Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

8790810596

ADDITIONAL MATHEMATICS **4037/13**

Paper 1 **October/November 2017**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

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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 $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

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

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

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

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

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1 Given that $y = 2\sec^2\theta$ and $x = \tan\theta - 5$, express y in terms of x. [2]

2 A curve is such that its gradient at the point (x, y) is given by $10e^{5x} + 3$. Given that the curve passes though the point (0, 9), find the equation of the curve. [4]

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[Turn over

3 Find the set of values of k for which the equation $kx^2 + 3x - 4 + k = 0$ has no real roots. [4]

4 The graph of $y = a\cos(bx) + c$ has an amplitude of 3, a period of $\frac{\pi}{4}$ and passes through the point $\left(\frac{\pi}{12}, \frac{5}{2}\right)$. Find the value of each of the constants a, b and c. [4]

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5 **(i)** Find $\int (7x - 10)^{-\frac{3}{5}} \mathrm{d}x$. [2]

(ii) Given that $\int_6^a (7x - 10)^{-\frac{3}{5}} \mathrm{d}x = \frac{25}{14}$, find the exact value of a. [3]

6 When $\ln y$ is plotted against x^2 a straight line is obtained which passes through the points (0.2, 2.4) and (0.8, 0.9).

(i) Express $\ln y$ in the form $px^2 + q$, where p and q are constants. [3]

(ii) Hence express y in terms of z, where $z = \mathrm{e}^{x^2}$. [3]

7 **(i)** Find, in ascending powers of x, the first 3 terms in the expansion of $\left(2-\frac{x^2}{4}\right)^6$. Give each term in its simplest form. [3]

(ii) Hence find the coefficient of x^2 in the expansion of $\left(2-\frac{x^2}{4}\right)^6\left(\frac{1}{x}+x\right)^2$. [4]

8 It is given that $y = (x-4)(3x-1)^{\frac{5}{3}}$.

(i) Show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = (3x-1)^{\frac{2}{3}}(Ax+B)$, where A and B are integers to be found. [5]

(ii) Hence find, in terms of h, where h is small, the approximate change in y when x increases from 3 to $3 + h$. [3]

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9 **(a)** A 6-digit number is to be formed using the digits 1, 3, 5, 6, 8, 9. Each of these digits may be used only once in any 6-digit number. Find how many different 6-digit numbers can be formed if

(i) there are no restrictions, [1]

(ii) the number formed is even, [1]

(iii) the number formed is even and greater than 300 000. [3]

(b) Ruby wants to have a party for her friends. She can only invite 8 of her 15 friends.

(i) Find the number of different ways she can choose her friends for the party if there are no restrictions. [1]

Two of her 15 friends are twins who cannot be separated.

(ii) Find the number of different ways she can now choose her friends for the party. [3]

10 **(a)** Given that $\mathbf{A} = \begin{pmatrix} 4 & -1 \\ a & b \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 2 & 3 \\ -5 & 4 \end{pmatrix}$ and $\mathbf{AB} = \begin{pmatrix} 13 & 8 \\ 18 & 4 \end{pmatrix}$, find the value of a and of b. [4]

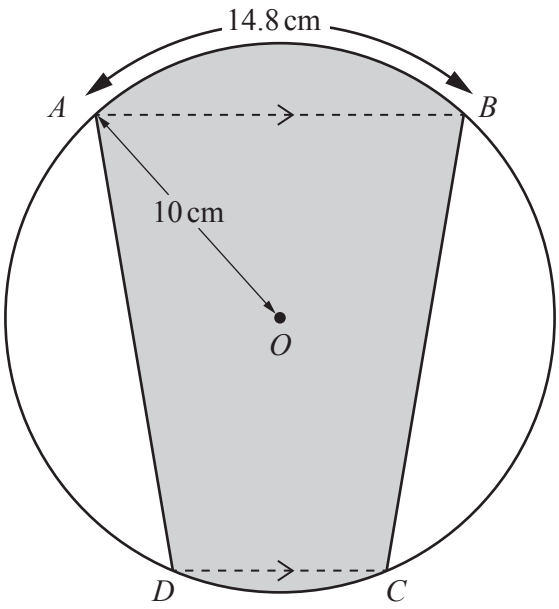
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(b) It is given that $\mathbf{X} = \begin{pmatrix} 3 & -5 \\ -4 & 1 \end{pmatrix}$, $\mathbf{Y} = \begin{pmatrix} -1 & 2 \\ 4 & 0 \end{pmatrix}$ and $\mathbf{XZ} = \mathbf{Y}$.

(i) Find $\mathbf{X}^{-1}$. [2]

(ii) Hence find $\mathbf{Z}$. [3]

11



The diagram shows a circle, centre O, radius 10 cm. The points A, B, C and D lie on the circumference of the circle such that AB is parallel to DC. The length of the minor arc AB is 14.8 cm. The area of the minor sector ODC is 21.8 cm^2.

(i) Write down, in radians, angle AOB. [1]

(ii) Find, in radians, angle DOC. [2]

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

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

12 The line $y = 2x + 1$ intersects the curve $xy = 14 - 2y$ at the points P and Q. The midpoint of the line PQ is the point M.

(i) Show that the point $\left(-10, \frac{23}{8}\right)$ lies on the perpendicular bisector of PQ. [9]

The line PQ intersects the y-axis at the point R. The perpendicular bisector of PQ intersects the y-axis at the point S.

(ii) Find the area of the triangle RSM. [3]

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