UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

ADDITIONAL MATHEMATICS (US) **0459/02**

Paper 2 **For Examination from 2013**

SPECIMEN PAPER

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 Centre number, candidate number, and name on the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue, or correction fluid.

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 answer.

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 **16** printed pages.

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

1 Using long division show that $\dfrac{x^3 + x^2 + 4x + 6}{x^2 - 3} = x + a + \dfrac{bx + c}{x^2 - 3}$, where a, b and c are consta
be found. [3]

2 The points P, Q, and R are such that $\overrightarrow{QR} = 4\overrightarrow{PQ}$. The position vectors of P and Q relative to $\begin{pmatrix} 6 \\ 7 \end{pmatrix}$ and $\begin{pmatrix} 9 \\ 20 \end{pmatrix}$ respectively. Find the unit vector parallel to $\overrightarrow{OR}$. [5]

3 Solve the equation $$\frac{(3-x)^{\frac{-2}{3}}+\sqrt[3]{3-x}}{\sqrt[3]{3-x}}=\frac{2}{3}.$$

4 A sequence of terms is defined recursively by

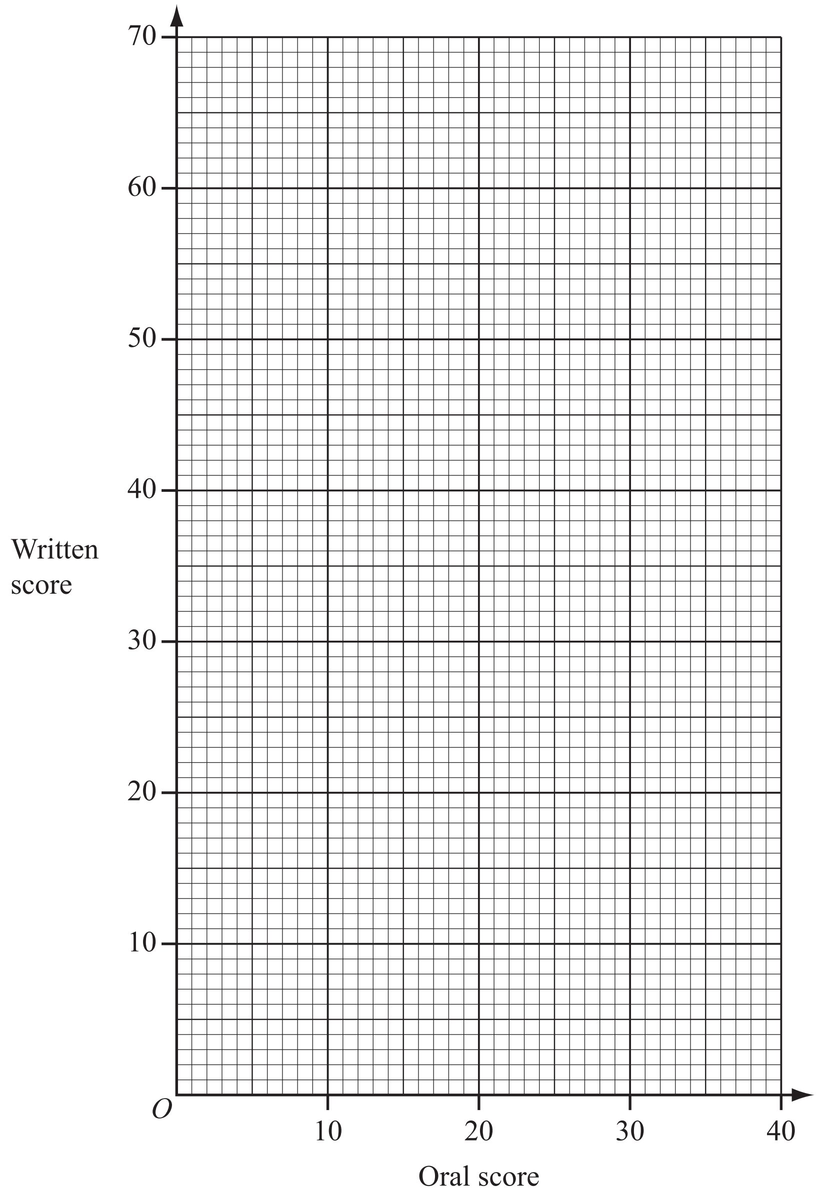
$$f(0) = a\,,$$
$$f(1) = b\,,$$
$$f(n+1) = \frac{1}{2}f(n) + f(n-1) \text{ for } n \geqslant 1.$$

Given that f(2) = 17 and f(3) = 28.5, find the value of a and of b. [5]

5 7 candidates take a language examination that consists of two tests, one written and one or[al]. The scores obtained are shown below.

Candidate	A	B	C	D	E	F	G
Oral	14	21	20	26	29	34	38
Written	43	47	48	53	61	65	68

(i) Construct a scatter diagram to represent this information. [2]



(ii) Find the equation of a line that best fits your scatter diagram.

(iii) Estimate a score in the oral test for a candidate who, because of illness, only took the written test, obtaining a score of 56. [1]

6 Solve the following equations

(a) $\dfrac{4^x}{2^{5-x}} = \dfrac{2^{4x}}{8^{x-3}}$, [3]

(b) $\lg(2y + 10) + \lg y = 2$. [3]

7 A small company produces two types of candy, C_1 and C_2. The table below shows th production, in kilograms, of C_1 and C_2 and the percentages of the three ingredients P, Q, a required to produce C_1 and C_2.

	Percentage			Daily Production (kg)
Ingredient	P	Q	R	
Type C_1	60	30	10	300
Type C_2	50	40	10	240

The costs, in dollars per kilogram, of P, Q, and R are 5, 7, and 10 respectively. Write down three matrices such that matrix multiplication will give the total cost of daily production and hence evaluate this total cost. [6]

8 A and B are acute angles such that $\sin(A - B) = \frac{3}{8}$ and $\sin A \cos B = \frac{5}{8}$.

Without using a calculator, find the value of

(i) $\cos A \sin B$, [2]

(ii) $\sin(A + B)$, [2]

(iii) $\frac{\tan A}{\tan B}$. [3]

9 The times for a motorist to travel from home to work are normally distributed with a m… 24 minutes and a standard deviation of 4 minutes. Find the probability that a particular trip … home to work takes

(i) more than 27 minutes, [2]

(ii) between 20 and 25 minutes. [4]

10 The complex number $z = -3 + 2\mathrm{i}$.

(i) Write down an expression for $\bar{z}$, the complex conjugate of z. [

(ii) Represent $z, \bar{z}$, and $-z$ on an Argand diagram by the points L, M, and N respectively. [2]

(iii) Explain why triangle LMN is right-angled. [2]

Given also that the complex number $w = 5 - \mathrm{i}$,

(iv) express zw in the form $a + b\mathrm{i}$, where a and b are constants to be found, [3]

(v) find the modulus and the argument of zw. [2]

11 The function f is defined, for all real values of x, by $f(x) = 4\cos 2x - 2$.

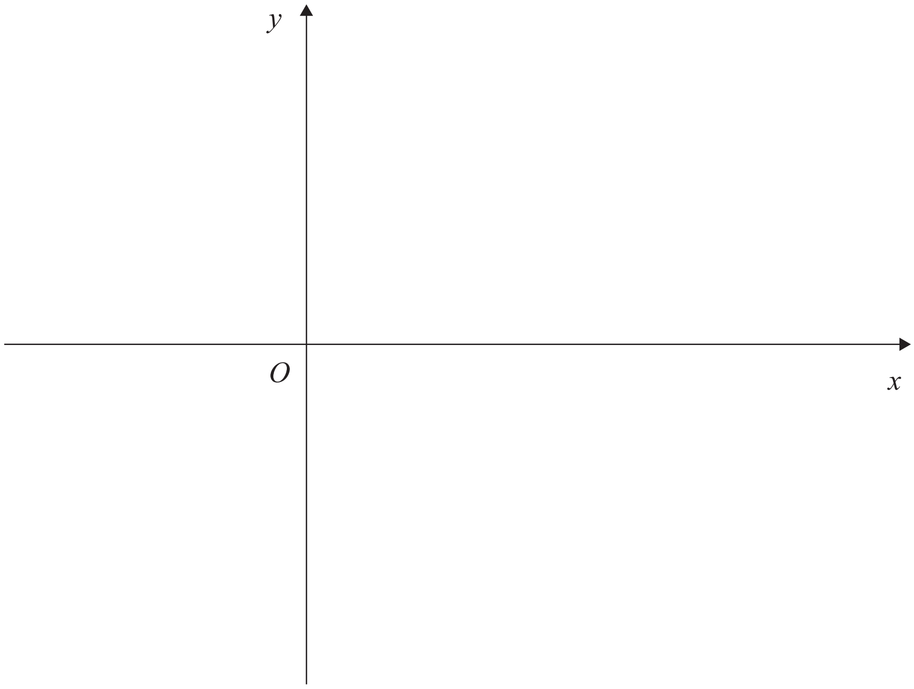
(i) State the amplitude and period of f. [2]

The function g is defined, for $0° \leqslant x \leqslant 180°$ by $g(x) = 4\cos 2x - 2$.

(ii) Find the coordinates of the minimum point of the graph of $y = g(x)$. [2]

(iii) Find the coordinates of the points where the graph of $y = g(x)$ intersects the x-axis. [3]

(iv) Sketch the graph of $y = \mathrm{g}(x)$.



(v) Explain clearly how the graph of $y = |\mathrm{g}(x)|$ would differ from the graph of $y = \mathrm{g}(x)$. [1]

12 **(a)** Factorize completely the expression $2x^3 - 11x^2 - 20x - 7$.

(b) The expression $x^3 + ax^2 - 15x + b$ has a factor $x - 2$ and leaves a remainder of 75 when divided by $x + 3$. Find the value of a and of b. [5]