AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

# GCSE STATISTICS

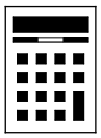
# H

## Higher tier Paper 2

Tuesday 18 June 2019 Morning Time allowed: 1 hour 45 minutes

**Materials**

For this paper you must have:
- a calculator
- mathematical instruments
- a copy of the Data Sheet.



**Instructions**
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of the page.
- 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 out any work you do not want to be marked.

**Information**
- The marks for the questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper and graph paper. These must be tagged securely to this answer booklet.

| For Examiner's Use | |
|---|---|
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | |
| 12 | |
| 13 | |
| 14 | |
| 15 | |
| 16 | |
| **TOTAL** | |

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

*Do not write outside the box*

**1** A set of data has

mean = 30

median = 25

standard deviation = 4

Circle the value of the skew for the data.

Use skew = $\frac{3\ (\text{mean} - \text{median})}{\text{standard deviation}}$

**[1 mark]**

−11.25 1.25 3.75 16.25

1

**2** Here are some statements comparing the use of closed questions and open questions on a questionnaire.

A Closed questions are generally quicker to answer than open questions.

B The responses to closed questions are easier to analyse.

C Closed questions allow respondents to give their true feelings more easily than open questions.

D The response choices given for closed questions can help clarify the meaning of the question for respondents.

Circle the letter for the statement that is **false**.

**[1 mark]**

A B C D

1

*Do not write outside the box*

**3** A gym has 800 members.

Lara asks a random sample of 40 members how many times they used the swimming pool last week.

Here are her results.

| **Number of times** | 0 | 1 | 2 | 3 or more |
|---|---|---|---|---|
| **Frequency** | 21 | 10 | 5 | 4 |

Use Lara's results to estimate the total number of gym members who used the swimming pool **3 or more** times last week.

Circle your answer.

**[1 mark]**

4 80 160 200

1

**4** Tina uses four online tests to measure her reaction time.

She measures her reaction times 20 times using each of the four tests.

The mean and standard deviation (s.d) of her results from each test are shown.

| | **Test A** | **Test B** | **Test C** | **Test D** |
|---|---|---|---|---|
| **mean (seconds)** | 0.415 | 0.583 | 0.379 | 0.375 |
| **s.d. (seconds)** | 0.025 | 0.054 | 0.104 | 0.075 |

Circle the test that appears to give the most **reliable** measure of Tina's reaction time.

**[1 mark]**

Test A Test B Test C Test D

1

*Do not write outside the box*

**5** The spreadsheet shows the number of people attending Accident and Emergency (A&E) for major hospitals and for all A&E hospitals from 2008 to 2016.

| Year | Major hospitals | All A&E hospitals |
|---|---|---|
| 2008 | 13 426 136 | 19 588 344 |
| 2009 | 13 618 300 | 20 511 908 |
| 2010 | 13 931 715 | 21 380 985 |
| 2011 | 14 013 922 | 21 481 402 |
| 2012 | 14 252 068 | 21 738 637 |
| 2013 | 14 213 148 | 21 778 657 |
| 2014 | 14 584 736 | 22 354 781 |
| 2015 | 14 960 805 | 22 920 435 |
| 2016 | 15 262 758 | 23 362 301 |

Source: www.england.nhs.uk

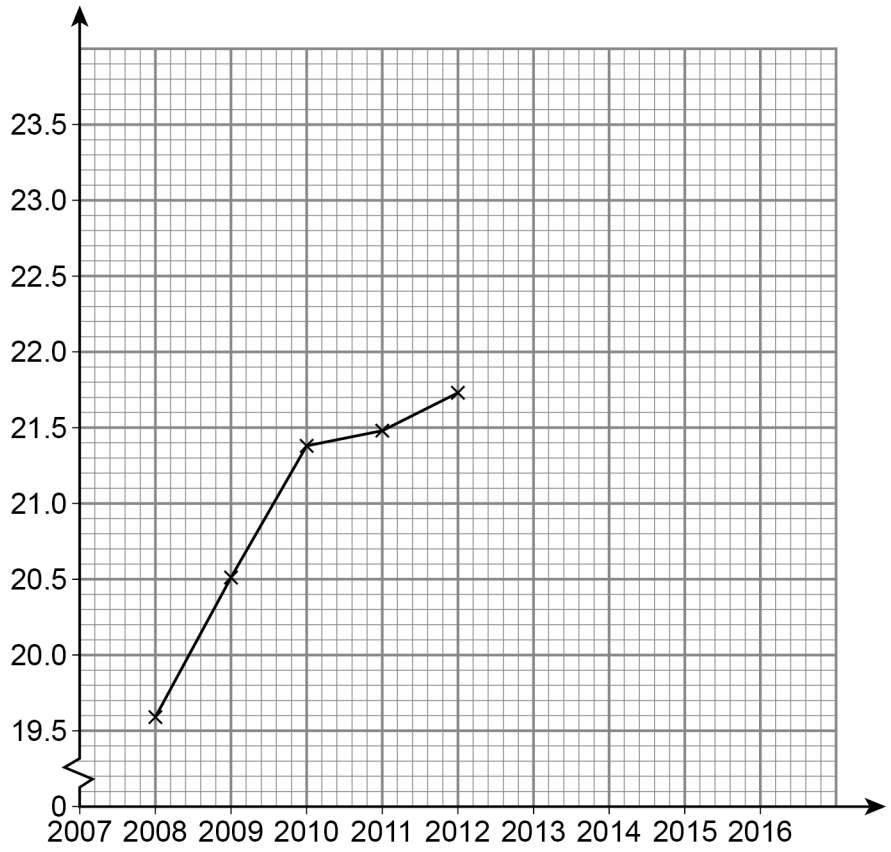
**5 (a)** Name the year when **Major hospitals** attendances fell.

**[1 mark]**

Answer _____

*Do not write outside the box*

**5 (b)** Here is a partially completed time series graph showing the '**All A&E hospitals**' attendances.




Complete the time series graph including labelling axes.

**[4 marks]**

**5 (c)** There is a break in the vertical axis in the time series graph.

Write down **one** positive reason and **one** negative reason for using this break.

**[2 marks]**

Positive _____

_____

Negative _____

_____

**Question 5 continues on the next page**

*Do not write outside the box*

**5 (d)** Dan said,

"As there are more people going to A&E, you must have to wait longer."

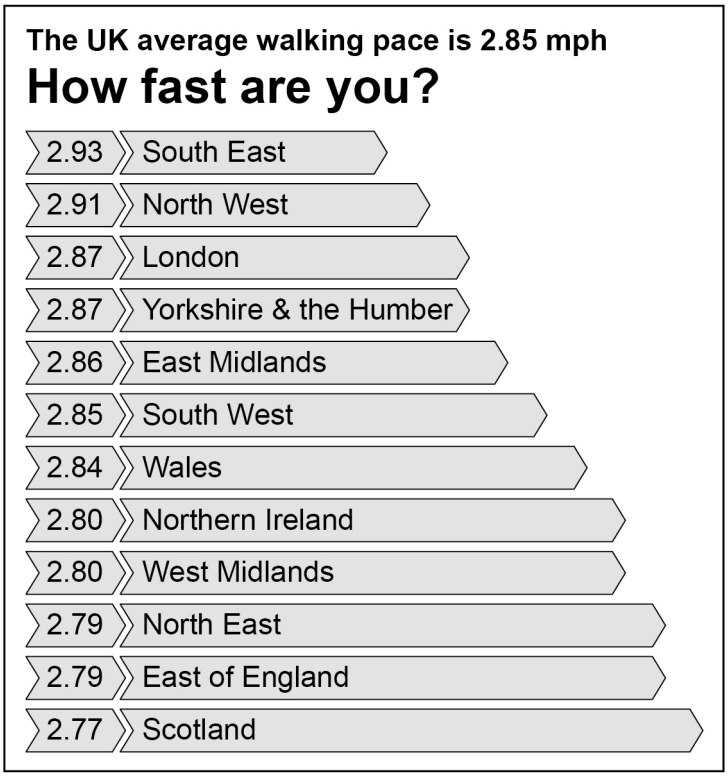
Give a reason why Dan's statement may **not** be true.

**[1 mark]**

8

*Do not write outside the box*

**6** Samira records the average walking speed, in miles per hour (mph), of shoppers in different regions of the UK. The diagram shows her results.




**6 (a)** List the regions in the UK where the walking speed is more than 0.05 mph faster than the **UK average**.

**[1 mark]**

Answer _____

_____

**6 (b)** Give **two** reasons why the diagram is misleading.

**[2 marks]**

Reason 1 _____

_____

_____

Reason 2 _____

_____

_____

**Turn over ►**

*Do not write outside the box*

**6 (c)** A manager in a shopping centre measures the walking speed (in mph) of a random sample of shoppers in June and a random sample of shoppers in December.

The walking speeds of 25 shoppers in June are shown in the stem-and-leaf diagram.

| June | | | | | | | | | | December | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 9 | 8 | **0** | | | | | | | | | | |
| | | | | 7 | 7 | 6 | 4 | 2 | **1** | | | | | | | | | | |
| | 9 | 8 | 8 | 7 | 6 | 5 | 5 | 2 | **2** | | | | | | | | | | |
| | | | 7 | 6 | 4 | 3 | 3 | 1 | **3** | | | | | | | | | | |
| | | | | | 5 | 4 | 1 | 0 | **4** | | | | | | | | | | |

**Key:** 8 | **0** | 7 represents a speed of 0.8 mph in June and a speed of 0.7 mph in December

**6 (c) (i)** The speeds (in mph) of 25 shoppers in December are,

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.2 | 3.4 | 0.9 | 1.9 | 2.4 | 2.7 | 1.6 | 3.2 | 2.1 | 0.7 |
| 1.0 | 2.2 | 2.5 | 1.8 | 4.1 | 1.7 | 2.6 | 1.8 | 3.2 | 1.3 |
| 2.5 | 0.7 | 3.1 | 2.2 | 1.4 | | | | | |

Complete the back to back stem-and-leaf diagram above to show the speeds of shoppers in December.

**[3 marks]**

*Do not write outside the box*

**6 (c) (ii)** Without further calculation, make a comparison of the average walking speeds of shoppers in June and December.

**[1 mark]**

**6 (c) (iii)** Give a possible reason to explain the difference in average walking speeds in June and December.

**[1 mark]**

8

**Turn over for the next question**

*Do not write outside the box*

**7** Gareth has a washing machine and a dishwasher.

**W** is the event that his washing machine breaks down next year.

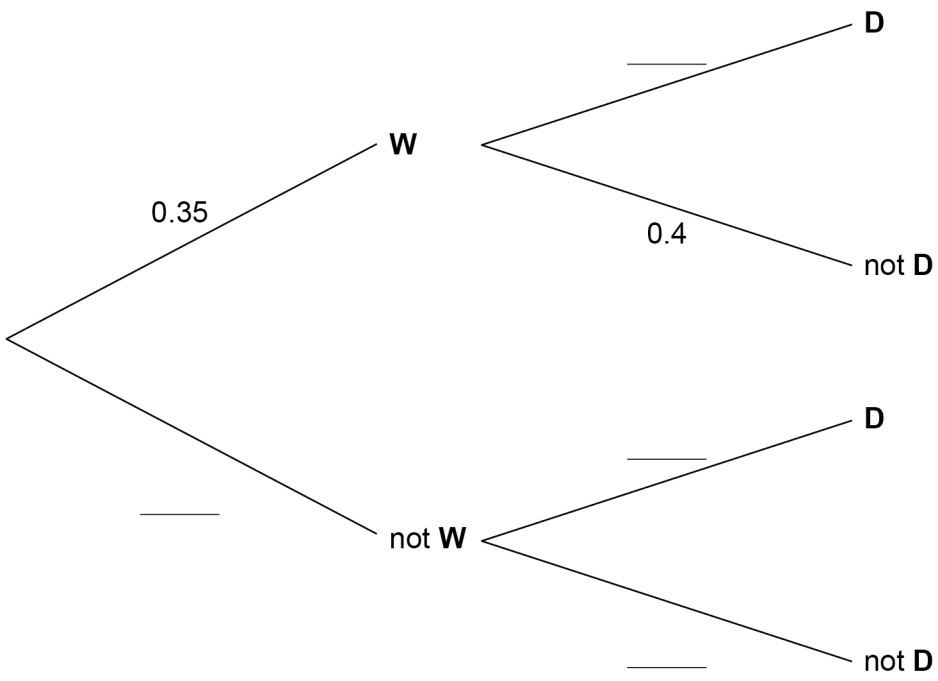
**D** is the event that his dishwasher breaks down next year.

Assume that the events **W** and **D** are independent.

**7 (a)** The tree diagram shows some of the probabilities.

Complete the tree diagram.

**[2 marks]**




**7 (b)** Find the probability that **at least one** of these machines breaks down next year.

**[3 marks]**

Answer _____

5

*Do not write outside the box*

**8** Maxine and Toby are investigating the amount of fat in supermarket ready meals.

**8 (a)** They each design a table for collecting the data.

**Maxine**

| Fat (grams) | Tally | Frequency |
|---|---|---|
| 4 – 8 | | |
| 8 – 12 | | |
| 12 – 16 | | |
| 16 – 20 | | |
| 20 – 24 | | |
| 24 – 28 | | |
| 28 – 32 | | |
| 32 – 36 | | |
| Over 36 | | |

**Toby**

| Fat, $x$ (grams) | Tally | Frequency |
|---|---|---|
| $0 \leqslant x < 5$ | | |
| $5 \leqslant x < 10$ | | |
| $10 \leqslant x < 15$ | | |
| $15 \leqslant x < 20$ | | |
| $20 \leqslant x < 25$ | | |
| $25 \leqslant x < 30$ | | |
| $30 \leqslant x < 35$ | | |
| $35 \leqslant x < 40$ | | |
| $x \geqslant 40$ | | |

Give **two** different reasons why Toby's table is more suitable than Maxine's.

**[2 marks]**

Reason 1 _____

_____

_____

Reason 2 _____

_____

_____

**Question 8 continues on the next page**

*Do not write outside the box*

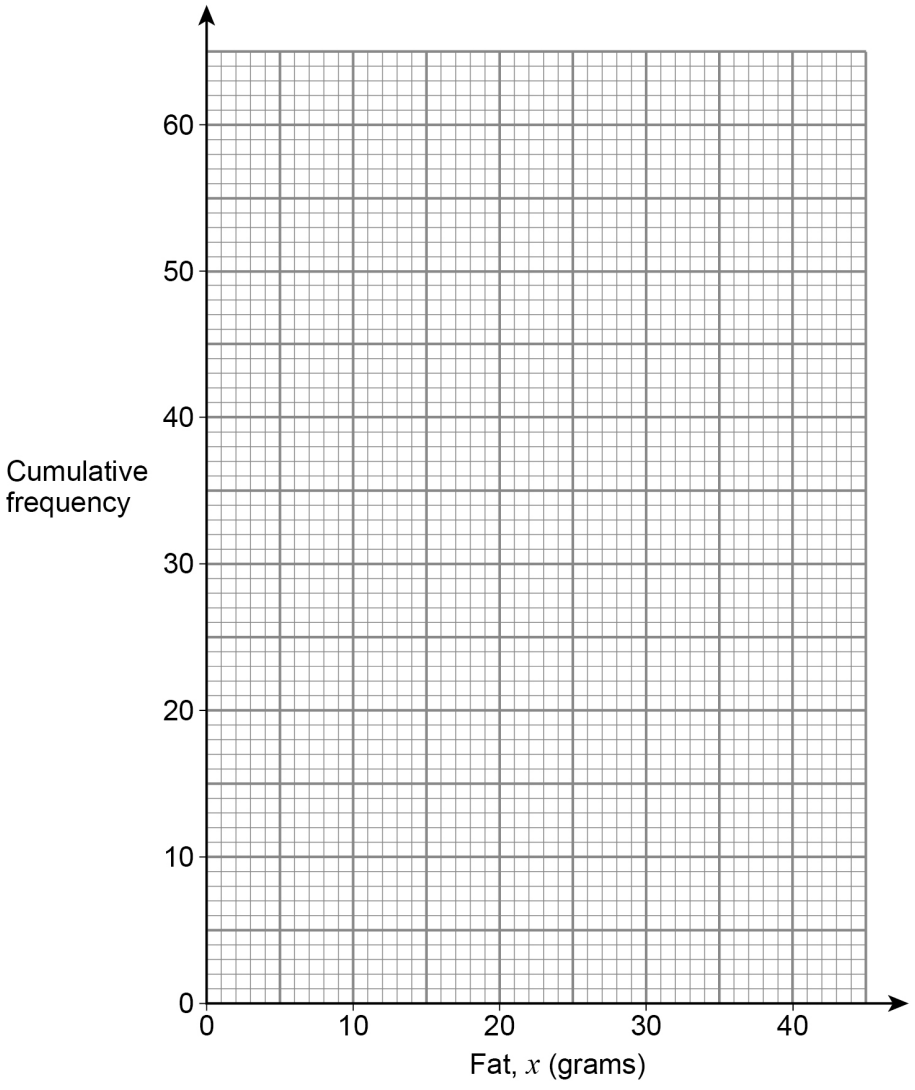
**8 (b)** Toby records the amount of fat in ready meals made for one person.

He collects this information from 60 ready meals sold at his local supermarket.

| Fat, $x$ (grams) | Cumulative frequency |
|---|---|
| $x < 5$ | 0 |
| $x < 10$ | 8 |
| $x < 15$ | 23 |
| $x < 20$ | 34 |
| $x < 25$ | 48 |
| $x < 30$ | 54 |
| $x < 35$ | 59 |
| $x < 40$ | 60 |

**8 (b) (i)** Draw a cumulative frequency graph to show Toby's results.

**[3 marks]**



*Do not write outside the box*

**8 (b) (ii)** Use your cumulative frequency graph to work out an estimate of the 70th percentile.

**[2 marks]**

Answer _____ grams

**8 (b) (iii)** Toby had previously carried out the same investigation 5 years ago.

He found then that 30% of ready meals contained more than 25 grams of fat.

Has there been a reduction in the percentage of ready meals containing more than 25 grams of fat?

Tick (✓) one box.

Yes ☐ No ☐

Give a reason for your answer.

**[1 mark]**

8

**Turn over for the next question**

*Do not write outside the box*

**9 (a)** Laboratory experiments can be quicker and cheaper to perform than field experiments.

Give **one** other advantage of performing a laboratory experiment over a field experiment.

**[1 mark]**

**9 (b)** Steve wants to investigate this hypothesis,

'Drinking a cup of coffee helps students to perform better in tests.'

He plans this laboratory experiment.

He chooses 80 Year 11 students.
He gives every student a computer-based intelligence test.
He then divides all the students into two groups.

- 40 of the students are randomly chosen to drink a cup of coffee.
- The rest are the control group and drink nothing.

Each student then takes a similar intelligence test.

**9 (b) (i)** Give a reason why Steve has used a control group.

**[1 mark]**

*Do not write outside the box*

**9 (b) (ii)** Here are Steve's results.

| Coffee drinkers | Control group |
|---|---|
| Test results increase by an average of 6 marks | Test results increase by an average of 7 marks |

Do these results support Steve's hypothesis?

Give a reason for your answer.

**[1 mark]**

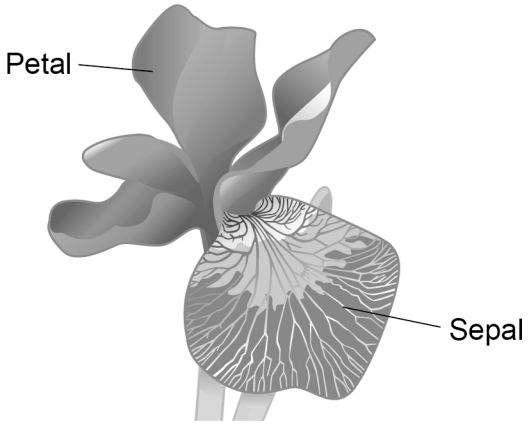
3

**Turn over for the next question**

*Do not write outside the box*

**10** An iris is a type of flowering plant.

The flower of the iris is made up from petals and sepals.




A scientist collected the length and width of petals and of sepals from samples of iris flowers.

The scatter diagrams show sepal lengths (cm) plotted in turn against each of the other variables.

The scientist's computer automatically draws a line of best fit on each diagram.

**Diagram A**

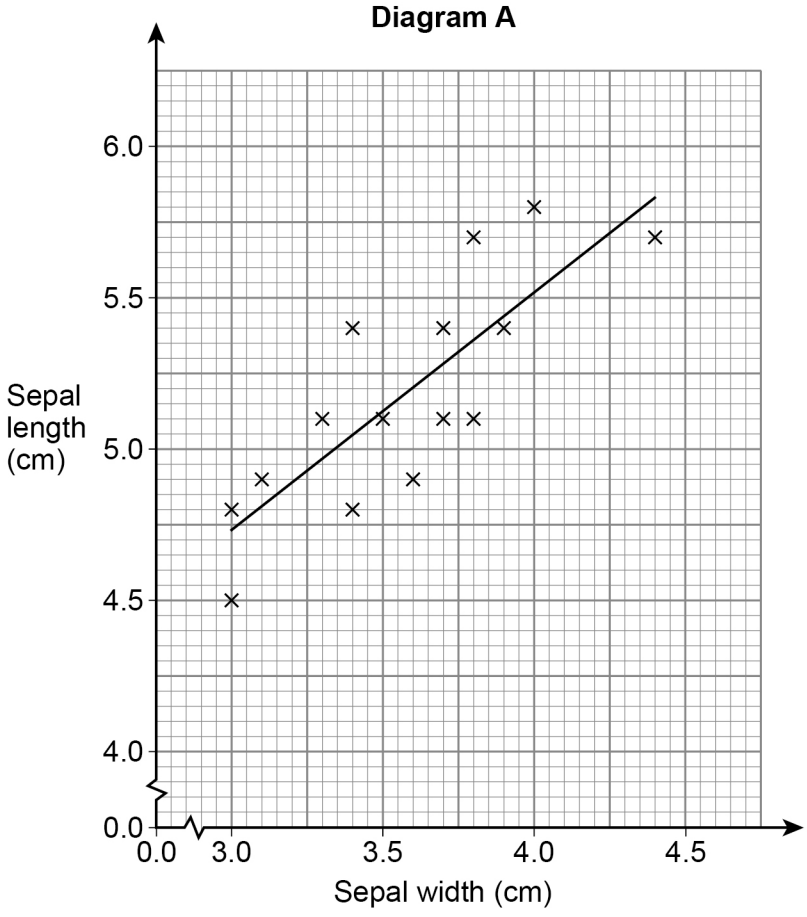


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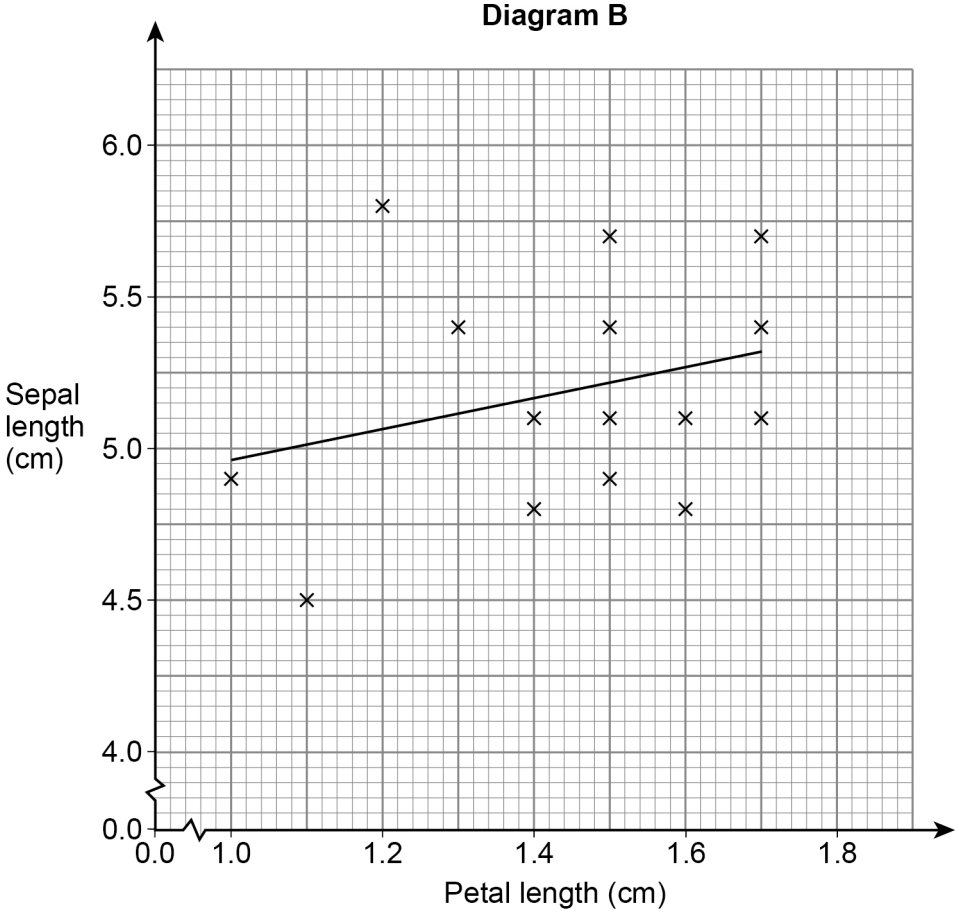
**Diagram B**




**Question 10 continues on the next page**

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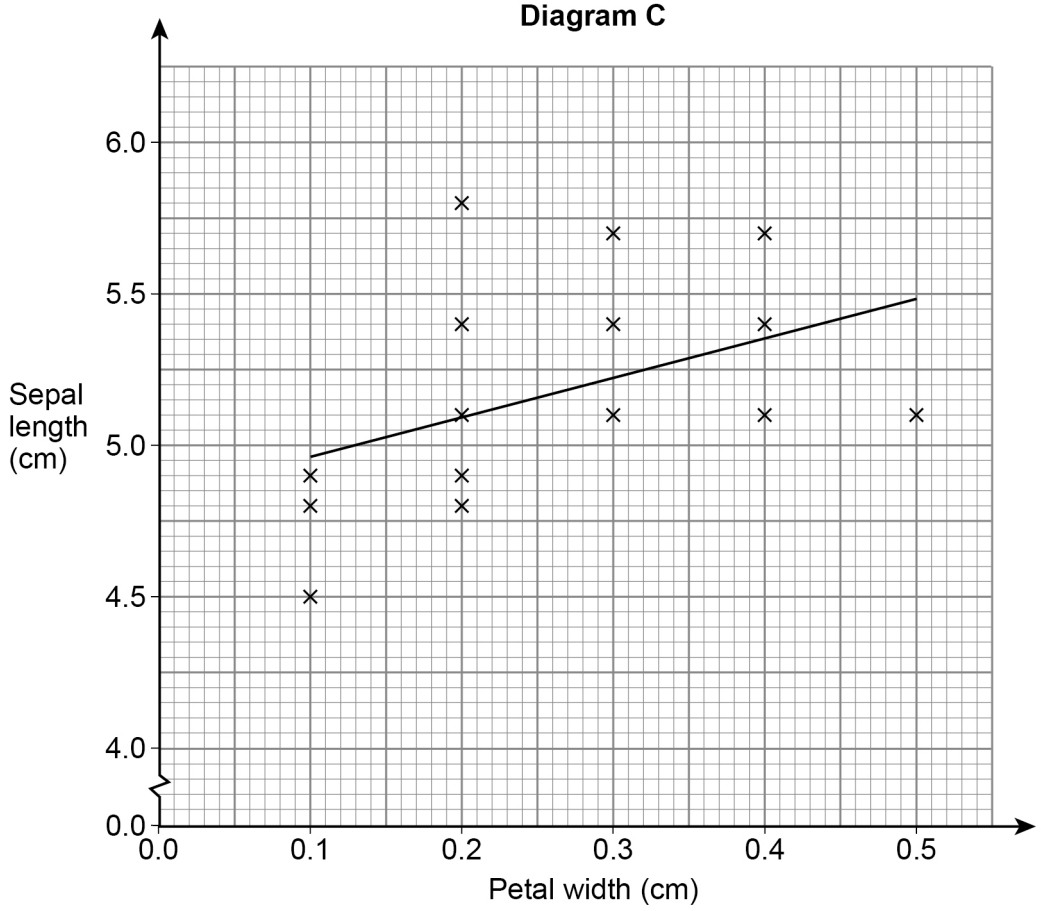
**Diagram C**




Some of the measurements of another iris flower are,

Sepal width = 3.2 cm

Petal length = 1.2 cm

Petal width = 0.1 cm

Use **one** of the scatter diagrams to predict the **sepal length** of this flower.

You should state which diagram you chose to use and give a **statistical** reason for your choice.

**[3 marks]**

Scatter graph used _____

Reason for choice _____

_____

Sepal length _____ cm

3

*Do not write outside the box*

**11 (a)** Here are the volumes, in $cm^3$, of 11 small containers.

15 16 19 21 25 26 28 29 31 34 37

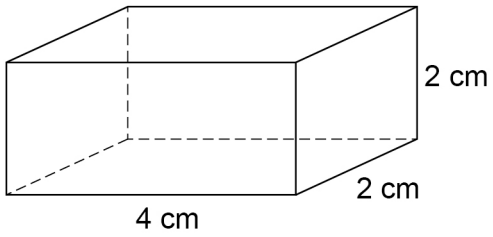
Circle the value, in $cm^3$, of the interquartile range.

**[1 mark]**

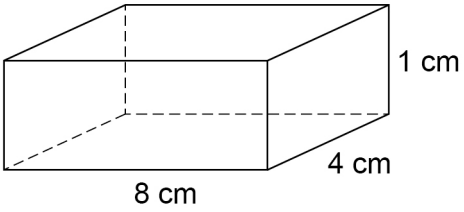
6 12 22 25

**11 (b)** Here are four cuboids.

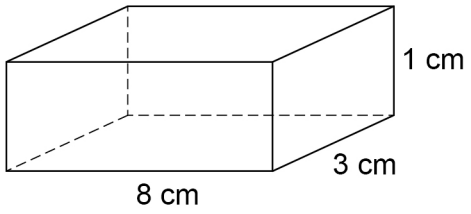
**A**



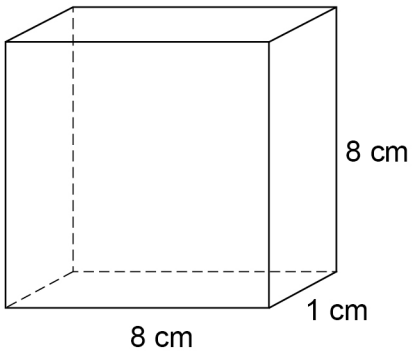

**B**




**C**




**D**




The geometric mean of the three side lengths of one of the cuboids is 4 cm

Circle the letter of this cuboid.

**[1 mark]**

A B C D

2

**Turn over ►**

*Do not write outside the box*

**12** Max, Natalie and Lottie work on a cruise ship.

They want to ask passengers staying in standard class accommodation what they think about their cabins.

There are 900 passengers in total on the cruise ship, of which 460 are staying in standard cabins.

Max, Natalie and Lottie each decide to collect information from a sample of 50 passengers.

**12 (a)** Max says that the population for the investigation is all passengers on the cruise ship.

Explain why he is wrong.

**[1 mark]**

**12 (b)** Natalie's calculator has a button marked Ran#.

This button generates a random number between 0 and 1

She uses her calculator to select 50 passengers from the population using the following method.

> Assign every passenger in the population a number.
>
> Generate random numbers from a calculator by typing Ran# × 100
>
> Select the passenger that matches the answer.

Natalie's method contains some errors.

Correct Natalie's method to show how she can use her Ran# button to choose a **random sample** from the population.

**[3 marks]**

*Do not write outside the box*

**12 (c)** Lottie designs a questionnaire.

Here is part of her questionnaire.

| How would you rate the value for money and the quality of standard class cabins? |
|---|
| Excellent ☐ Very good ☐ Good ☐ Fair ☐ |

Rewrite this part of Lottie's questionnaire so that she is more likely to obtain useful data.

**[2 marks]**

6

**Turn over for the next question**

*Do not write outside the box*

**13** Seb and Laura are studying for a gardening qualification.

Their overall mark is found as the **weighted average** of their marks in,

| | |
|---|---|
| coursework | weight = 20% |
| a written examination | weight = 35% |
| a practical examination | weight = 45% |

**13 (a)** Seb's marks are shown in the table.

| Coursework | Written examination | Practical examination |
|---|---|---|
| 85% | 54% | 70% |

Calculate Seb's overall mark for the course.

**[3 marks]**

Answer _____ %

*Do not write outside the box*

**13 (b)** Students need an overall mark of 60% to pass the qualification.

Laura scores,

40% in her coursework

32% in her written examination.

She has **not** yet taken the practical examination.

Can she still pass the qualification?

Tick (✓) one box.

Yes ☐ No ☐

You **must** show your working.

**[3 marks]**

6

**Turn over for the next question**

*Do not write outside the box*

**14** Carly has an activity tracker watch which tells her the distance she walks each day.
She sets herself the following target,

Target: Walk at least 6 km **every** day.

**14 (a)** She records the distance, $x$ km, she walks on each of 24 different days.
Here is a summary of her results.

$$\sum x = 149.76 \qquad \sum x^2 = 968.72$$

**14 (a) (i)** Show that the mean distance she walks each day is 6.24 km

**[1 mark]**

**14 (a) (ii)** Show that the standard deviation is 1.2 km to 1 decimal place.

Use standard deviation = $\sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$

**[2 marks]**

*Do not write outside the box*

**14 (a) (iii)** Carly says that she has met her target.

Comment on Carly's claim.

Explain your answer.

**[2 marks]**

**14 (b)** Tomasz and Erika also have activity tracker watches.

The mean and the standard deviation for the distance they walk each day are shown in the table.

| | Mean (km) | Standard deviation (km) |
|---|---|---|
| **Tomasz** | 5.15 | 2.34 |
| **Erika** | 5.36 | 0.45 |

Compare statistically the distances walked by Tomasz and Erika.

**[2 marks]**

7

**Turn over for the next question**

*Do not write outside the box*

**15** A hotel has a choice of coffee or tea as the hot drink for breakfast.

The hotel finds that 18% of its customers have tea with their breakfast.

**15 (a)** Theo says,

"82% of customers at the hotel **must** have coffee with their breakfast."

Comment on Theo's statement.

**[1 mark]**

**15 (b)** The hotel selects a random sample of 5 customers.

Use the Binomial distribution to find the probability that **exactly one** of these customers has tea with their breakfast.

**[3 marks]**

Answer _____

*Do not write outside the box*

**15 (c)** A family of 3 people have breakfast at the hotel.

Explain why the number of people in the family having tea with their breakfast may **not** follow a Binomial distribution.

**[1 mark]**

5

**Turn over for the next question**

*Do not write outside the box*

**16** University undergraduate degrees are graded as First Class, Upper Second Class, Lower Second Class, Third Class or Pass.

Luca wants to investigate how the number of degrees awarded in the UK in 2016 compares with the number awarded in the UK in 2008.

He also wants to see if there are any changes in the proportion of First Class degrees awarded.

He collects data about degree results from the website hesa.ac.uk.

The **Data Sheet** contains the data he collects for degrees awarded in the UK in 2016.

**16 (a)** Luca uses secondary data for his investigation.

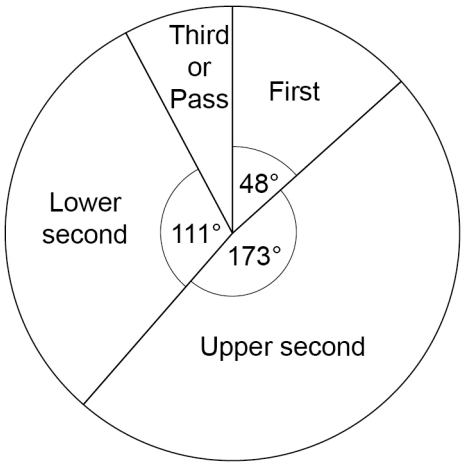
Explain why it would **not** be sensible for him to collect primary data.

**[1 mark]**

He decides to use **comparative pie charts** to show the data.

He draws this pie chart to show the grades of degree awarded in 2008.

**2008**
Number of degrees
308 395




Radius 3.0 cm

**2016**

*Do not write outside the box*

**16 (b)** Give **one** reason why comparative pie charts are a suitable way to show the data.

**[1 mark]**

**16 (c)** Draw the corresponding pie chart for 2016 next to the one for 2008.

Use the information from the 2008 pie chart and **TABLE 1** on the **Data Sheet**.

You **must** show your working.

**[6 marks]**

**16 (d)** More **First Class** degrees were awarded in 2016 than in 2008.

How many more?

**[3 marks]**

Answer _____

**Question 16 continues on the next page**

*Do not write outside the box*

**16 (e)** Luca makes the following conclusion,

'It has become easier to get a First Class degree in the UK.'

Give **one** reason why Luca's conclusion may **not** be correct.

**[1 mark]**

**16 (f)** Luca extends his investigation by exploring the proportion of full-time students awarded a First Class degree compared to the proportion of part-time students awarded a First Class degree.

The data for 2016 are shown on the **Data Sheet** in **TABLE 2**.

Compare these proportions.

**[3 marks]**

15

**END OF QUESTIONS**

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**ANSWER IN THE SPACES PROVIDED**

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**ANSWER IN THE SPACES PROVIDED**

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