AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE STATISTICS

H

Higher Tier Unit 1 Written Paper

Monday 27 June 2016 Morning Time allowed: 2 hours

Materials

For this paper you must have:
- a calculator
- mathematical instruments.

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.
- You are expected to use a calculator where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

You may need to use the following formulae:

Mean of a frequency distribution $= \dfrac{\sum fx}{\sum f}$

Mean of a grouped frequency distribution $= \dfrac{\sum fx}{\sum f}$, where x is the mid-interval value.

Standard deviation for a set of numbers $x_1, x_2, \ldots, x_n$ having a mean value of $\bar{x}$ is given by

$$\sqrt{\frac{\sum (x-\bar{x})^2}{n}} \quad \text{or} \quad \sqrt{\frac{\sum x^2}{n} - \bar{x}^2}$$

Standard deviation for a frequency distribution

$$\sqrt{\frac{\sum f(x-\bar{x})^2}{\sum f}} \quad \text{or} \quad \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$$

The same formulae apply to the standard deviation of a grouped frequency distribution where x is the mid-interval value.

Spearman's rank correlation coefficient = $1 - \dfrac{6\sum d^2}{n(n^2-1)}$

Turn over for the first question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Answer **all** questions in the spaces provided.

1 In a supermarket, people can choose a basket, a small trolley or a large trolley to put their shopping in.

Martin, the supermarket manager, knows that people are

equally likely to choose a small trolley or a large trolley

twice as likely to choose a small trolley as a basket.

Martin wants to simulate what the next 15 people will choose to put their shopping in.

Martin allocates random numbers as follows.

Random number	Choice
0, 1, 2 or 3	S (small trolley)
4, 5, 6 or 7	L (large trolley)
8 or 9	B (basket)

1 (a) How many of the 15 people would he expect to choose a basket?

[2 marks]

Answer _____

Martin selects the following 15 random numbers.

6	2	1	4	9	6	7	5	0	2	3	1	7	4	0
L	S													

1 (b) Write the letters S, L and B in the table to show the results of the simulation. The first two have been done for you.

[2 marks]

1 (c) Complete the frequency table below to show the 15 simulated results.

[1 mark]

Choice	Number of people
S (small trolley)	
L (large trolley)	
B (basket)	

1 (d) Write down one difference between these simulated results and the results Martin would expect.

[1 mark]

1 (e) Write down one similarity between these simulated results and the results Martin would expect.

[1 mark]

7

2 The table shows the percentage of boys and girls who play different musical instruments.

Instrument	Boys	Girls
Keyboard	29%	31%
Piano	27%	30%
Recorder	22%	34%
Classical guitar	19%	21%
Drum kit	20%	8%
Electric guitar	16%	11%
Violin	8%	15%
Flute	4%	10%

2 (a) Write down the most popular instrument played by boys and by girls.

[1 mark]

Boys _____ Girls _____

2 (b) Write down one different comparison of the instruments played by boys and by girls.

[1 mark]

_____

_____

2 (c) Hannah says

"61% of girls play either the Keyboard or the Piano."

Is she likely to be correct?
Tick a box.

Yes ☐ No ☐

Give a reason for your answer.

[1 mark]

_____

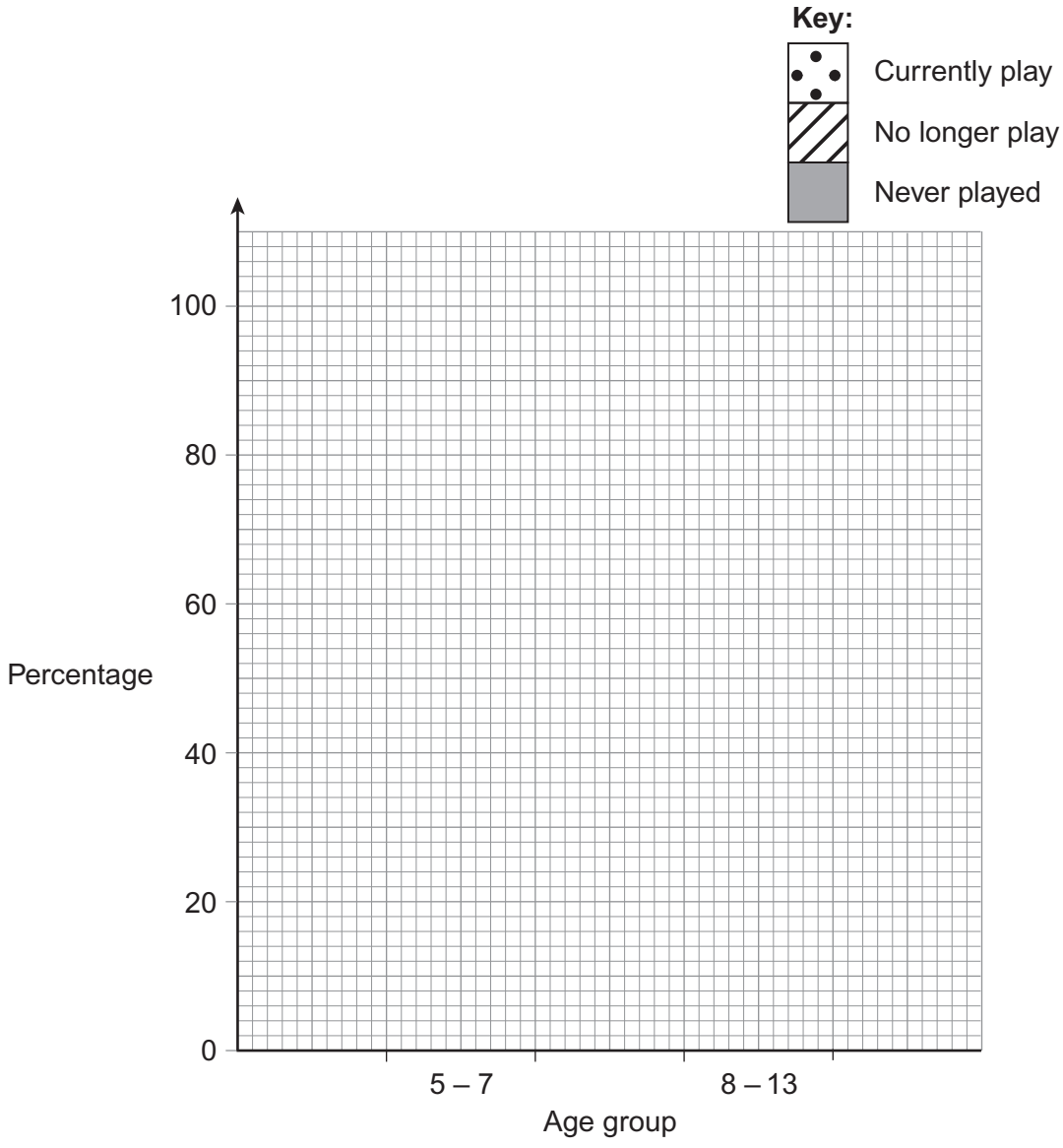
_____

2 (d) This table shows the percentages of children of different ages who play instruments.

	Age group	
	5 – 7 years	**8 – 13 years**
Currently play	65%	75%
No longer play	5%	13%
Never played	30%	12%

Draw a composite bar graph to show this information.

[3 marks]



6

3 Rodney wants to open a market stall in his town.
He will sell fruit and vegetables.

For people in his town, he wants to find out information about

A which fruit and vegetables they like best

B the number of days in a week they usually buy fruit and vegetables

C where they usually buy fruit and vegetables

D how far they live from the market

3 (a) Which of these four variables is **discrete**?

Circle your answer.

[1 mark]

A B C D

He designs a questionnaire.

3 (b) Give **one** reason why he should carry out a pilot study.

[1 mark]

3 (c) Rodney uses closed questions in his questionnaire.

3 (c) (i) What is the difference between a closed question and an open question?

[1 mark]

3 (c) (ii) Give **two** different advantages of using closed questions in a questionnaire.

[2 marks]

Advantage 1 _____

_____

_____

Advantage 2 _____

_____

_____

3 (d) Rodney delivers the questionnaire to all the houses in his town.
Only 5% of the questionnaires are posted back to him.

Write down **one** thing that Rodney could have done to get a better response rate.

[1 mark]

_____

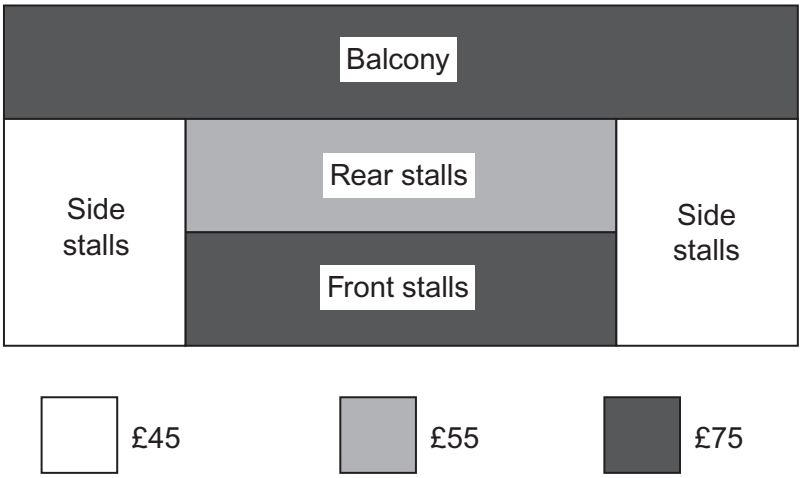
_____

_____

6

Turn over for the next question

4 The choropleth map shows the prices for concert tickets for different areas of a theatre.



4 (a) Four friends buy the **last** four tickets for a concert.
One is in the front stalls and three are in the rear stalls.
They decide to share the total cost equally.

How much does each friend pay?

[2 marks]

Answer £ _____

All the seats for a concert have been sold.
The table gives details about the 800 people who will attend the concert.

Men	Women	Boys	Girls
321	360	72	47

The owner of the theatre wants to survey 40 of these people.

4 (b) The manager suggests picking every 10th seat.

Write down the name of the manager's sampling method.

[1 mark]

Answer _____

4 (c) The manager has made a mistake.

What mistake has the manager made?

[1 mark]

_____

_____

4 (d) The owner of the theatre decides to use stratified sampling.

Work out the number of **men** that should be surveyed.

[3 marks]

_____

_____

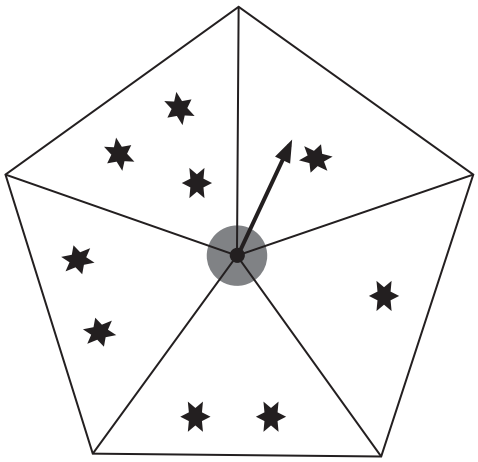
_____

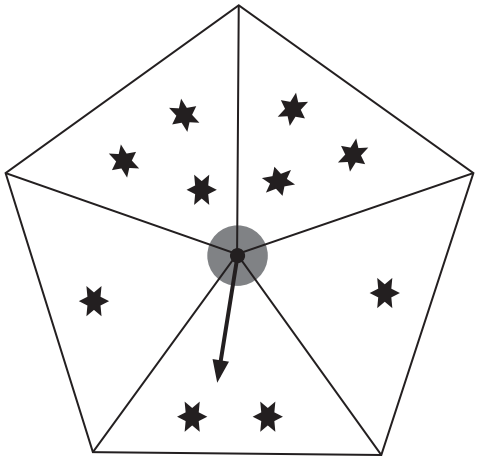
_____

Answer _____ men

7

5 Kira is organising a game at a school fair.
The game involves two fair spinners.





Each section on the spinners has one, two or three stars.

Win a Bottle Game!

Spin both spinners

Get a total of 5 stars... win a Small bottle

Get a total of 6 stars... win a Large bottle

The diagram shows the possible outcomes for the **total** number of stars.

		Second spinner				
		★	★	★★	★★★	★★★
First spinner	★	2	2	3	4	4
	★	2	2	3	4	4
	★★	3	3	4	5	5
	★★	3	3	4	5	5
	★★★	4	4	5	6	6

5 (a) Work out the probability of **not** winning a bottle on one go of the game.

[1 mark]

Answer _____

5 (b) Show that the probability of winning at least one bottle on **three** goes of the game is more than 0.6

[3 marks]

4

The question continues on the next page

At the start of the fair Kira has 120 bottles as prizes.
Each bottle contains either Fruit juice or Cola or Lemonade.

Half of the bottles are Small.

One quarter of the bottles contain Cola.

The same number of bottles contain Fruit juice as Lemonade.

60% of the bottles of Lemonade are Small.

20 of the Large bottles contain Fruit juice.

5 (c) Complete the table to show the number of bottles of each type and size.

[5 marks]

	Fruit juice	**Cola**	**Lemonade**	**Total**
Small				
Large				
Total				120

5 (d) The first person to win a prize wins a **Small** bottle.
He gets one of the Small bottles at random.

What is the probability that it contains Cola?

[2 marks]

Answer _____

5 (e) The game is very popular.

Explain why Kira is likely to run out of Small bottles before she runs out of Large bottles.

[1 mark]

8

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

6 The table shows the average number of miles travelled per person per year in Britain. The data are given for different years and show the different types of transport used.

Type of transport	Miles per person per year					
	2002	**2004**	**2006**	**2008**	**2010**	**2012**
Private:						
Walk	198	203	201	193	187	181
Bicycle	36	39	39	42	42	53
Car	5775	5707	5693	5467	5257	5214
Motorcycle	35	38	34	38	30	35
Other private transport	145	156	118	111	138	95
Public:						
Bus	339	348	359	368	370	368
London Underground	81	68	75	75	73	73
Rail	413	433	466	494	506	553
Taxi	59	51	52	53	54	53
Other public transport	55	61	96	80	77	67
All types	**7136**	**7104**	**7133**	**6921**	**6734**	**6692**

6 (a) Write down the average number of miles travelled per person by **taxi** in 2010

[1 mark]

Answer _____ miles

6 (b) (i) Describe the trend in the average number of miles travelled per person by **car** between 2002 and 2012

[1 mark]

_____

_____

6 (b) (ii) Give a possible reason to explain this trend.

[1 mark]

_____

_____

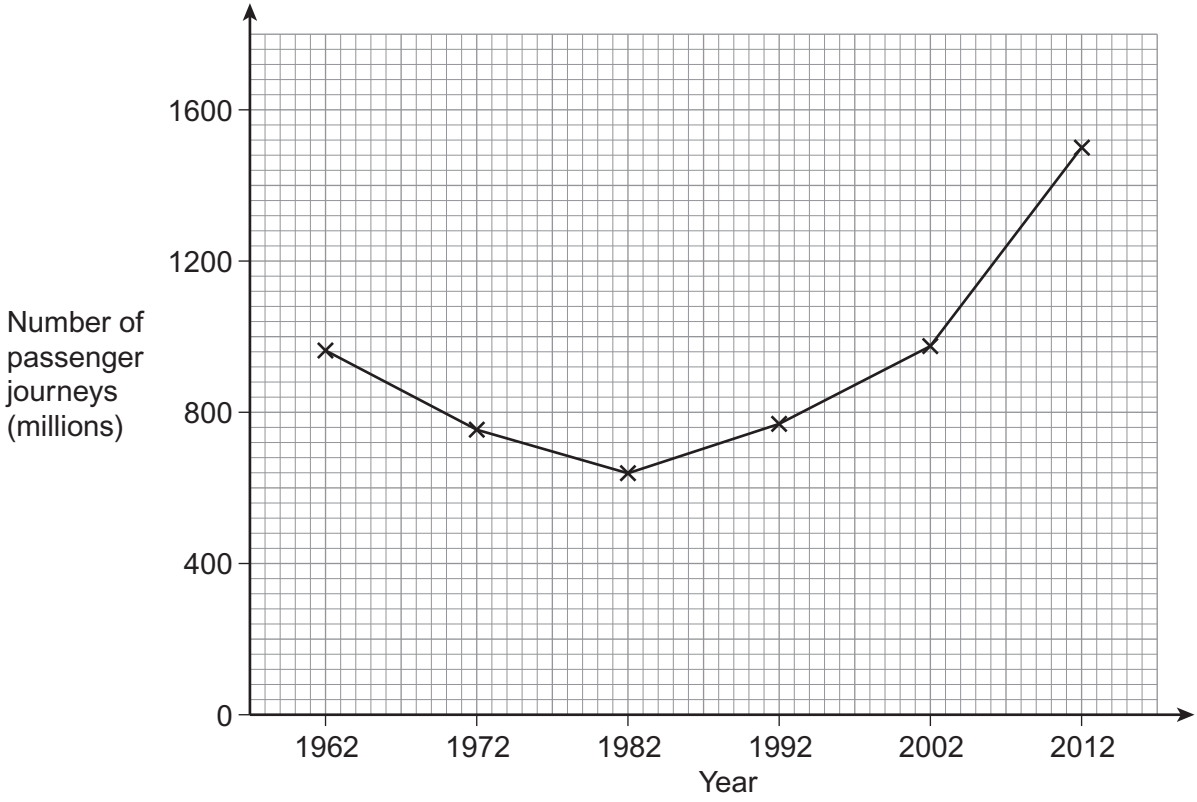
6 (c) How many more miles were travelled on average by **bus** per person in 2010 than in 2002?

[2 marks]

_____

Answer _____ miles

The graph shows the total number of journeys (millions) made by **rail** by people living in Britain in different years.



6 (d) Work out the percentage increase in the number of journeys made by rail from 1982 to 2012

[3 marks]

Answer _____ %

6 (e) The population of Britain in 2002 was 54.7 million.

Use the table **and** the graph to estimate the average length of a person's rail journey in 2002

[3 marks]

Answer _____ miles

11

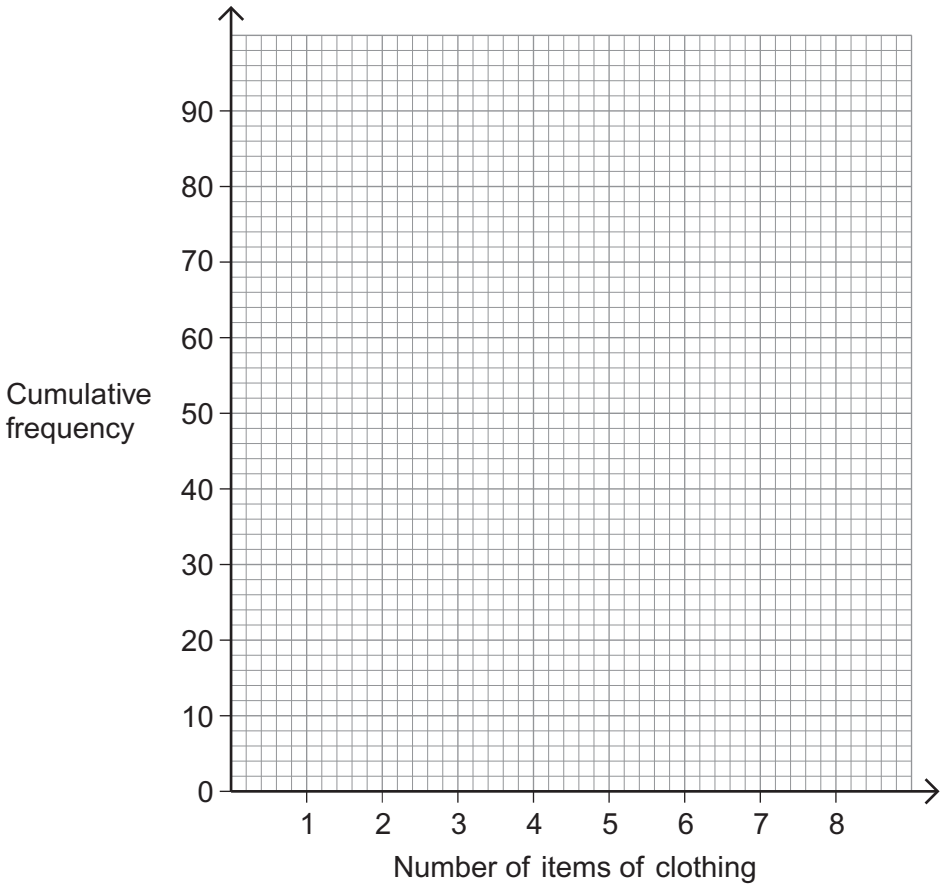
7 A dry cleaning company records the number of items of clothing customers bring in to its shop for cleaning.
The company had 90 customers last week.

Number of items of clothing	Frequency
1	14
2	20
3	16
4	14
5	6
6	8
7	10
8	2

Cumulative frequency

7 (a) Draw a cumulative frequency step polygon to show the number of items of clothing.

[4 marks]



7 (b) Every week the shop has to send a summary report to Head Office.

Complete the report form for last week.

[3 marks]

Head Office Report Form

Week 20th to 26th June 2016

Number of items of clothing

Median _____

2nd decile = _____ 8th decile = _____

Range between 2nd and 8th deciles = _____

7 (c) The company gives customers a questionnaire about the quality of the cleaning. One of the questions on the questionnaire is shown.

How satisfied are you with how the company cleans your clothes?
Tick a box.

Extremely dissatisfied	Very dissatisfied	Dissatisfied		Satisfied	Very satisfied	Extremely satisfied
☐	☐	☐	☐	☐	☐	☐

One of the headings is covered up.

Complete the heading.

[1 mark]

_____

8

8 Carl is a primary school teacher.
He wants to investigate if children learn their multiplication tables better if they learn a song.
To test this, he plans an experiment.

He matches the 30 children in his class in pairs.

One child in each pair learns a multiplication song.

The other child in the pair learns multiplication tables without a song.

After one week, he gives all of his class a tables test.

8 (a) Write down a possible hypothesis that Carl could test with this experiment.

[1 mark]

8 (b) Here are four possible ways that Carl could match the children in pairs.

Method 1: Form the pairs randomly.

Method 2: Match children with similar abilities in maths.

Method 3: Match children with similar heights.

Method 4: Match a boy with a girl.

Which of these four methods is best in this experiment?
Circle your answer.

[1 mark]

Method 1 Method 2 Method 3 Method 4

8 (c) Briefly describe a method that Carl could use to decide which child in each pair should learn the multiplication song.

[1 mark]

8 (d) Matched pair experiments help to reduce the effect of which type of variable? Circle your answer.

[1 mark]

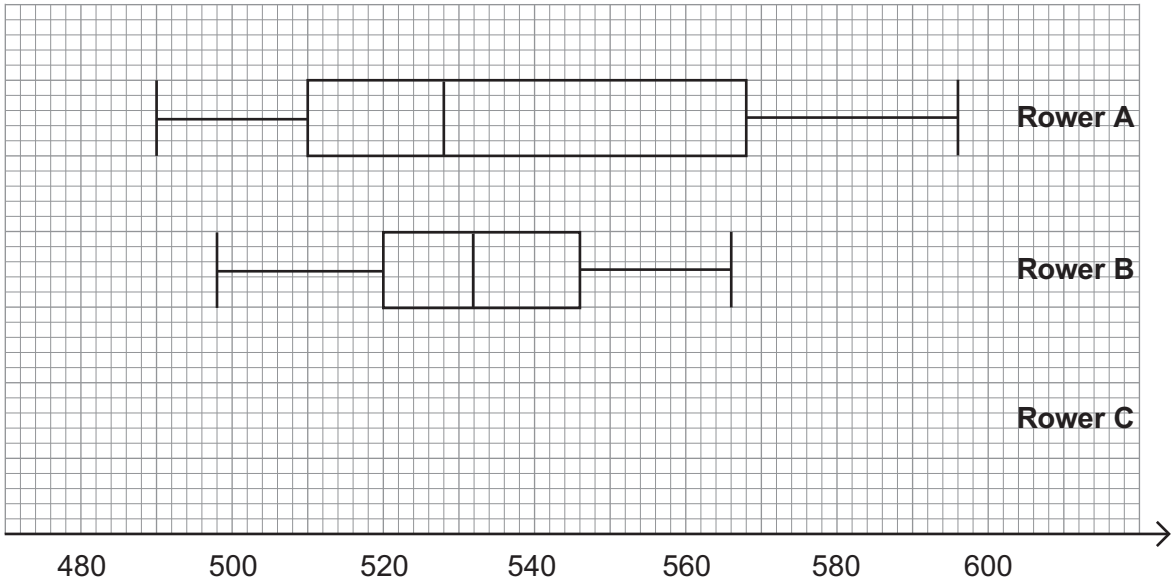
response extraneous quantitative dependent

4

Turn over for the next question

9 Steve is a rowing coach.
He trains three rowers, A, B and C.

The diagram summarises the times (seconds) of rower A and rower B in 30 practice races.



A summary of the times (seconds) for rower C in the practice races is shown in the table.

Median time	558
Interquartile range	20
Upper quartile	570
Quickest two times	517 and 524
Slowest two times	592 and 593

9 (a) Show that 517 is an outlier for rower C.

[3 marks]

9 (b) Draw a box plot showing the times for rower C on the grid on page 22.

[3 marks]

9 (c) Steve has to choose one of the three rowers for a competition.
He wants to choose a rower that meets these two conditions:

- has rowed faster than 540 seconds on at least 50% of practice races
- has practice times with an interquartile range less than 40 seconds

9 (c) (i) Only one of the rowers meets both conditions.

Which rower?
Circle your answer.

[1 mark]

Rower A Rower B Rower C

9 (c) (ii) Explain why Steve does **not** choose each of the other two rowers.

[2 marks]

Rower _____

Reason _____

_____

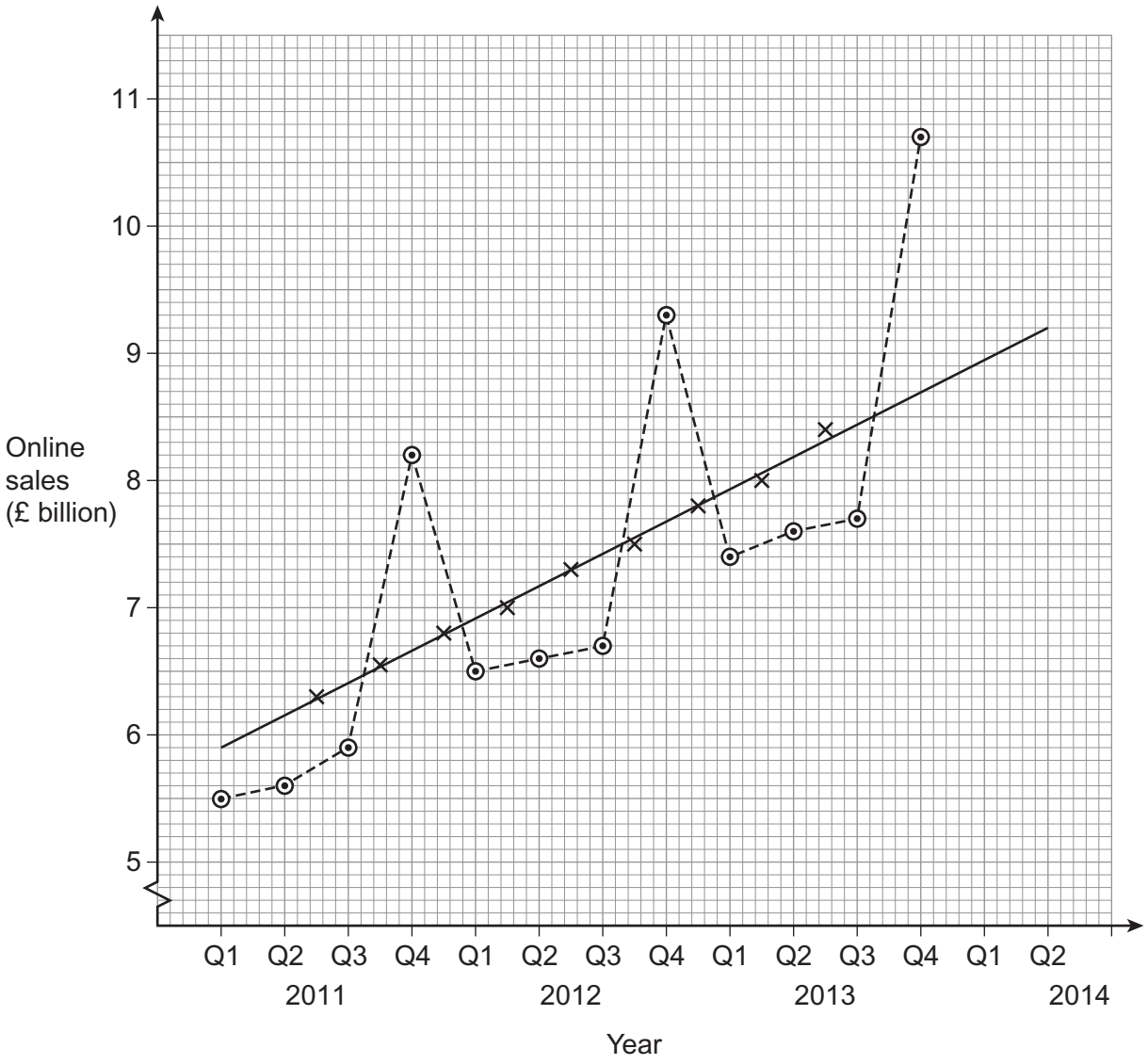
Rower _____

Reason _____

_____

9

10 The time series graph shows the value of online sales (£ billion) in Britain.
The data are shown every quarter from 2011 to 2013
The four-point moving averages are also plotted.



10 (a) Online sales are highest in Quarter 4

Give a possible reason for this.

[1 mark]

10 (b) Describe one other pattern in the data.

[1 mark]

10 (c) Complete the table to find the average seasonal effect for Quarter 1

[3 marks]

	Online sales (£ billion)	Trend line value (£ billion)	Seasonal effect (£ billion)
2011 Q1	5.5	5.9	–0.4
2012 Q1			
2013 Q1			
		Average seasonal effect =	

10 (d) Use your answer to **(c)** to predict the value of online sales for Quarter 1 in 2014

[2 marks]

Answer £ _____ billion

7

Turn over for the next question

11 A team of biologists are investigating a type of frog that lives on a small island. They capture at random a sample of 800 frogs, 440 females and 360 males. Some information about the masses, in grams, of the captured frogs is shown.

Female frogs

Sample size = 440

Mean mass = 45.3 g

Standard deviation = 18.6 g

Male frogs

Sample size = 360

$\sum x = 13\,860$

$\sum x^2 = 573\,300$

11 (a) Work out the mean mass of the male frogs.

[1 mark]

Answer _____ g

11 (b) Work out the standard deviation of the masses of the male frogs.

[3 marks]

Answer _____ g

11 (c) Compare the masses of the male frogs with the masses of the female frogs.

[2 marks]

The 800 captured frogs are marked with dye.
The frogs are then released.

After four weeks the biologists capture a second sample of 600 of this type of frog.
They find that 48 of these are marked.

11 (d) Estimate the total number of this type of frog on this island.

[3 marks]

Answer _____

11 (e) One biologist thinks that the dye used to mark the frogs has come off some of them.

Assuming this is true, which of these statements about the number of frogs on the island is correct?

Tick a box.

[1 mark]

The number of frogs is likely to be higher than estimated in **(d)** ☐

The number of frogs is likely to be equal to the estimate in **(d)** ☐

The number of frogs is likely to be lower than estimated in **(d)** ☐

10

12 Twelve women take part in a heptathlon competition.
They are awarded points for the seven events.
The table shows values of the Product Moment Correlation Coefficient between the points awarded in pairs of events.

	100 m hurdles	**High jump**	**Shot put**	**200 m**	**Long jump**	**Javelin**
High jump	–0.29					
Shot put	–0.11	–0.10				
200 m	0.74	–0.27	–0.29			
Long jump	0.54	0.13	–0.38	0.61		
Javelin	–0.06	0.47	0.06	–0.31	–0.03	
800 m	0.15	–0.67	0.02	–0.08	–0.18	–0.56

12 (a) In which event do results correlate most strongly with results in the Long jump?

[1 mark]

Answer _____

12 (b) Mandy says

"Women who did well in the shot put also did well in the 800 m."

Is she correct?
Tick a box.

Yes ☐ No ☐

Explain your answer.

[1 mark]

_____

_____

The results from some of these pairs of events are plotted in the scatter diagrams.

Diagram 1

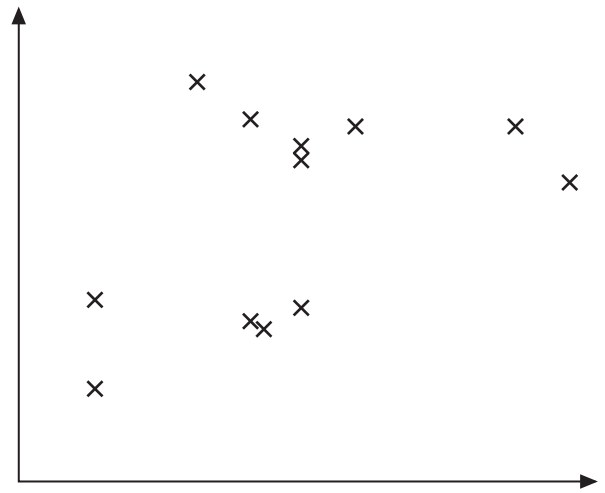


Diagram 2

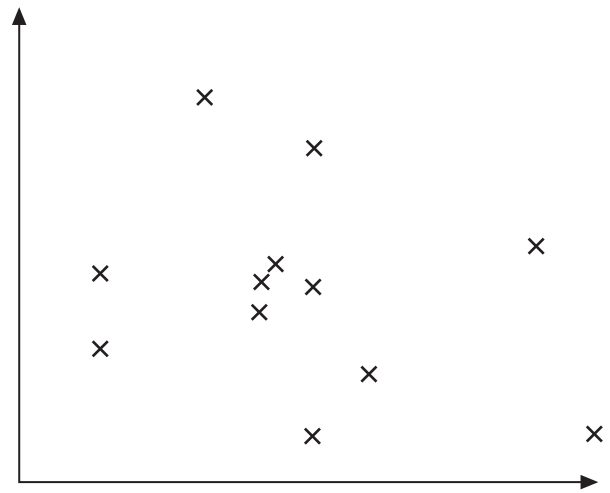


Diagram 3

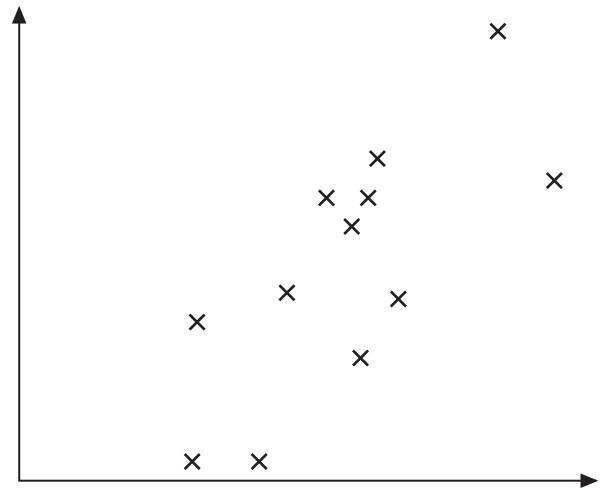
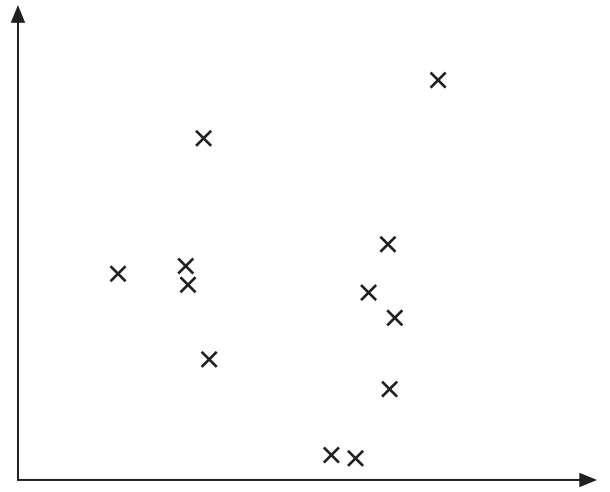


Diagram 4



12 (c) The Correlation Coefficient between the results of the 200 m and the 100 m hurdles is 0.74

Which diagram shows this pair of events?
Circle your answer.

[1 mark]

Diagram 1 Diagram 2 Diagram 3 Diagram 4

3

13 The table shows values for the Consumer Price Index for Clothing from 2009 to 2013
The base year is 2005

Year	2009	2010	2011	2012	2013
Index	78.4	77.5	80.0	80.7	81.7

13 (a) What was the percentage decrease in the price of Clothing between 2005 and 2013?
[1 mark]

Answer _____ %

13 (b) A clothes shop sells jeans.

Year	2009	2013
Price	£34.50	£36.00

Compare the change in price of the jeans with the change in prices in the Consumer Price Index for Clothing over this period.
You **must** show your working.
[4 marks]

14 Three types of bluebell plant grow in a garden, English, Spanish and Hybrid.
Alex measures the widths of the leaves of random samples of each type of bluebell.
She finds that the widths follow **Normal distributions** with different means and standard deviations.

	English bluebell	**Spanish bluebell**	**Hybrid bluebell**
Mean (mm)	11.9	26.1	19.6
Standard deviation (mm)	1.7	3.6	4.5

14 (a) Alex concludes

"Nearly all leaves on English bluebell plants in the garden have widths that are less than 17 mm"

Use your knowledge of the Normal distribution to show that Alex is correct.

[2 marks]

14 (b) One of the bluebells has a width of 23.5 mm

Use standardised scores to work out if the bluebell is more likely to be a Spanish bluebell or a Hybrid bluebell.

[3 marks]

END OF QUESTIONS

10

There are no questions printed on this page

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