UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

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

Paper 1 **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 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 **15** printed pages and **1** blank page.

UNIVERSITY *of* CAMBRIDGE
International Examinations

1 Find the equation of the circle with center $(-2, 8)$ and radius 7 units.

2 **(a)** State briefly two possible reasons for gathering statistical information by taking a sample from a population. [2]

(b) Explain why choosing every tenth item from a list does not produce a random sample. [2]

3 Find z_1 such that $z_1 = \dfrac{a + \mathrm{i}\sqrt{b}}{c}$ is a root of the equation $z^2 - 3z + 4 = 0$ where a, b, and c are cons
to be determined. State also z_2, the other root of this equation. [3]

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4 P is the point (x, y) and S is the point $(6, 1)$. The point P moves in such a way that its distance from S is equal to its distance from the line $x = -1$. Show that the equation of the parabola traced out by the point P is $y(y - 2) = 14x + k$ where k is a constant to be found. [4]

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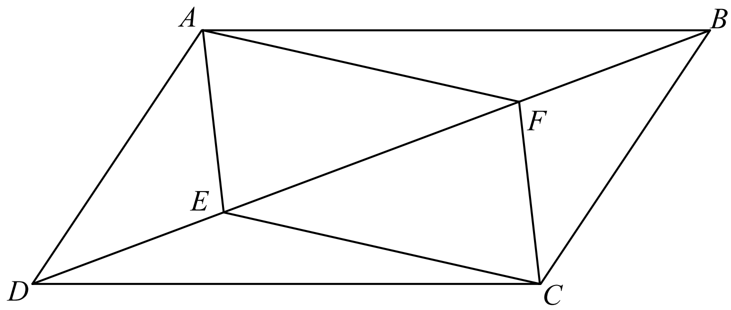
5 **Without using a calculator**, express $\dfrac{\left(5+2\sqrt{3}\right)^2}{2+\sqrt{3}}$ in the form $p+q\sqrt{3}$, where p and q are intege

[4]

6



ABCD is a parallelogram. The points *E* and *F* lie on the diagonal *DB* such that *DE* : *EF* : *FB* is 1 : 2 : 1. Prove that the quadrilateral *AFCE* is a parallelogram. [5]

7 Given that the matrix $\mathbf{A} = \begin{pmatrix} 2 & -3 \\ 1 & 1 \end{pmatrix}$, find the matrix $\mathbf{B}$, such that $10\mathbf{A}^{-1} - \mathbf{B} = \mathbf{A}^2$.

8 A hospital uses a test to determine whether incoming patients have a particular disease. It is that:

- 97% of patients with the disease are declared positive
- 5% of patients without the disease are declared positive.

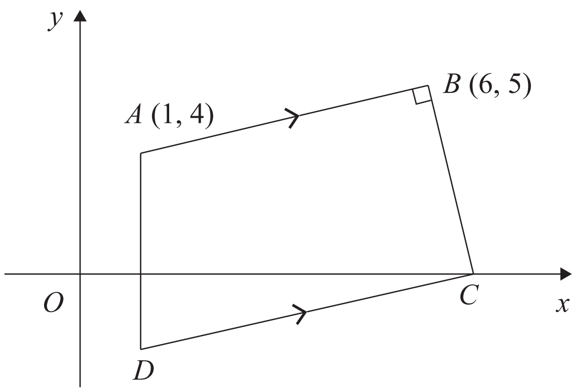
Over time the hospital has found that 4% of incoming patients have the disease.

(i) Calculate the probability that an incoming patient is declared positive. [4]

(ii) Given that an incoming patient is declared positive, show that the probability the incoming patient is actually suffering from the disease is approximately 0.447. [2]

9 The line $y = x + 4$ intersects the curve $2x^2 + 3xy - y^2 + 1 = 0$ at the points A and B. Find the le[ngth of] the line AB.

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



The diagram shows a quadrilateral $ABCD$ in which A is the point $(1, 4)$ and B is the point $(6, 5)$. Angle ABC is a right angle and the point C lies on the x-axis. The line AD is parallel to the y-axis and the line CD is parallel to BA.

(i) Find the equation of the line CD. [5]

(ii) State the coordinates of D. [1]

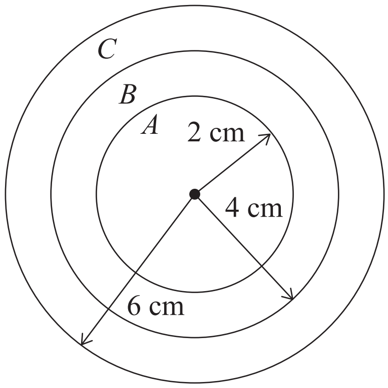
11 Solve, for angles between 0° and 360°,

(a) $5(\sin x - \cos x) = 4\sin x - 3\cos x$, [4]

(b) $2\sin^2 y + 3\cos y = 0$. [4]

12 A plane flies from A to B. The position vector of B relative to A is $(1200\mathbf{i} + 240\mathbf{j})$ km, where are unit vectors due East and North. The flight takes 4 hours because of a constant wind. Given the velocity in still air of the plane is $(260\mathbf{i} + 156\mathbf{j})$ kmh^{-1}, calculate the speed and direction of th wind. [7]

13



The figure shows a circular target, radius 6 cm, divided into three regions, A, B, and C, by two concentric circles of radii 2 cm and 4 cm.

(i) Show that the areas of A, B and C are in the ratio 1 : 3 : 5. [2]

A man shoots an arrow at the target. The probability that he hits the target with any single shot is $\frac{3}{4}$ and he is just as likely to hit one point of the target as any other. The man scores 12, 6, or 3 points if he hits A, B, or C respectively. The number of points he scores with one shot is denoted by S.

(ii) Find P ($S = 12$). [2]

(iii) Determine the probability distribution of S, displaying this information in a table.

(iv) By first finding $E(S)$, deduce the expected number of points the man would score with 20 shots. [3]

14 **(a)** Functions f and g are defined, for $x \in \mathbb{R}$, by

$$f(x) = 3 - x,$$
$$g(x) = \frac{x}{x+2}, \text{ where } x \neq -2.$$

(i) Find $f(g(x))$. [1]

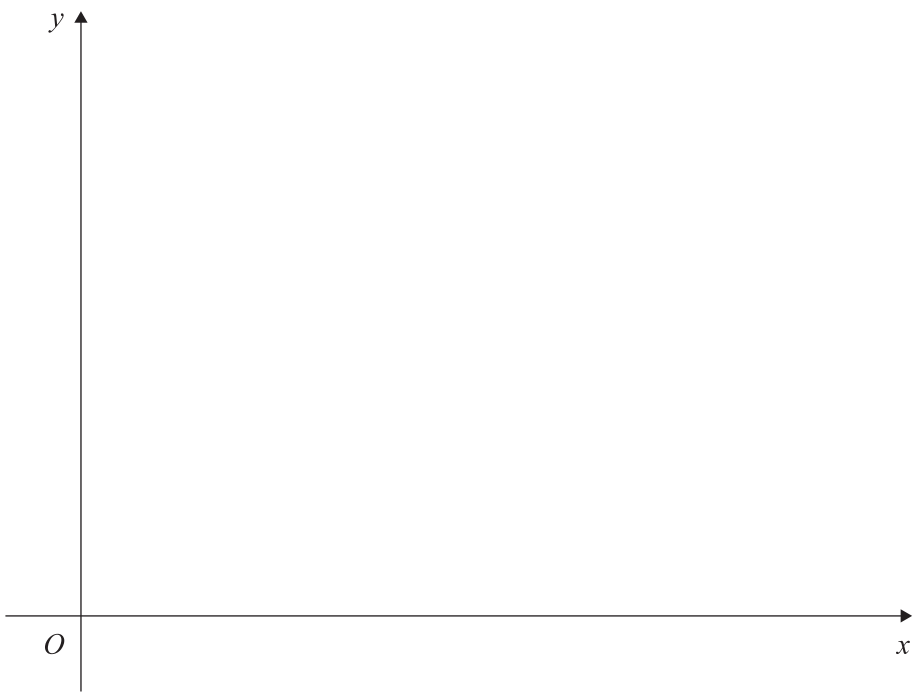
(ii) Hence find the value of x for which $f(g(x)) = 10$. [2]

(b) A function h is defined for $x \in \mathbb{R}$, by $h(x) = 4 + \ln x$, where $x > 1$.

(i) Find the range of h. [1]

(ii) Find the value of $h^{-1}(9)$. [2]

(iii) On the same axes, sketch the graphs of $y = h(x)$ and $y = h^{-1}(x)$. [3]



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