

GCSE Statistics

Deep dive into “appropriateness”

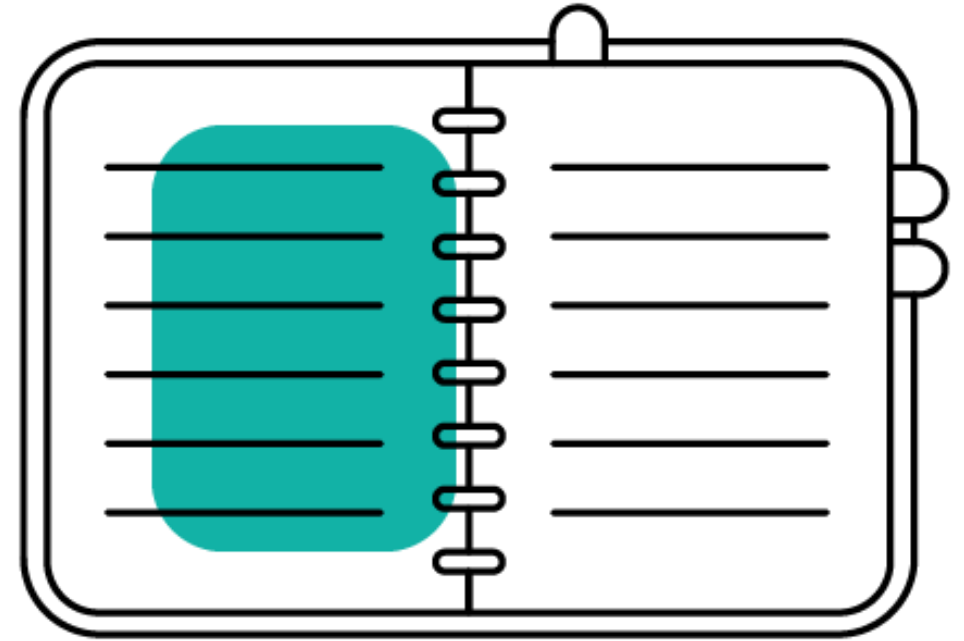
Melanie Muldowney

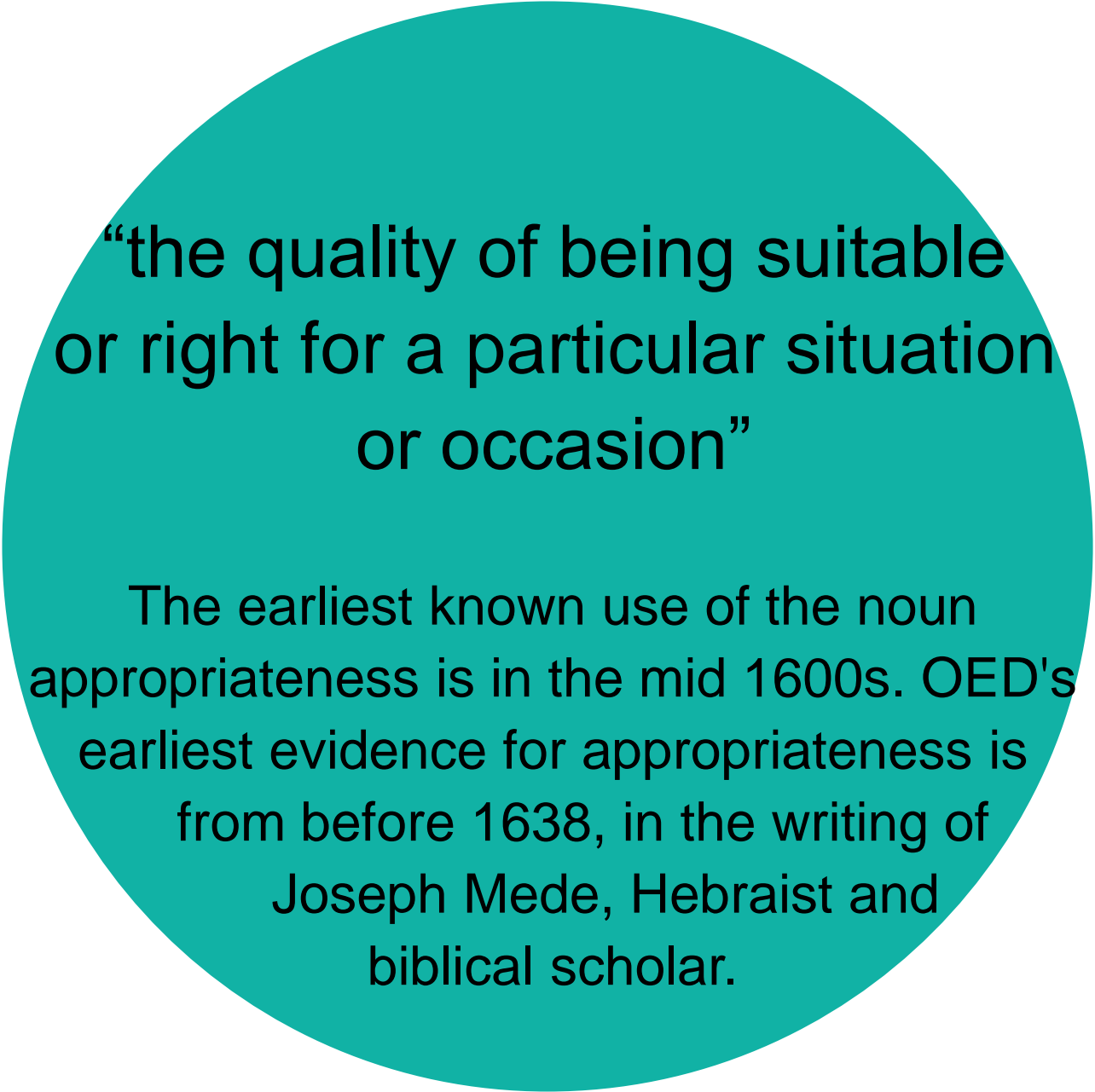


Agenda

In this session we are going to look at:

- Where this sits in the specification
- Why?
- Key ideas / Issues
- Share some ideas / resources to help in the classroom





“the quality of being suitable
or right for a particular situation
or occasion”

The earliest known use of the noun
appropriateness is in the mid 1600s. OED's
earliest evidence for appropriateness is
from before 1638, in the writing of
Joseph Mede, Hebraist and
biblical scholar.

Specification



Assessment Objectives

Students must:		% in GCSE
A01	Demonstrate knowledge and understanding, using appropriate terminology and notation, of standard statistical techniques used to: <ul style="list-style-type: none">• collect and represent information• calculate summary statistics and probabilities	55
A02	Interpret statistical information and results in context and reason statistically to draw conclusions <i>Where questions/tasks targeting this Assessment Objective will also credit students for their ability to 'demonstrate knowledge and understanding of standard statistical techniques (A01) and/or to 'assess the appropriateness of statistical methodologies and the conclusions drawn through the application of the statistical enquiry cycle' (A03), an appropriate proportion of the marks for the question/task must be attributed to the corresponding Assessment Objective(s).</i>	25
A03	Assess the appropriateness of statistical methodologies and the conclusions drawn through the application of the statistical enquiry cycle <i>Where questions/tasks targeting this Assessment Objective will also credit students for their ability to 'demonstrate knowledge and understanding of standard statistical techniques' (A01) and/or to 'interpret statistical information and results in context and reason statistically to draw conclusions' (A02), an appropriate proportion of the marks for the question/task must be attributed to the corresponding Assessment Objective(s).</i>	20

Assessment Objectives

Breakdown of Assessment Objectives

Paper	Assessment Objectives			Total for all Assessment Objectives
	AO1 %	AO2 %	AO3 %	
Paper 1 (1F/1H)	27.5	12.5	10	50%
Paper 2 (2F/2H)	27.5	12.5	10	50%
Total for GCSE	55% ±3	25% ±3	20% ±3	100%

Past Performance ... the Why? Foundation

Question	Skill tested	mean score	max score	Mean %	ALL	5	4	3	2	1	U
Q01d	Importance of reliability and validity	1.16	2	58	1.16	1.67	1.47	1.18	0.82	0.43	0.11
Q02d	Justify the appropriate format and produce accurate visualisation of data	0.39	2	20	0.39	0.85	0.49	0.29	0.16	0.05	0.01
Q05c	Comment on the differences between experimental and theoretical values in terms of possible bias	1.09	2	55	1.09	1.70	1.40	1.11	0.71	0.24	0.04
Q06f	Importance of reliability and validity	0.60	1	60	0.60	0.80	0.73	0.64	0.48	0.25	0.04
Q08c	Select and justify appropriate form of representation with regard to the nature of data	0.13	2	7	0.13	0.40	0.15	0.05	0.02	0.01	0.00
	Appropriateness Qs		9	37%	3.37	5.42	4.24	3.27	2.19	0.98	0.2
	Paper 1F	36.53	80	46%	36.53	56.40	45.04	35.29	25.44	14.19	4.08
Q03e	Justify the rationale for selecting appropriate types of average	0.52	2	26	0.52	0.79	0.64	0.52	0.35	0.17	0.05
Q05	Key features to be considered when planning data collection	1.02	6	17	1.02	2.39	1.36	0.67	0.26	0.10	0.01
Q07d	Techniques used to deal with problems with collected data Tabulation	0.60	2	30	0.60	1.01	0.76	0.57	0.36	0.15	0.03
Q08a	Select and justify appropriate form of representation with regard to the nature of data	0.13	1	13	0.13	0.32	0.16	0.07	0.04	0.02	0.00
Q09b	Justify the appropriate format and produce accurate visualisation of data	0.17	1	17	0.17	0.40	0.22	0.11	0.04	0.01	0.00
Q10a	Difference between primary and secondary data Sources of data	0.49	1	49	0.49	0.80	0.67	0.47	0.25	0.10	0.02
	Appropriateness Qs		13	23%	2.93	5.71	3.81	2.41	1.3	0.55	0.11
	Paper 2F	27.29	80	34%	27.29	47.04	34.83	24.37	15.38	8.41	2.79

Past Performance ... the Why? Higher

[illegible]

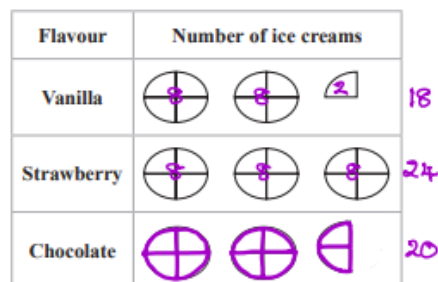
Foundation P1 Q1


Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 The incomplete pictogram gives information about the flavour and number of ice creams sold at Pradeep's cafe one Saturday morning.



Key:  represents 8 ice creams

20 chocolate ice creams were sold on Saturday morning.

- (a) Complete the pictogram for the number of chocolate ice creams sold.

- (b) Work out the total number of ice creams sold on Saturday morning.

$$18 + 24 + 20 =$$

62

B2 for e.g. not appropriate / no and one reason from:

- Only in the morning
- Only on a weekend / do not know the data for the week days
- Depends on the weather / the season / time of year / day
- Larger sample required / 2 days is not enough
- Large variation in data

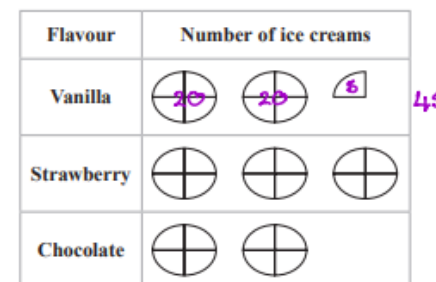
(B1 for a correct reason with no conclusion


OR

for not appropriate with an attempt at a reason)

B2 for correct conclusion with equivalent corresponding reasoning.

The pictogram below gives information about the flavour and number of ice creams sold at Pradeep's cafe one Sunday morning.



Key:  represents 20 ice creams ← the key is different!

- (c) Compare the number of vanilla ice creams sold in the cafe on Saturday morning = 18 with the number of vanilla ice creams sold in the cafe on Sunday morning. = 45

Give a reason for your answer.

e.g. More vanilla ice creams were sold on Sunday than on Saturday morning $45 > 18$

(2)

Pradeep wants to use the collected data to estimate how many ice creams of each flavour she will sell for the whole of next week.

- (d) Considering Pradeep's data decide if this is appropriate.

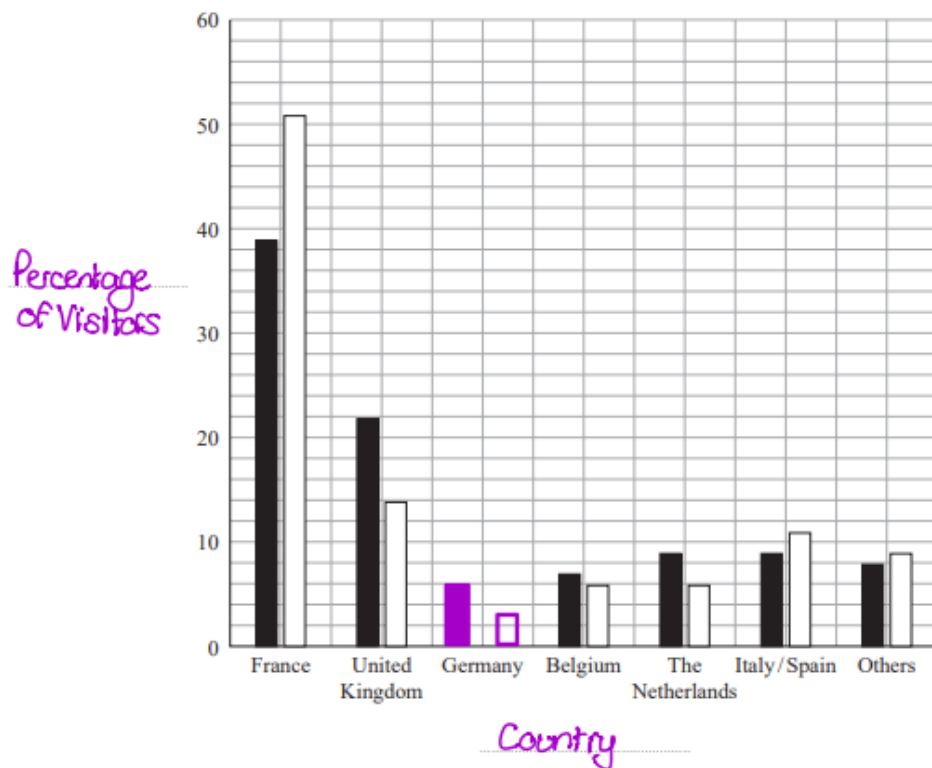
e.g. it is not appropriate because the data was only collected in the morning (or only on a weekend)

(2)

(Total for Question 1 is 7 marks)

Foundation P1 Q2

- 2 The incomplete multiple bar chart gives information about the home country of visitors to a theme park in 2003 and in 2013



Key: ■ 2003 □ 2013

(Source: <https://www.dlpguide.com/>)

In 2003, 39% of the visitors were from France.

- (a) (i) On the multiple bar chart complete the label for the horizontal axis. (the x-axis) (1)
- (ii) On the multiple bar chart complete the label for the vertical axis. (the y-axis) (1)

In 2003, 6% of the visitors were from Germany.
In 2013, 3% of the visitors were from Germany.

- (b) Complete the multiple bar chart for visitors from Germany. ✓

- (c) Compare the change in the percentage of visitors to the theme park from France in 2003 and in 2013 with the change in the percentage of visitors to the theme park from the United Kingdom in 2003 and in 2013.
 increased (2)
 decreased.

eg. The percentage of visitors from France increased between 2003 and 2013 but the percentage of visitors from the UK over the same period decreased.

(2)

John is investigating how the total number of visitors to the theme park has changed from 2003 to 2013

- (d) Comment on whether or not it is appropriate to use this multiple bar chart for his investigation.

eg. It is not appropriate as the graph only shows percentages and not any visitor numbers

(2)

(Total for Question 2 is 8 marks)

B2 for a correct reason and conclusion e.g.

- The graph only shows percentages so not appropriate / no
- The graph does not show the total number of visitors so not appropriate / no
- The graph only shows 2003 and 2013 so not appropriate / no.

(B1 for e.g.

- The graph only shows percentages
- The graph does not show the total number of visitors
- The graph only shows 2003 and 2013)

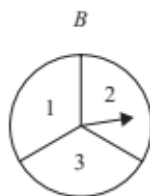
B2 for not appropriate with a correct reason

(B1 for a correct reason and no conclusion)

Foundation P1 Q5

- 5 Carol spins the two spinners *A* and *B*. She adds their scores together.

Read this!



- (a) Complete the sample space diagram below to show all the possible totals.

		Score on spinner <i>B</i>		
		1	2	3
Score on spinner <i>A</i>	1	2	3	4
	2	3	4	5
	3	4	5	6
	4	5	6	7

(2)

- (b) Assuming that the spinners are fair, find the probability

- (i) that the total score is 3,

$$\frac{2}{12}$$

(1)

- (ii) that the spinners show the same score.

$$\frac{3}{12}$$

(1)

Carol spins spinner *A* 120 times. The table below shows the scores that she got.

Score	Frequency
1	60
2	18
3	27
4	15

$$P(A) = \frac{60}{120} = \frac{1}{2}$$

Carol concludes that spinner *A* is biased towards the number 1

- (c) Assess whether or not Carol's conclusion is appropriate.

Yes her conclusion is appropriate because spinner *A* does appear to be biased towards the number 1 ... we would have expected a number close to 30 ($\frac{1}{4}$ of 120) and not 60.

(2)

(Total for Question 5 is 6 marks)

B1 for e.g.

- There is a large number of a score of 1
- The frequency of 1 is double what it should be
- Would have expected a score of 1 to be closer to 30
- Would expect the frequencies to be similar / same

depB1 for... so Carol's conclusion is appropriate / Carol is correct

dep on B1 scored

Foundation P1 Q6

6 The manager of a gym is reviewing the current opening times of the gym.
The manager thinks that if the gym is open for more hours it will affect the number of people using the gym.

(a) Suggest a hypothesis that the manager could use.

eg. The longer the gym is open, the more people will use it.

(1)

The manager wants to get the opinions of the people who have a membership at the gym by giving them a questionnaire.

The manager obtains a numbered list of the 1500 people with a membership and decides to take a sample of 10% of the gym members.

The manager chooses the person who is numbered 0004 as the random starting point on the list and then picks every 20th person.

(b) Name the sampling method that the manager plans to use.

Systematic

(1)

(c) (i) Give one reason why this is a good plan.

eg it should result in an unbiased sample.
(or it is easy / convenient)

(1)

(ii) Will the manager's plan give a 10% sample of the gym members?
Give a reason for your answer.

eg No, to give a 10% sample he would need to take every 10th person not every 20th.

B1 for any one from e.g.

- getting the views of people who are not currently members and might then become members
- they might want different opening times to members
- so that it is not biased to only members
- to find out why they do not have memberships
- might have different opinions to members

Or any other reasonable explanations

Here is one of the questions that the manager is considering for the questionnaire.

"Do you agree that the gym should stay open for 24 hours a day?"

(d) Suggest two improvements to this question.

1 remove 'do you agree' as it is leading.

2 add response boxes.

(2)

The manager decides to do a pre-test of the questionnaire by giving it to a small group of people.

(e) (i) What is it called when a questionnaire is tested in this way?

Pilot

(1)

(ii) Give **two** reasons why the manager might do this.

eg Two from: They can monitor the response rate

- Check the questions are understood
- identify likely responses
- Allows him to make improvements

(2)

Following the full survey the manager concludes that if the gym is open for 24 hours a day it will not affect the number of people using the gym.

(f) Give a reason why it would also be **appropriate** for the manager to find the opinions of people who do **not** have a gym membership.

eg opening longer hours may encourage them to become members.

(1)

(Total for Question 6 is 11 marks)

Foundation P1 Q8 & Higher P1 Q2

8 A fjord is a deep and narrow part of a sea with steep land on three sides.

Emily is investigating the length of fjords in Norway. She collects some data from the internet and puts the data into a grouped frequency table.

The grouped frequency table below shows information about the results she collected.

Length of fjord (l km)	Frequency
$0 \leq l < 50$	199
$50 \leq l < 100$	17
$100 \leq l < 150$	12
$150 \leq l < 200$	3
$200 \leq l < 250$	1

(Source: https://en.wikipedia.org/wiki/List_of_Norwegian_fjords)

(a) Work out the number of fjords that have a length of at least 100 km.

$$12 + 3 + 1$$

16

(2)

(b) (i) Calculate an estimate of the mean length of these fjords. Give your answer to 1 decimal place.

$$\begin{aligned} &25 \times 199 + \\ &75 \times 17 + \\ &125 \times 12 + \\ &175 \times 3 + \\ &225 \times 1 \\ &\hline &8500 \end{aligned}$$

$$\begin{aligned} &8500 \div 232 \\ &= 36.637.. \end{aligned}$$

36.6

(3)

km

(ii) Explain why your answer to part (b)(i) is only an estimate.

eg. The data is grouped and so we've estimated by using midpoints of each interval

(1)

(iii) How could Emily have improved the accuracy of her answer to part (b)(i)?

eg. Emily could have used smaller intervals

(1)

Emily plans to use a frequency polygon to represent the lengths of the fjords.

(c) Discuss whether or not a frequency polygon would be an appropriate diagram to use.

eg. Yes it is appropriate for frequency polygons with continuous data.

No, because the intervals are not consistent sizes

(2)

(Total for Question 8 is 9 marks)

B2 for appropriate and a correct reason

- (continuous) grouped data
- can show the distribution of lengths

(B1 for e.g. grouped data with no / incorrect conclusion)

OR

B2 for not appropriate and a correct reason

- poor class widths
- variable frequencies / a lot more lengths in $0 \leq l < 50$

(B1 for poor class widths / large variation in frequencies with no / incorrect conclusion)

B2 for assessing the appropriateness of using a frequency polygon with consistent reason

(B1 for a correct reason and no conclusion / incorrect conclusion)

Ignore additional non-contradictory statements. Ignore reference to alternative diagrams.

Higher P1 Q5

B1B1 for e.g.

- Biased / everyone on production line may have same opinions
- Not random / not everyone has the same chance of being selected
- Not representative / only asking in one area of the factory / other areas of factory not included / may not get information about some changes

B1 for each of two bullet points

5 The management of a factory is considering changing the working hours of their employees.

Muhammad and Rose want to get the views of the employees in the factory.

Employees in the factory work on the production line or in the warehouse or in the office.

20 employees work on the production line.

15 employees work in the warehouse.

25 employees work in the office.

Muhammad plans to use a questionnaire.

He plans to take a sample of the employees and ask them the questions on his questionnaire.

For his sample, he decides to ask all of the employees who work on the production line.

(a) (i) Name this sampling technique.

cluster

(1)

(ii) Give two reasons why using this sampling technique may not be appropriate.

- eg 1 asking only the production line employees may lead to a biased result as they may all have the same opinion.
- 2 Selection is not random

(2)

Muhammad wants to find out how many extra hours each employee would be willing to work each week.

(b) Design a closed question that Muhammad could use in his questionnaire.

(2)

How many extra hours would you be willing to work each week?

☐
☐
☐
☐
☐

0 hours

$0 < h \leq 3$

$3 < h \leq 6$

$6 < h \leq 9$

$h > 9$

Muhammad collects the completed questionnaires.

He finds that some of the employees on the production line have not responded.

(c) Suggest **two** ways in which Muhammad could have reduced the number of non-responses.

eg. He could have offered an incentive or used a face to face interview with each employee.

(2)

Rose decides to take a 10% systematic sample of all the 60 employees in the factory.

(d) Describe in detail how this sample could be selected. $10\% = 6$

eg He could

- get a list of employees in a spreadsheet
- randomise the order of the names
- pick every 10th person.

(3)

Rose plans to use a face-to-face interview.

(e) How would using a face-to-face interview rather than a questionnaire improve the quality of the responses?

eg. Any queries about the actual questions can be answered.

(1)

(Total for Question 5 is 11 marks)

Higher P1 Q7

7 Roberta is investigating how the ages of brides getting married in the UK has changed from 2003 to 2013
She collects official data from the internet using the website 'Office for National Statistics'.

(a) Explain why this website will give reliable data.

eg The ONS has quality assurance standards.

(1)

Roberta wrote the following hypothesis before she collected her data,

Has the age of brides increased between 2003 and 2013?

(b) Explain why it is not appropriate to use this as a hypothesis.

it is written as a question. A hypothesis needs to be a statement.

(1)

The table gives information about the data that Roberta collected.

Age of bride	2003	2013
Under 25	53 837	32 197
25 to 34	130 138	126 377

(b)	B1 as it is a question/should be a statement	
(c)	<p>B1 pie charts appropriate as want to compare proportions (of brides in different age groups) / pie charts allow us to compare proportions (of brides in different age groups)</p> <p>B2 Comparative pie charts more appropriate / better or Roberta correct plus a reason e.g.</p> <ul style="list-style-type: none"> as totals are different more brides in 2003 <p>(B1 for e.g. totals are different / more brides in 2003 with no conclusion or incorrect conclusion)</p> <p>OR</p> <p>B2 Comparative pie charts are not appropriate / not necessary or Andria plus reason</p> <ul style="list-style-type: none"> totals are similar <p>(B1 for e.g. totals are similar with no conclusion or incorrect conclusion)</p>	<p>B1 for indicating a pie chart is appropriate together with a correct reason This may be as part of a comment on comparative pie charts.</p> <p>B2 for a decision on the appropriateness of comparative pie charts with a correct reason (B1 for a correct reason with no conclusion or incorrect conclusion) Note: indication that comparative pie charts are more appropriate may be e.g. 'Andria should use comparative pie charts' (as Andria originally planned only to use pie charts).</p>

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Roberta wants to compare the proportion of brides in each age group and the total number of brides in each age group by presenting the results in charts for 2003 and 2013
She discusses how to present the results with Andria.

Andria thinks that they should use pie charts.

Roberta thinks that they should use comparative pie charts.

(c) What advice would you give to Andria and to Roberta on their choice of charts?

eg Pie charts are appropriate as they will allow Andria and Roberta to compare proportions.

Comparative pie charts are however more appropriate because the totals are different in 2003 and 2013.

(3)

Roberta used a circle with a radius of 4 cm for her comparative pie chart for 2003

(d) Calculate the radius of the circle for her comparative pie chart for 2013
Give your answer correct to 2 decimal places.

$$\frac{240822}{270109} = \frac{r^2}{4^2}$$

$$r^2 = 16 \times \frac{240822}{270109}$$

$$r = \sqrt{14.265...} = 3.7769... \quad 3.78 \text{ cm} \quad (2)$$

Roberta is going to present her comparative pie charts to non-statisticians.

(e) What extra information could she include on her pie charts to help the non-statisticians make comparisons?

eg She could include the percentages for each category or she could include the total number of brides each year.

(Total for Question 7 is 8 marks)

Foundation P2 Q3

- 3 Ben is researching information about the number of British swimming medals won at the Olympics.

Here are his results, giving the number of British swimming medals won at the Olympics from 1900 to 2016

~~2~~ ~~0~~ 7 6 ~~2~~ ~~4~~ ~~4~~ ~~2~~ ~~8~~
~~1~~ ~~1~~ ~~2~~ ~~3~~ ~~1~~ ~~1~~ ~~1~~ ~~3~~ 5
 5 ~~3~~ ~~1~~ ~~2~~ ~~8~~ ~~2~~ ~~3~~ ~~3~~ 6

(Source: www.teamgb.com)

- (a) Fill in the tally chart for Ben's results and complete the frequency column.

Number of Olympic medals won	Tally	Frequency
0	III	3
1	IIII I	6
2	IIII	5
3	IIII I	6
4	II	2
5	II	2
6	II	2
7	I	1

(2)

- (b) Suggest a suitable diagram that could be used for Ben's results.

e.g. pictogram or bar chart
or pie chart

(1)

- (c) Write down the mode or modes.

1 and 3

(1)

- (d) Work out the median.

27 in total so $\frac{27+1}{2} = 14\text{th value}$

$3+6=9$ $9+5=14$ ✓

2

(2)

Ben wants to use an average to summarise the data.

- (e) Which of the mode or the median would be more appropriate?
Give a reason for your answer.

eg. The median as there is more than one mode

(2)

(Total for Question 3 is 8 marks)

A1 2

B2 ft for e.g. median as there is more than one mode
(B1 for e.g. median with an attempt at a reason OR there is more than one mode)

B2 ft for identifying the appropriate average together with a reason
(B1 for identifying median with an attempt at a reason OR for a reason without a decision)

B0 for median with no attempt at reason

(2)

Foundation P2 Q5

<p>B1</p> <p>Comments on data collection:</p> <ul style="list-style-type: none"> • Taking a random sample would mean each test centre in a region had an equal chance/unbiased chance of being selected • Visiting the test centres would take too long / cost too much / isn't practical • It would be quicker / easier / cheaper to collect data from the internet / secondary data • May not be able to get the information required by asking at the test centres • A good idea to ask for data for the same month for each test centre • Should collect data in more than one month • Should include information on sample size • Good to include all of the regions/representative of the regions <p>B1ft dep for appropriate comment on appropriateness on method of data collection consistent with the observations made.</p>	<p>B1 for a correct comment relating to the methods of data collection</p> <p>B1ft for comment on appropriateness of data collection consistent with their observations Dependent on previous B mark being awarded for data collection</p>
<p>B1</p> <p>Comments on calculations:</p> <ul style="list-style-type: none"> • Use of an average is a good way to represent the waiting time overall for each region. • Claire should specify which average she plans to use. • Calculating the mean/median of each region. • Mode would not be a suitable average to use. • The range would give an idea of the spread of waiting times within each region. <p>B1ft dep for appropriate comment on appropriateness on calculations consistent with the observations made.</p>	<p>B1 for a correct comment relating to the calculations</p> <p>B1ft for comment on appropriateness of calculations consistent with their observations Dependent on previous B mark being awarded for calculations</p>

<p>B1</p> <p>Comments on diagrams:</p> <ul style="list-style-type: none"> • A bar chart would make it easier to <u>compare</u> the average waiting times for the different areas. • A bar chart is not suitable for time as it is continuous data. • A histogram or frequency polygon would be better to show continuous data. • A pie chart would not be a suitable way represent the type of data for the range of waiting times for the different areas. <p>B1ft dep for appropriate comment on appropriateness on diagrams consistent with the observations made.</p>	<p>B1 for a correct comment relating to the diagrams</p> <p>B1ft for comment on appropriateness of diagrams consistent with their observations Dependent on previous B mark being awarded for diagrams</p>
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- 5 Claire is planning an investigation into the length of time that a learner has to wait for a driving test.
She wants to find out about how waiting time varies in different regions of the UK.

Here is her plan for data collection, for calculations and for diagrams.

Data collection

Visit a random sample of driving test centres in each region to ask for their waiting time in June.

Calculations

Calculate the average waiting time for each region for June.

Calculate the range of the waiting times for each region for June.

Diagrams

Draw a bar chart showing the average waiting time for each region in June.

Draw a pie chart showing the range of waiting times for each region in June.

Discuss whether Claire's plans for data collection, for calculations and for diagrams are **appropriate**.

Data collection

eg • taking a random sample means each test centre has an equally likely chance of being selected but it would be quicker, easier and cheaper to collect data from the internet. Data for more than one month should be collected which would make it more **appropriate**.

Calculations

Calculating an average is a good way to compare waiting times for each region but she hasn't said which average she'll use. The range is a good way to measure spread so is **appropriate**.

Diagrams. A bar chart is not **appropriate** for wait times as it's continuous data and a pie chart is not **appropriate** either.

Hint: Look at the number of marks (Total for Question 5 is 6 marks) for guidance about the number of points to make.

Foundation P2 Q7

7 Chris is a manager at a theme park.

He wants to find out what food options visitors would like to be able to buy in the theme park.

(a) State the population for this investigation.

all visitors to the theme park.

(1)

Chris decides that he will take a convenience sample of visitors in the section of the park selling food.

(b) Explain what is meant by a convenience sample.

eg a sample from people who are available at the time.

(1)

(c) Give one disadvantage of using a convenience sample.

It may not be representative or may be biased

(1)

Chris plans to use the data collection sheet below.

Type of food	Tally
Pizza	
Chinese	
Curry	
Fish and chips	

(d) Discuss whether this data collection sheet is **appropriate**.

You should consider how Chris might use the data and describe any problems he might have when he uses the data collection sheet.

*eg. There are a very limited number of choices and there is no 'other' option or an option for people who don't buy food at the theme park so it is not **appropriate**.*

(2)

B2 for two comments from

- (a data collection sheet makes it) easy to analyse responses / put in graphs/ can identify the most liked product
- There are too few options (e.g. no 'burgers')
- Visitors may choose more than one option
- Visitors may not buy/like food at the theme park
- Chinese and curry are vague options
- Other should be included

(B1 for one comment from the list)

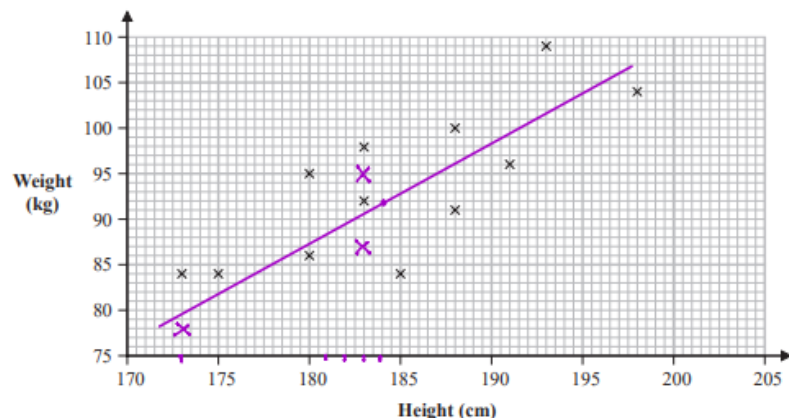
B2 for two comments on the appropriateness of using this data collection sheet.
(B1 for one comment on the appropriateness of using this data collection sheet)

(2)

Foundation P2 Q8

- 8 Timur is investigating the heights and weights of rugby players. He collected data from the internet about the heights and weights of players from the Wales rugby squad.

The players from the Wales rugby squad are classed as Forwards or Backs. Timur draws a scatter diagram for the heights and weights of some of the Backs from the Wales rugby squad.



(Source: www.wru.wales/)

- (a) Explain why a scatter diagram is **appropriate** for the type of data Timur collected.

The data is bivariate and allows us to see if there is a correlation between two variables. (1)

The data for three of the players was not plotted on the scatter diagram. The height and weight of each of these players is given in the table below.

Player	A	B	C
Height (cm)	183	183	173
Weight (kg)	95	87	78

- (b) Complete the scatter diagram by plotting the points for players A, B and C. (2)

- (c) Describe and interpret the type of correlation shown by the scatter diagram.

There is a positive correlation in that as the height increases the weight increases. (2)

B1 for e.g.

- Data is bivariate / paired / 'because each person has 2 pieces of data recorded'
- Allows Timur to see if there is a correlation / relationship / association

B1 for justifying the appropriateness of a scatter diagram. Underlined words are needed. Allow miss-spellings if underlined word is clearly attempted.

Accept bivariable

He found the Spearman's rank correlation coefficient for the heights and weights of the Forwards from the England rugby squad.

The correlation coefficient was 0.00

- (e) Interpret this correlation coefficient in context.

There is no relationship between the heights and weights of the forwards. (1)

Timur used statistical software to find the following information about the heights (x cm) and weights (y kg) of the Backs from the Wales rugby squad and the Backs from the England rugby squad.

	Spearman's rank correlation coefficient	Gradient of line of best fit
Wales rugby squad Backs	0.81 ↑	0.96
England rugby squad Backs	0.65	1.02 ↑

(Source: www.englandrugby.com)

- (f) Compare the Spearman's rank correlation coefficients and interpret this comparison in the context of the question.

The correlation between the height and weight of the Wales rugby squad backs is stronger than for England's; which means the heights and weights for Wales are more closely related. (2)

Timur uses the information in the table to conclude that the weight of the England rugby squad Backs increases faster than the weight of the Wales rugby squad Backs as their height increases.

- (g) Assess the validity of Timur's conclusion with reference to the statistical results.

eg. Timur is correct as the gradient of the line of best fit for the England rugby squad backs is greater so their weight increases faster than Wales for each cm of height. (2)

(Total for Question 8 is 12 marks)

Foundation P2 Q9

- 9 Mobeen is investigating whether there is a difference in the amount of time spent reading by pupils in Green Park school and pupils at Golden Plains school.

He uses a census of all of the pupils at each school.

Each pupil is asked to record the amount of time spent reading in a week.

Mobeen then collects this information from each student through an online database.

Part of the database is shown below.

	School	Time spent reading
1	Green Park	3 hours and 10 minutes
2	Golden	2.5 hours
3	GP	45
4	GREEN PARK	1h30
5	Golden Plains	$3\frac{1}{2}$ h
6	Green park	About 5 hours
7	Green park school	None
8	—	90
9	Golden plains	1.5h

- (a) Give **two** reasons why the data should be cleaned before processing.

e.g. There are inconsistent units for time
The school name is not recorded in a consistent way.

(2)

Mobeen wants to compare the data for Green Park school with the data for Golden Plains school.

Once the data has been cleaned Mobeen plans to use all of the times to draw a single box plot.

- (b) Explain why this is **not** an **appropriate** thing to do.

eg. In order to compare you would need two separate box plots.

(1)

(Total for Question 9 is 3 marks)

B1 e.g. in order to compare you would need to draw two separate box plots – one for Green Park school and one for Golden Plains school

B1 for identifying that more than one box plot would be required to allow for comparison

(1)

Foundation P2 Q10 and Higher P2 Q1

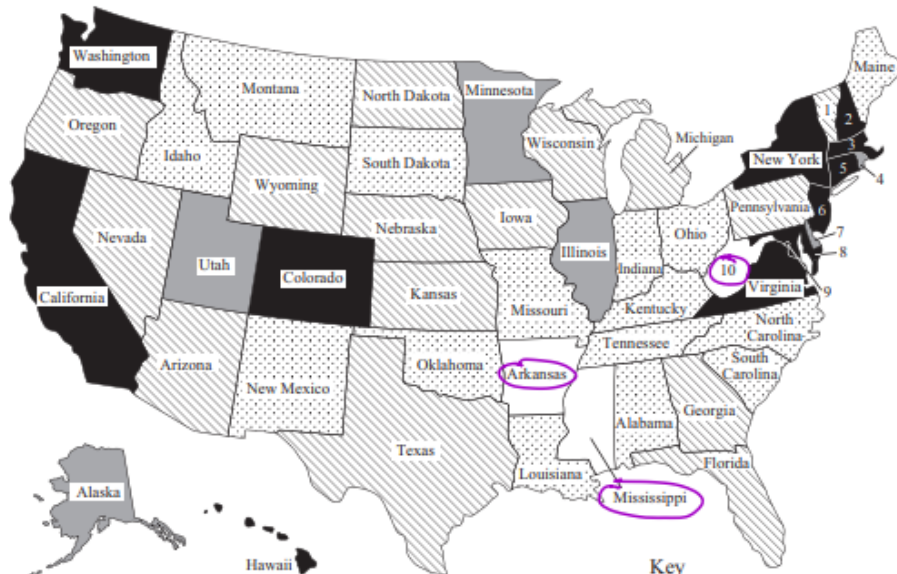
10 Matthew is investigating average household income for different states in the USA.

(a) Give a reason why it is **appropriate** to use secondary data for this.

eg It would take too long to collect all the data himself.
or It would be very expensive to collect the data himself. (1)

Matthew creates a choropleth map giving information about the mean household income by state for the USA in 2023

Mean annual household income in \$ thousands.



1. Vermont
2. New Hampshire
3. Massachusetts
4. Rhode Island
5. Connecticut
6. New Jersey
7. Delaware
8. Maryland
9. District of Columbia
10. West Virginia

(Source: worldpopulationreview.com)

(b) Which **three** states have the lowest mean household income?

West Virginia, Arkansas, Mississippi

(1)

Matthew concludes that the mean household incomes are highest on the West coast and the East coast.

(c) Does the choropleth map support this conclusion?

Give a reason for your answer.

eg. In general the map supports this conclusion as the highest mean incomes ie the darkest areas are either on the west or east coast, with the exception of Colorado. (2)

(Total for Question 10 is 4 marks)

B1 for one of:

- it would be faster **or** it would take too long to collect the data himself
- data is easily accessible/easier to collect **or** too much data to collect/analyse / not practical to collect himself
- it would be cheaper **or** it would be too expensive to collect the data himself

B1 for identifying why it is appropriate to use secondary data.
Allow a disadvantage of primary data as long as it is clear that they are referring to primary data.
e.g. people might not want to tell Matthew their average income – sensitive question

(1)

B0 for more accurate or more data.

R1 for West Virginia, Arkansas, Mississippi

R1 for identifying the three states

(1)

Higher P2 Q5

- 5 Zack is comparing the players from the England Rugby Union team with the players from the Welsh Rugby Union team. The players are listed as Rugby Union Forwards or Rugby Union Backs.

Here are the weights, in kilograms, of the England Rugby Union team players who are listed as Backs.

96	112	94	87	93	88	90	92
98	96	96	82	107	111	84	88

(Source: www.englandrugby.com/england/senior-men/squad)

The back-to-back stem and leaf diagram gives the weights, in kilograms, of the Welsh Rugby Union Backs.

- (a) Complete the back-to-back stem and leaf diagram with the weights, in kilograms, of the England Rugby Union Backs.

7
8 | 7 8 2 4 8
9 | 6 4 3 0 2 8 6 6
10 | 7
11 | 2 1

	Welsh		England
→	8	7	
	7 8 8 8 8	8	2 4 7 8 8
	8 8 8 8 2 1	9	0 2 3 4 6 6 6 8
→	8 8 8	10	7
		11	1 2

Key: 8 | 7 | 4 means 78 kg for Welsh Backs
74 kg for England Backs

(Source: www.wru.wales/fixtures-and-teams/teams/wales/)

- (b) Work out the median weight for the Welsh Rugby Union Backs.

92 kg
(1)

B1 for e.g.

- Not appropriate as readers may not understand what they (median and interquartile range) are
- Appropriate if the meaning of the statistics were explained for the target audience

B1 for assessing the appropriateness of the use of median and interquartile range for the article
Allow not appropriate as IQR and median do not use all the data or appropriate as median and IQR are not effected by outliers.

(1)

14 kg
(2)

The table gives information about the weights for the England Rugby Union Backs.

Wales	92 kg	14 kg
England	93.5 kg ↑	9 kg ↓

Zack thinks that the Welsh Rugby Union Backs are heavier and have less consistent weights than the England Rugby Union Backs.

- (d) Do the statistics support these conclusions?
You must give reasons for your answer.

The first conclusion is incorrect and the second is correct.
eg The Welsh backs have a lower median so the Welsh players are not heavier than the English players.
eg However the IQR of the Welsh players is greater than the English players so their weights are less consistent.

Amy wants to use the median and interquartile range statistics in a news article for a sports magazine. The article will compare the players on the two teams who are Backs.

- (e) Comment on the appropriateness of using the median and the interquartile range in the article.

eg. It is not appropriate because some readers may not know what the median and IQR relate to.

- (f) Give a limitation of using Zack's statistics to compare all the players on the two teams.

eg The data we have only relates to the backs so we can't assume it will be the same for all players

(Total for Question 5 is 11 marks)

Higher P2 Q7

- 7 The Consumer Price Index (CPI) is a measure of the rate of change of prices in everyday life.

The table shows the annual average CPI from 2017 to 2021 with 2015 as the base year.

Year	2017	2018	2019	2020	2021
Annual average CPI	103.6	106.0	107.8	108.9	111.6

(Source: www.ons.gov.uk)

- (a) Give an interpretation of the number 108.9 in the table.

CPI has increased by 8.9% between 2015 and 2020

(2)

- (b) Find the percentage increase in consumer prices from 2017 to 2021. You must show your working. Give your answer correct to one decimal place.

$$\frac{111.6}{103.6} \times 100 = 7.7220$$

7.7

(2)

A representative sample of consumer product prices is included in the calculations for CPI.

In the non-alcoholic beverages category there are two classes of product included.

The table gives the weightings for these two classes and the price index for one of the classes for November 2022

Non-alcoholic beverages	Weights	Price index
Coffee, tea and cocoa	2	115.6
Mineral waters, soft drinks and juices	7	

The price index for non-alcoholic beverages in November 2022 was 124.2

(Source: www.ons.gov.uk)

- (c) Calculate the price index for mineral waters, soft drinks and juices in November 2022. Give your answer correct to one decimal place.

$$\frac{2 \times 115.6 + 7 \times x}{9} = 124.2$$

$$x = \frac{9 \times 124.2 - 2 \times 115.6}{7}$$

$$= 126.657...$$

126.7

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

the same	coffee, tea and cocoa is B0.	
M1 for $\sqrt[5]{1.0256 \times 1.0229 \times 1.0174 \times 1.0099 \times 1.0252}$	Must see working to award M, A marks (arithmetic mean is also 2.02%)	(3)
A1 for 1.02018... [=2.02%]	A0 for an answer 1.02%	
OR	B1 depft on one previous mark scored.	
SCB1 for 1.91 or 1.91%		
B1 dep ft for average annual inflation rate was greater for the UK than for Germany (from 2017 to 2021)		

- (d) Explain what this means for the relative importance in the CPI of 'Coffee, tea and cocoa' and 'Mineral waters, soft drinks and juices' in 2021 compared with 2022

eg Coffee, tea and cocoa were more important in the CPI in 2021 than in 2022.

(1)

The rate of inflation is the change in prices for goods and services over time.

David wants to compare annual inflation in Germany from 2017 to 2021 with annual inflation in the UK from 2017 to 2021

The table gives the annual inflation for the UK from 2017 to 2021

Year	2017	2018	2019	2020	2021
Annual inflation	2.56%	2.29%	1.74%	0.99%	2.52%

1.0256 1.0229 1.0174 1.0099 1.0252

(Source: worlddata.info)

From 2017 to 2021 the average annual inflation for Germany was 1.66%.

- (e) By calculating an appropriate geometric mean, compare the average annual inflation for Germany from 2017 to 2021 with the average annual inflation for the UK from 2017 to 2021. You must show your working.

$$\sqrt[5]{1.0256 \times 1.0229 \times 1.0174 \times 1.0099 \times 1.0252} = 1.02018... \text{ so } 2.02\% \text{ Germany } = 1.66\%$$

eg The average annual inflation was higher in the UK than in Germany between 2017 and 2021

(3)

(Total for Question 7 is 10 marks)

Higher P2 Q8

8 Roxann wants to investigate the resting heart rates for members of her running club.

She believes that the resting heart rates will be normally distributed.

Here is the plan for her investigation.

Data collection

Take a census of the 110 members of the running club (50 female runners and 60 male runners).

Each runner will measure their resting heart rate and input the information into the spreadsheet when they come to the club.

Processing and presenting data

Construct a box plot for the resting heart rate of the male runners and a box plot for the resting heart rate of the female runners.

Work out the mean, median and mode for the resting heart rate of the male runners and for the resting heart rate of the female runners.

Work out the standard deviation for the resting heart rate of the male runners and for the resting heart rate of the female runners.

Discuss whether Roxann's plans for collecting and presenting data are **appropriate**.

DATA COLLECTION

eg It is **not appropriate** for the runners to be measuring their own heart rates as there will be no control over extraneous variables such as time of day etc.

However it is **appropriate** to take measurements when they come to the club.

PROCESSING AND PRESENTING

eg Constructing box plots and averages for male and female is **appropriate** to allow Roxann to ascertain if there are any differences between the genders. Whilst a box plot allows you to see if the data is distributed symmetrically, a histogram would tell us if the distribution is bell shaped.

Using mean, median and mode is **appropriate** as they should be equal for data that is normally distributed.

Working out SD is **appropriate** because distributed data approximately 95% of lies within 2 standard deviations of so Roxann could check this too.

(Total for Que

Answer	Additional guidance	Mark
<p>B1 for each of six correct comments. Maximum 3 marks for data collection. Maximum 3 marks for processing and presenting data.</p> <p>Data collection:</p> <ul style="list-style-type: none"> • Suitable sample size as it is large/representative as it includes all the members of the running club. • Runners measuring their own heart rates may lead to errors/inconsistency's/runners may lie about their heart rates/Roxann should measure the heart rates. • Some runners may not take part/forget to add it on the spreadsheet. • Data may need cleaning • Entering results on a spreadsheet means it will be quicker to do calculations • Appropriate for the runners to measure their heart rate when they come to the club. • She should also ask runners to record their gender on the spreadsheet. • (Runners measuring their own heart rates means that there is) no control over extraneous variables e.g. time of day, caffeine consumption 	<p>B1 for each correct comment on the appropriateness of the plans for data collection, process and presenting data.</p> <p>Do not accept: number of female and male runners differ. Each bullet point can be awarded once only.</p> <p>Comments about appropriate/not appropriate alone are not sufficient. There needs to be a correct reason.</p>	(6)

Processing and presenting data:

- Separating male and female data is sensible as there may be a difference between the sexes
- A histogram would be better than a box plot to (show the shape of the distribution)
- A box plot would allow you to see if the data is symmetrically distributed/see the spread of the distribution
- A **histogram** would allow you to see if the distribution is bell shaped
- Mean, median and mode would be expected to be equal for normally distributed data
- Mean and median would allow her to calculate the skew.
- Working out the (mean and) standard deviation would be appropriate for deciding if the distribution is normal.
- For normally distributed data approximately 95% of data lies within 2 standard deviations of the mean or 68% of data lies within one standard deviation of the mean or almost all data is within 3 standard deviations of the mean - calculating mean and standard deviation allows for this to be checked

Higher P2 Q9

- 9 Researchers wanted to find a method to predict the height of an ancient Egyptian upon bones from their skeletons.

They calculated the Pearson's product moment correlation coefficient for the relationship between the length of particular bones and the height of the skeleton for some female skeletons.

They also found regression equations for the relationship between bone length (x centimetres) and height (y centimetres) for each of these bones in male skeletons and in female skeletons.

The table gives information about these product moment correlation coefficients and these regression equations.

	Product moment correlation coefficient	Regression equation
Males		
Femur	0.826	$y = 2.257x + 63.93$
Tibia	0.850	$y = 2.554x + 69.21$
Humerus	0.656	$y = 2.594x + 83.85$
Radius	0.649	$y = 2.641x + 100.91$
Females		
Femur	0.891	$y = 2.340x + 56.99$
Tibia	0.938	$y = 2.699x + 61.08$
Humerus	0.806	$y = 2.827x + 70.94$
Radius	0.580	$y = 2.509x + 96.73$

(Source: www.semanticscholar.org)

- (a) Which bone measurement would you recommend using to estimate the height of an ancient Egyptian?
Give a reason for your answer.

The tibia length because the PMCC is the highest for both males and females.

B2 for e.g.

- not appropriate as the y-intercepts relate to a bone length of 0cm which is not realistic
- not appropriate as the y-intercepts relate to a bone length of 0cm which would be outside the range of data for any measurements

(B1 for identifying that the y-intercepts relate to a bone length of 0cm with no or incorrect comment on appropriateness)

B2 for evaluating the appropriateness of comparing the y-intercepts of the regression equations with reasoning
(B1 for correct reasons with no or incorrect evaluation of appropriateness)

Do not allow reference to a height

(2)

increase by 2.594 cm

(1)

- (c) Use the regression equations to compare the relationships between bone length and height for the different bones.
Include in your answer comparisons between male and female ancient Egyptians.

eg As all bone lengths increase the height increases.

eg The female height is estimated to increase more than males for every additional cm of length, with femurs, tibias and humerus.

eg However for the radius the male height is estimated to increase more than females for every additional cm of length.

(3)

Dina suggests comparing the y-intercepts for the regression equations.

- (d) Is Dina's suggestion appropriate?

eg This is not appropriate as the y intercept would relate to a bone length of 0cm which is unrealistic.

(2)

Higher P2 Q9

- 9 Researchers wanted to find a method to predict the height of ancient Egyptians based upon bones from their skeletons.

They calculated the Pearson's product moment correlation coefficient between the length of particular bones and the height of the skeleton for some male skeletons and for some female skeletons.

They also found regression equations for the relationship between bone length (x centimetres) and height (y centimetres) for each of these bones in male skeletons and in female skeletons.

The table gives information about these product moment correlation coefficients and these regression equations.

	Product moment correlation coefficient	Regression equation
Males		
Femur	0.826	$y = 2.257x + 63.93$
Tibia	0.850	$y = 2.554x + 69.21$
Humerus	0.656	$y = 2.594x + 83.85$
Radius	0.649	$y = 2.641x + 100.91$
Females		
Femur	0.891	$y = 2.340x + 56.99$
Tibia	0.938	$y = 2.699x + 61.08$
Humerus	0.806	$y = 2.827x + 70.94$
Radius	0.580	$y = 2.509x + 96.73$

(Source: www.semanticscholar.org)

- (a) Which bone measurement would you recommend using to estimate the height of an ancient Egyptian?
Give a reason for your answer.

The tibia length because the PMCC is the highest for both males and females.

B2 for e.g.

- appropriate since the regression equations are based on ancient Egyptian skeletons and the bones are from ancient Egyptians
- appropriate provided the bones in the pyramid are from ancient Egyptians (and not from non-Egyptian workers)

of 0cm

B2 for evaluating the appropriateness of using the regression equations with reasoning

(2)

It means that for every additional cm of length of the humerus the height is estimated to increase by 2.594 cm

(1)

- (c) Use the regression equations to compare the relationships between bone length and height for the different bones.
Include in your answer comparisons between male and female ancient Egyptians.

eg As all bone lengths increase the height increases.

eg The female height is estimated to increase more than males for every additional cm of length, with femurs, tibias and humerus.

eg However for the radius the male height is estimated to increase more than females for every additional cm of length.

Dina suggests comparing the y-intercepts.

- (d) Is Dina's suggestion appropriate?

eg This is not appropriate relate to a bone length

A museum has some bones that were recovered from an Egyptian pyramid.

The museum wants to predict the height of the ancient Egyptians from whom the bones were recovered.

- (e) Is it appropriate to use these regression equations to make this prediction?

eg It is appropriate because they are based on Egyptians and the bones are also Egyptian, provided that the bones are the same type and the gender is known.

(2)

Specifically ...

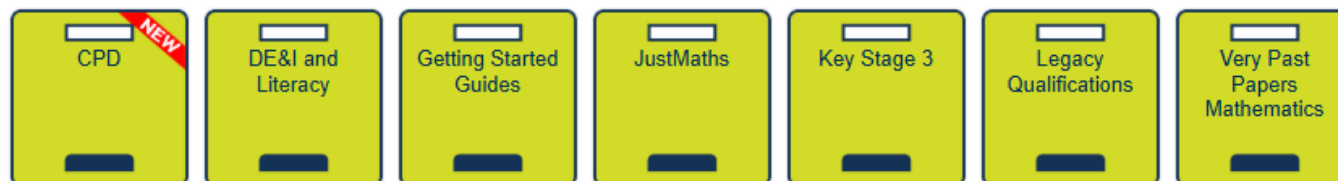
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- Use it around adjacent discussions, i.e. pros & cons
- Use it with non examples ... demonstrate why things won't work in certain situations.

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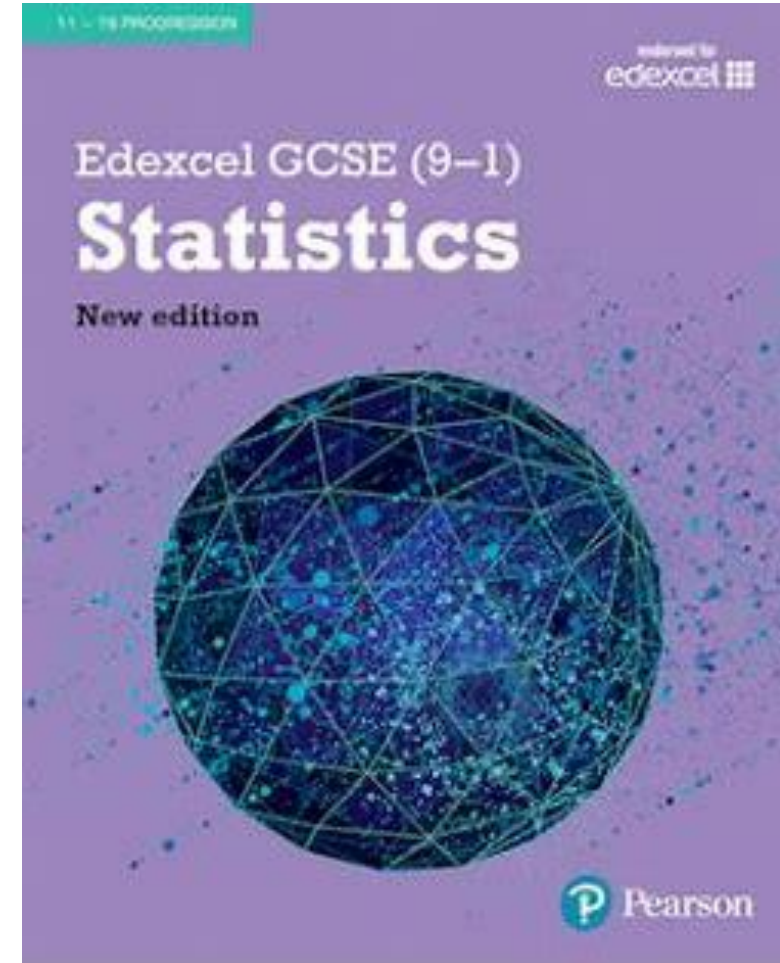
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But old ones are not defunct

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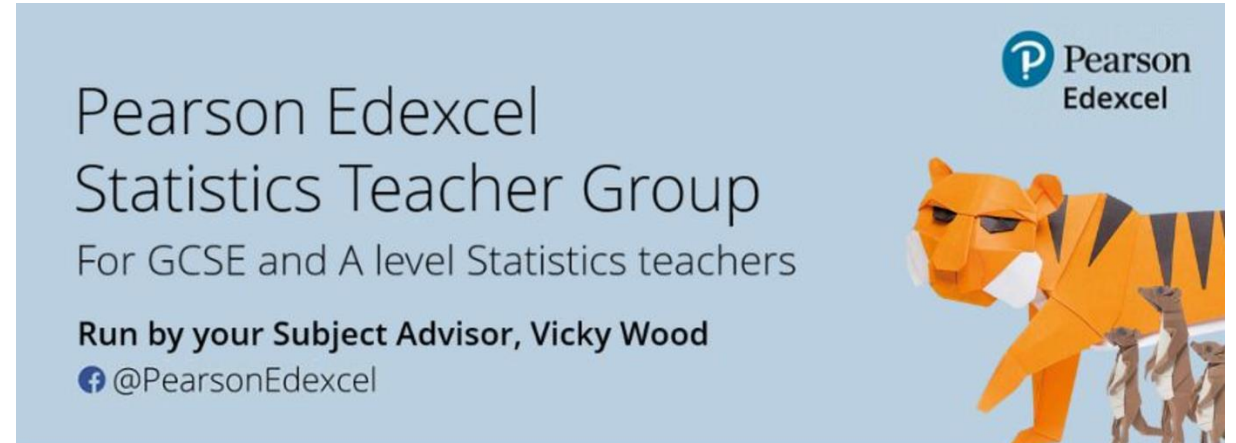
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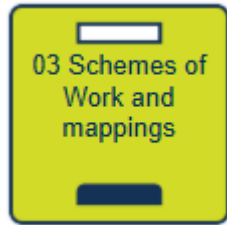
- practice papers, including Statistical Enquiry practice and themed papers for the higher tier
- common question papers,
- past papers, mark schemes, examiner reports
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Category: GCSE Statistics

GCSE Statistics documents for the current 9-1 specification (1ST0)



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F61

☐ ☐

GCSE (9-1) Statistics - Foundation Tier				GCSE (9-1) Mathematics - Foundation Tier			
GCSE STATISTICS CHAPTER / LESSON	HOURS	GCSE STATISTICS SPEC REFERENCE	GCSE STATISTICS OBJECTIVES	GCSE STATISTICS GUIDANCE	GCSE MATHS CHAPTER / LESSON	GCSE MATHS SPEC REFERENCE	GCSE MATHS OBJECTIVES
1 - Collection of data	20	1a, 1b, 1c, 1d, 2h	Know and apply terms used to describe different types of data that can be collected for statistical analysis: raw data, quantitative, qualitative, categorical, ordinal, discrete, continuous, ungrouped, grouped, bivariate.	Use of correct statistical terminology to describe given data is expected. Know that more than one term may be appropriate. Identification of variables relevant to an investigation or hypothesis is expected.	Book 1 3 - Graphs, tables and charts	3.1 - Frequency tables	Interpret and construct ... for ungrouped discrete numerical data
1.1 Describing data	1	1b.01				S2	
1.2 Grouping data	1	1b.02	Know the advantages and implications of merging data into more general categories, and of grouping numerical data into class.	Expected to know class width, and implications of grouping data, e.g. loss of accuracy in both calculations and presentations.	Book 1 3 - Graphs, tables and charts	3.1 - Frequency tables	construct and interpret diagrams for grouped discrete data and continuous data, ...
1.3 Primary and secondary data	1	1b.04	Know the difference between primary and secondary data.	Including advantages and disadvantages of each. Consideration of the reliability and accuracy of the data (including issues of rounding) and the recognition of possible constraints in accessing	Book 1 7 - Averages and range	7.5 - Sampling	infer properties of populations or distributions from a sample, while knowing the limitations of sampling
1.4 Populations	1	1c.01	Know the difference between population, sample frame and sample.	Identify a population, and suggest a suitable sampling frame	Book 1 7 - Averages and range	7.5 - Sampling	infer properties of populations or distributions from a sample, while knowing the limitations of sampling
1.6 Random sampling	2	1c.04	Know that 'population' can have different meanings within a stated context. Know appropriate sampling techniques in the context of the problem to avoid bias. Understand random, systematic, and quota sampling.	For example, all employees in an office; all females in the UK; all items produced in a	Book 1 7 - Averages and range	7.5 - Sampling	infer properties of populations or distributions from a sample, while knowing the limitations of sampling
		1c.05	Know the key features of a simple random sample and demonstrate understanding of	Be aware that all items in the population should have the same likelihood of inclusion in		S1	infer properties of populations or distributions from a sample, while

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GCSE Statistics

6th January 2025

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- New 'Aiming for' Practice Papers

Spring Term 2025

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Contact us

Mel Muldowney
mel@justmaths.co.uk

Christian Seager
christian@justmaths.co.uk

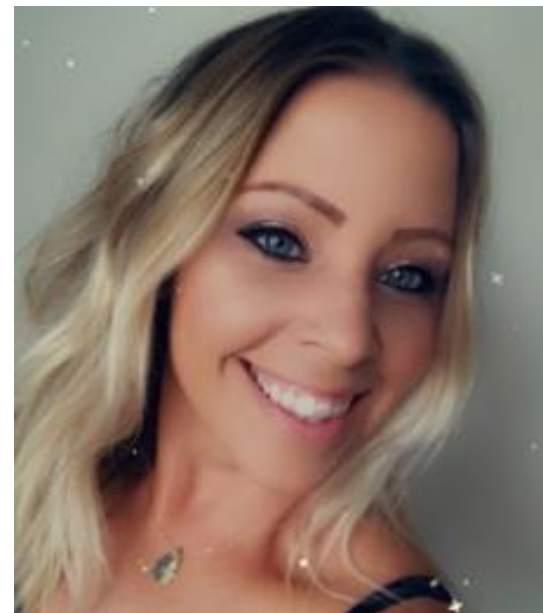
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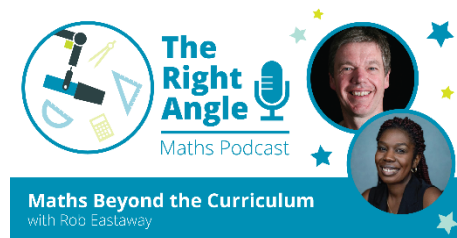
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NEW Podcast: The Right Angle



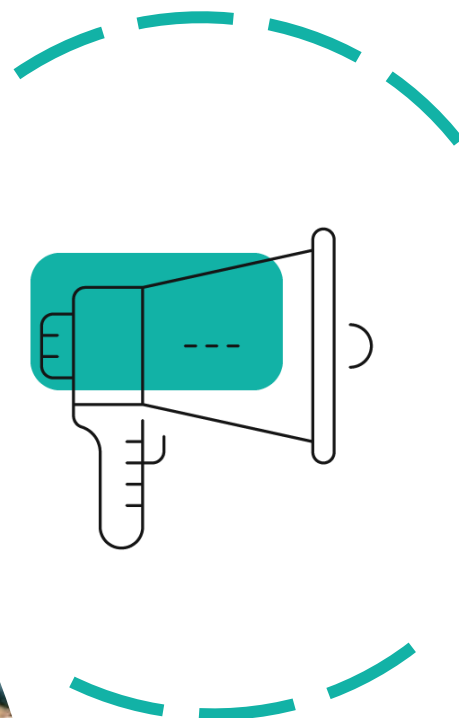
The Right Angle invites topical discussions, debates and insights from a range of thought leaders, award-winning maths educators and facilitators. Our subject partner hosts, Mark Heslop and Nicola Woodford-Smith lead conversations on themes such as the evolution of technology to support learning, student engagement and diversity and inclusion across the education of mathematics. Listen and subscribe for FREE on Apple Podcasts, Spotify and on Soundcloud.



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Your Feedback Matters

Following this event, you will receive an invitation to share your thoughts about the session. Your feedback is invaluable to us, as it helps us tailor our professional development materials to better meet your needs. Please don't hesitate to let us know what you'd like to see more of and what areas you think could be improved.



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