

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

FURTHER MATHEMATICS

9231/22

Paper 2

May/June 2018

3 hours

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF10)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.

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.

DO NOT WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.

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 is necessary, take the acceleration due to gravity to be 10 m s^{-2} .

The use of a calculator is expected, where appropriate.

Results obtained solely from a graphic calculator, without supporting working or reasoning, will not receive credit.

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.

This document consists of **22** printed pages and **2** blank pages.



1 A bullet of mass m kg is fired horizontally into a fixed vertical block of material. It enters the block horizontally with speed 250 m s^{-1} and emerges horizontally with speed 70 m s^{-1} after 0.04 s. The block offers a constant horizontal resisting force of magnitude 450 N . Find the value of m . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

2 A particle P moves on a straight line in simple harmonic motion. The centre of the motion is O . The points A and B are on the line, on opposite sides of O , with $OA = 1.6 \text{ m}$ and $OB = 1.2 \text{ m}$. The ratio of the speed of P at A to its speed at B is $3 : 4$.

(i) Find the amplitude of the motion. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

The maximum speed of P during its motion is $\frac{1}{3}\pi \text{ m s}^{-1}$.

(ii) Find the period of the motion. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(iii) Find the time taken for P to travel directly from A to B . [3]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Show that small oscillations of the object about the axis l are approximately simple harmonic, and state the period. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6 The continuous random variable X has distribution function given by

$$F(x) = \begin{cases} 1 - e^{-0.4x} & x \geq 0, \\ 0 & \text{otherwise.} \end{cases}$$

(i) Find $P(X > 2)$. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Find the interquartile range of X . [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

9 At a ski resort, the probability of snow on any particular day is constant and equal to p . The skiing season begins on 1 November. The random variable X denotes the day of the skiing season on which the first snowfall occurs. (For example, if the first snowfall is on 5 November, then $X = 5$.) The variance of X is $\frac{4}{9}$.

(i) Show that $4p^2 + 9p - 9 = 0$ and hence find the value of p . [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Find the probability that the first snowfall will be on 3 November. [1]

.....

.....

.....

.....

.....

.....

(iii) Find the probability that the first snowfall will not be before 4 November. [2]

.....
.....
.....
.....
.....
.....
.....
.....
.....

(iv) Find the least integer N so that the probability of the first snowfall being on or before the N th day of November is more than 0.999. [4]

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

(ii) Find the product moment correlation coefficient for the data.

[2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(iii) Test, at the 5% significance level, whether there is evidence of positive correlation between the variables. [4]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

BLANK PAGE

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.