Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

0569484449

ADDITIONAL MATHEMATICS **4037/22**

Paper 2 **May/June 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.

This document consists of **12** printed pages.

DC (ST/FC) 143154/1

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 $|5x+3| = |1-3x|$. [3]

2 **Without using a calculator**, express $\left(\frac{1+\sqrt{5}}{3-\sqrt{5}}\right)^{-2}$ in the form $a + b\sqrt{5}$, where a and b are integers. [5]

3 **Without using a calculator**, factorise the expression $10x^3 - 21x^2 + 4$. [5]

4 The point P lies on the curve $y = 3x^2 - 7x + 11$. The normal to the curve at P has equation $5y + x = k$. Find the coordinates of P and the value of k. [6]

5 **(i)** Show that $\frac{\mathrm{d}}{\mathrm{d}x}[0.4x^5(0.2 - \ln 5x)] = kx^4 \ln 5x$, where k is an integer to be found. [2]

(ii) Express $\ln 125x^3$ in terms of $\ln 5x$. [1]

(iii) Hence find $\int (x^4 \ln 125x^3)\,\mathrm{d}x$. [2]

6 Show that the roots of $px^2 + (p - q)x - q = 0$ are real for all real values of p and q. [4]

7 **(a)** Given that $a^7 = b$, where a and b are positive constants, find,

(i) $\log_a b$, [1]

(ii) $\log_b a$. [1]

(b) Solve the equation $\log_{81} y = -\frac{1}{4}$. [2]

(c) Solve the equation $\dfrac{32^{x^2-1}}{4^{x^2}} = 16$. [3]

8 **Solutions to this question by accurate drawing will not be accepted.**

The points A and B are $(-8, 8)$ and $(4, 0)$ respectively.

(i) Find the equation of the line AB. [2]

(ii) Calculate the length of AB. [2]

The point C is $(0, 7)$ and D is the mid-point of AB.

(iii) Show that angle ADC is a right angle. [3]

The point E is such that $\overrightarrow{AE} = \begin{pmatrix} 4 \\ -7 \end{pmatrix}$.

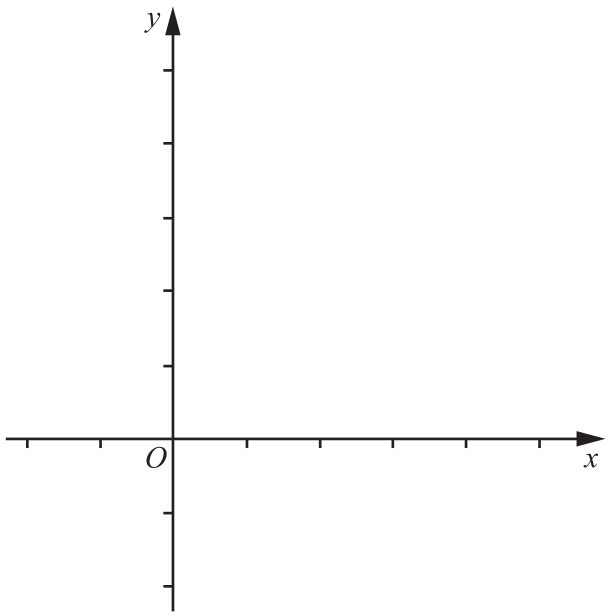
(iv) Write down the position vector of the point E. [1]

(v) Show that $ACBE$ is a parallelogram. [2]

9 A function f is defined, for $x \leqslant \frac{3}{2}$, by $\mathrm{f}(x) = 2x^2 - 6x + 5$.

(i) Express $\mathrm{f}(x)$ in the form $a(x-b)^2 + c$, where a, b and c are constants. [3]

(ii) On the same axes, sketch the graphs of $y = \mathrm{f}(x)$ and $y = \mathrm{f}^{-1}(x)$, showing the geometrical relationship between them. [3]



(iii) Using your answer from part **(i)**, find an expression for $\mathrm{f}^{-1}(x)$, stating its domain. [3]

10 Solve the equation

(i) $4\sin\left(3x-\frac{\pi}{4}\right)=3$ for $0 \leqslant x \leqslant \frac{\pi}{2}$ radians, [4]

(ii) $2\tan^2 y+\sec^2 y=14\sec y+3$ for $0° \leqslant y \leqslant 360°$. [5]

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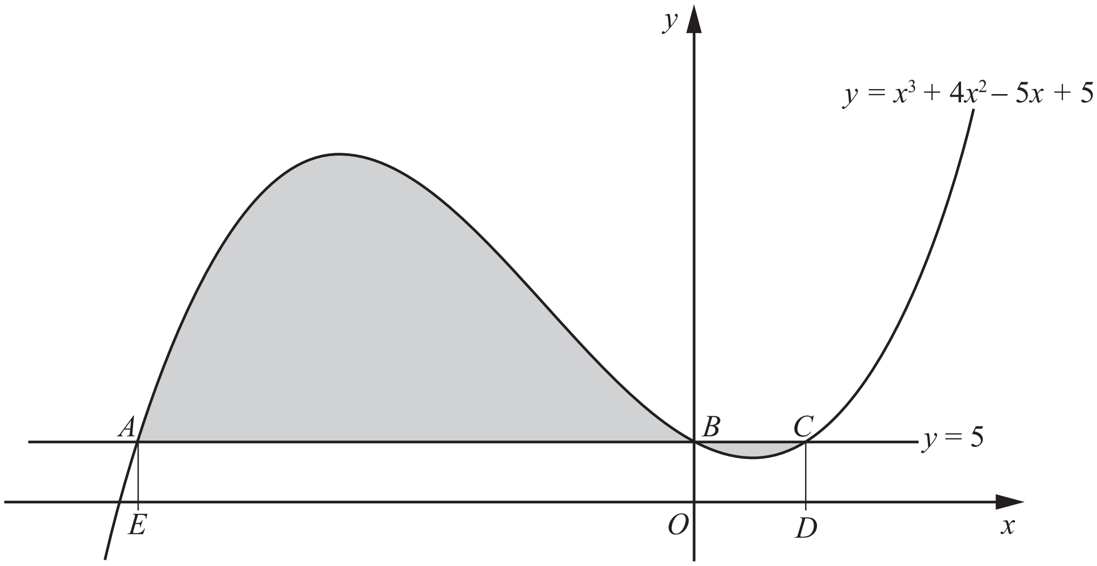

The diagram shows part of the curve $y = x^3 + 4x^2 - 5x + 5$ and the line $y = 5$. The curve and the line intersect at the points A, B and C. The points D and E are on the x-axis and the lines AE and CD are parallel to the y-axis.

(i) Find $\int (x^3 + 4x^2 - 5x + 5)\,dx$. [2]

(ii) Find the area of each of the rectangles $OEAB$ and $OBCD$. [4]

(iii) Hence calculate the total area of the shaded regions enclosed between the line and the curve. You must show all your working. [4]

Question 12 is printed on the next page.

12 The function g is defined, for $x > -\frac{1}{2}$, by $g(x) = \frac{3}{2x+1}$.

(i) Show that $g'(x)$ is always negative. [2]

(ii) Write down the range of g. [1]

The function h is defined, for all real x, by $h(x) = kx + 3$, where k is a constant.

(iii) Find an expression for $hg(x)$. [1]

(iv) Given that $hg(0) = 5$, find the value of k. [2]

(v) State the domain of hg. [1]