Cambridge Pre-U

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
Cambridge International Level 3 Pre-U Certificate
Short Course

MATHEMATICS (STATISTICS WITH PURE MATHEMATICS) **1347/01**

Paper 1 Pure Mathematics **May/June 2013**

1 hour 45 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF21)

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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 65.

This document consists of **4** printed pages.

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[Turn over

1 **(i)** Expand $(1 - 2x)^7$ in ascending powers of x, up to and including the term in x^2. Give each term in its simplest form. [2]

(ii) Use your answer to part **(i)** to find a rational approximation to $\left(\frac{33}{35}\right)^7$. [2]

2 **(i)** Sketch the graph of $y = 2(0.7)^x$. [2]

(ii) Make x the subject of the formula $y = 2(0.7)^x$. [2]

3 It is given that $\sum_{r=1}^{n} r^2 = \frac{n(n+1)(2n+1)}{6}$. Use this formula to evaluate:

(i) $\sum_{r=1}^{100} r^2$, [1]

(ii) $\sum_{r=1}^{100} (2r)^2$, [1]

(iii) $\sum_{r=1}^{100} (r^2 + 1)$. [1]

4 A substance undergoes radioactive decay. The mass m kg of the substance at time t hours is given by $m = A\mathrm{e}^{-kt}$, where A and k are constants. It is given that $m = 18$ when $t = 2$ and $m = 12$ when $t = 4$.

(i) Find the values of A and k. [3]

(ii) Find the value of m when $t = 8$. [2]

5 The equation

$$kx^2 + kx + 3 = 0$$

is a quadratic equation in x. It is given that the equation has no real solutions. Use the discriminant of the equation to obtain a quadratic inequality for k, and solve this inequality. [5]

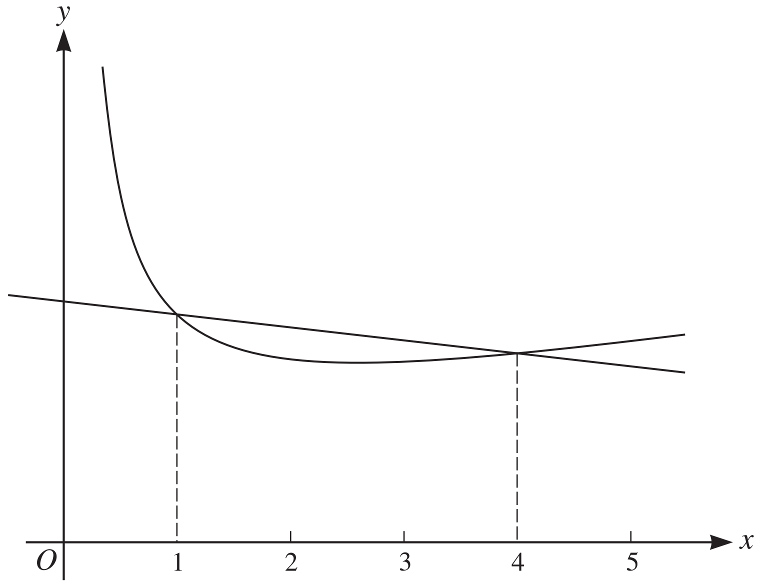
6 The point A has coordinates (4, 5). The point B has coordinates (0, 3).

(i) Find the exact value of the length AB. [2]

The point C lies on the line between A and B, and $BC = 3$. The point D is such that AD is perpendicular to AC, and the area of triangle ACD is 22.

(ii) Calculate the length AD, giving your answer in the form $a + b\sqrt{c}$, where a, b and c are integers. [5]

7 A curve has equation $y = \sqrt{x} + \dfrac{2}{x}$. A line intersects the curve at points with x-coordinates 1 and 4, as shown in the diagram. Find the area between the curve and the line. [6]



8 The coordinate axes represent two roads which meet at right angles. The position of car A at time t seconds after noon is given by $(20t - 250,\ 0)$, where distances are measured in metres.

(i) Interpret this statement in terms of the position and direction of motion of the car. [2]

The position of car B at t seconds after noon is given by $(0,\ 15t - 500)$.

(ii) Show that the distance s between the cars at time t satisfies

$$s^2 = 625t^2 - 25\,000t + 312\,500.$$ [2]

(iii) By writing this expression in the form $625[(t - a)^2 + b]$, find the minimum distance between the two cars, stating the time at which this minimum distance occurs. [5]

9 A curve has equation $y = \mathrm{f}(x)$, where $\mathrm{f}(x) = x^2 - 3x$.

(i) Find the equation of the normal to the curve at the point $A\ (3,\ 0)$, giving your answer in the form $x = py + q$. [4]

(ii) The normal meets the curve again at B. Find the coordinates of B. [4]

(iii) Find the coordinates of the points corresponding to A and B for the curves

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

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

(c) $y = 2\mathrm{f}\left(\tfrac{1}{2}x\right)$. [2]

[Question 10 is printed on the next page.]

10 The quantity of petrol, P litres, that a vehicle requires for a given journey when the top speed is v km/minute is given by

$$P = 2v^3 + 3v + \frac{18}{v}.$$

(i) Find $\frac{dP}{dv}$. [2]

It is required to find the value of v for which P is a minimum.

(ii) Solve a suitable quadratic equation in v^2 to find the value of v and the corresponding value of P, giving your answers correct to 3 significant figures. [5]

(iii) Show that this value of P is a minimum. [1]