Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2019

Statistics

Unit 1
Higher Tier

GST12

[GST12]
THURSDAY 13 JUNE, AFTERNOON

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all ten** questions.
Any working should be clearly shown in the spaces provided since marks may be awarded for partially correct solutions.
You **may** use a calculator for this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 100.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You should have a calculator, ruler, compasses and protractor.
The formula sheet is on page 2.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

HIGHER TIER FORMULA SHEET

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Spearman's Rank Correlation Coefficient

$$r_s = 1 - \left(\frac{6\sum d^2}{n(n^2 - 1)}\right)$$

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(Questions start overleaf)

Answer **all** questions

Examiner Only	
Marks	Remark

1 A researcher wants to get the opinions of a town's residents about proposed changes to the traffic system.

The council decides to carry out a sample survey to gather residents' opinions instead of a census.

(a) Give two advantages to carrying out a sample survey rather than a census.

1. _____

_____ [1]

2. _____

_____ [1]

The researcher will use a questionnaire for the survey.

One of the questions on the questionnaire is:

> *There is currently too much road traffic in the town. Don't you agree?*
>
> **Yes** ☐ **No** ☐

(b) Give one reason why this question is not suitable.

_____

_____

_____ [1]

Before using the questionnaire with the sample of residents, the researcher decides to conduct a pilot survey.

(c) Give two reasons why this is a good idea.

1. _____

_____ [1]

2. _____

_____ [1]

A sample of 300 people is chosen in the town centre for the survey.

(d) Suggest a reason why this would not be a suitable sampling method.

_____

_____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 The table below gives information about the employment rate and median starting salary for students graduating from university in 2017

Graduates 21–30	Employment rate	Unemployment rate	Continuing education	Median salary (nearest £500)
Gender				
Male	78.6%	4.7%	17.0%	£26,500
Female	78.8%	3.5%	18.0%	£23,000
Area of England				
East Midlands	79.0%	3.8%	17.3%	£22,000
East of England	77.9%	5.2%	17.2%	£26,000
London	78.8%	5.4%	16.0%	£29,500
North East	74.9%	12.1%	12.9%	£22,000
North West	79.1%	2.4%	18.5%	£23,500
South East	80.3%	2.9%	16.8%	£26,500
South West	77.7%	2.0%	20.3%	£24,000
West Midlands	77.7%	3.5%	18.8%	£22,000
Yorkshire and the Humber	79.8%	2.7%	17.5%	£23,000

For one area of England, the unemployment rate is twice that of another.

(a) Name these two areas.

_____ [1]

(b) Does the area of England with the highest employment rate have the lowest unemployment rate?

Yes ☐ **No** ☐ [1]

The median starting salary for graduates in London was £29,500

Examiner Only	
Marks	Remark

(c) Give an interpretation, in context, of this value.

_____

_____

_____

_____ [2]

James is in his final year at university and he is looking at the table to see where he should look for a job next year.

(d) Which area of England would you recommend for James?

_____

Give a reason for your answer.

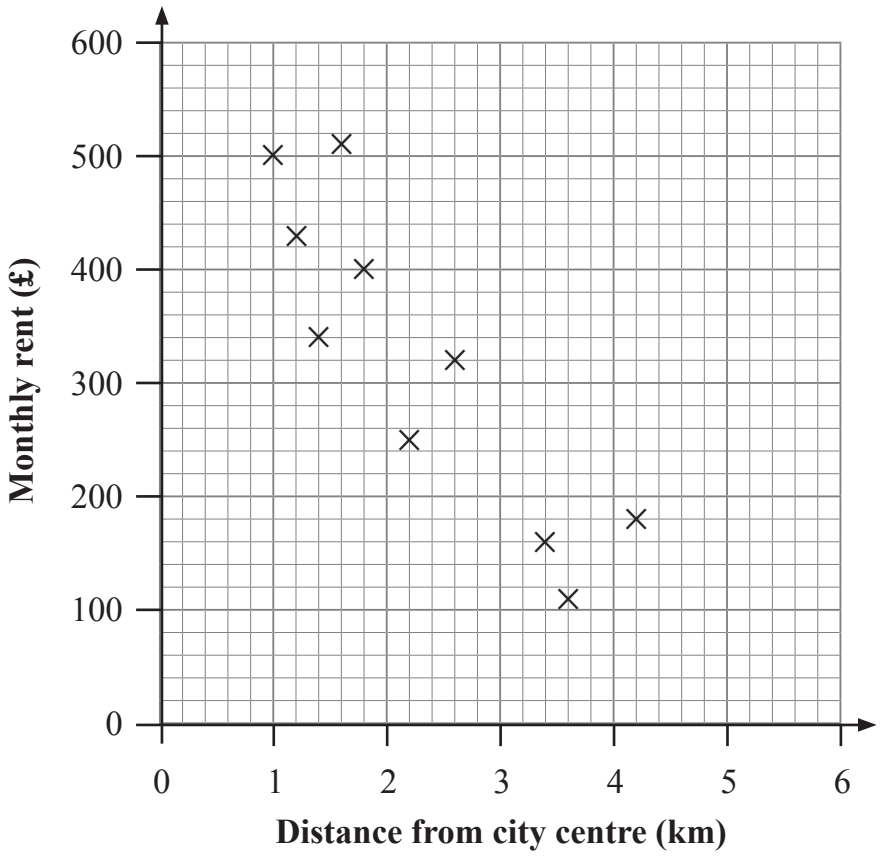
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

3 The scatter diagram below shows some information about the monthly rent and distance from the city centre for 10 apartments in a city.



(a) Show that the mean distance from the city centre is 2.3 km.

[2]

The mean monthly rent for the 10 apartments is £320

(b) Plot the double mean point on the scatter diagram and draw a line of best fit. [2]

(c) **(i)** What type of correlation does the scatter diagram show?

Positive Correlation ☐ **Negative Correlation** ☐ [1]

(ii) What conclusion can you draw about the relationship between the distance from the city centre and the monthly rent of an apartment?

_____

_____

_____ [1]

(d) Ella lives 3.0 km from the city centre.

(i) Could Ella use the line of best fit on the scatter diagram to estimate a price for her monthly rent?

Yes ☐ **No** ☐ [1]

(ii) Give a reason for your answer.

_____

_____

_____ [1]

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Marks	Remark

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Marks	Remark

4 Peter and Helen want to collect information about how much time pupils at their school spend on homework every week. They attend a large post-primary school with 1400 pupils.

Peter is planning to use systematic sampling to select 50 pupils.

(a) Describe how Peter could select his sample.

_____

_____

_____

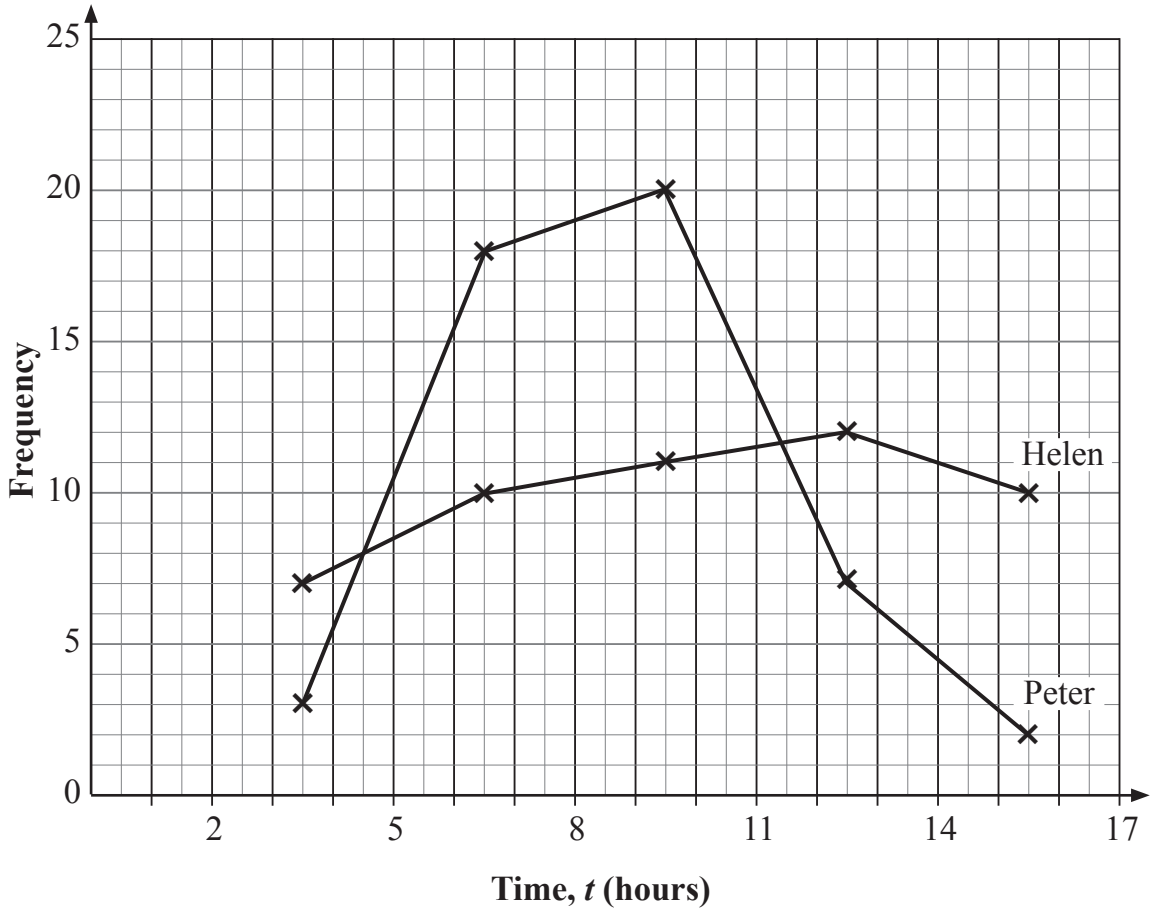
_____ [3]

Helen is planning to select 50 pupils from outside the canteen.

(b) Name the method of sampling which Helen is planning to use.

_____ [1]

Peter and Helen summarise their results in a frequency polygon.



(c) Use the frequency polygon to write down:

(i) the median class for Peter's data;

Answer _____ [2]

(ii) the modal class for Helen's data.

Answer _____ [1]

(d) Compare the results from both sample surveys.

_____

_____

_____

_____ [2]

(e) **(i)** Who has collected a more reliable set of data?

_____ [1]

(ii) Give a reason for your answer.

_____

_____

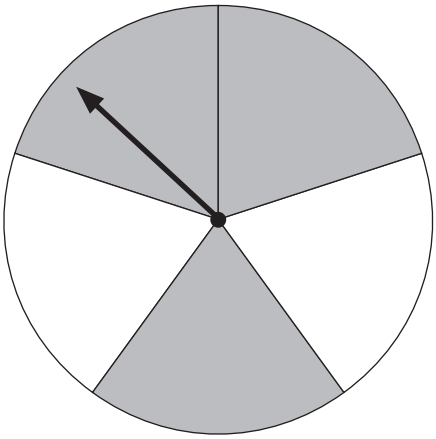
_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

5 Cathy and John are doing an investigation with a spinner.

The spinner has equally-sized sectors which are either shaded (**S**) or not shaded (**N**), as shown in the diagram below.

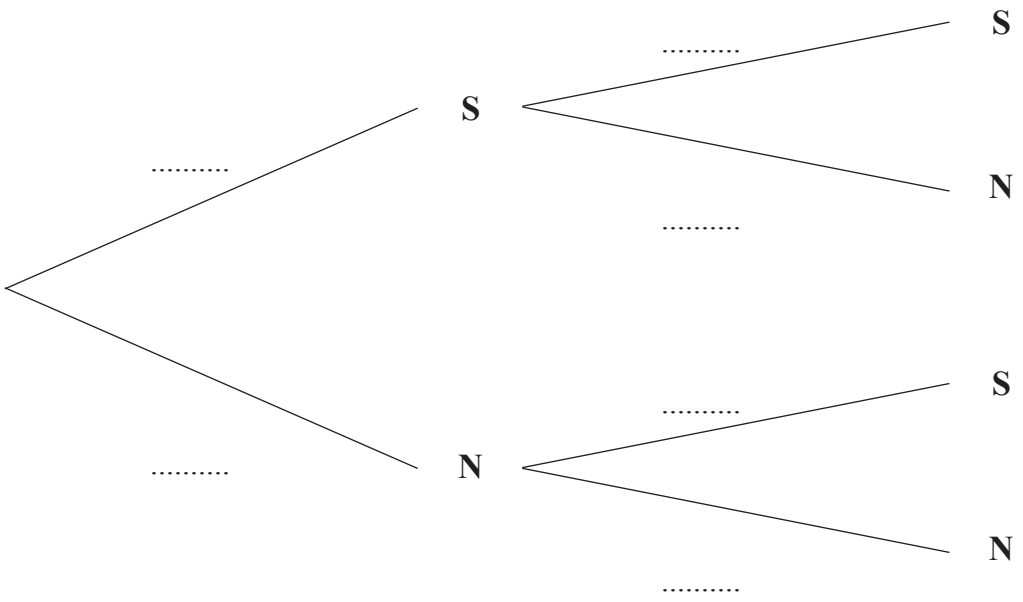


John spins the spinner twice.

(a) Write down the probability that the arrow lands on a shaded sector on John's first spin.

Answer _____ [1]

(b) Complete the probability tree diagram for John's two spins.



[3]

(c) Calculate the probability that John gets

(i) a shaded sector on both spins;

Answer _____ [2]

(ii) a different outcome on each spin.

Answer _____ [3]

Cathy thinks that the spinner might be biased, so she spins it 200 times and records the outcome each time.

(d) How many times should Cathy expect the spinner to land on a shaded sector?

Answer _____ [1]

In the 200 spins, the spinner landed on a shaded sector 118 times.

(e) How might Cathy interpret this result?

_____

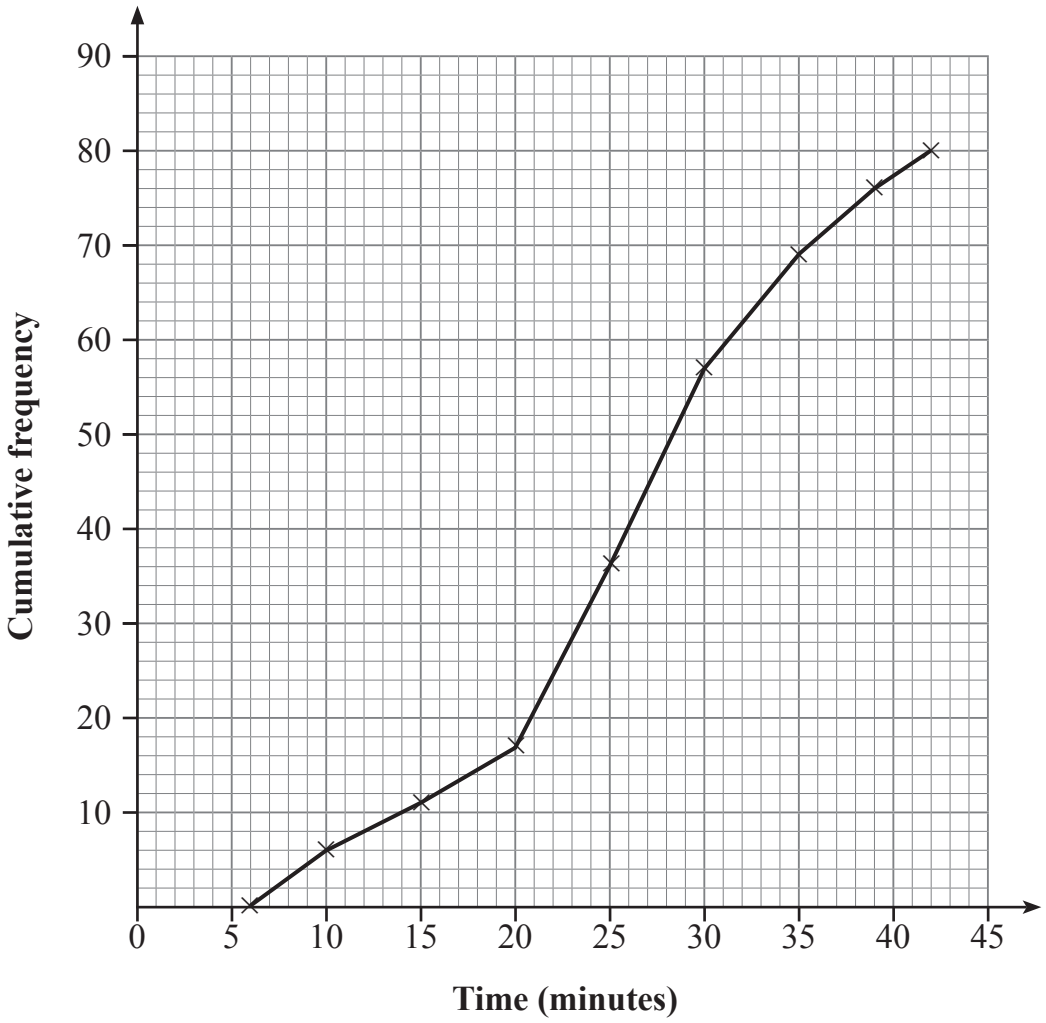
_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 Mark surveyed the teachers in his school to find out how long it took them to travel to work. He plotted his results in the cumulative frequency diagram below.



(a) What was the median time taken by the teachers to travel to school?

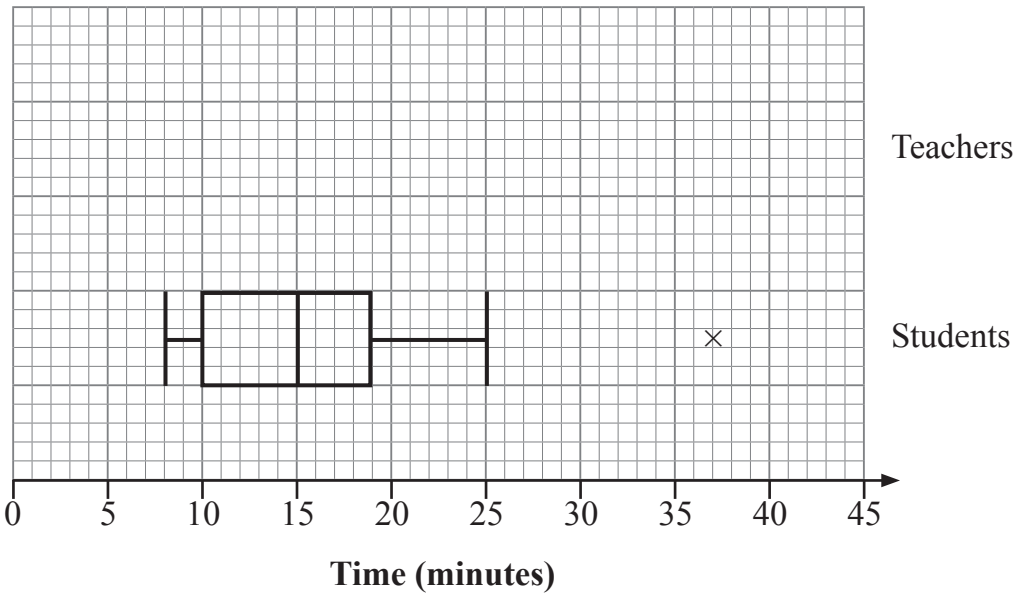
Answer _____ minutes [1]

(b) Find the interquartile range of the times taken by the teachers to travel to school.

Answer _____ minutes [2]

Examiner Only	
Marks	Remark

On the same day, Mark surveyed the students in the school about how long it took them to travel to school. His results are summarised in the box plot below.



The point marked × on the diagram represents an outlier.

(c) Use a suitable calculation to verify that the value represented by × is an outlier.

[3]

(d) In the space indicated on the diagram, draw a box plot for the teachers.

[3]

(e) Compare the travel times for teachers with the travel times for students.

_____

_____

_____

_____

_____

_____ [4]

Due to roadworks, the travel time for every student in the school will increase by exactly 5 minutes.

Examiner Only	
Marks	Remark

(f) Comment on the effect this will have on

(i) the median of the journey times for students;

_____ [1]

(ii) the range of the journey times for students.

_____ [1]

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(Questions continue overleaf)

Examiner Only	
Marks	Remark

7 **Table 1** below shows the estimated quarterly expenditure on cycling equipment in Northern Ireland between 2014 and 2016

Table 1

		Expenditure (nearest £ thousand)			
		Q1	**Q2**	**Q3**	**Q4**
Year	**2014**	127	188	240	160
	2015	145	199	254	147
	2016	145	202	254	163

The estimated expenditure on cycling equipment was highest in Quarter 3 each year.

(a) Suggest a reason for this.

_____

_____

_____ [1]

(b) The first seven 4-point moving averages have been calculated, to the nearest thousand, as follows:

179 **183** **186** **190** **186** **186** **187**

(i) Explain briefly why a 4-point moving average has been used.

_____

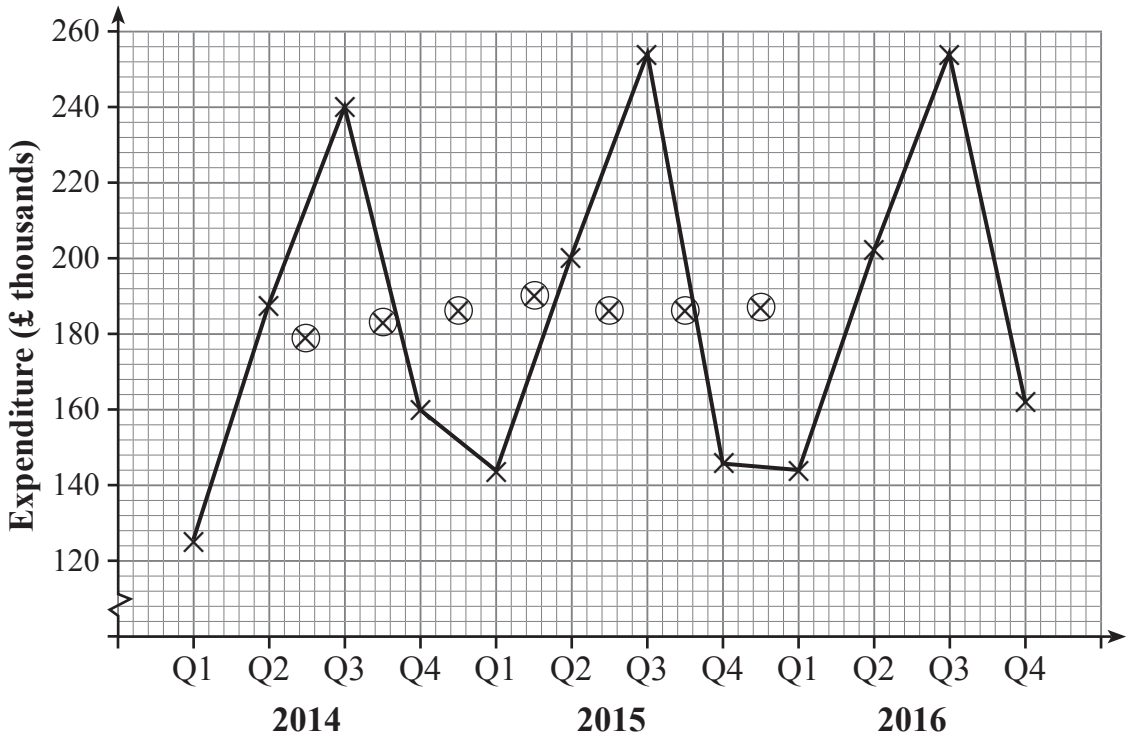
_____

_____ [1]

(ii) Calculate the last two 4-point moving averages.

Answer _____ and _____ [2]

The time series graph below shows the data in **Table 1**.
In addition, the first seven moving averages have been plotted.



(c) Plot the remaining two moving averages, calculated in part **(b)(ii)**, on the graph and draw a trend line. [2]

(d) Use your trend line to estimate the expenditure, to the nearest £ thousand, for Quarter 1 of 2017

Answer £ _____ thousand [3]

Examiner Only	
Marks	Remark

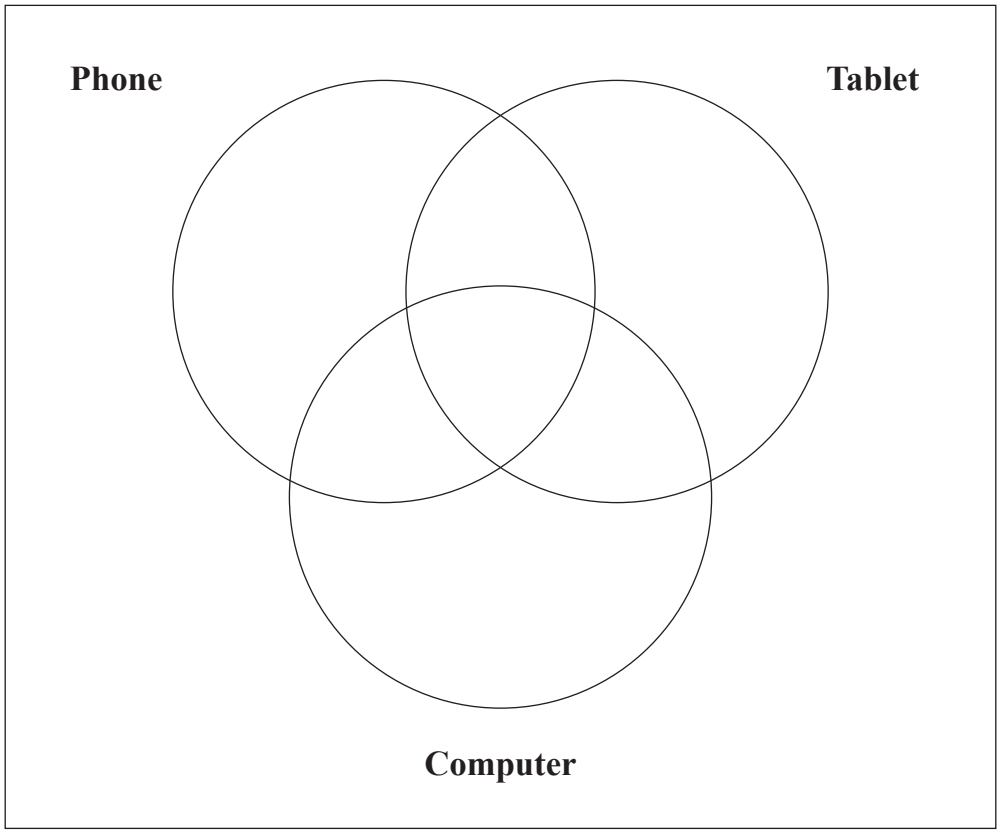
Examiner Only	
Marks	Remark

8 A group of 150 people were surveyed about electronic devices they owned.

The results were as follows:

96 people owned a phone,
87 people owned a tablet,
91 people owned a computer,
53 people owned a phone and a tablet,
62 people owned a phone and a computer,
55 people owned a tablet and a computer,
28 people owned all three devices.

(a) Complete the Venn diagram below.



[4]

(b) How many people did not own a phone or a computer?

Answer _____ [1]

One of the 150 people surveyed was chosen at random.

(c) Find the probability that this person owned a tablet only.

Answer _____ [1]

One person who owned a tablet was chosen at random.

(d) Find the probability that they owned a computer too.

Answer _____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

9 On a given day, the probability that Michael is on time for work is 0.6

(a) Calculate the probability that Michael is not on time for work on two days in a row.

Answer _____ [2]

(b) **(i)** Write down the name of the most appropriate distribution to model the number of times Michael will be on time for work in a five-day period.

Answer _____ [1]

(ii) For this model, write down the number of trials, n, and the probability of a success, p.

$n =$ _____ [1]

$p =$ _____ [1]

(c) Calculate the probability that Michael will be on time for work twice in a five-day period.

You may use $(p + q)^5 = p^5 + 5p^4q + 10p^3q^2 + 10p^2q^3 + 5pq^4 + q^5$

Answer _____ [3]

(d) Calculate the probability that Michael will be on time for work at least four times in a five-day period.

You may use $(p + q)^5 = p^5 + 5p^4q + 10p^3q^2 + 10p^2q^3 + 5pq^4 + q^5$

Answer _____ [3]

Examiner Only	
Marks	Remark

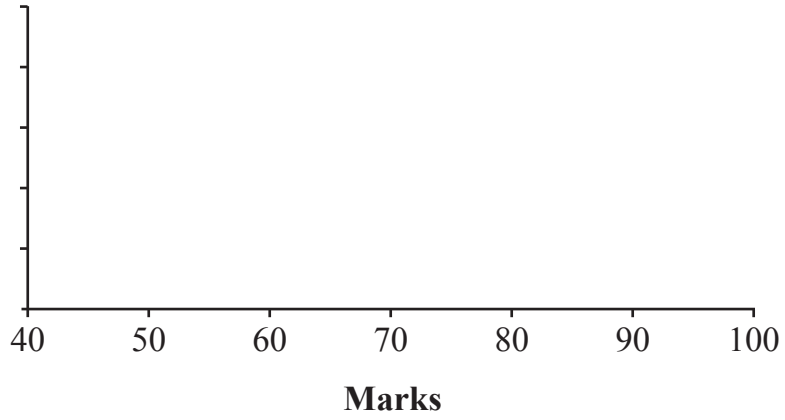
Examiner Only	
Marks	Remark

10 Year 12 students completed tests in Digital Technology, Home Economics and Religious Studies.

The results in each test were normally distributed.

The mean of the Digital Technology results was 65 and the standard deviation was 5

(a) On the grid below sketch the distribution of the Digital Technology results.



[2]

Niamh got 71 marks in the Digital Technology test.

(b) Calculate Niamh's standardised score in Digital Technology.

Answer _____ [2]

Niamh's standardised score in the Home Economics test was 0.3

(c) **(i)** Which test did Niamh do better in?

Digital Technology ☐ **Home Economics** ☐ [1]

(ii) Give a reason for your answer.

_____

_____

_____

_____ [1]

The marks (x) of 30 students in the Religious Studies test are summarised as follows:

$$\sum x = 2124 \qquad \sum x^2 = 151\,887$$

(d) (i) Calculate the mean of the Religious Studies marks.

Answer _____ [2]

(ii) Calculate the standard deviation of the Religious Studies marks.

Answer _____ [3]

Niamh's standardised score in the Religious Studies test was − 0.92

(e) Using your answers to parts **(d)(i)** and **(d)(ii)**, calculate Niamh's test result in Religious Studies.

Answer _____ [3]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark