NAME:

Date to be handed in:

MARK (out of 60):

PAPER J

Qu	1	2	3	4	5	6	7	TOTAL

Mathematics

Advanced Subsidiary

Paper 2: Statistics and Mechanics
Time 1 hour 15 minutes

Practice Paper K

Paper Reference
8MA0/01

You must have:
Mathematical Formulae and Statistical Tables, calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic 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** the questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.

<u>Questions to revise</u>:

SECTION A: Statistics

1. A factory produces shopping bags for a large supermarket chain. The breaking load of a bag is the maximum load that it can carry before it breaks. The supermarket chain places an order for 50 000 shopping bags but wishes to know the breaking load of the bags.

(a) Suggest two reasons why a census would be unsuitable for this purpose.

(2)

The factory tests five shopping bags and the loads required for the bags to break are shown below:

17.89 kg 15.24 kg 9.72 kg 12.31 kg 13.89 kg

(b) The factory claims that the shopping bags can carry 12 kg of goods without breaking. Use the sample data to comment on this claim.

(2)

(c) Describe any limitations to the sample the factory has collected.

(2)

(d) Suggest one way the factory could improve the reliability of its prediction.

(1)

(Total 7 marks)

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2. Data relating to the lifetimes (to the nearest hour) of a random sample of 200 light bulbs from the production line of a manufacturer were summarised in a grouped frequency table. The mid-point of each class in the table was represented by x and the corresponding frequency for that class by f. The data were then coded using:

$$y = \frac{(x - 755.0)}{2.5}$$

and summarised as follows:

$$\sum fy = -467, \ \sum fy^2 = 9179$$

Calculate estimates of the mean and the standard deviation of the lifetimes of this sample of bulbs.

(Total 9 marks)

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3. A researcher measured the foot lengths of a random sample of ten-year-old children. The lengths are summarised in the table below.

Foot length, *l*, (cm)	**Number of children**
$10 \leqslant l < 12$	5
$12 \leqslant l < 17$	52
$17 \leqslant l < 19$	30
$19 \leqslant l < 21$	15
$21 \leqslant l < 23$	11
$23 \leqslant l < 25$	7

(a) Find the probability that a child chosen at random has a foot length less than 17 cm.

(3)

(b) Find the probability that a child chosen at random has a foot length between 12 cm and 18 cm. State one assumption you have made.

(3)

(Total 6 marks)

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4. The discrete random variable X has probability function

$$\mathrm{P}(X = x) = \begin{cases} 0.15 & x = -3, -2 \\ \alpha & x = -1, 0 \\ 0.1 & x = 1, 2 \\ 0 & \text{otherwise} \end{cases}$$

Find

(a) α,

(2)

(b) $\mathrm{P}(-1 \leqslant X < 2)$,

(1)

(c) $\mathrm{P}(X > -2.3)$.

(1)

(Total 4 marks)

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5. Amir and Ed play each other at badminton and for each game, independently of all others, the probability that Amir loses is 0.2

Find the probability that, in 9 games, Amir loses:

(a) exactly 3 of the games,

(2)

(b) fewer than half of the games.

(2)

(Total 4 marks)

SECTION B: Mechanics

6. The height of a pole vaulter above the ground can be modelled using the equation $h = \frac{1}{60}\left(125x - 12x^2\right)$, where h metres is the vertical height of the pole vaulter and x metres is the horizontal distance travelled after his feet leave the ground.

(a) Find the horizontal distance travelled when the pole vaulter lands.

(3)

(b) Given that the pole vaulter is at his greatest height halfway between leaving the ground and landing, find the greatest height of the pole vaulter.

(3)

For a jump to be successful, the pole vaulter must clear a bar of height 4.9 m.

(c) Calculate the range of horizontal distances from the bar that the pole vaulter can leave the ground and have a successful jump.

(7)

(d) State the effect in this model of

(i) modelling the pole vaulter as a particle,

(1)

(ii) making air ressistance negligible.

(1)

(Total 15 marks)

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7. A box A of mass 0.8 kg rests on a rough horizontal table and is attached to one end of a light inextensible string. The string passes over a smooth pulley fixed at the edge of the table. The other end of the string is attached to a sphere B of mass 1.2 kg, which hangs freely below the pulley. The magnitude of the frictional force between A and the table is F N. The system is released from rest with the string taut. After release, B descends a distance of 0.9 m in 0.8 s.

Modelling A and B as particles, calculate

(a) the acceleration of B,

(2)

(b) the tension in the string,

(3)

(c) the value of F.

(3)

Sphere B is 0.9 m above the ground when the system is released. Given that it does not reach the pulley and the frictional force remains constant throughout,

(d) find the total distance travelled by A.

(7)

(Total 15 marks)

TOTAL FOR PAPER IS 60 MARKS