



**CAMBRIDGE A LEVEL PROGRAMME
SEMESTER ONE EXAMINATION JUNE 2011**
(January 2011 Intake)

Thursday

9 June 2011

10.30 am – 11.45 am

MATHEMATICS

9709/6

PAPER 6 Probability & Statistics 1 (S1)

1 hour 15 minutes

Additional materials: Answer Paper
Graph Paper
List of formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your name and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
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.
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 marks for this paper is 50.

Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

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

- 1 The times t (in seconds) taken by an athlete to run 400 metres on ten successive days were

53 55 54 52 53 56 54 53 59 53

Calculate the mean and standard deviation of the times. [3]

- 2 The discrete random variable X takes values 0, 1 and 2. The probability distribution of X is shown in the table, where p is a constant ($0 < p < \frac{1}{3}$).

x	0	1	2
$P(X = x)$	$1-3p$	$2p$	p

Given that $Var(X) = \frac{1}{2}$, find the two possible values of $E(X)$. [6]

- 3 Students have to pass a test before they are allowed to work in a laboratory. Students do not retake the test once they have passed it. For a randomly chosen student, the probability of passing the test at the first attempt is $\frac{1}{3}$. On any subsequent attempt, the probability of the student failing is half the probability of failing on the previous attempt. By drawing a tree diagram,

(i) show that the probability of a student passing in 3 attempts or fewer is $\frac{26}{27}$. [4]

(ii) find the conditional probability that a student passed at the first attempt, given that the student passed in 3 attempts or fewer. [2]

- 4 Lessons in a school are supposed to last for 40 minutes. However, a Mathematics teacher finds that pupils are usually late arriving for his lesson, and that the actual length of teaching time available can be modeled by a normal distribution with mean 34.8 minutes and standard deviation 1.6 minutes.

(i) Find the probability that the length of teaching time available will be less than 37.0 minutes. [2]

(ii) The probability that the length of teaching time available exceeds m minutes is 0.75. Find m . [3]

(iii) Assuming independence between lessons, find the probability that length of teaching time for three lessons will be less than 37.0 minutes. [2]

- 5 The examination marks obtained by 844 candidates in an examination are shown in the following table.

Marks	Number of students
0-9	28
10-19	55
20-29	88
30-39	128
40-49	115
50-59	142
60-69	123
70-79	101
80-89	52
90-99	12

- (i) Draw a cumulative frequency polygon to illustrate the distribution of marks. [2]
From your graph, estimate the
- (a) median, [1]
(b) interquartile range. [2]
- (ii) If the pass mark is 45, estimate how many candidates will fail this examination. [1]
- (iii) If 10% of the candidates get the top grade A, estimate the lowest mark that will obtain this grade. [1]
- 6 Eggs are sold in a supermarket in cartons of 12. For each egg the probability that it is cracked is 0.025, and independence may be assumed. Calculate the probability that a randomly chosen carton will contain
- (i) at most 2 cracked eggs [3]
(ii) at least one cracked egg. [2]
- Eggs are delivered to the supermarket in boxes each containing 40 cartons. Use a suitable approximation to find the probability that a randomly chosen box will contain more than 11 cartons with at least one cracked egg. [4]

[Turn over

- 7 Four married couples, Mr. and Mrs. Albert, Mr. and Mrs. Ben, Mr. and Mrs. Chan and Mr. and Mrs. David are to be seated in a row of eight seats numbered 1 to 8.
- (i) If no two men and no two women are to sit together, find the number of different ways in which the eight people can be arranged. [3]
 - (ii) If the four men, Mr. Albert, Mr. Ben, Mr. Chan and Mr. David sit down in seats 1, 3, 5, and 7 respectively, find the number of ways in which the wives can sit so that none of them sits next to her husband. [2]
 - (iii) Hence or otherwise, find the total number of arrangements in which the men and women occupy alternate seats and no wife sits next to her husband. [4]
 - (iv) If husbands and wives are to sit together, find the number of ways in which the eight people can be arranged. [3]