



Rewarding Learning

General Certificate of Secondary Education

Centre Number

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Candidate Number

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# Statistics

Unit 2  
Higher Tier



**MV18**

## [GST22] Assessment

Assessment Level of Control    Tick the relevant box (✓)

### Time

Controlled Conditions	<input type="checkbox"/>
Other	<input type="checkbox"/>

2 hours, plus your additional allowance.

### 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 at the end of each question 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.

## HIGHER TIER FORMULA SHEET

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

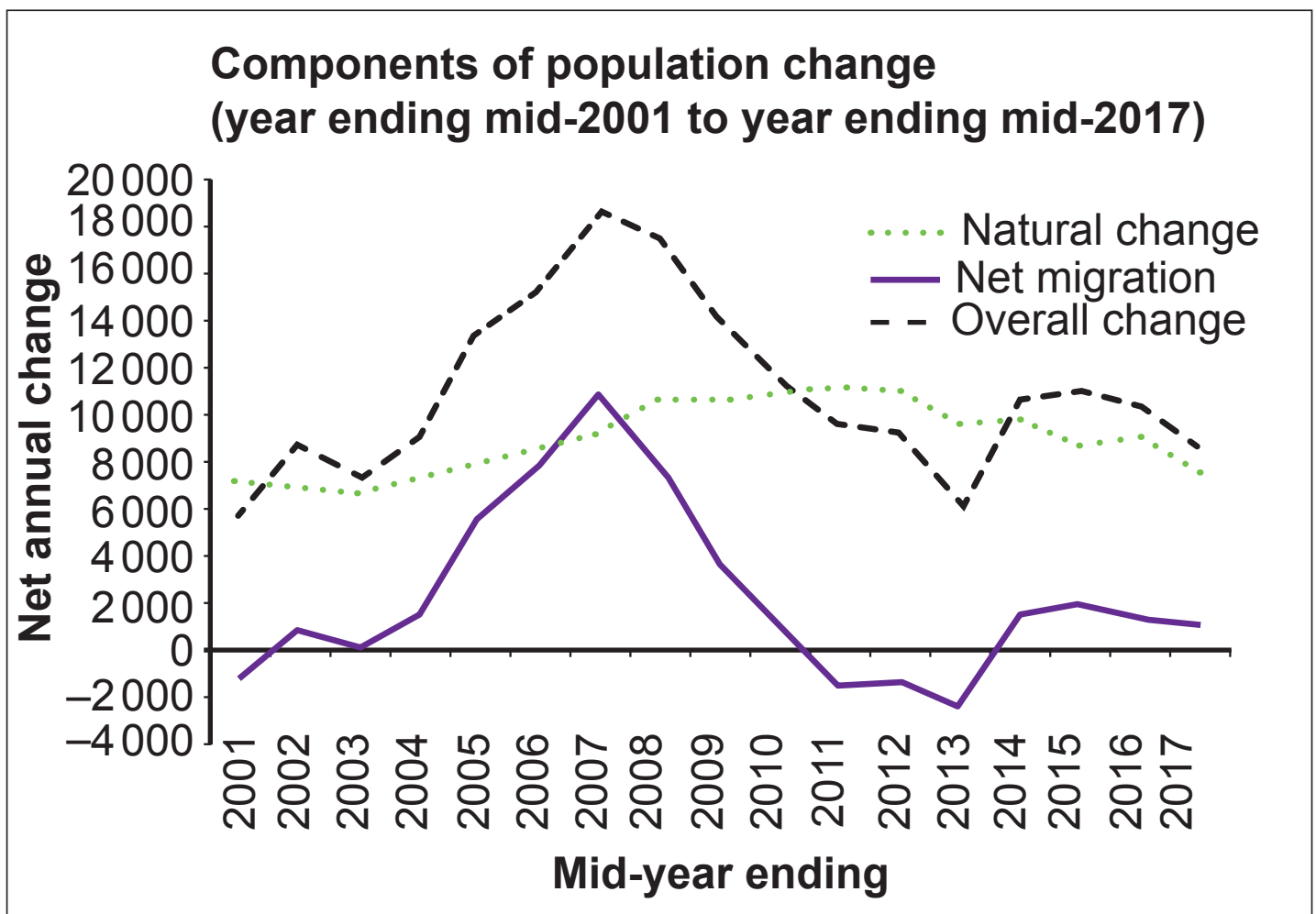
### Spearman's Rank Correlation Coefficient

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

**Blank page**  
**(Questions begin overleaf)**

Answer **all** questions

1 The chart below shows the components of population change between mid-2001 and mid-2017



(a) (i) Use the graph to estimate the net migration figure for mid-2013 [1 mark]

Answer \_\_\_\_\_

(ii) Explain the meaning of this value. [1 mark]

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**(b)** Describe the trend in natural change between mid-2001 and mid-2017 [2 marks]

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The Natural change line crosses the Overall change line three times.

**(c) (i)** When did this happen? [3 marks]

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**(ii)** Give a possible interpretation, in context, of this observation. [2 marks]

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- 2** Sam wants to find out about the number of pets owned by the residents in Castlewellan.

She records the number of pets owned by a sample of people.

The table below shows her results.

<b>Number of pets</b>	0	1	2	3	4
<b>Number of people</b>	27	58	11	3	1

- (a)** How many people were in the sample? [1 mark]

Answer \_\_\_\_\_

- (b)** Calculate the mean number of pets per person.  
[3 marks]

Answer \_\_\_\_\_

**(c)** Work out the range for this set of data. [1 mark]

Answer \_\_\_\_\_

**(d)** Suggest a suitable diagram to display the data in the table.

Give a reason for your choice. [2 marks]

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To collect the data for her sample, Sam asked people as they left Castlewellan Forest Park one afternoon.

**(e) (i)** Write down the name of this method of sampling. [1 mark]

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**(ii)** Give a reason why the results of the survey may not be reliable. [1 mark]

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**3** Maria is investigating how the age and gender distribution of the population of Northern Ireland has changed between June 2008 and June 2018

She intends to use the statistical enquiry cycle to carry out her investigation.

**(a)** Write down a suitable question which Maria could use for her investigation. [1 mark]

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**(b)** What data would Maria need to collect? [3 marks]

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**(c)** Suggest a suitable source for Maria's data. [1 mark]

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**(d)** How could Maria present her results in diagrammatic form? [2 marks]

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(e) Suggest a suitable calculation which Maria could use and how she could interpret the result. [3 marks]

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4 The table below shows the annual population estimates by age group in Northern Ireland between mid-2001 and mid-2017

**Annual population estimates by broad age groups, Northern Ireland (mid-2001 to mid-2017)**

Mid-Year Ending	Age groups					As a proportion of all ages				
	All ages	0–15	16–64	65+	85+	0–15	16–64	65+	85+	
2001	1688800	397500	1067200	224100	23500	23.5	63.2	13.3	1.4	
2002	1697500	391700	1079000	226800	23700	23.1	63.6	13.4	1.4	
2003	1704900	385900	1089700	229400	23800	22.6	63.9	13.5	1.4	
2004	1714000	381200	1100600	232200	24400	22.2	64.2	13.5	1.4	
2005	1727700	378800	1114100	234900	25900	21.9	64.5	13.6	1.5	
2006	1743100	377100	1127900	238100	27000	21.6	64.7	13.7	1.6	
2007	1761700	377100	1142700	241900	27900	21.4	64.9	13.7	1.6	
2008	1779200	378500	1153200	247500	28900	21.3	64.8	13.9	1.6	
2009	1793300	379500	1160400	253400	29700	21.2	64.7	14.1	1.7	
2010	1804800	380000	1165200	259600	30800	21.1	64.6	14.4	1.7	
2011	1814300	380800	1167800	265800	31800	21.0	64.4	14.6	1.8	
2012	1823600	382100	1168700	272800	32700	21.0	64.1	15.0	1.8	
2013	1829700	382600	1168000	279100	33300	20.9	63.8	15.3	1.8	
2014	1840500	383800	1170800	285900	34400	20.9	63.6	15.5	1.9	
2015	1851600	385200	1174600	291800	35500	20.8	63.4	15.8	1.9	
2016	1862100	388000	1176400	297800	36500	20.8	63.2	16.0	2.0	
2017	1870800	390700	1177200	303000	37200	20.9	62.9	16.2	2.0	

**(a)** What was the estimated total population in mid-2004?  
[1 mark]

Answer \_\_\_\_\_ million people

**(b)** Does the information in the table suggest that the population is continuing to age? Explain your answer.  
[2 marks]

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Teresa thinks that the totals for all ages in the table have been calculated incorrectly. She says, “In 2001 the total population has been stated as 1 688 800 but the age group totals add up to 1 712 300.”

**(c)** Explain whether or not Teresa is correct. [3 marks]

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Teresa wishes to analyse the trend in estimated total population in Northern Ireland between mid-2001 and mid-2017

**(d)** Write down the name of one diagram Teresa could use to illustrate this trend. [1 mark]

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Teresa decides to use simple index numbers to analyse the trend in estimated total population in Northern Ireland between mid-2001 and mid-2017

She uses mid-2001 as the base period.

**(e)** Write down the index number for mid-2001 [1 mark]

Answer \_\_\_\_\_

Teresa calculates the simple index number for mid-2017 to be 110.8

**(f)** Use this information to complete the sentence below. [3 marks]

The population in \_\_\_\_\_ is  
\_\_\_\_\_ % more than it was in  
\_\_\_\_\_ .

- 5 The table below shows the amount of rainfall, in millimetres (mm), recorded over a period of time at a weather station in Armagh.

Rainfall, $r$ , (mm)	Number of days	Cumulative frequency
$0 < r \leq 10$	12	
$10 < r \leq 20$	20	
$20 < r \leq 30$	48	
$30 < r \leq 40$	32	
$40 < r \leq 50$	8	

- (a) Write down the modal class interval for the amount of rainfall. [1 mark]

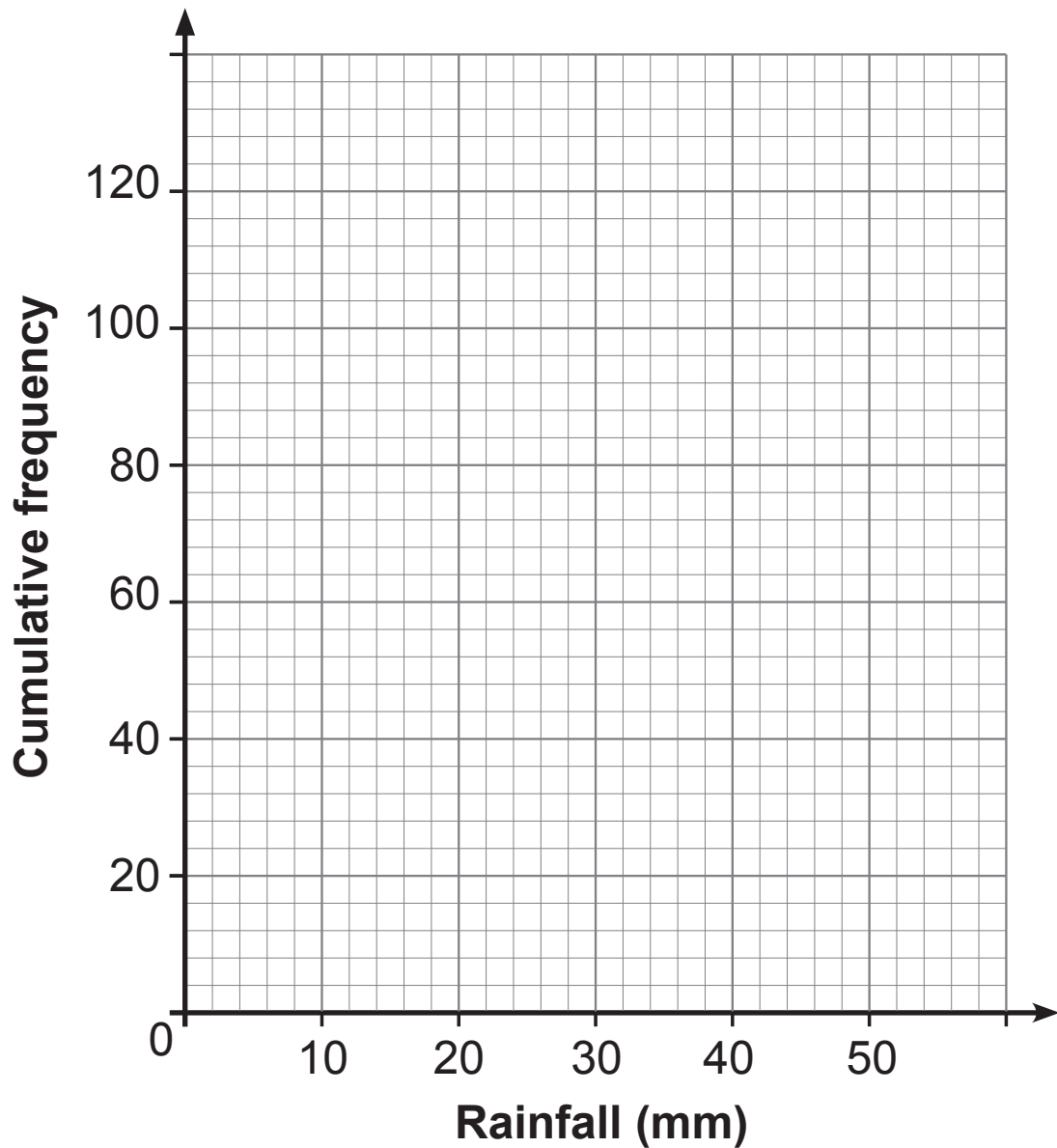
Answer \_\_\_\_\_

- (b) Complete the cumulative frequency column in the table above. [2 marks]

- (c) Write down the class interval which contains the median. [1 mark]

Answer \_\_\_\_\_

(d) Using the axes below, draw a cumulative frequency diagram for the data in the table. [3 marks]



(e) Use the cumulative frequency diagram to find an estimate of

(i) the median amount of rainfall; [1 mark]

Answer \_\_\_\_\_ mm

**(ii)** the interquartile range for the amount of rainfall;  
[2 marks]

Answer \_\_\_\_\_ mm

**(iii)** the percentage of days that had more than 38 mm of rain. [3 marks]

Answer \_\_\_\_\_ %

**(f)** Explain why the answers to part **(e)** are estimates.  
[1 mark]

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**6** The manager of a supermarket is worried that customers are unhappy about how long they have to queue at the checkouts.

He decides to carry out a survey among a sample of customers.

**(a)** Why would it not be possible for the manager to select a simple random sample? [1 mark]

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To collect the data, each customer is given a link to an online survey at the bottom of their receipt.

**(b)** Give one advantage and one disadvantage of this method of data collection. [1 mark for each]

Advantage \_\_\_\_\_

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Disadvantage \_\_\_\_\_

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The results of the survey show that most customers think they spend too long in queues.

The manager is considering installing a new checkout to reduce the length of the queues.

The assistant manager suggests carrying out a simulation before installing the new checkout.

**(c)** Explain why a simulation is an appropriate method of data collection in this case. [2 marks]

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- 7 Friends Emma and Ronan are tasting different types of cake to serve at their wedding.

They taste eight types of cake and give each one a score out of 20

Their scores are given in the table below.

Type of cake	A	B	C	D	E	F	G	H
Emma's score	12	19	7	10	13	15	5	8
Ronan's score	14	17	10	12	18	15	7	10

- (a) Calculate Spearman's rank correlation coefficient for the data in the table. [4 marks]

Answer \_\_\_\_\_

**(b)** How could Emma and Ronan interpret this value?  
[2 marks]

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**(c)** Give two reasons why calculating Spearman's rank correlation coefficient is appropriate for the type of data in the table. [1 mark for each]

1. \_\_\_\_\_

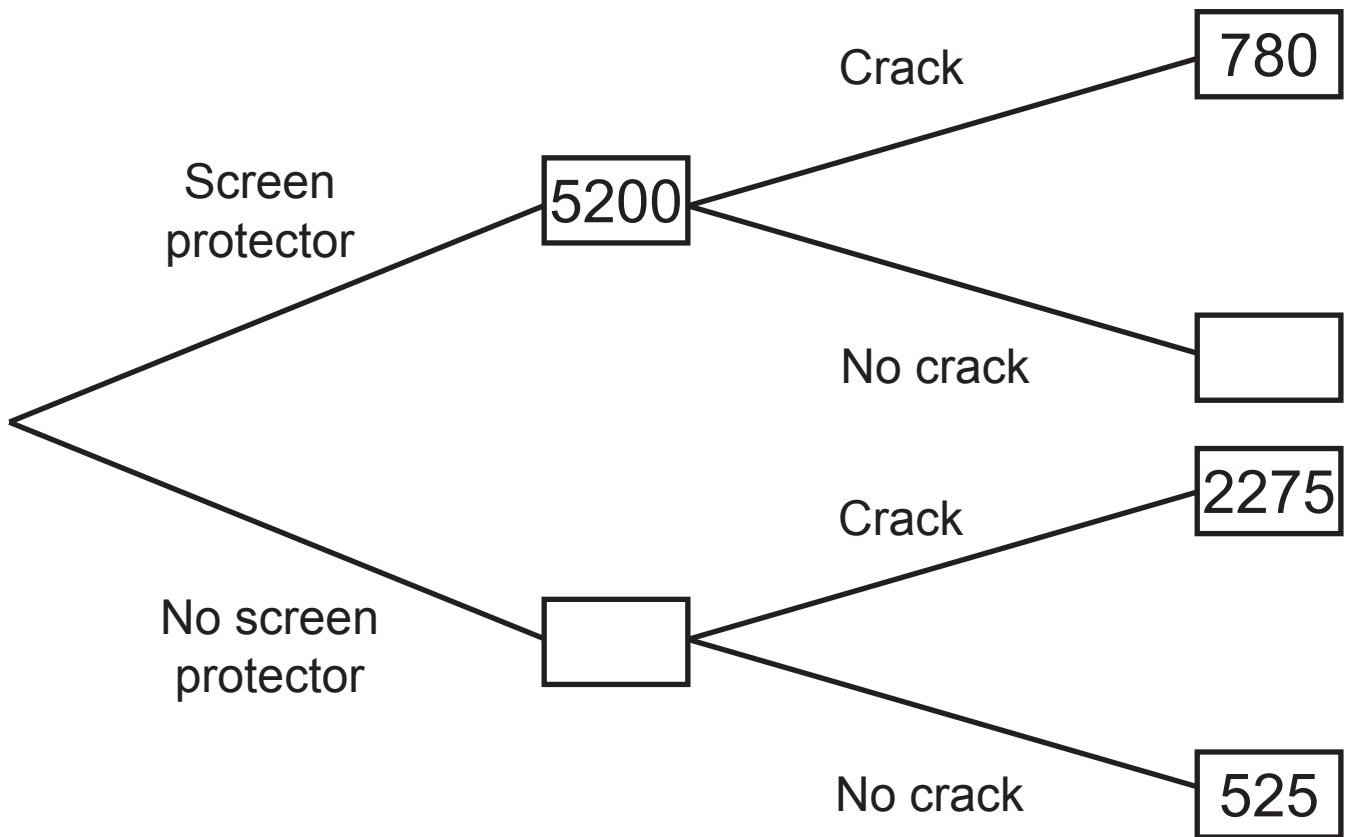
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2. \_\_\_\_\_

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- 8 The frequency tree diagram below shows the number of mobile phone owners in a small town who applied a screen protector to their phone and whether their screen had cracked after one year.



- (a) Complete the missing frequencies in the tree diagram.  
[2 marks]

A mobile phone owner from the town is chosen at random.

- (b) Calculate the probability that this owner applied a screen protector and their screen had not cracked.  
[2 marks]

Answer \_\_\_\_\_

**(c) (i)** Show that the risk of a mobile phone screen cracking for those who have applied a screen protector is 0.15 [2 marks]

**(ii)** Find the risk of a mobile phone screen cracking for those who have not applied a screen protector. [1 mark]

Answer \_\_\_\_\_

**(d)** Using your answers to parts **(c)(i)** and **(c)(ii)**, calculate the relative risk of a mobile phone screen cracking for those who have not applied a screen protector compared to those who have applied a screen protector. [2 marks]

Answer \_\_\_\_\_

**(e)** Give an interpretation of your answer to part **(d)**.  
[2 marks]

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- 9 The grouped frequency table below shows the distribution of ages of a sample of people who live in Lisburn.

Age, $A$ , (years)	Frequency		
$0 \leq A \leq 14$	180		
$15 \leq A \leq 29$	300		
$30 \leq A \leq 44$	105		
$45 \leq A \leq 74$	90		
$75 \leq A \leq 89$	15		
$A \geq 90$	0		

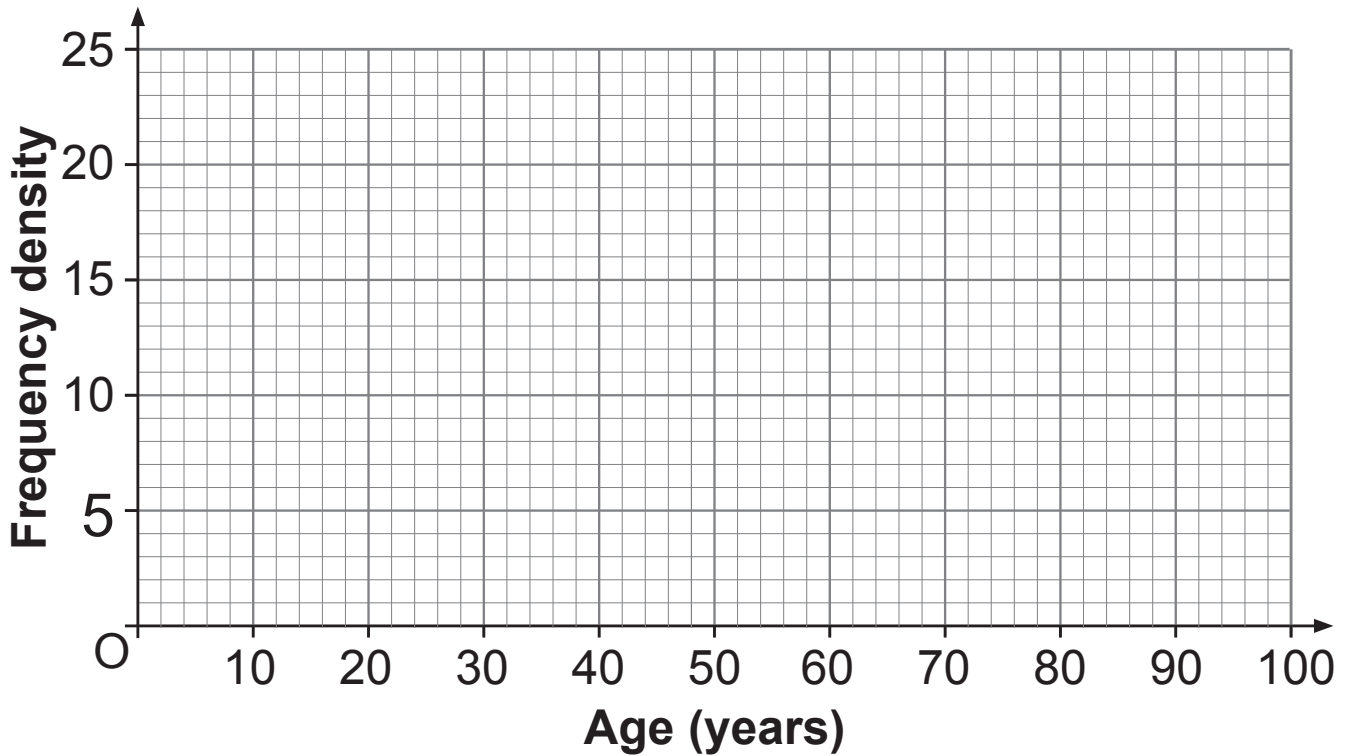
- (a) Explain why the width of the  $15 \leq A \leq 29$  class is 15  
[2 marks]

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(b) On the grid below, draw a histogram to illustrate the distribution of ages of the sample of people who live in Lisburn. [4 marks]



Paula says that nobody in Lisburn is 90 years old or more.

(c) Explain, with a reason, whether or not you think Paula is correct. [2 marks]

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**(d)** Would the normal distribution be a suitable model for this data?

Give a reason for your answer. [2 marks]

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**10** The table below shows the average house price and associated chain base index numbers between 2014 and 2018 in Northern Ireland.

The base year is 2013

<b>Year</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
<b>Average house price</b>	£110 750	£118 756	£125 059	£129 601	£136 179
<b>Chain base index number</b>	108.7	107.2	105.3	103.6	

**(a)** What was the average house price in 2013? [3 marks]

Answer £ \_\_\_\_\_

**(b)** Calculate the chain base index number for 2018  
[2 marks]

Answer \_\_\_\_\_

**(c)** Give an interpretation of your answer to part **(b)**.  
[2 marks]

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Wayne is working on a project about house prices in Northern Ireland and he wishes to find an average figure of the five index numbers in the table.

**(d) (i)** Write down the name of an appropriate calculation Wayne could carry out. [1 mark]

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**(ii)** Find the value of the calculation you identified in **(d)(i)**. [2 marks]

Answer \_\_\_\_\_

Wayne extended his study by looking at the change in average price for different types of house between 2017 and 2018

Taking 2017 as the base year, Wayne collected the following data for a district in Northern Ireland.

	<b>Detached</b>	<b>Semi-detached</b>	<b>Terraced</b>
<b>Index number for 2018</b>	103.6	107.2	109.1
<b>Number of properties sold</b>	523	671	458

(e) For Wayne's data, calculate the weighted index number for the average house price for 2018. [3 marks]

Answer \_\_\_\_\_

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**This is the end of the question paper**

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## Sources

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Question Number	Marks
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<b>Total Marks</b>	

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