Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

2445269796

ADDITIONAL MATHEMATICS 0606/13

Paper 1 **May/June 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

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

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 Find the possible values of the constant k such that the equation $kx^2 + 4kx + 3k + 1 = 0$ has two different real roots. [4]

2 **(a)** Find $\frac{\mathrm{d}}{\mathrm{d}x}\left(x^2 \mathrm{e}^{3x}\right)$. [3]

(b) **(i)** Find $\frac{\mathrm{d}}{\mathrm{d}x}\left(3x^2+4\right)^{\frac{1}{3}}$. [2]

(ii) Hence find $\int_0^2 x\left(3x^2+4\right)^{-\frac{2}{3}}\,\mathrm{d}x$. [3]

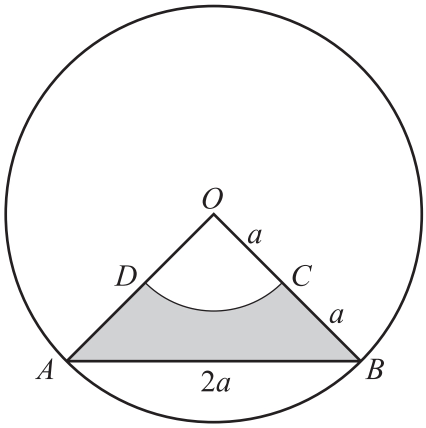
3 Solve the equation $\operatorname{cosec}^2\theta + 2\cot^2\theta = 2\cot\theta + 9$, where θ is in radians and $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$. [5]

4 **(a)** Find the first three non-zero terms in the expansion of $\left(2-\frac{x^2}{4}\right)^6$ in ascending powers of x. Simplify each term. [3]

(b) Hence find the term independent of x in the expansion of $\left(2-\frac{x^2}{4}\right)^6\left(3-\frac{1}{x^2}\right)^2$. [3]

5 When e^y is plotted against x^2 a straight line graph passing through the points $(2.24, 5)$ and $(4.74, 10)$ is obtained. Find y in terms of x. [5]

6



The diagram shows a circle, centre O, radius $2a$. The points A and B lie on the circumference of the circle. The points C and D are the mid-points of the lines OB and OA respectively. The arc DC is part of a circle centre O. The chord AB is of length $2a$.

(a) Find angle AOB, giving your answer in radians in terms of π. [1]

(b) Find, in terms of a and π, the perimeter of the shaded region $ABCD$. [2]

(c) Find, in terms of a and π, the area of the shaded region $ABCD$. [3]

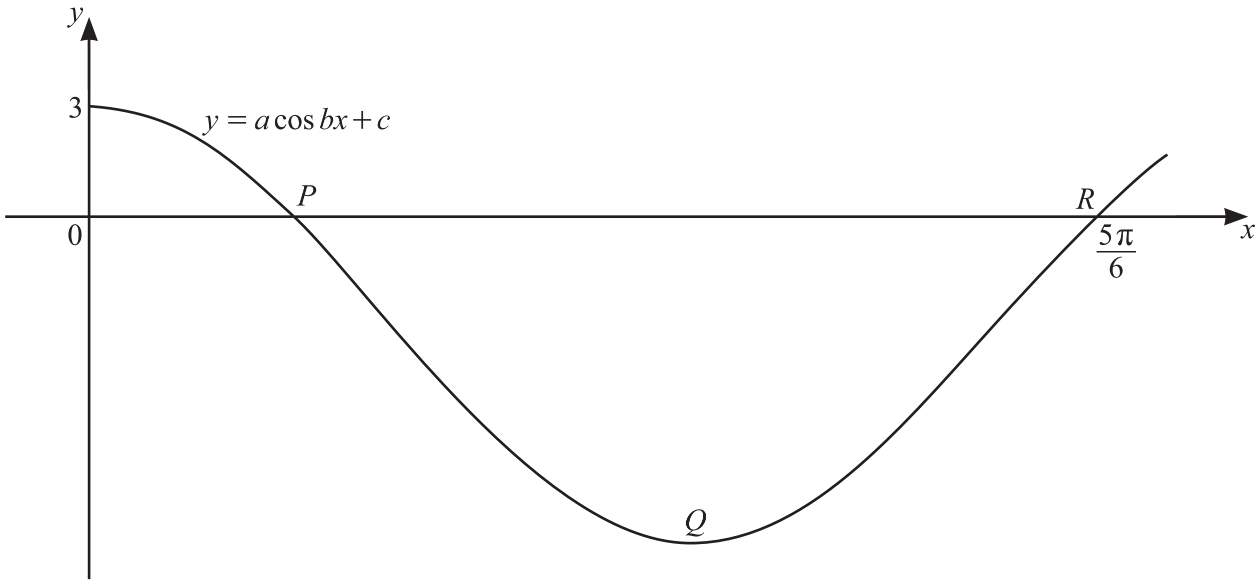
7 **(a)** A committee of 8 people is to be formed from 5 teachers, 4 doctors and 3 police officers. Find the number of different committees that could be chosen if

(i) all 4 doctors are on the committee, [2]

(ii) there are at least 2 teachers on the committee. [3]

(b) Given that ${}^{n}\mathrm{P}_5 = 6 \times {}^{n-1}\mathrm{P}_4$, find the value of n. [3]

8



The graph shows the curve $y = a\cos bx + c$, for $0 \leqslant x \leqslant 2.8$, where a, b and c are constants and x is in radians. The curve meets the y-axis at $(0, 3)$ and the x-axis at the point P and point $R\left(\frac{5\pi}{6}, 0\right)$. The curve has a minimum at point Q. The period of $a\cos bx + c$ is π radians.

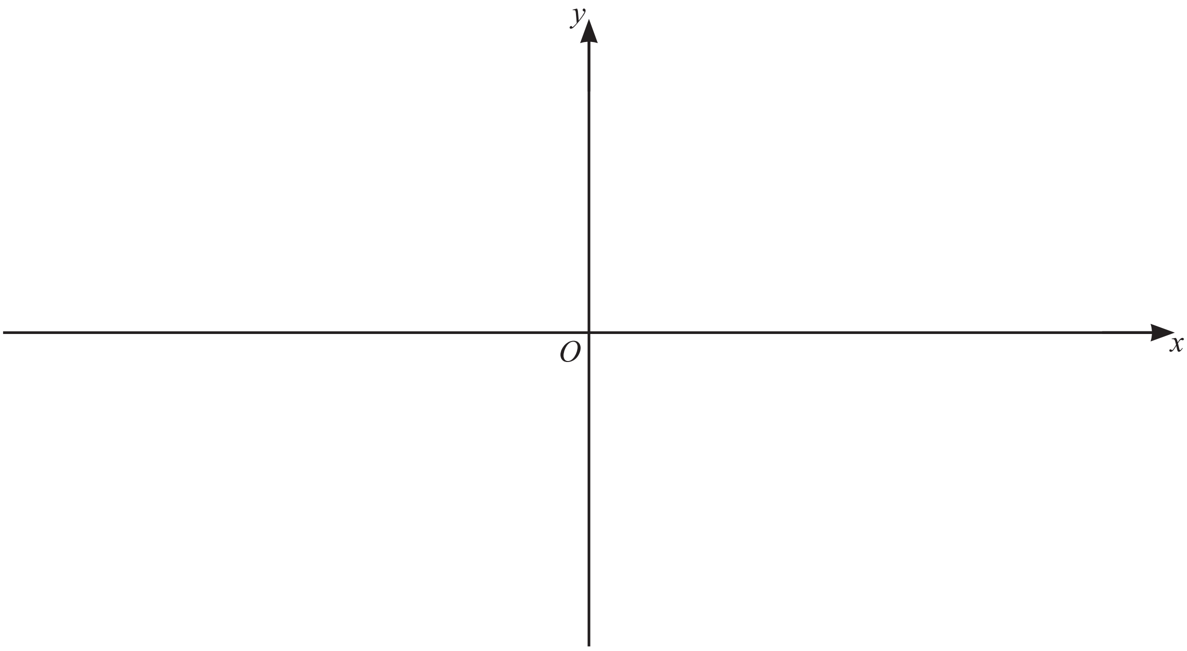
(a) Find the value of each of a, b and c. [4]

(b) Find the coordinates of P. [1]

(c) Find the coordinates of Q. [2]

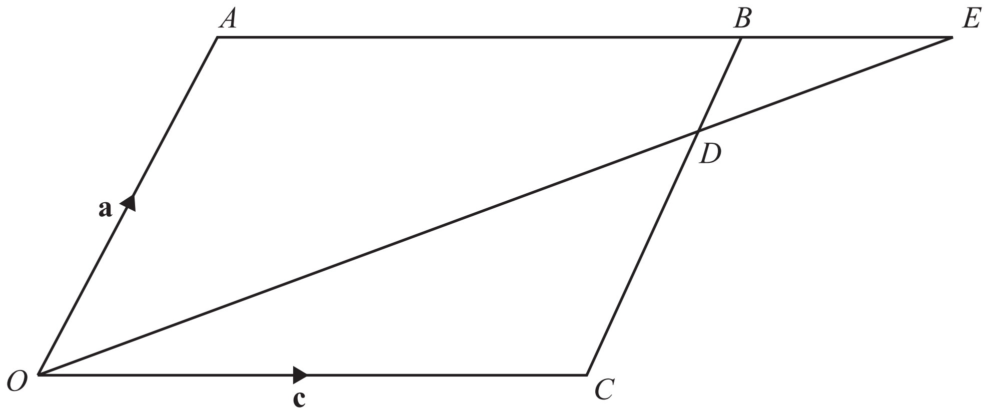
9 **(a)** Show that the equation of the curve $y=(x^2-4)(x-2)$ can be written as $y=x^3+ax^2+bx+8$, where a and b are integers. Hence find the exact coordinates of the stationary points on the curve. [4]

(b) On the axes, sketch the graph of $y=\left|(x^2-4)(x-2)\right|$, stating the intercepts with the coordinate axes. [4]



(c) Find the possible values of the constant k for which $\left|(x^2-4)(x-2)\right|=k$ has exactly 4 different solutions. [2]

10



The diagram shows the parallelogram $OABC$, such that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$. The point D lies on CB such that $CD : DB = 3 : 1$. When extended, the lines AB and OD meet at the point E. It is given that $\overrightarrow{OE} = h\overrightarrow{OD}$ and $\overrightarrow{BE} = k\overrightarrow{AB}$, where h and k are constants.

(a) Find $\overrightarrow{DE}$ in terms of $\mathbf{a}$, $\mathbf{c}$ and h. [4]

(b) Find $\overrightarrow{DE}$ in terms of **a**, **c** and k. [1]

(c) Hence find the value of h and of k. [4]

11 The line $x+2y=10$ intersects the two lines satisfying the equation $|x+y|=2$ at the points A and B.

(a) Show that the point $C(-5, 20)$ lies on the perpendicular bisector of the line AB. [8]

(b) The point D also lies on this perpendicular bisector. M is the mid-point of AB. The distance CD is three times the distance of CM. Find the possible coordinates of D. [4]

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