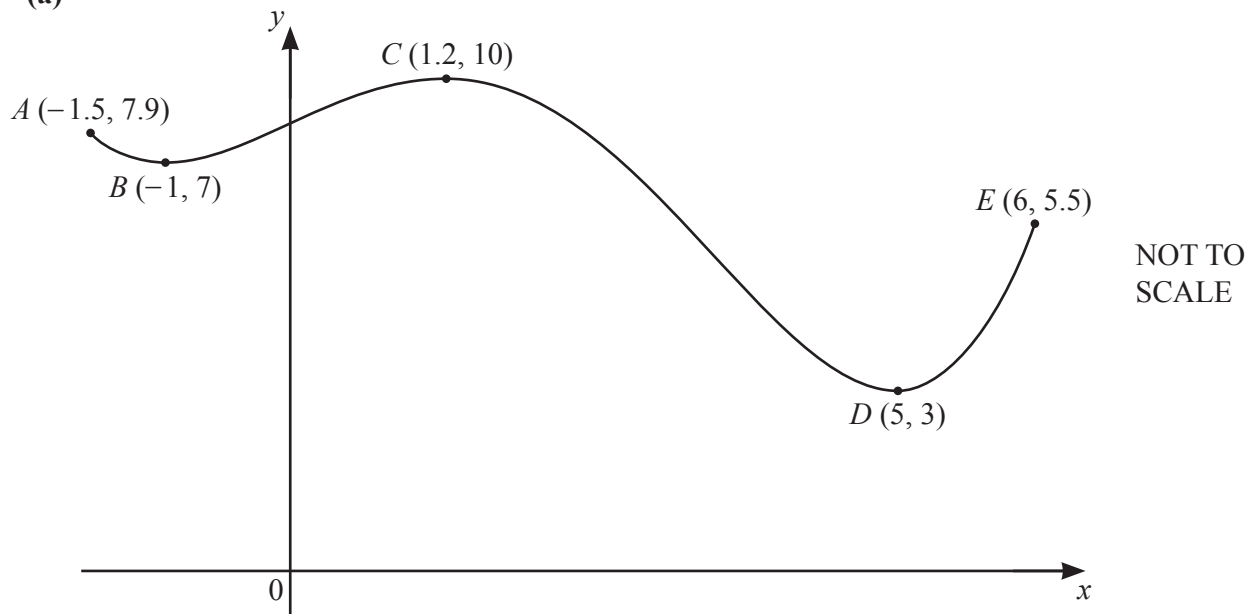


The diagram shows two rectangles where  $H - h = 1$ .

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

$$y = \dots\dots\dots [7]$$

10 (a)



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

- (i)  $f(x) = k$  has two solutions in the interval  $-1.5 \leq x \leq 6$ .

Write down a possible integer value of  $k$ .

$k = \dots\dots\dots$  [1]

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

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

$a = \dots\dots\dots$

$b = \dots\dots\dots$  [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]

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