Cambridge Pre-U

Cambridge International Examinations
Cambridge Pre-U Certificate

MATHEMATICS (PRINCIPAL) **9794/03**

Paper 3 Applications of Mathematics **May/June 2016**

2 hours

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

6731473530

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 an HB 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.
Where a numerical value for the acceleration due to gravity is needed, use $10\,\text{m}\,\text{s}^{-2}$.
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.
You are advised to spend no more than 1 hour on Section A and 1 hour on Section B.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

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

CAMBRIDGE International Examinations

[Turn over

Section A: Probability (40 marks)

You are advised to spend no more than 1 hour on this section.

1 The following data refer to the annual rate of inflation and the annual percentage pay increase measured on 10 randomly chosen occasions.

Inflation rate (%)	0.9	1.2	1.6	1.5	1.7	3.0	4.1	3.7	2.8	4.2
Pay increase (%)	4.8	4.7	3.8	4.4	5.6	5.5	2.4	0.4	0.6	1.7

Show that, for these data, the product moment correlation coefficient between the rate of inflation and the annual pay increase is -0.679, correct to 3 significant figures. [4]

2 The weights of pineapples on sale at a wholesaler are normally distributed with mean 1.349 kg and standard deviation 0.236 kg. Before going on sale the pineapples are classified as 'Small', 'Medium', 'Large' and 'Extra Large'.

(i) A pineapple is classified as 'Small' if it weighs less than 1.100 kg. Find the probability that a randomly chosen pineapple will be classified as 'Small'. [5]

(ii) 10% of pineapples are classified as 'Extra Large'. Find the minimum weight required for a pineapple to be classified as 'Extra Large'. [3]

3 Chris plays for his local hockey club. In his first 20 games for the club, the mean number of goals per game he has scored is 0.7, with a standard deviation of 0.9.

In the next 5 games he scores 0, 1, 0, 2, 1 goals.

(i) Find the mean and standard deviation for the number of goals per game Chris has scored in all 25 games. [7]

(ii) A sponsor pays Chris £65 each time he plays for the club and a further £25 for each goal he scores. Find the mean and standard deviation of the amount per game he earns from the sponsor for all 25 games. [4]

4 A certain type of sweet is made in a variety of colours. 20% of the sweets made are blue. Sweets of the various colours are thoroughly mixed before being put into packets.

(i) In a packet that contains 10 sweets, find the probability that the packet contains

(a) at most 3 blue sweets, [1]

(b) exactly 3 blue sweets, [2]

(c) at least 1 blue sweet. [2]

(ii) What is the smallest number of sweets that a packet should contain in order to be at least 95% certain of having at least 1 blue sweet? [3]

5 The letters of the word 'SEPARATE' are to be rearranged. Find the probability that, in a randomly chosen rearrangement, the two letters 'A' are not next to each other. [4]

6 A and B are independent events. $\mathrm{P}(A) = \frac{3}{4}$ and $\mathrm{P}(A \cap B) = \frac{1}{4}$.

Find $\mathrm{P}(A' \cap B)$ and $\mathrm{P}(A' \cap B')$. [5]

Section B: Mechanics (40 marks)

You are advised to spend no more than 1 hour on this section.

7 A stone that weighs 15 kg is propelled across the ice in an ice rink with an initial speed of $4\,\mathrm{m\,s^{-1}}$. The coefficient of friction between the stone and the ice is 0.017. How far does the stone slide before it comes to rest? [5]

8 A particle is projected with speed $U\,\mathrm{m\,s^{-1}}$ at an angle θ above the horizontal, where $\sin\theta = \frac{12}{13}$, and reaches its maximum height after 2.4 seconds.

(i) Find U and the maximum height reached by the particle. [4]

(ii) Find the horizontal range of the particle. [4]

9 A particle of mass 0.01 kg is projected vertically upwards from a point G at ground level with speed $165\,\mathrm{m\,s^{-1}}$ and reaches a maximum height of 1237.5 m. Throughout its motion it experiences a constant resistance.

(i) Find the acceleration of the particle as it ascends and hence the magnitude of the resistance. [4]

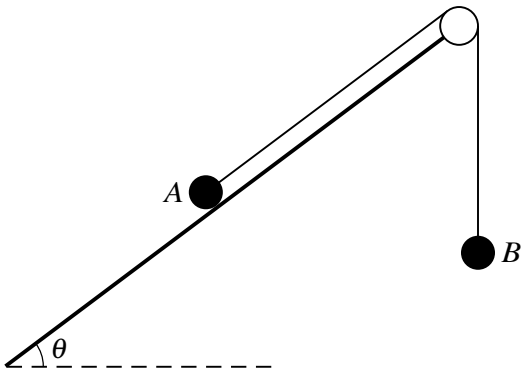
(ii) During its descent back to G the particle experiences the same constant resistance. Find the time taken for the descent. [4]

10 **(a)** A particle A of mass m travelling with speed u on a smooth horizontal surface collides directly with a particle B of mass λm travelling with speed $2u$ in the opposite direction. After the collision, A travels at speed $\frac{7}{2}u$ and B travels at speed $\frac{11}{10}u$, both in the same direction as B before the collision. Find λ and the coefficient of restitution between the two particles. [4]

(b) A particle of mass 3 kg moving with velocity $(2\mathbf{i} + 3\mathbf{j} - 2\mathbf{k})\,\mathrm{m\,s^{-1}}$ receives an impulse of $(6\mathbf{i} - 6\mathbf{j} - 9\mathbf{k})\,\mathrm{N\,s}$. Find the velocity of the particle after the impulse. [3]

[Question 11 is printed on the next page.]

11



The diagram shows a particle, A, of mass m_1 at rest on a rough slope at an angle θ to the horizontal, where $\sin\theta = \frac{3}{5}$. Particle A is connected by a light inextensible string to another particle, B, of mass m_2. The string passes over a smooth peg at the top of the slope and particle B is hanging freely.

(i) In the case when $m_2 = \frac{1}{2}m_1$, particle A is on the point of sliding *down* the slope.

(a) Draw a fully labelled diagram to show all the forces acting on the particles. [2]

(b) Find the coefficient of friction between A and the slope. [6]

(ii) In the case when $m_2 = m_1$, find the acceleration of the particles. [4]