UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International Level 3 Pre-U Certificate
Principal Subject

MATHEMATICS **9794/01**

Paper 1 Pure Mathematics 1 **October/November 2013**

2 hours

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF20)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
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 a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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 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 **3** printed pages and **1** blank page.

1 Solve the simultaneous equations

$$x^2 + y^2 = 5,$$
$$y = 2x.$$ [4]

2 Find the equation of the line perpendicular to the line $y = 5x$ which passes through the point $(2, 11)$. Give your answer in the form $ax + by = c$ where a, b and c are integers to be found. [4]

3 The first term of a geometric progression is 50 and the common ratio is 0.9.

(i) Find the fifth term. [1]

(ii) Find the sum of the first thirty terms. [3]

(iii) Find the sum to infinity. [2]

4 Solve the equation $x^2 + (\sqrt{3})x - 18 = 0$, giving each root in the form $p\sqrt{q}$ where p and q are integers. [4]

5 Express $\dfrac{7 - x}{(x - 1)(x + 2)}$ in partial fractions. [4]

6 Describe fully the transformations which, when applied to the graph of $y = \mathrm{f}(x)$, will produce the graphs with equations given by

(i) $y = \mathrm{f}(-x)$, [2]

(ii) $y = \mathrm{f}(x - 3)$, [2]

(iii) $y = \mathrm{f}\left(\dfrac{x}{2}\right)$. [2]

7 Given that z is a complex number, prove that $zz^* = |z|^2$. [3]

8 **(i)** Express $\sin x - \sqrt{8}\cos x$ in the form $R\sin(x - \alpha)$ where $R \geqslant 0$ and $0 \leqslant \alpha \leqslant 90°$. [4]

(ii) Hence write down the maximum value of $\sin x - \sqrt{8}\cos x$ and find the smallest positive value of x for which it occurs. [3]

9 Find $\int x \sin 2x \, \mathrm{d}x$. [4]

10 A curve has equation $y = \dfrac{\mathrm{e}^x}{x^2}$. Show that

(i) the gradient of the curve at $x = 1$ is $-\mathrm{e}$, [4]

(ii) there is a stationary point at $x = 2$ and determine its nature. [4]

11 The functions f and g are defined by $\mathrm{f}(x) = \dfrac{1}{2+x} + 5$, $x > -2$ and $\mathrm{g}(x) = |x|$, $x \in \mathbb{R}$.

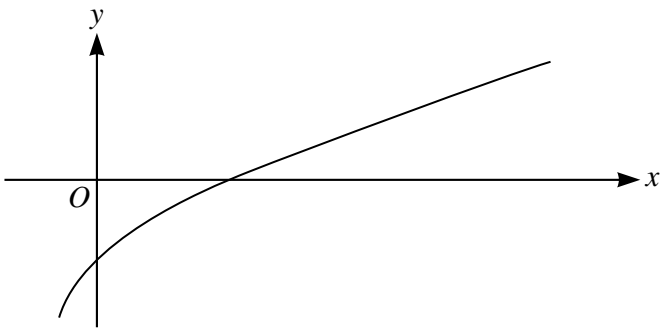
(i) Given that the range of f is of the form $\mathrm{f}(x) > a$, find a. [1]

(ii) Find an expression for f^{-1}, stating its domain and range. [4]

(iii) Show that $\mathrm{gf}(x) = \mathrm{f}(x)$. [2]

(iv) Find an expression for $\mathrm{fg}(x)$. Determine whether fg has an inverse. [3]

12 The diagram shows the curve $y = \dfrac{x^2 - 3}{x + 1}$ for $x > -1$.



(i) Find the coordinates of the points where the curve crosses the axes. [2]

(ii) Express $\dfrac{x^2 - 3}{x + 1}$ in the form $Ax + B + \dfrac{C}{x+1}$, where A, B and C are constants, and hence show that the exact area enclosed by the x-axis, the curve $y = \dfrac{x^2 - 3}{x + 1}$ and the lines $x = 2$ and $x = 4$ is $4 + \ln \frac{9}{25}$. [8]

13 Solve the differential equation $\dfrac{\mathrm{d}y}{\mathrm{d}x} = -k(y - 10)$, where k is a constant, given that $y = 70$ when $x = 0$ and $y = 40$ when $x = 1$. Express your answer in the form $y = a + b\left(\frac{1}{2}\right)^x$ where a and b are constants to be found. [10]

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