Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1078766162

ADDITIONAL MATHEMATICS **0606/21**

Paper 2 **October/November 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

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.

DC (NH/JG) 116665/2

CAMBRIDGE International Examinations

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

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

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

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

1 Solve the equation $|4x-3|=x$. [3]

2 **Without using a calculator**, find the integers a and b such that $\frac{a}{\sqrt{3}+1}+\frac{b}{\sqrt{3}-1}=\sqrt{3}-3$. [5]

3 Solve the equation $2\lg x - \lg\left(\frac{x+10}{2}\right) = 1$. [5]

4 The number of bacteria, N, present in a culture can be modelled by the equation $N = 7000 + 2000e^{-0.05t}$, where t is measured in days. Find

(i) the number of bacteria when $t = 10$, [1]

(ii) the value of t when the number of bacteria reaches 7500, [3]

(iii) the rate at which the number of bacteria is decreasing after 8 days. [3]

5 The curve with equation $y = x^3 + 2x^2 - 7x + 2$ passes through the point A (−2, 16). Find

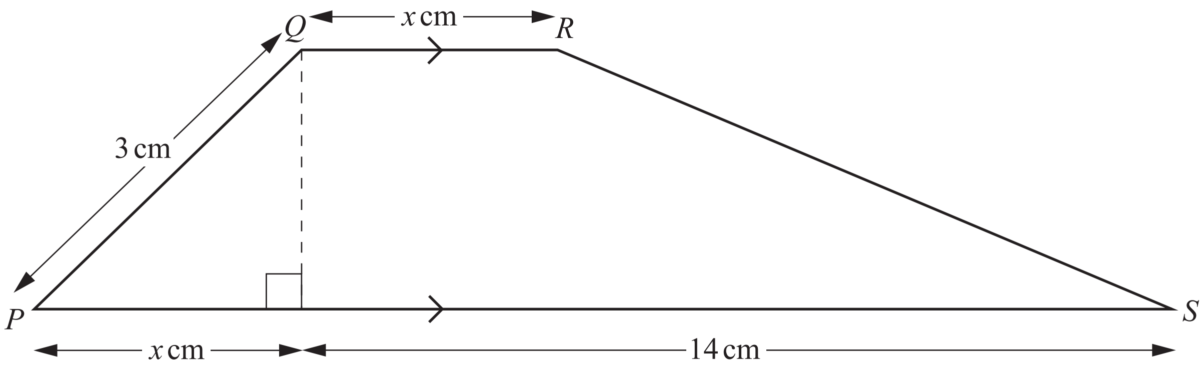
(i) the equation of the tangent to the curve at the point A, [3]

(ii) the coordinates of the point where this tangent meets the curve again. [5]

6 **(i)** Prove that $\dfrac{\cos x}{1+\tan x}-\dfrac{\sin x}{1+\cot x}=\cos x-\sin x$. [4]

(ii) Hence solve the equation $\dfrac{\cos x}{1+\tan x}-\dfrac{\sin x}{1+\cot x}=3\sin x-4\cos x$ for $-180° < x < 180°$. [4]

7



(i) Show that the area, A cm^2, of the trapezium $PQRS$ is given by $A = (7 + x)\sqrt{9 - x^2}$. [2]

(ii) Given that x can vary, find the stationary value of A. [7]

8 The function f(x) is given by $\quad \mathrm{f}(x)=\dfrac{3x^3-1}{x^3+1} \quad$ for $\quad 0 \leqslant x \leqslant 3$.

(i) Show that $\mathrm{f}'(x)=\dfrac{kx^2}{(x^3+1)^2}$, where k is a constant to be determined. [3]

(ii) Find $\displaystyle\int \frac{x^2}{(x^3+1)^2}\,\mathrm{d}x$ and hence evaluate $\displaystyle\int_1^2 \frac{x^2}{(x^3+1)^2}\,\mathrm{d}x$. [4]

(iii) Find $f^{-1}(x)$, stating its domain. [4]

9 The line $y = kx - 4$, where k is a positive constant, passes through the point $P\ (0, -4)$ and is a tangent to the curve $x^2 + y^2 - 2y = 8$ at the point T. Find

(i) the value of k, [5]

(ii) the coordinates of T, [3]

(iii) the length of TP. [2]

10 The town of Cambley is 5 km east and p km north of Edwintown so that the position vector of Cambley from Edwintown is $\begin{pmatrix} 5000 \\ 1000p \end{pmatrix}$ metres. Manjit sets out from Edwintown at the same time as Raj sets out from Cambley. Manjit sets out from Edwintown on a bearing of 020° at a speed of $2.5\,\text{ms}^{-1}$ so that her position vector relative to Edwintown after t seconds is given by $\begin{pmatrix} 2.5t\cos 70° \\ 2.5t\cos 20° \end{pmatrix}$ metres. Raj sets out from Cambley on a bearing of 310° at $2\,\text{ms}^{-1}$.

(i) Find the position vector of Raj relative to Edwintown after t seconds. [2]

Manjit and Raj meet after T seconds.

(ii) Find the value of T and of p. [5]

Question 11 is printed on the next page.

11 Mr and Mrs Coldicott have 5 sons and 4 daughters. All 11 members of the family play tennis. Six members of the family enter a tennis competition where teams consist of 4 males and 2 females.

Find the number of different teams of 4 males and 2 females that could be selected if

(i) there are no further restrictions, [2]

(ii) Mr and Mrs Coldicott must both be in the team, [2]

(iii) either Mr or Mrs Coldicott is in the team but not both. [3]