OCR
Oxford Cambridge and RSA

Wednesday 6 June 2018 – Morning

AS GCE/Level 3 Certificate

QUANTITATIVE METHODS (MEI)

G244/01 Introduction to Quantitative Methods (IQM)

Question Paper

Candidates answer on the Question Paper.

OCR supplied materials:
- Insert (inserted)

Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

G244401

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Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The Insert will be found inside this document.
- Write your name, centre number and candidate number in the spaces provided. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided.** If additional answer space is required you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the barcodes.
- You are permitted to use a scientific or graphical calculator in this paper unless the question states otherwise.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The Insert contains a copy of the pre-release material for use with three of the questions.
- The total number of marks for this paper is **72**.
- This Question Paper consists of **20** pages. Any blank pages are indicated.

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1 This question is based on pre-release material.

The article 'Exoplanet discovery' includes the following sentence.

> The planets closely circle a dwarf star named Trappist-1, which at 39 light years away makes the system a prime candidate to search for signs of life.

To 4 significant figures, the speed of light is 1.079×10^9 kilometres per hour.

Find the distance in kilometres of the star Trappist-1 from the Earth, giving your answer in standard form correct to 2 significant figures. **[4]**

1	

2 Fig. 2.1 shows the first few rows of a column in a spreadsheet. Only three of the cells have been completed.

	A
1	5
2	10
3	20
4	...
5	...
...	...

Fig. 2.1

The formula in cell A2 is shown in Fig. 2.2.

```
= A1*2
```

Fig. 2.2

This formula is copied down the column as far as cell A20.

(i) Write down the **number** in cell A6. **[1]**

(ii) Write down the **formula** in cell A20. **[1]**

(iii) Which cell contains the number 163 840? **[3]**

2 (i)	
2 (ii)	
2 (iii)	

3 This question is based on the article 'Crime figures for a Devon town' in the pre-release material.

(i) Show the calculation that gave rise to the headline 'Recorded crime drops in Town by 16%' and explain briefly how the answer was interpreted. **[3]**

(ii) Find the percentage of crimes in Totnes Town in 2016 that were classified as shoplifting. Compare this with the corresponding figures for Totnes East and Totnes West for the same year.

Suggest a reason for the difference. **[4]**

3 (i)

3 (ii)

4 This question is based on the article 'Lightning strike' in the pre-release material.

In parts **(i)** and **(ii)** of this question, you should assume that over the next 10 years there will be 34 million females in the UK and 33 million males and that these figures will remain constant.

You should also use the most recent figures from the insert for 'Average fatalities/year' and '% male'.

(i) Give your answers to this part to the nearest whole number.

Estimate the number of people who will die from lightning strike in the UK in the next 10 years.

Estimate also how many of them will be male and how many female. **[2]**

(ii) Show that the risk to a particular female of being killed by lightning strike in the UK next year is about 1 in 100 million.

What is the corresponding figure for a male? **[4]**

(iii) Give a plausible explanation as to why the risks of being killed by lightning strike in the UK are so different for males and females. **[1]**

4 (i)	
4 (ii)	

4 (iii)	

(iv) Estimate the probability that someone who is struck by lightning in the UK survives the incident. **[2]**

4 (iv)	

5 Asif is a bowling coach for cricket players. The length of a cricket pitch is 22 yards and Asif teaches people how to bowl the ball so that its first bounce is at a suitable place on the pitch.

Asif gives the bowlers the frequency chart in Fig. 5.1. It shows the distances in yards from the bowler's end that he expects 120 of their deliveries to land. It is based on a Normal distribution.

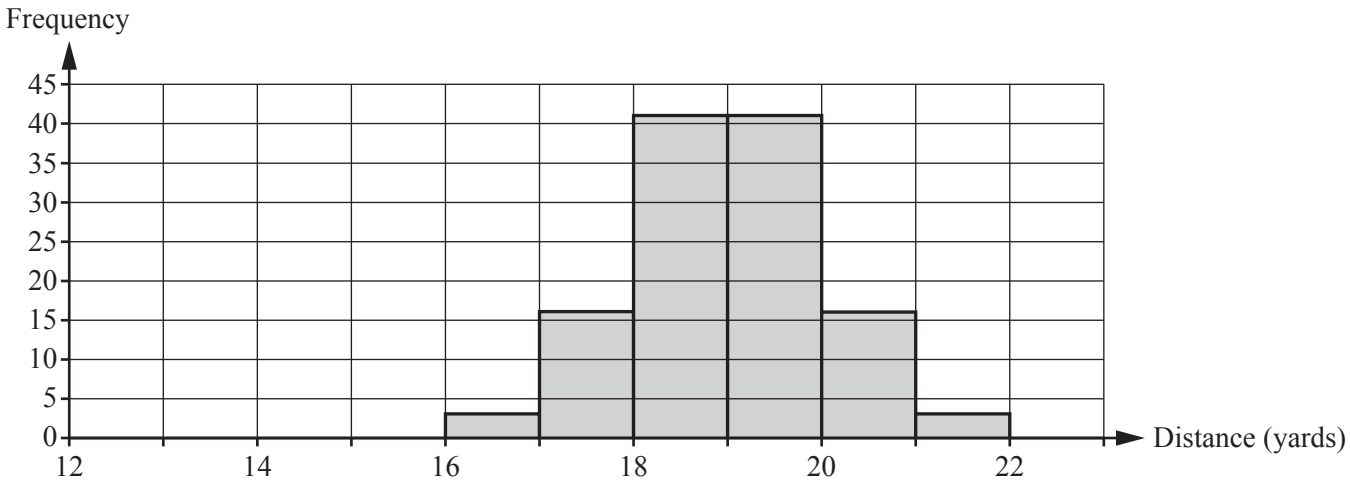

Fig. 5.1

(i) **(*A*)** Identify one feature of Asif's graph that confirms that it is consistent with a Normal distribution. **[1]**

(*B*) Write down the mean of the distribution. **[1]**

(ii) The standard deviation of the distribution is 1 yard.

Show that the frequencies for 16–17 yards and 21–22 yards should both be 3 (as shown in Fig. 5.1). **[4]**

5 (i)	**(*A*)**
	(*B*)
5 (ii)	

Charlie is a bowler. Asif keeps a record of 120 balls that Charlie bowls and constructs the frequency chart below (Fig. 5.2).

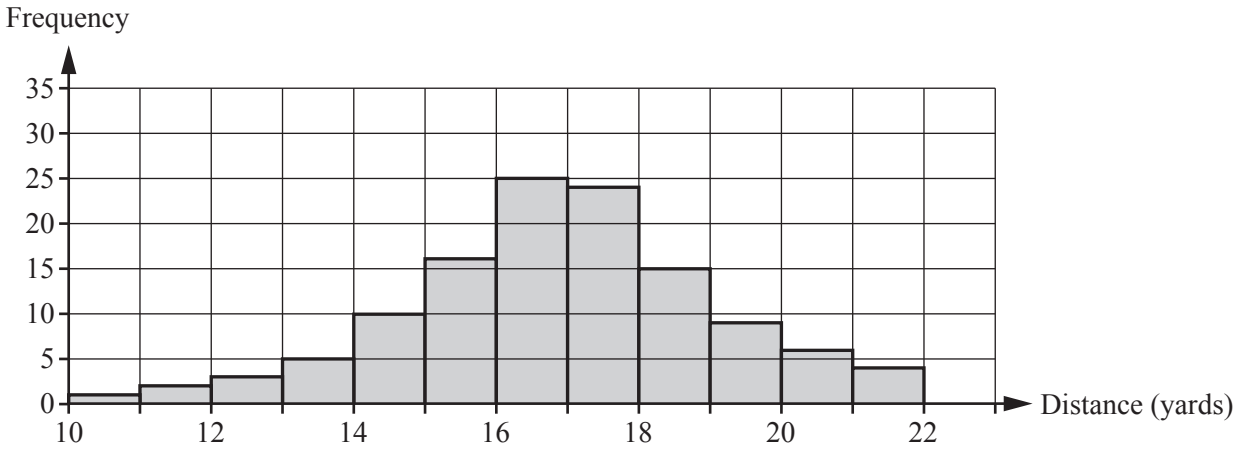

Fig. 5.2

(iii) Give two comments on how Charlie's bowling compares with what Asif is expecting. **[2]**

5 (iii)	

6 Vicky is a folk singer. She gives concerts in village halls in the area where she lives. When deciding how much to charge for tickets she uses the demand curve in Fig. 6.1. This is based on experience from previous concerts.

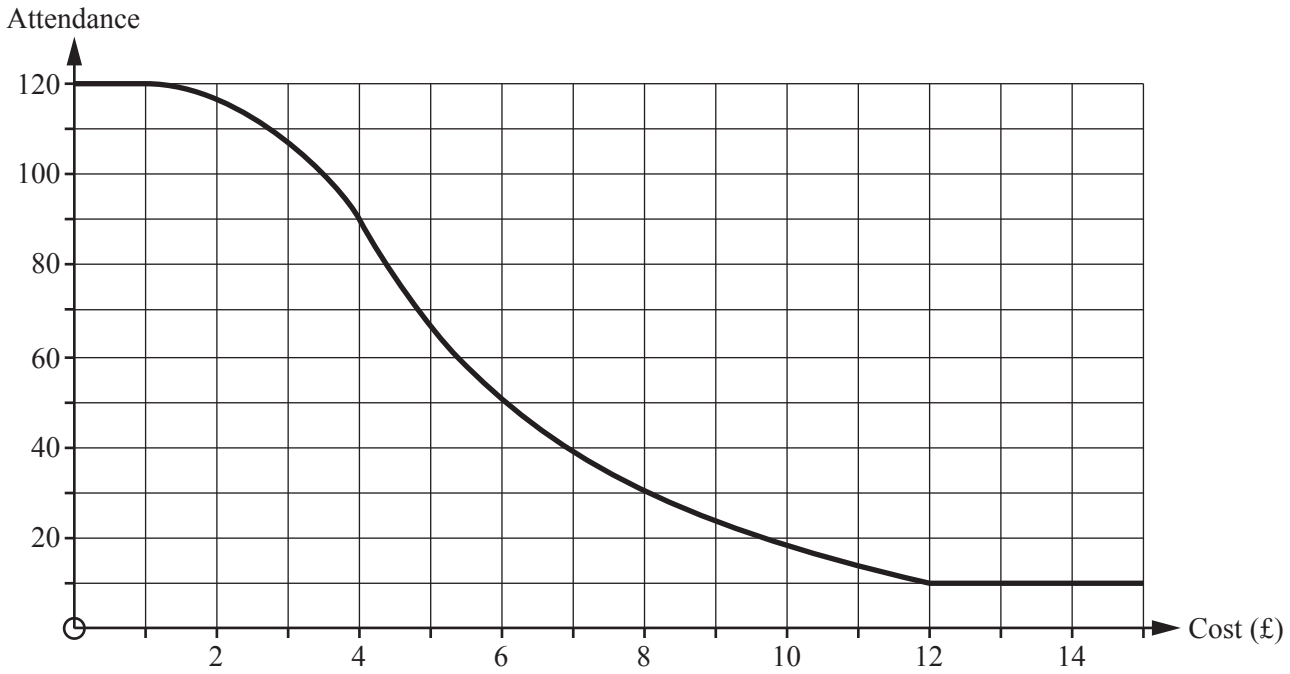

Fig. 6.1

(i) How many people does Vicky expect if she charges £6? **[1]**

(ii) Vicky has a group of loyal supporters who will come to her concerts whatever the cost, up to £25.

How many people are in this category? **[1]**

6 (i)	
6 (ii)	

Vicky pays £120 for the hire of the hall.

(iii) Complete this spreadsheet (Fig. 6.2), showing Vicky's expected income, costs and profit when she charges various prices for the entrance tickets. **[3]**

(iv) There are formulae in cells C2 and E2 and they are copied down their columns.

Write down the formulae in cells C2 and E6. **[2]**

(v) State, with a reason, how much you would advise Vicky to charge for a ticket, given that she wants it to a whole number of pounds. **[1]**

6 (iii)

	A	B	C	D	E
1	**Ticket price (£)**	**Attendance**	**Income (£)**	**Hall (£)**	**Profit (£)**
2	0	120	0	120	−120
3	1	120	120	120	0
4	2	117	234	120	114
5	3	107	321	120	201
6	4				
7	5	66	330	120	210
8	6				
9	7	39	273	120	153
10	8	30	240	120	120
11	9	23	207	120	87
12	10	18	180	120	60
13	11	14	154	120	34
14	12	10	120	120	0
15	13	10	130	120	10
16	14				
17	15	10	150	120	30

Fig. 6.2

6 (iv) **C2**

E6

6 (v)

Vicky realises that her concert will be on the same evening as the final of a very popular competition on television. She estimates this will reduce total attendance by 60%.

(vi) For what ticket price will Vicky just break even?

For what prices will she still make a profit? **[5]**

6 (vi)	

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Question 7 begins on page 14

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7 **(a)** Table 7 below refers to weekday trains from London Paddington to Plymouth. For each train it gives the scheduled times of departure and arrival, the duration of the journey in minutes and the number of station stops along the way.

(i) Complete the three missing figures from the 'Journey time' column. **[2]**

7(a)(i)

Paddington Departure	Plymouth Arrival	Station stops	Journey time (Minutes)
0706	1033	9	207
0906	1227	7	201
1006	1305	3	179
1106	1433	8	207
1205	1505	3	180
1305	1623	6	198
1406	1721	6	195
1506	1839	9	213
1606	1926	7	200
1703	2024	7	201
1803	2118	5	
1903	2226	7	203
1945	2325	11	
2035	0011	10	

Table 7

(ii) In Fig. 7.1, the journey times, t, for these trains are plotted against the number of stops, n, but three of the points are missing. Mark in the missing points.

Draw the line with equation $t = 165 + 5n$ on the graph. **[4]**

(iii) Comment on whether the line $t = 165 + 5n$ is a good model, justifying your answer.

Interpret the numbers 165 and 5 in this equation. **[3]**

7(a)(ii)

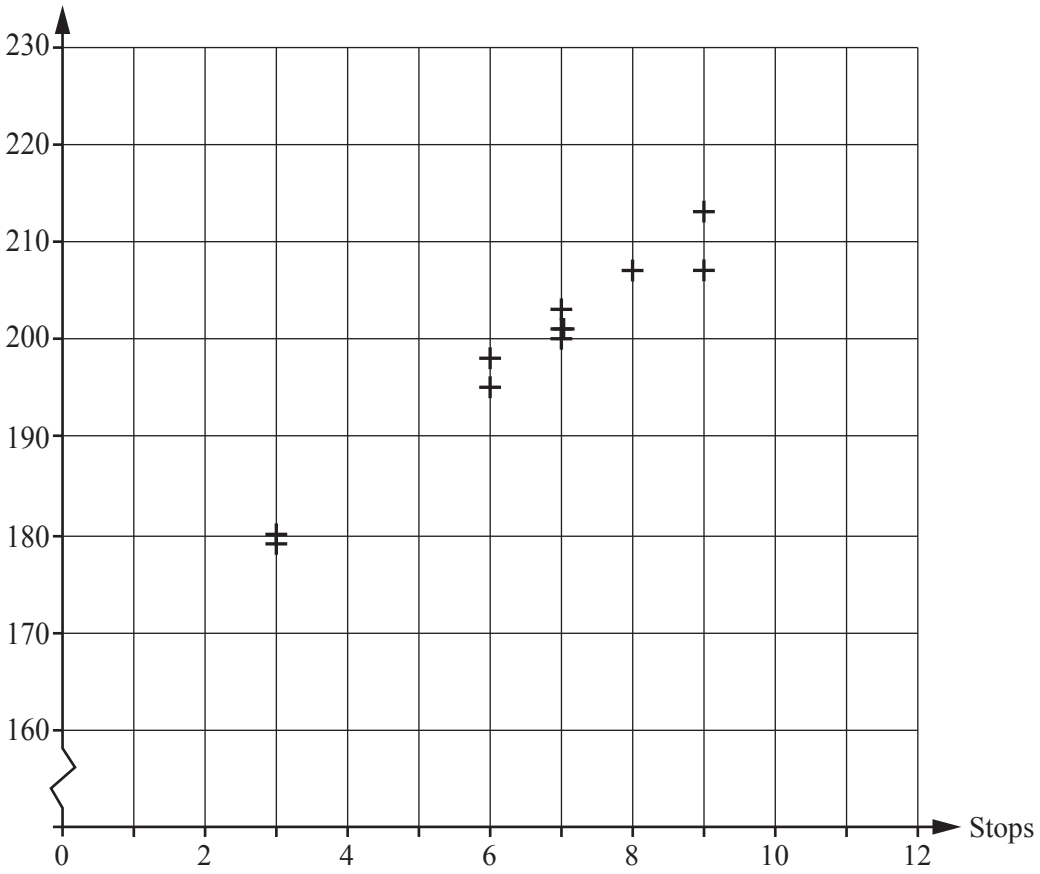

Fig. 7.1

7(a)(iii)

(iv) Make n the subject of the equation $t = 165 + 5n$.

Use your answer to estimate the number of stops for a special train taking 4 hours and 1 minute from London Paddington to Plymouth. **[3]**

7(a)(iv)	

(b) **(i)** Fig. 7.2 is a speed-time graph modelling a train approaching, stopping at and leaving a station. Speed is in metres per second ($m\,s^{-1}$) and time is in seconds (s).
[There is another copy of Fig. 7.2 for you to refer to on page 18.]

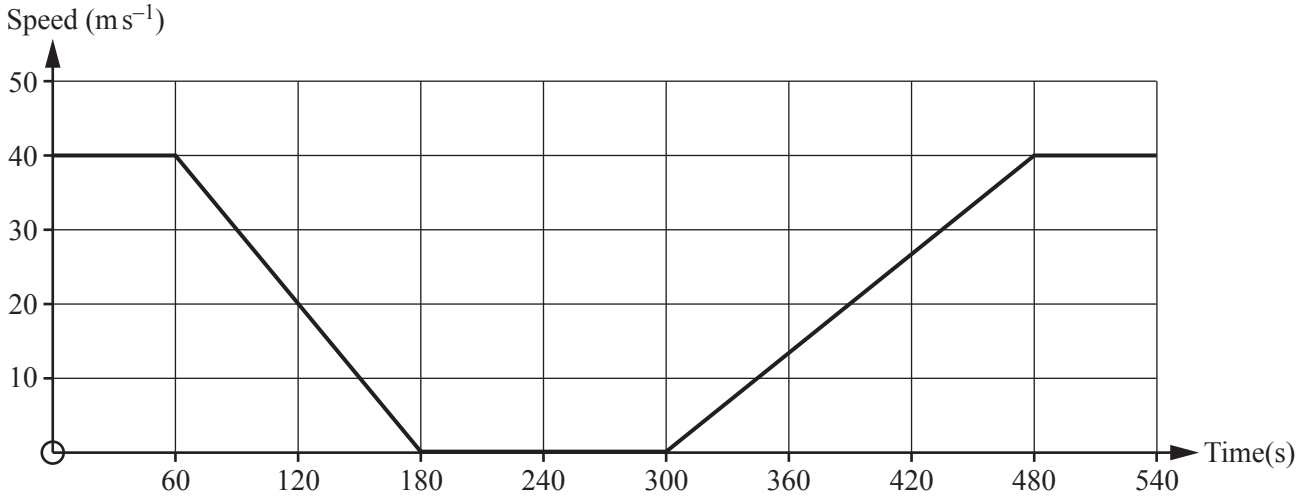

Fig. 7.2

Use the graph to find the number of minutes for which the train was stationary at the station.

Find also the number of minutes for which the train was **not** travelling at full speed of $40\,m\,s^{-1}$.

[2]

7(b)(i)	

(ii) According to this model, the maximum speed of the train was $40\,m\,s^{-1}$.

Convert this speed into miles per hour.

Comment on whether this is a realistic top speed for a train.

[You may use the fact that 5 miles is about the same as 8 km.] **[4]**

7(b)(ii)	

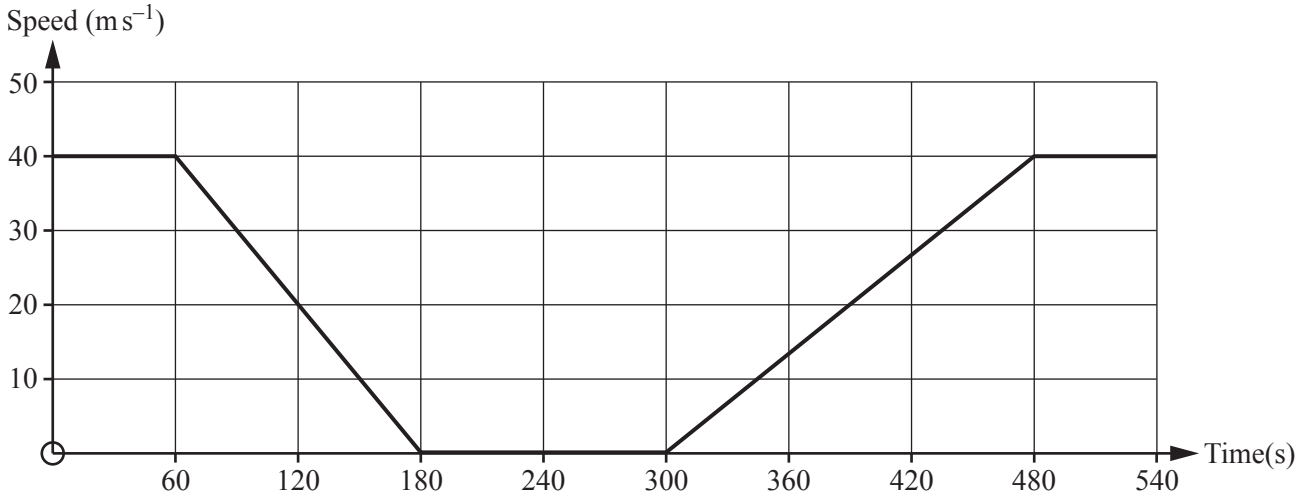

Fig. 7.2 (repeated)

(iii) Use the graph to calculate the acceleration of the train when it leaves the station. **[2]**

(iv) The distance travelled is given by the area under a speed-time graph.

Show that the distance the train travelled in the 540 seconds covered by the graph was 10.8 km.

Find also the distance the train would have travelled during this time if it had not stopped at the station but instead had maintained its speed of 40 m s^{-1}. **[3]**

7(b)(iii)	

7(b)(iv)	

(v) Hence estimate the increase in the train's journey time caused by its stopping at the station.

Compare your answer with the equivalent figure for the London Paddington to Plymouth trains in part **(a)** of this question. **[3]**

7(b)(v)	

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).