Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2037547431

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.

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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

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

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

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

Formulae for ΔABC

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

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

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

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. [3]

(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.

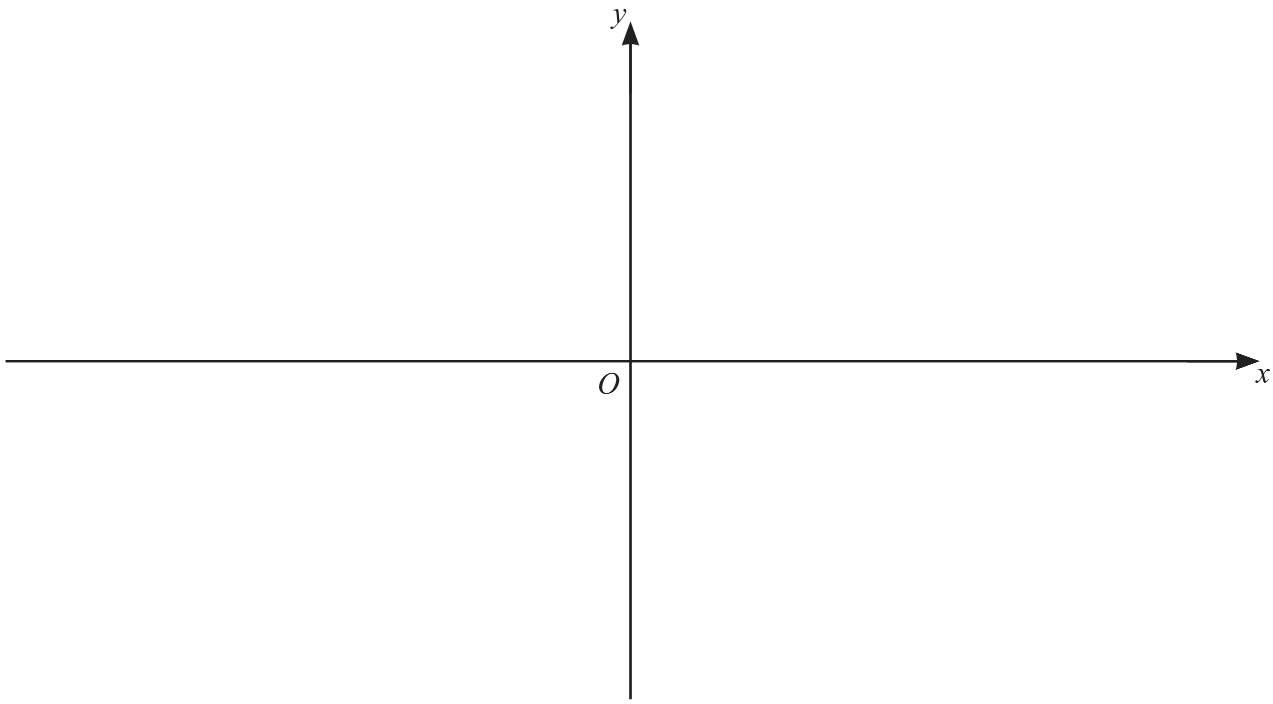
(a) Find the velocity of the particle at time t s. [3]

(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 $y=\left|2x^2+3x-4\right|$, showing the exact values of the intercepts of the curve with the coordinate axes. [3]



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

5 $p(x) = 6x^3 + ax^2 + 12x + b$, where a and b 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.

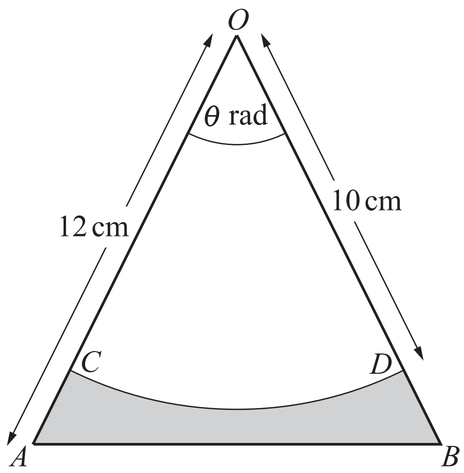
(i) Find $\overrightarrow{AB}$ in terms of $\mathbf{p}$ and $\mathbf{q}$. [1]

(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 $OA = OB = 12\,\text{cm}$ 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 $10\,\text{cm}$. The area of the sector $OCD = 35\,\text{cm}^2$.

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

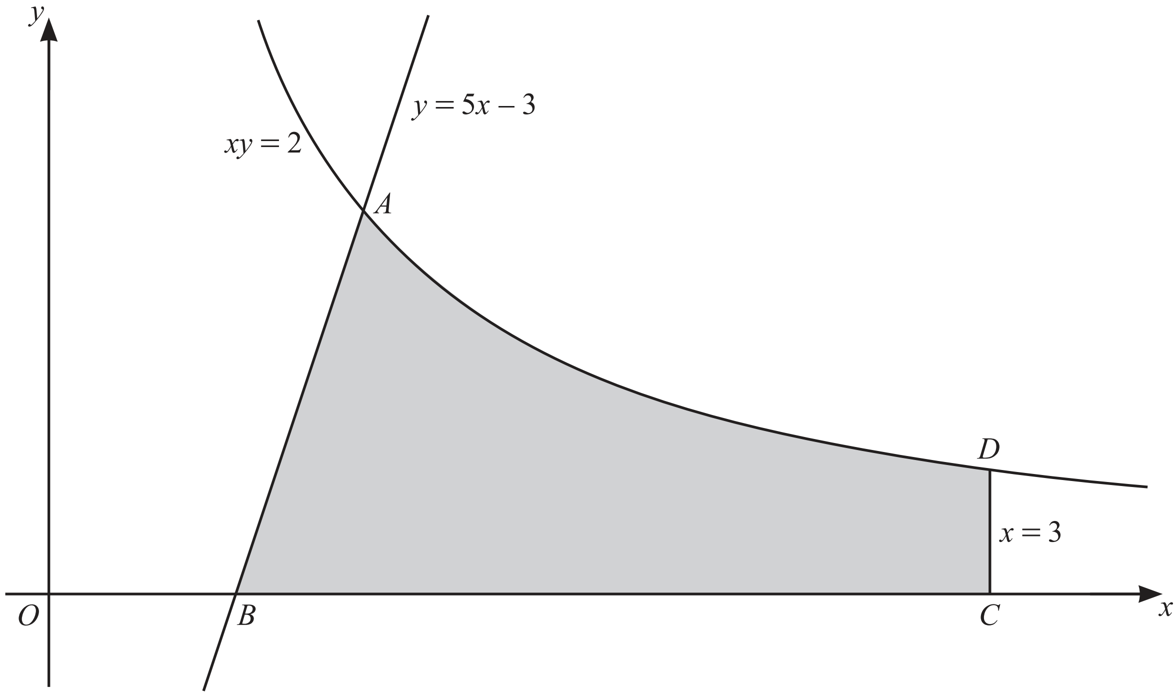
(b) Find the perimeter of the shaded region. [4]

(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 $\dfrac{dy}{dx} = \dfrac{Ax+B}{2\sqrt{x+2}}$, where A and B are constants. [5]

(b) Find the exact coordinates of the stationary point of the curve $y = x\sqrt{x+2}$. [3]

(c) Determine the nature of this stationary point. [2]

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