



# Cambridge IGCSE™

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**ADDITIONAL MATHEMATICS**

**0606/13**

Paper 1

**May/June 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

$$f(x) = 3 + e^x \quad \text{for } x \in \mathbb{R}$$

$$g(x) = 9x - 5 \quad \text{for } x \in \mathbb{R}$$

(a) Find the range of  $f$  and of  $g$ . [2]

(b) Find the exact solution of  $f^{-1}(x) = g'(x)$ . [3]

(c) Find the solution of  $g^2(x) = 112$ . [2]

- 2 (a) Given that  $\log_2 x + 2 \log_4 y = 8$ , find the value of  $xy$ .

[2]

- (b) Using the substitution  $y = 2^x$ , or otherwise, solve  $2^{2x+1} - 2^{x+1} - 2^x + 1 = 0$ .

[4]

3 At time  $t$  s, a particle travelling in a straight line has acceleration  $(2t+1)^{-\frac{1}{2}} \text{ms}^{-2}$ . When  $t = 0$ , the particle is 4 m from a fixed point  $O$  and is travelling with velocity  $8 \text{ms}^{-1}$  away from  $O$ .

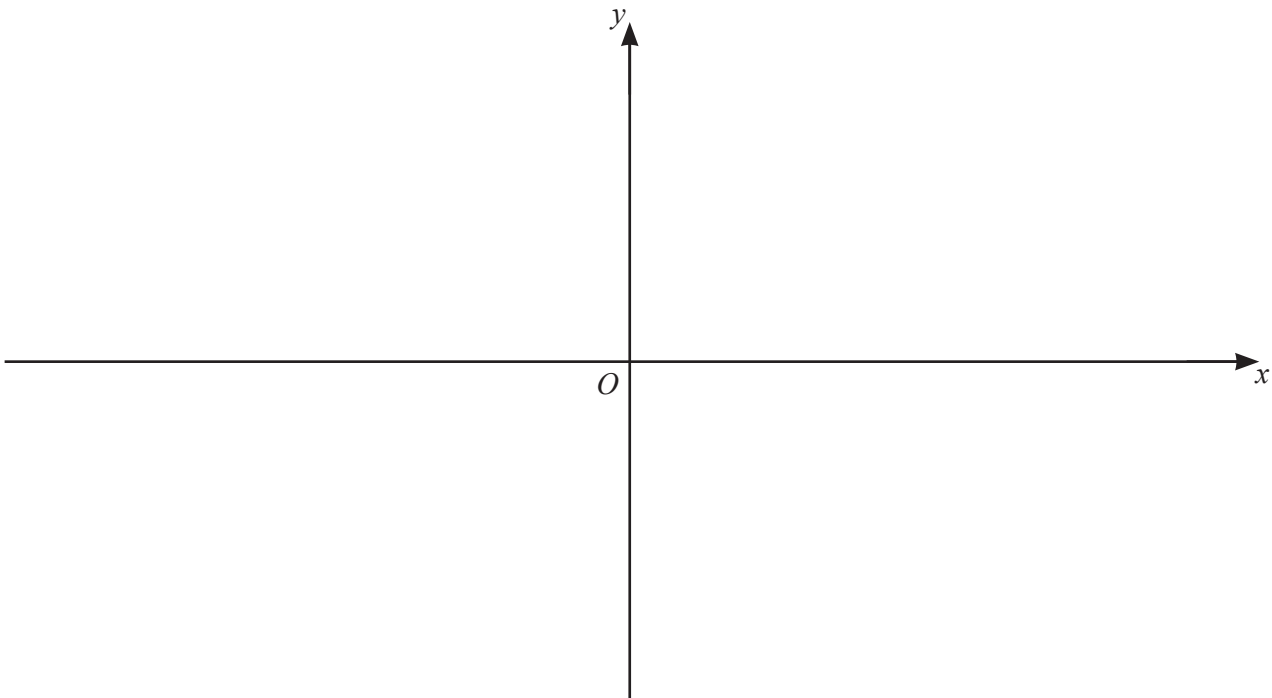
(a) Find the velocity of the particle at time  $t$  s. [3]

(b) Find the displacement of the particle from  $O$  at time  $t$  s. [4]

4 (a) Write  $2x^2 + 3x - 4$  in the form  $a(x+b)^2 + c$ , where  $a$ ,  $b$  and  $c$  are constants. [3]

(b) Hence write down the coordinates of the stationary point on the curve  $y = 2x^2 + 3x - 4$ . [2]

(c) On the axes below, sketch the graph of  $y = |2x^2 + 3x - 4|$ , showing the exact values of the intercepts of the curve with the coordinate axes. [3]



(d) Find the value of  $k$  for which  $|2x^2 + 3x - 4| = k$  has exactly 3 values of  $x$ . [1]

5

$$p(x) = 6x^3 + ax^2 + 12x + b, \text{ where } a \text{ and } b \text{ are integers.}$$

$p(x)$  has a remainder of 11 when divided by  $x - 3$  and a remainder of  $-21$  when divided by  $x + 1$ .

(a) Given that  $p(x) = (x - 2)Q(x)$ , find  $Q(x)$ , a quadratic factor with numerical coefficients. [6]

(b) Hence solve  $p(x) = 0$ . [2]

- 6 (a) Find the unit vector in the direction of  $\begin{pmatrix} 5 \\ -12 \end{pmatrix}$ .

[1]

- (b) Given that  $\begin{pmatrix} 4 \\ 1 \end{pmatrix} + k\begin{pmatrix} -2 \\ 3 \end{pmatrix} = r\begin{pmatrix} -10 \\ 5 \end{pmatrix}$ , find the value of each of the constants  $k$  and  $r$ .

[3]



(c) Relative to an origin  $O$ , the points  $A$ ,  $B$  and  $C$  have position vectors  $\mathbf{p}$ ,  $3\mathbf{q} - \mathbf{p}$  and  $9\mathbf{q} - 5\mathbf{p}$  respectively.

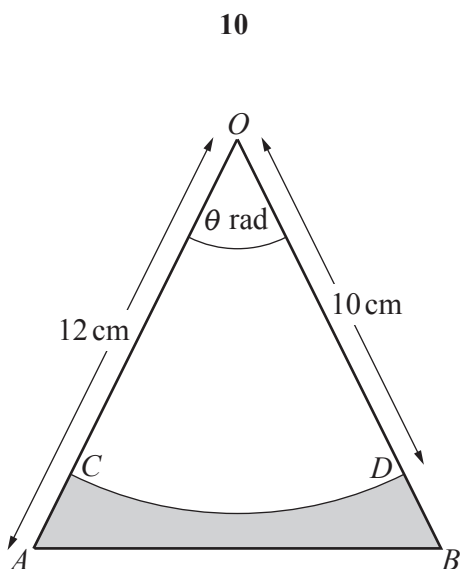
(i) Find  $\overrightarrow{AB}$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$ . [1]

(ii) Find  $\overrightarrow{AC}$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$ . [1]

(iii) Explain why  $A$ ,  $B$  and  $C$  all lie in a straight line. [1]

(iv) Find the ratio  $AB : BC$ . [1]

7



The diagram shows an isosceles triangle  $OAB$  such that  $OA = OB = 12$  cm and angle  $AOB = \theta$  radians. Points  $C$  and  $D$  lie on  $OA$  and  $OB$  respectively such that  $CD$  is an arc of the circle, centre  $O$ , radius 10 cm. The area of the sector  $OCD = 35$  cm<sup>2</sup>.

(a) Show that  $\theta = 0.7$ . [1]

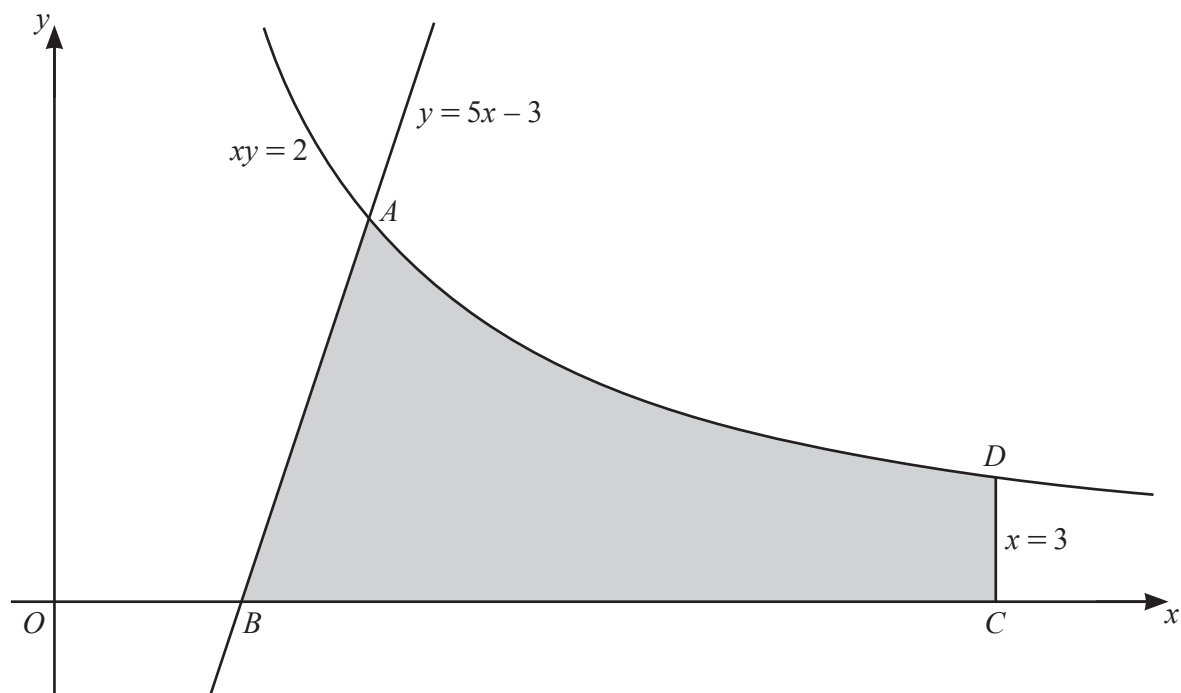
(b) Find the perimeter of the shaded region. [4]

(c) Find the area of the shaded region. [3]

- 8 (a) An arithmetic progression has a first term of 7 and a common difference of 0.4. Find the least number of terms so that the sum of the progression is greater than 300. [4]

- (b) The sum of the first two terms of a geometric progression is 9 and its sum to infinity is 36. Given that the terms of the progression are positive, find the common ratio. [4]

9



The diagram shows part of the curve  $xy = 2$  intersecting the straight line  $y = 5x - 3$  at the point  $A$ . The straight line meets the  $x$ -axis at the point  $B$ . The point  $C$  lies on the  $x$ -axis and the point  $D$  lies on the curve such that the line  $CD$  has equation  $x = 3$ . Find the exact area of the shaded region, giving your answer in the form  $p + \ln q$ , where  $p$  and  $q$  are constants. [8]

Additional working space for question 9.



10 (a) Given that  $y = x\sqrt{x+2}$ , show that  $\frac{dy}{dx} = \frac{Ax+B}{2\sqrt{x+2}}$ , where  $A$  and  $B$  are constants. [5]

(b) Find the exact coordinates of the stationary point of the curve  $y = x\sqrt{x+2}$ .

[2]

(c) Determine the nature of this stationary point.

[2]

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