Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

5982126712

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2021**

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. Any 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

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

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

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

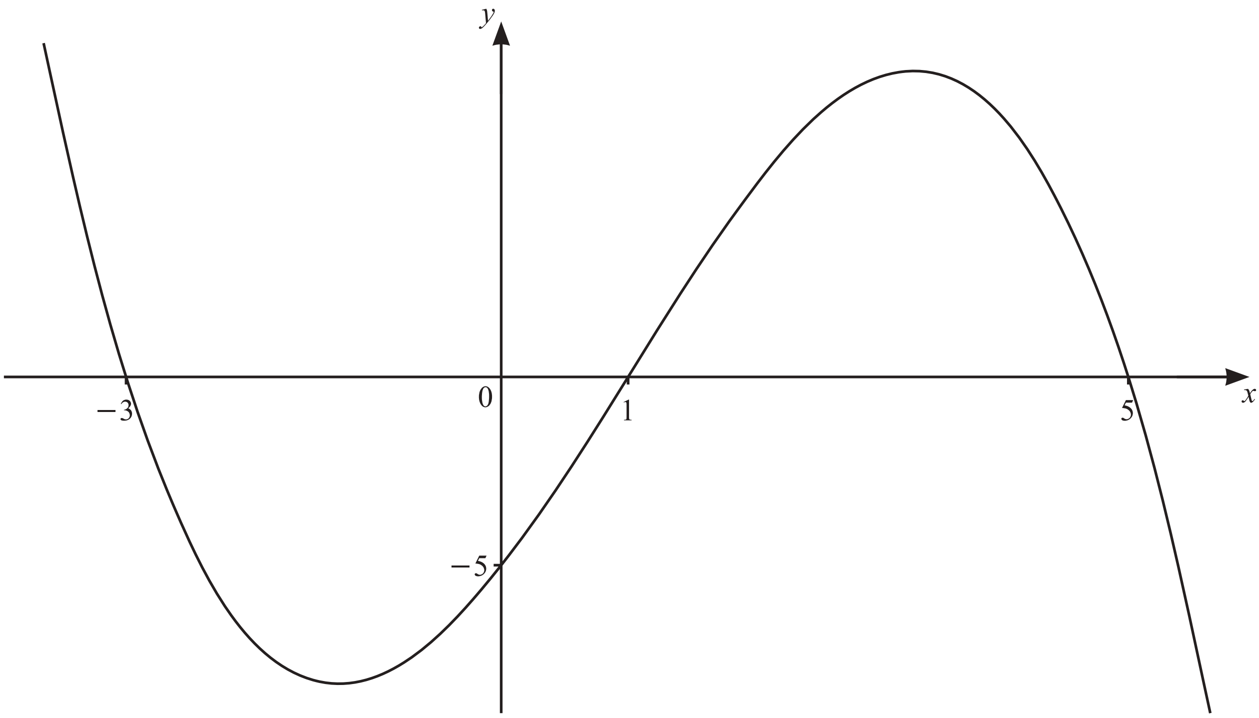
Formulae for ΔABC

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

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

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

1



The diagram shows the graph of the cubic function $y = \mathrm{f}(x)$. The intercepts of the curve with the axes are all integers.

(a) Find the set of values of x for which $\mathrm{f}(x) < 0$. [1]

(b) Find an expression for $\mathrm{f}(x)$. [3]

  [Turn over

2 **(a)** Given that $\dfrac{\sqrt[3]{xy}\left(zy\right)^2}{\left(xz\right)^{-3}\sqrt{z}} = x^a y^b z^c$, find the exact values of the constants a, b and c. [3]

(b) Solve the equation $5(2^{2p+1}) - 17(2^p) + 3 = 0$. [4]

3 **(a)** Write $3+2\lg a-4\lg b$ as a single logarithm to base 10. [4]

(b) Solve the equation $3\log_a 4+2\log_4 a=7$. [5]

4 Solve the equation $\cot\left(2x+\frac{\pi}{3}\right)-\sqrt{3}=0$, where $-\pi < x < \pi$ radians. Give your answers in terms of π. [4]

5 Find the possible values of the constant c for which the line $y=c$ is a tangent to the curve $y=5\sin\frac{x}{3}+4$. [3]

6 **DO NOT USE A CALCULATOR IN THIS QUESTION.**

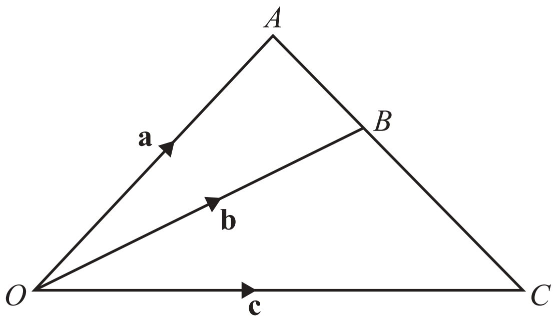
The polynomial $\mathrm{p}(x) = 10x^3 + ax^2 - 10x + b$, where a and b are integers, is divisible by $2x + 1$. When $\mathrm{p}(x)$ is divided by $x + 1$, the remainder is -24.

(a) Find the value of a and of b. [4]

(b) Find an expression for $\mathrm{p}(x)$ as the product of three linear factors. [4]

(c) Write down the remainder when $\mathrm{p}(x)$ is divided by x. [1]

7 **(a)**



The diagram shows triangle OAC, where $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$. The point B lies on the line AC such that $AB:BC = m:n$, where m and n are constants.

(i) Write down $\overrightarrow{AB}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. [1]

(ii) Write down $\overrightarrow{BC}$ in terms of $\mathbf{b}$ and $\mathbf{c}$. [1]

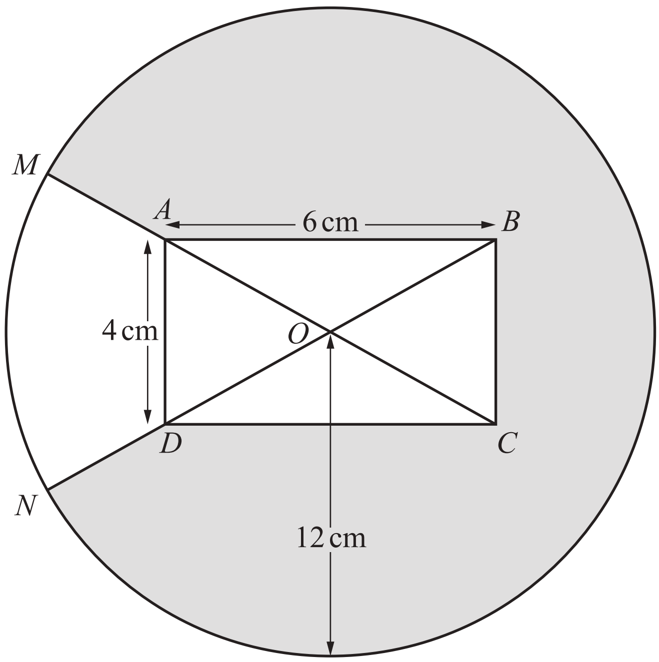
(iii) Hence show that $n\mathbf{a} + m\mathbf{c} = (m+n)\mathbf{b}$. [2]

(b) Given that $\lambda\begin{pmatrix}2\\1\end{pmatrix} + (\mu - 1)\begin{pmatrix}-4\\7\end{pmatrix} = (\lambda + 1)\begin{pmatrix}4\\-2\end{pmatrix}$, find the value of each of the constants λ and μ. [4]

8 **(a)** A 5-digit number is made using the digits 0, 1, 4, 5, 6, 7 and 9. No digit may be used more than once in any 5-digit number. Find how many such 5-digit numbers are even and greater than 50 000. [3]

(b) The number of combinations of n objects taken 4 at a time is equal to 6 times the number of combinations of n objects taken 2 at a time. Calculate the value of n. [5]

9



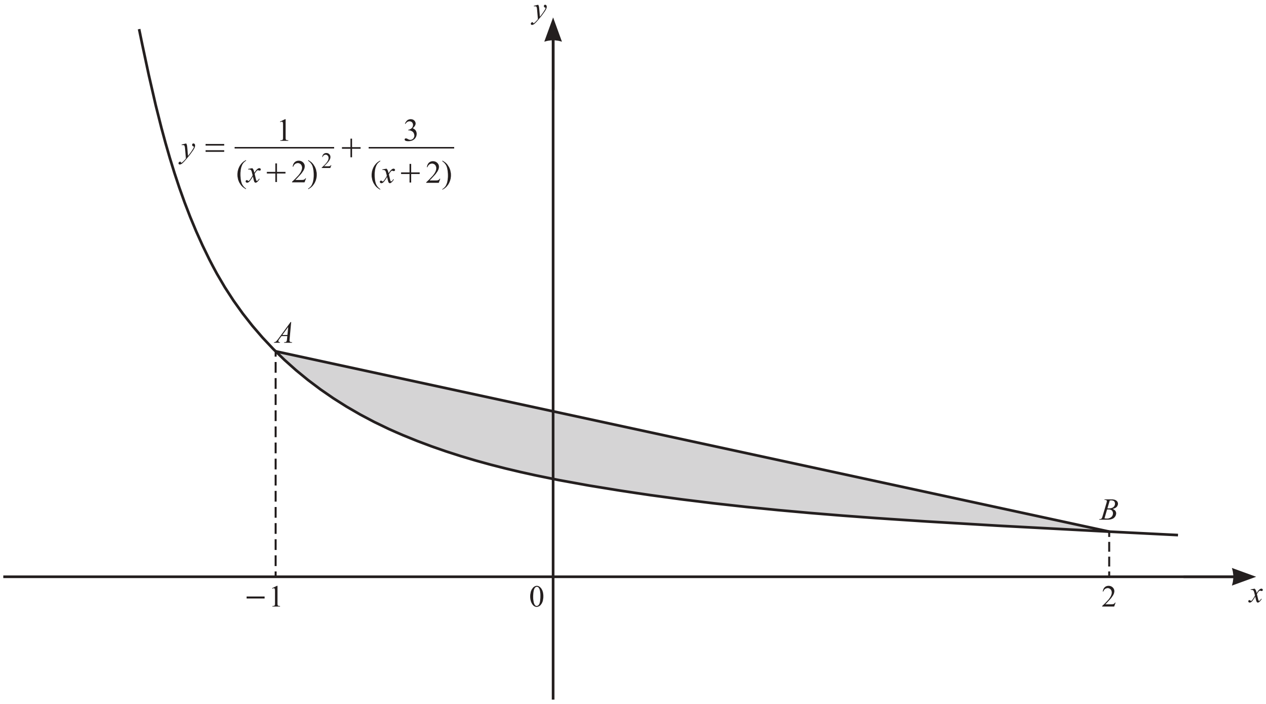
The diagram shows a circle, centre O, radius 12 cm, and a rectangle $ABCD$. The diagonals AC and BD intersect at O. The sides AB and AD of the rectangle have lengths 6 cm and 4 cm respectively. The points M and N lie on the circumference of the circle such that MAC and NDB are straight lines.

(a) Show that angle AOD is 1.176 radians correct to 3 decimal places. [2]

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

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

10



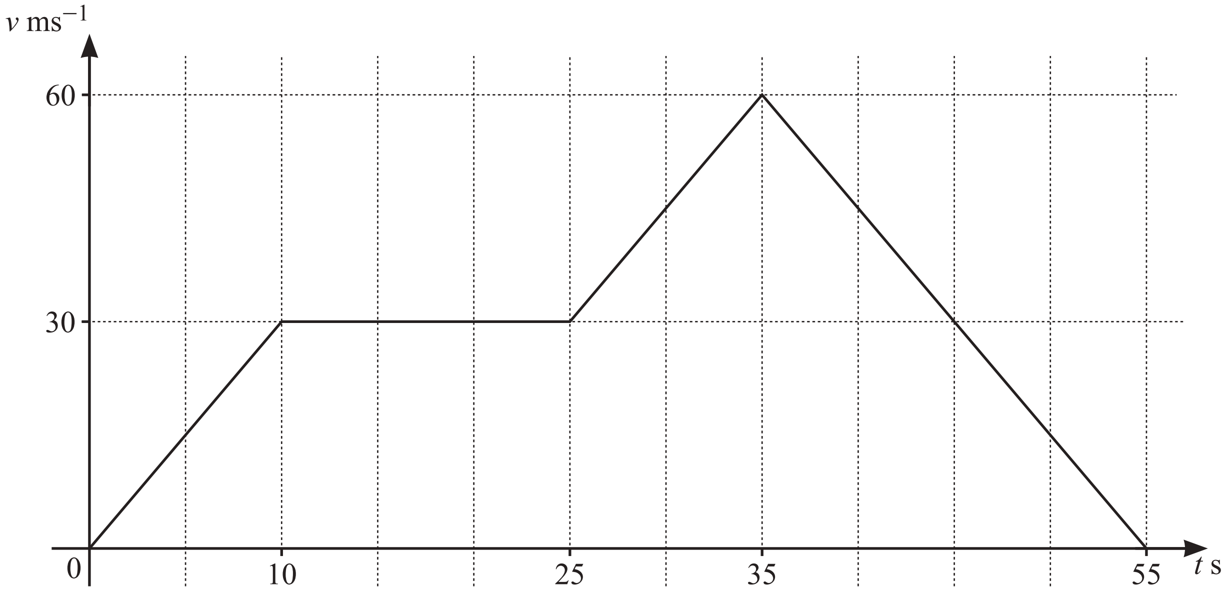
The diagram shows the graph of the curve $y = \frac{1}{(x+2)^2} + \frac{3}{(x+2)}$ for $x > -2$. The points A and B lie on the curve such that the x-coordinates of A and of B are -1 and 2 respectively.

(a) Find the exact y-coordinates of A and of B. [2]

(b) Find the area of the shaded region enclosed by the line AB and the curve, giving your answer in the form $\frac{p}{q} - \ln r$, where p, q and r are integers. [6]

Additional working space for Question 10(b).

11 (a)



The diagram shows the velocity–time graph for a particle P, travelling in a straight line with velocity $v\,\text{ms}^{-1}$ at a time t seconds. P accelerates at a constant rate for the first 10 s of its motion, and then travels at constant velocity, $30\,\text{ms}^{-1}$, for another 15 s. P then accelerates at a constant rate for a further 10 s and reaches a velocity of $60\,\text{ms}^{-1}$. P then decelerates at a constant rate and comes to rest when $t = 55$.

(i) Find the acceleration when $t = 12$. [1]

(ii) Find the acceleration when $t = 50$. [1]

(iii) Find the total distance travelled by the particle P. [2]

(b) A particle Q travels in a straight line such that its velocity, $v\,\mathrm{ms}^{-1}$, at time t s after passing through a fixed point O is given by $v = 4\cos 3t - 4$.

(i) Find the speed of Q when $t = \frac{5\pi}{9}$. [2]

(ii) Find the smallest positive value of t for which the acceleration of Q is zero. [3]

(iii) Find an expression for the displacement of Q from O at time t. [2]