



# Cambridge IGCSE™

CANDIDATE  
NAME

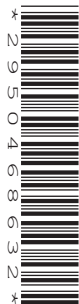
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CENTRE  
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**ADDITIONAL MATHEMATICS**

**0606/13**

Paper 1

**October/November 2020**

**2 hours**

You must answer on the question paper.

No additional materials are needed.

## 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 must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- 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.

## INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

**Mathematical Formulae****1. ALGEBRA***Quadratic Equation*

For the equation  $ax^2 + bx + c = 0$ ,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

*Binomial Theorem*

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{r}a^{n-r}b^r + \dots + b^n$$

where  $n$  is a positive integer and  $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

*Arithmetic series*

$$u_n = a + (n-1)d$$

$$S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n\{2a + (n-1)d\}$$

*Geometric series*

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

**2. TRIGONOMETRY***Identities*

$$\begin{aligned} \sin^2 A + \cos^2 A &= 1 \\ \sec^2 A &= 1 + \tan^2 A \\ \operatorname{cosec}^2 A &= 1 + \cot^2 A \end{aligned}$$

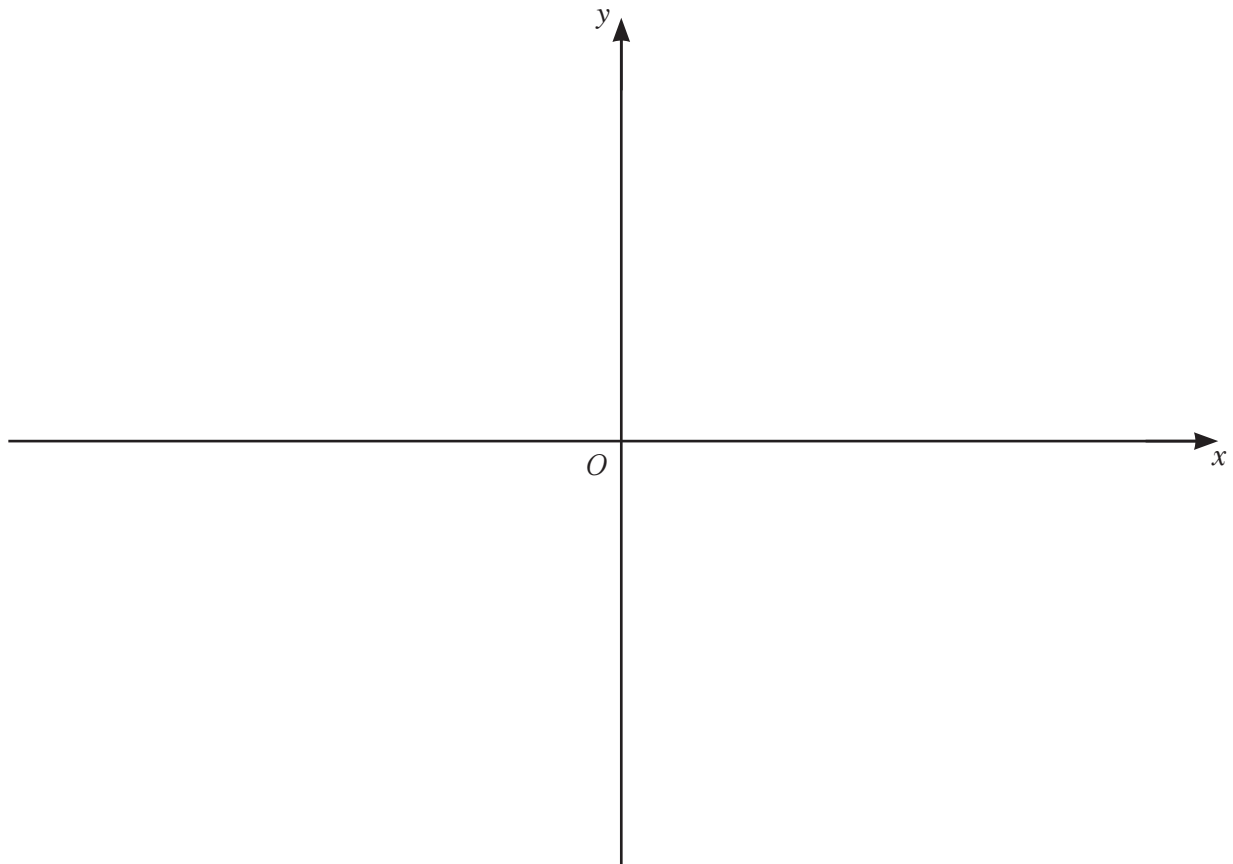
*Formulae for  $\triangle ABC$* 

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

- 1 (a) On the axes below, sketch the graph of  $y = (x-2)(x+1)(3-x)$ , stating the intercepts on the coordinate axes.



[3]

- (b) Hence write down the values of  $x$  such that  $(x-2)(x+1)(3-x) > 0$ .

[2]

2 (a) Given that  $y = \frac{e^{2x-3}}{x^2+1}$ , find  $\frac{dy}{dx}$ .

[3]

(b) Hence, given that  $y$  is increasing at the rate of 2 units per second, find the exact rate of change of  $x$  when  $x = 2$ . [3]

3 (a)  $f(x) = 4 \ln(2x - 1)$

(i) Write down the largest possible domain for the function  $f$ . [1]

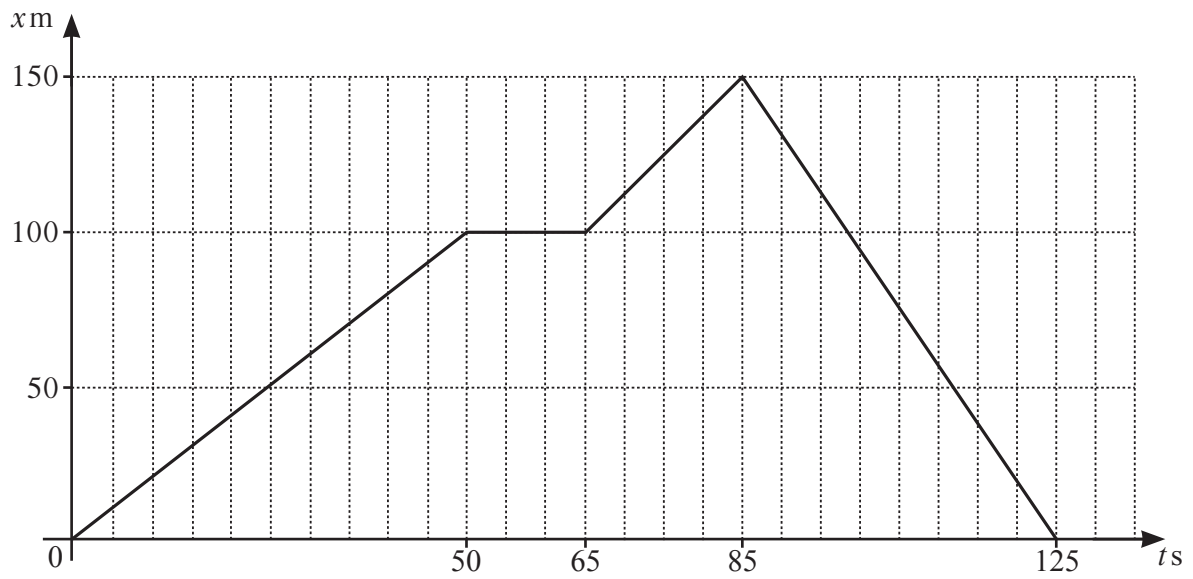
(ii) Find  $f^{-1}(x)$  and its domain. [3]

(b)  $g(x) = x + 5$  for  $x \in \mathbb{R}$

$$h(x) = \sqrt{2x - 3} \text{ for } x \geq \frac{3}{2}$$

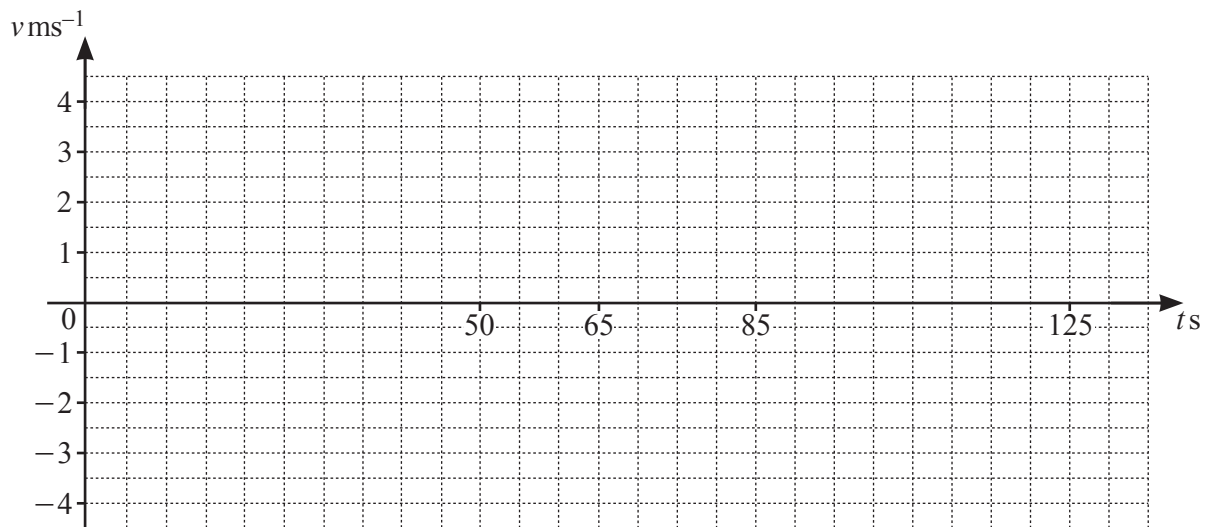
Solve  $gh(x) = 7$ . [3]

4 (a)



The diagram shows the  $x-t$  graph for a runner, where displacement,  $x$ , is measured in metres and time,  $t$ , is measured in seconds.

(i) On the axes below, draw the  $v-t$  graph for the runner. [3]



(ii) Find the total distance covered by the runner in 125 s. [1]

- (b) The displacement,  $x$  m, of a particle from a fixed point at time  $t$  s is given by  $x = 6 \cos\left(3t + \frac{\pi}{3}\right)$ .  
Find the acceleration of the particle when  $t = \frac{2\pi}{3}$ . [3]

- 5 Given that the coefficient of  $x^2$  in the expansion of  $(1+x)\left(1-\frac{x}{2}\right)^n$  is  $\frac{25}{4}$ , find the value of the positive integer  $n$ . [5]

- 6 It is known that  $y = A \times 10^{bx^2}$ , where  $A$  and  $b$  are constants. When  $\lg y$  is plotted against  $x^2$ , a straight line passing through the points (3.63, 5.25) and (4.83, 6.88) is obtained.
- (a) Find the value of  $A$  and of  $b$ . [4]

Using your values of  $A$  and  $b$ , find

- (b) the value of  $y$  when  $x = 2$ , [2]

- (c) the positive value of  $x$  when  $y = 4$ . [2]



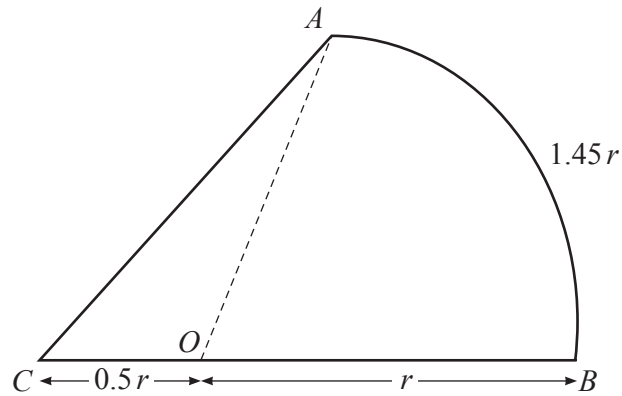
7 The polynomial  $p(x) = ax^3 + bx^2 - 19x + 4$ , where  $a$  and  $b$  are constants, has a factor  $x + 4$  and is such that  $2p(1) = 5p(0)$ .

(a) Show that  $p(x) = (x + 4)(Ax^2 + Bx + C)$ , where  $A$ ,  $B$  and  $C$  are integers to be found. [6]

(b) Hence factorise  $p(x)$ . [1]

(c) Find the remainder when  $p'(x)$  is divided by  $x$ . [1]

8 In this question all lengths are in centimetres.



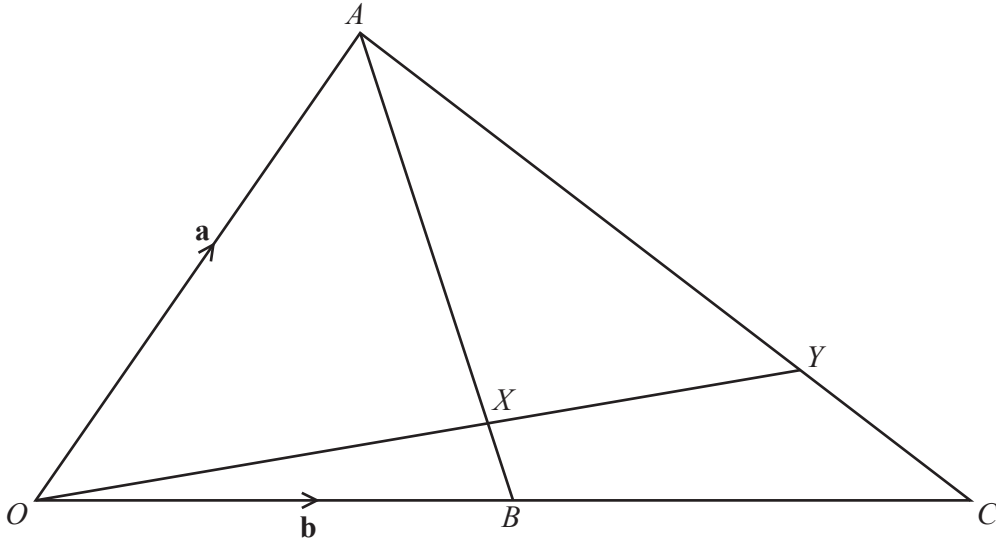
The diagram shows the figure  $ABC$ . The arc  $AB$  is part of a circle, centre  $O$ , radius  $r$ , and is of length  $1.45r$ . The point  $O$  lies on the straight line  $CB$  such that  $CO = 0.5r$ .

(a) Find, in radians, the angle  $AOB$ . [1]

(b) Find the area of  $ABC$ , giving your answer in the form  $kr^2$ , where  $k$  is a constant. [3]

(c) Given that the perimeter of  $ABC$  is 12 cm, find the value of  $r$ .

[4]



The diagram shows the triangle  $OAC$ . The point  $B$  is the midpoint of  $OC$ . The point  $Y$  lies on  $AC$  such that  $OY$  intersects  $AB$  at the point  $X$  where  $AX:XB = 3:1$ . It is given that  $\vec{OA} = \mathbf{a}$  and  $\vec{OB} = \mathbf{b}$ .

(a) Find  $\vec{OX}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ , giving your answer in its simplest form. [3]

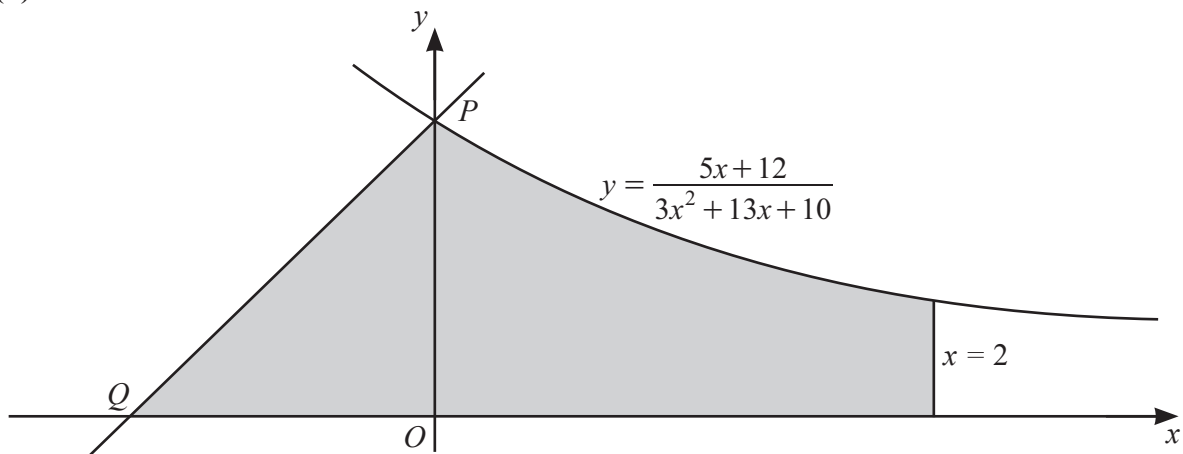
(b) Find  $\vec{AC}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ . [1]

(c) Given that  $\overrightarrow{OY} = h\overrightarrow{OX}$ , find  $\overrightarrow{AY}$  in terms of  $\mathbf{a}$ ,  $\mathbf{b}$  and  $h$ . [1]

(d) Given that  $\overrightarrow{AY} = m\overrightarrow{AC}$ , find the value of  $h$  and of  $m$ . [4]

- 10 (a) Show that  $\frac{1}{x+1} + \frac{2}{3x+10}$  can be written as  $\frac{5x+12}{3x^2+13x+10}$ . [1]

(b)



The diagram shows part of the curve  $y = \frac{5x+12}{3x^2+13x+10}$ , the line  $x = 2$  and a straight line of gradient 1. The curve intersects the  $y$ -axis at the point  $P$ . The line of gradient 1 passes through  $P$  and intersects the  $x$ -axis at the point  $Q$ . Find the area of the shaded region, giving your answer in the form  $a + \frac{2}{3} \ln(b\sqrt{3})$ , where  $a$  and  $b$  are constants. [9]

**Additional working space for question 10**

**Question 11 is printed on the next page.**

11 (a) Given that  $2 \cos x = 3 \tan x$ , show that  $2 \sin^2 x + 3 \sin x - 2 = 0$ . [3]

(b) Hence solve  $2 \cos\left(2\alpha + \frac{\pi}{4}\right) = 3 \tan\left(2\alpha + \frac{\pi}{4}\right)$  for  $0 < \alpha < \pi$  radians, giving your answers in terms of  $\pi$ . [4]

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