

NAME:

**PAPER E**

Date to be handed in:

MARK (out of 60):

Qu	1	2	3	4	5	6	7	8	9	TOTAL

# Mathematics

Advanced Subsidiary

Paper 2: Statistics and Mechanics

Time 1 hour 15 minutes

Practice Paper E

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.

Questions to revise:

**SECTION A: Statistics**

1. (a) Explain what is meant by a census. **(1)**

(b) Write down two disadvantages of using a census rather than a sample. **(2)**

Each circuit board produced at GC Electronics is given a unique serial number. GC Electronics produces circuit boards in batches of 5000. Before selling each batch, the company tests a random sample of 20 circuit boards from the batch to check that they will fit into a standard computer slot.

(c) Suggest a suitable sampling frame from which to obtain this sample. **(1)**

(d) Identify the sampling units. **(1)**

**(Total 4 marks)**

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2. There are 180 students at a college following a general course in computing. Students on this course can choose to take up to three extra options.

112 take systems support,  
70 take developing software,  
81 take networking,  
35 take developing software and systems support,  
28 take networking and developing software,  
40 take systems support and networking,  
4 take all three extra options.

- (a) Draw a Venn diagram to represent this information.

**(5)**

A student from the course is chosen at random.

- (b) Find the probability that this student takes

(i) none of the three extra options

**(1)**

(ii) networking only.

**(1)**

Students who take systems support and networking are eligible to become technicians.

- (c) Given that the randomly chosen student is eligible to become a technician, find the probability that this student takes all three extra options.

**(2)**

**(Total 9 marks)**

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3. A random sample of distances travelled to work for 120 commuters from a train station in Devon is recorded. The distances travelled, to the nearest mile, are summarised below.

Distance (to the nearest mile)	Number of commuters
0 – 9	10
10 – 19	19
20 – 29	43
30 – 39	25
40 – 49	8
50 – 59	6
60 – 69	5
70 – 79	3
80 – 89	1

For this distribution:

- (a) estimate the median.

(2)

The mid-point of each class was represented by  $x$  and its corresponding frequency by  $f$ . The mid-point of the lowest class was taken to be 4.75 giving:

$$\Sigma fx = 3552.5 \text{ and } \Sigma fx^2 = 138\,043.125$$

- (b) Estimate the mean and the standard deviation of this distribution.

(3)

- (c) Explain why the median is less than the mean for these data.

(1)

- (d) For a second random sample of 120 commuters travelling to work from a train station in Greater London, the mean distance travelled to work is 15.6 miles with standard deviation 21.2 miles. Compare the measures of location and spread for the distance travelled to work for the two samples, giving possible reasons for any differences.

(4)

**(Total 10 marks)**

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4. A manufacturer supplies MP3 players to retailers in batches of 20, which are randomly selected. Long-term analysis shows that 5% of the players are faulty.

(a) Write down a suitable model for the distribution of the number of faulty MP3 players in a batch giving the value(s) of any parameter(s). (2)

(b) Find the probability that a batch contains no faulty MP3 players. (2)

(c) Show that the probability of there being more than 4 faulty MP3 players in a batch is equal to 0.0026 to 2 significant figures. (2)

**(Total 6 marks)**

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**SECTION B: Mechanics**

5. The height of a tennis ball above the ground can be modelled using the equation

$$h = 1.7 + 0.18x - 0.01x^2,$$

where  $h$  metres is the height of a tennis ball above the ground and  $x$  metres is the horizontal distance travelled.

- (a) Find the height of the tennis ball when it is

(i) struck,

**(2)**

(ii) at a horizontal distance of 7 m.

**(2)**

To be called 'in' the tennis ball must hit the ground before it travels a horizontal distance of 25 m.

- (b) Will the tennis ball be called 'in'?

**(5)**

- (c) The tennis ball is hit with an initial speed of  $2 \text{ km min}^{-1}$ . Convert this into  $\text{m s}^{-1}$ .

**(3)**

**(Total 12 marks)**

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6. A particle  $P$  passes through point  $A$  with velocity  $2.8 \text{ m s}^{-1}$  and constant acceleration  $0.12 \text{ m s}^{-2}$ . Three seconds later a second particle  $Q$  passes through  $A$  with velocity  $2.4 \text{ m s}^{-1}$  and constant acceleration  $0.2 \text{ m s}^{-2}$ .

- (a) Write down expressions for the displacements of  $P$  and  $Q$  from  $A$ , in terms of  $t$ , where  $t$  s is the time after  $P$  passed through  $A$ ,

**(4)**

- (b) Show that, when the particles meet,  $2t^2 - 50t - 315 = 0$ .

**(3)**

- (c) Find the distance from  $A$  when the two particles meet.

**(5)**

**(Total 12 marks)**

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7. A cyclist of mass 80 kg is travelling with speed  $18 \text{ m s}^{-1}$ . The cyclist stops peddling and comes to rest, without braking, due to resistance forces totalling 120 N.

(a) Find how long it takes the cyclist to stop. (4)

(b) Find the distance the cyclist travels before stopping. (2)

(c) Describe one limitation in this model. (1)

**(Total 7 marks)**

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**TOTAL FOR PAPER IS 60 MARKS**