Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTER NUMBER

CANDIDATE NUMBER

3198931746

ADDITIONAL MATHEMATICS (US) **0459/01**

Paper 1 **May/June 2014**

2 hours

Candidates answer on the Question Paper

Additional Materials: Electronic calculator
List of formulas and statistical tables (MF25)

READ THESE INSTRUCTIONS FIRST

Write your Center 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 points is given in parentheses [ ] at the end of each question or part question.
The total number of points for this paper is 80.

This document consists of **16** printed pages.

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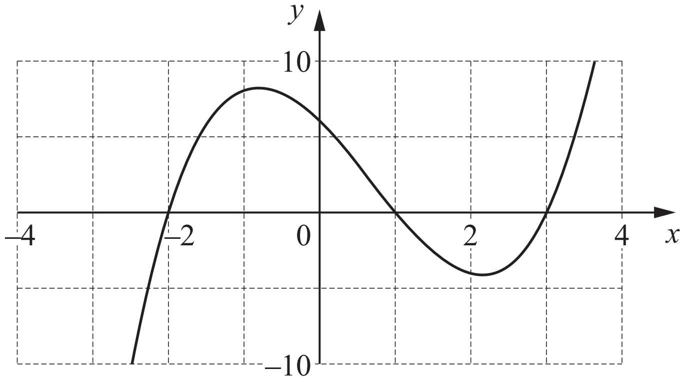
1 Part of the graph of $y = x^3 + ax^2 + bx + c$ is shown below.



Find the value of each of the constants a, b and c.

a = ... b = ... c = ... [3]

2 Simplify fully $\dfrac{x^2-2x-3}{x^2-5x+6} \div (x^2-1)$.

3 The table shows the numbers of members in different categories in a sports club.

	Junior	Intermediate	Senior
Male	25	10	25
Female	30	25	17

(i) A member of the club is chosen at random. Find the probability that this member is either female or a junior or both. [2]

(ii) Event F is "A randomly chosen member of the club is female".
Event J is "A randomly chosen member of the club is a junior".

Determine whether events F and J are independent. [4]

4 Mike and Susan have two cars. The table shows information about the cars and their usage la

	Fuel	Cost of fuel in dollars per gallon	Number of gallons of fuel used per mile	Number of m traveled last ye
Mike's car	Gasoline	\$2.25	0.020	8500
Susan's car	Diesel	\$2.35	0.018	9400

The matrix **B** is given as $\begin{pmatrix} 0.020 & 0 \\ 0 & 0.018 \end{pmatrix}$.

(i) Write down matrices **A** and **C** such that the matrix product **ABC** will give the total amount spent on fuel last year. [2]

(ii) Showing your working, evaluate the matrix product **ABC** to give this total amount. [3]

5 The complex number $z = 1 + \mathrm{i}$.

(i) Find the complex number, p, whose argument is the same as the argument of z and whose mo twice the modulus of z.

(ii) Find the complex number, q, whose modulus is the same as the modulus of z and whose argument is twice the argument of z. [2]

(iii) In the complex plane, p and q are represented by the points P and Q respectively. Find the complex number, m, that is represented by the midpoint, M, of PQ. [2]

6 Points P (–5, 1) and Q (–3, 5) are the endpoints of a diameter of a circle.

(i) Find, in the form $x^2 + y^2 + ax + by + c = 0$, the equation of the circle.

(ii) Find, in the form $y = mx + c$, the equation of the tangent to the circle at the point P (–5, 1). [3]

7 June has two tins of pumpkin and three tins of grapefruit in her cupboard. All the labels have [illegible]d in order to claim a free gift, and the tins are identical in appearance. June needs both tins of pu[illegible] pie. She opens tins at random until she has opened the two tins of pumpkin.

Let X be the number of tins that June opens.

(i) Complete the table showing the probability distribution of X. [4]

x				5
$P(X = x)$				$\frac{2}{5}$

(ii) Calculate $E(X)$ and $Var(X)$.

8 **Without using a calculator**, express $\dfrac{4-\sqrt{2}}{(1+\sqrt{2})^2}$ in the form $p+q\sqrt{2}$, where p and q are integer

9 The line $y = 5x + 5$ intersects the curve $x^2 - xy + x + y = 0$ at the points A an[illegible]e coordinates of A and of B.

10 You are not allowed to use a calculator in this question.

(a) Find the values of A between 0° and 180° which satisfy the equation $\sin 2A + \sin 30° = 0$.

(b) P, Q and R are acute angles such that $\cos P = \frac{3}{5}$, $\sin Q = \frac{5}{13}$ and $\tan R = 2$. Find the value of

(i) $\sin(P + Q)$, [3]

(ii) $\tan(Q + R)$.

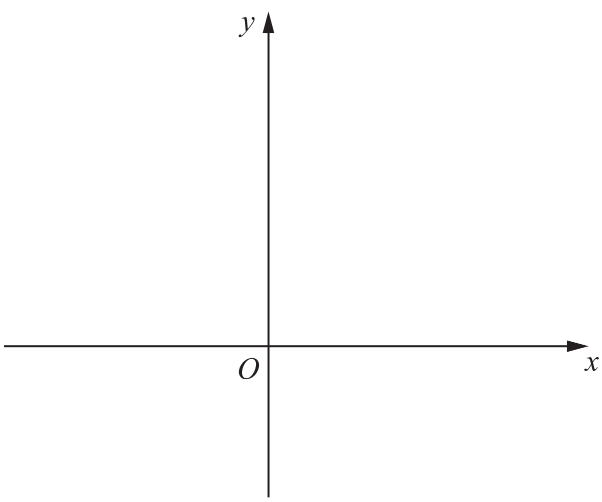
11 The function f is defined by $f(x) = (x + 2)^2 - 9$ for $x \geqslant k$, where k is a real constant. It is given that f has an inverse.

(i) State the smallest possible value of k.

(ii) State the range of f for this value of k. [1]

(iii) Find an expression for $f^{-1}(x)$. [3]

(iv) Sketch the graph of $y = |f(x)|$ for $x \geqslant k$, where k has the value found in part **(i)**. [3]



12 The points A, B and C have position vectors $\mathbf{a} = 6\mathbf{i} - \mathbf{j}$, $\mathbf{b} = 2\mathbf{i} + \mathbf{j}$ and $\mathbf{c} = 14\mathbf{i} - 5\mathbf{j}$ respectively, [illegible] origin O.

(i) Find the magnitude of the vector $\overrightarrow{AB}$.

(ii) Show that $\overrightarrow{AB} = k\overrightarrow{BC}$, where k is a constant to be found. [2]

(iii) State what part **(ii)** tells you about the points A, B and C. [1]

The point D is such that the quadrilateral $ODAB$ is a parallelogram.

(iv) Find the position vector of D and hence write down the position vector of the point E which lies on OD such that $OE : ED = 2 : 3$. [3]

Question 13 is printed on the next page.

13 **(a)** Write $\frac{3}{2}\log_b a^2 - (\log_a c)(\log_b a)$ as a single logarithm to the base b.

(b) Solve $3^{2x} - 3^{x+1} - 4 = 0$. [4]