Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Mathematics

Advanced Subsidiary
Paper 2: Statistics and Mechanics

Practice Paper 1

Paper Reference **8MA0/02**

You must have:
Mathematical Formulae and Statistical Tables, calculator

Total Marks

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all questions and ensure that your answers to parts of questions are clearly labelled.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- The total mark for this part of the examination is 60. There are 10 questions.
- The marks for each question are shown in brackets
  – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Answer ALL questions.

SECTION A: STATISTICS

1. The Venn diagram in Figure 1 shows the probabilities that a randomly chosen member of a group of monkeys likes bananas (*B*) or mangoes (*M*).

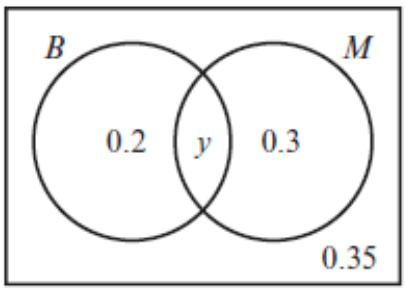

Figure 1

(a) Find the value of y.

(1)

(b) Determine whether the events 'likes bananas' and 'likes mangoes' are independent.

(2)

(Total for Question 1 is 3 marks)

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2. Clare is investigating the daily mean temperature in the UK in September 2015. She takes a sample of the first 10 days from September 2015 for Camborne from the large data set.

The results are shown below.

14.3 12.8 13.0 13.0 14.3 12.6 13.5 13.7 15.9 17.0

(a) State, with a reason, whether t is a discrete or continuous variable.

(1)

Given that $\sum t = 140.1$ and $\sum t^2 = 1981.33$,

(b) find the mean and standard deviation of the temperatures.

(3)

The mean temperature on 11 September is recorded as 15.8 °C.

(c) State what effect adding this value to the data set would have on the mean temperature.

(1)

(d) Suggest how Clare could make better use of the large data set for her study.

(2)

(Total for Question 2 is 7 marks)

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3. A biased dice has a probability distribution as shown in the table below:

x	1	2	3	4	5	6
$P(X = x)$	0.1	0.2	0.15	p	0.1	0.25

(a) Find the value of p.

(1)

(b) Find $P(2 \leq X \leq 5)$.

(1)

(c) The dice is rolled 10 times Find the probability that it lands on an odd number

(i) exactly twice,

(ii) more than 6 times.

(4)

(Total for Question 3 is 6 marks)

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4. A factory makes plates using a production line process. On average, 3 out of every 10 plates have flaws. A new production process is introduced designed to make the average number of flaws less. A new sample of 20 plates is taken.

(a) Describe the test statistic and state suitable null and alternative hypotheses.

(2)

(b) Using a 5% level of significance, find the critical region for a test to check the belief that the process has improved.

(3)

(c) State the actual significance level.

(1)

In the new sample, only 1 plate has flaws.

(d) Conclude whether there is evidence that the process has improved.

(1)

(Total for Question 4 is 7 marks)

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5. A scientist measures the amount of energy released by a chemical reaction, e Joules, against the temperature, h °C, as shown in Figure 2.

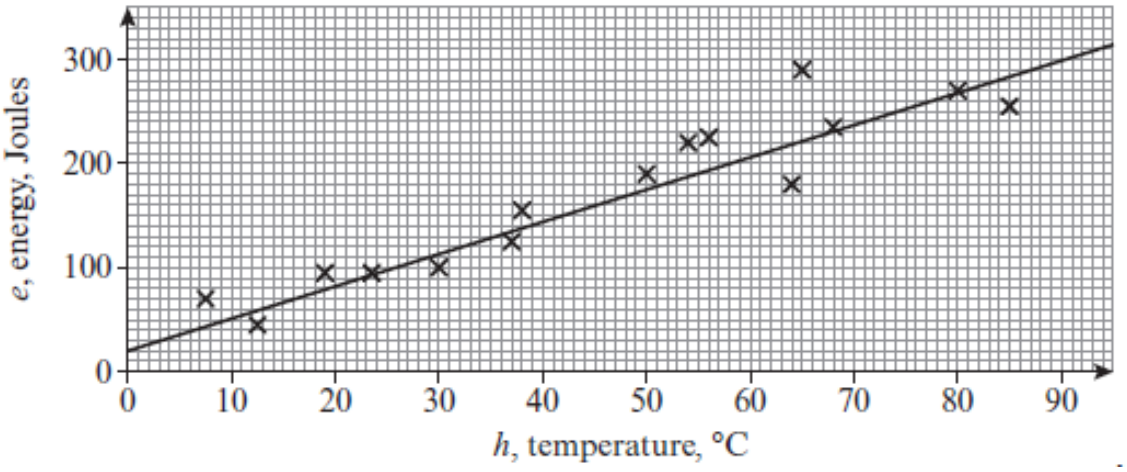

Figure 2

She found the equation of the regression line of e on h to be $e = 20 + 3.1h$.

(a) Give an interpretation of the value 3.1 in this model.

(1)

(b) State, with a reason, whether it is sensible to estimate e when $h = 200$ °C.

(1)

(c) State, with a reason, whether it is sensible to measure h when $e = 150$ Joules.

(1)

(Total for Question 5 is 10 marks)

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6. A conservationist is collecting data on the heights of giraffe. She displays the data in a histogram as shown in Figure 3.

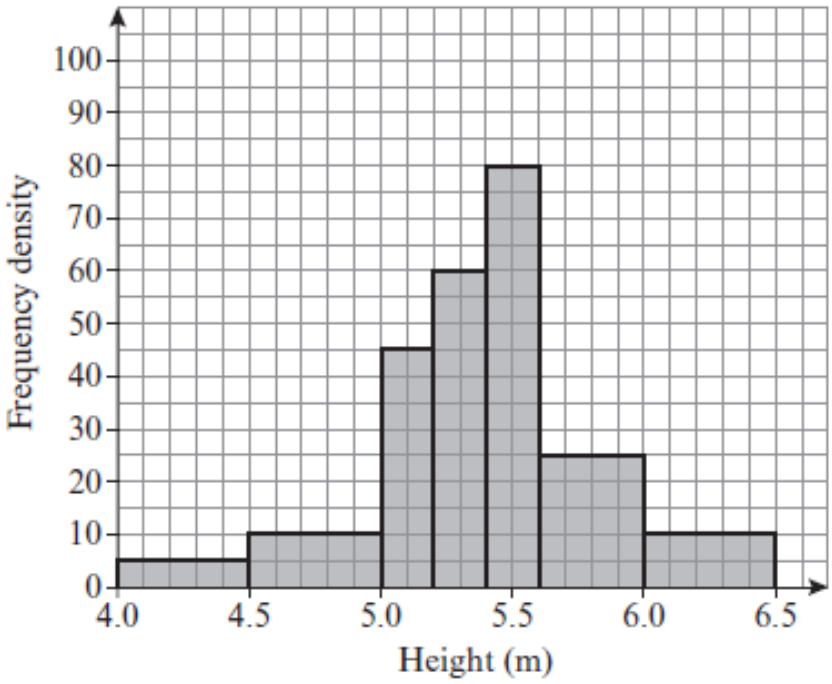

Figure 3

One giraffe is chosen at random. Estimate the probability that it is between 4.6 and 6.1 metres tall.

(Total for Question 6 is 4 marks)

TOTAL FOR STATISTICS IS 50 MARKS

SECTION B: MECHANICS

7. A car is towing a trailer along a straight horizontal road by means of a horizontal tow-rope. The mass of the car is 1500 kg. The mass of the trailer is 700 kg. The car and the trailer are modelled as particles and the tow-rope as a light inextensible string. The resistances to motion of the car and the trailer are assumed to be constant and of magnitude 660 N and 320 N respectively. The driving force on the car, due to its engine, is 2630 N.

Find

(a) the acceleration of the car

(3)

(b) the tension in the tow-rope.

(3)

(c) State how you have used the modelling assumption that the tow-rope is inextensible.

(1)

(Total for Question 7 is 7 marks)

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8. A particle P of mass 3 kg is moving under the action of forces

$$\mathbf{F}_1 = 3\mathbf{i} - 6\mathbf{j} \text{ N}, \quad \mathbf{F}_2 = 4\mathbf{i} + 5\mathbf{j} \text{ N} \quad \text{and} \quad \mathbf{F}_3 = 2\mathbf{i} - 2\mathbf{j} \text{ N}.$$

Find

(a) the acceleration of P in the form $p\mathbf{i} + q\mathbf{j}$,

(3)

(b) angle the acceleration makes with $\mathbf{i}$,

(2)

(c) the magnitude of the acceleration.

(2)

(Total for Question 8 is 7 marks)

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9. A small ball is projected vertically upwards from a point P with speed u m s^{-1}. After projection the ball moves freely under gravity until it returns to P. The time between the instant that the ball is projected and the instant that it returns to P is 5 seconds. The ball is modelled as a particle moving freely under gravity.

Find

(a) the value of u,

(3)

(b) the greatest height above P reached by the ball.

(2)

At time t seconds, the ball is 15 m above P.

(c) Find the possible values of t.

(4)

(Total for Question 9 is 9 marks)

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10. A particle, P, moves in a straight line through a fixed point O. The velocity of the particle, v m s^{-1} at a time t seconds after passing through O is given by $v = 3 + 9t^2 - 4t^3$, $0 \leq t \leq 2$.

Figure 4 shows a velocity–time graph of the motion of P.

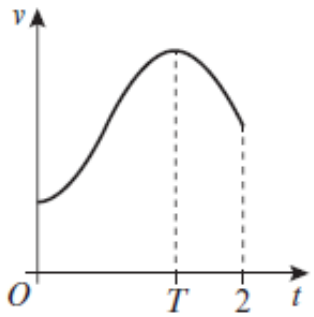

Figure 4

Find the distance of P from O at time T seconds, when the particle is moving with maximum velocity.

(Total for Question 10 is 7 marks)

TOTAL FOR MECHANICS IS 50 MARKS