Name	Date started	Target end date

WJEC GCSE Mathematics and Numeracy (Double Award) — Question Pack

Beyond the mean and median, the spread of a data set matters too. Calculate the range, lower and upper quartiles and the interquartile range from a li

REVISE
.wales

3.22 — Measures of spread & IQR

Spec 4.2.15, 4.2.16, 4.2.17 — Unit 3 (calculator allowed)

Beyond the mean and median, the spread of a data set matters too. Calculate the range, lower and upper quartiles and the interquartile range from a list or from a cumulative frequency curve, and use them to compare distributions. Sourced from legacy WJEC GCSE Mathematics and Mathematics-Numeracy papers, organised for revision under the 2025 spec.

2025 SPECIFICATION

Estimated time for entire question pack: ~1 hours 2 minutes

*Derived from the GCSE Higher pace of **~1.5 min/mark** (41 marks across 13 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. Questions are organised against the 2025 specification.

Questions are ordered chronologically by sitting, with custom-written and SAM questions at the end.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — method marks are awarded for clear setup.

A calculator is allowed on every question in this pack (Unit 3 is the calculator-allowed paper).

Measures of spread & IQR — what the new spec asks

WJEC GCSE Mathematics (first teaching 2025) · Unit 3: calculator-allowed.

Range 4.2.15

- Calculate the range as $\max - \min$.
- Recognise the range as a measure of spread sensitive to outliers.
- Quote the answer as a single number with units.

Quartiles & interquartile range 4.2.16

- Identify Q_1, Q_2, Q_3 from an ordered list using position $\frac{n+1}{4}$, $\frac{n+1}{2}$, $\frac{3(n+1)}{4}$.
- Calculate $\mathrm{IQR} = Q_3 - Q_1$.
- Recognise the IQR as the spread of the middle 50% of the data, robust to outliers.

Comparing distributions 4.2.17

- Compare two data sets by quoting an average *and* a measure of spread.
- Interpret the comparison in the context of the question.
- Justify the choice of statistic given the type of data and the presence of outliers.

Crib sheet »

Measures of spread & IQR in one page

Quick-reference notes — revisit before each question. Don't use during the questions.

Range

$$\text{range} = \max - \min$$

The simplest measure of spread. Quote it as a single number with units.

Strongly affected by extreme values (outliers).

Quartiles

Sort the data and split it into four equal parts.

- Q_1 (lower quartile) — one-quarter of the way through.
- Q_2 — the median (halfway).
- Q_3 (upper quartile) — three-quarters of the way.

Finding quartiles by position

For n ordered values:

- Q_1 at position $\frac{n+1}{4}$.
- Median at $\frac{n+1}{2}$.
- Q_3 at $\frac{3(n+1)}{4}$.

If the position isn't a whole number, take the mean of the two values either side.

Interquartile range (IQR)

$$\text{IQR} = Q_3 - Q_1$$

The spread of the middle 50% of the data.

Much less sensitive to outliers than the range — preferred for skewed data.

Range vs IQR

- *Range* — uses the two extremes; one outlier can dominate.
- *IQR* — ignores the bottom and top 25%; robust to outliers.

Quote IQR alongside the median; quote range alongside the mean (rough rule).

Reading quartiles off a CF curve

For total frequency n:

- Q_1 at $\frac{n}{4}$ on the CF axis.
- Median at $\frac{n}{2}$.
- Q_3 at $\frac{3n}{4}$.

Read across to the curve, then down to the value axis.

Comparing two data sets

Always compare *both* an average *and* a measure of spread.

E.g. "Group A's median is higher, so they scored better on average; A's IQR is smaller, so A's scores are more consistent."

Smaller IQR (or range) = less variation in the data.

Interpreting spread

A small IQR means the middle half of the data is bunched together.

A large IQR means the middle half is widely spread.

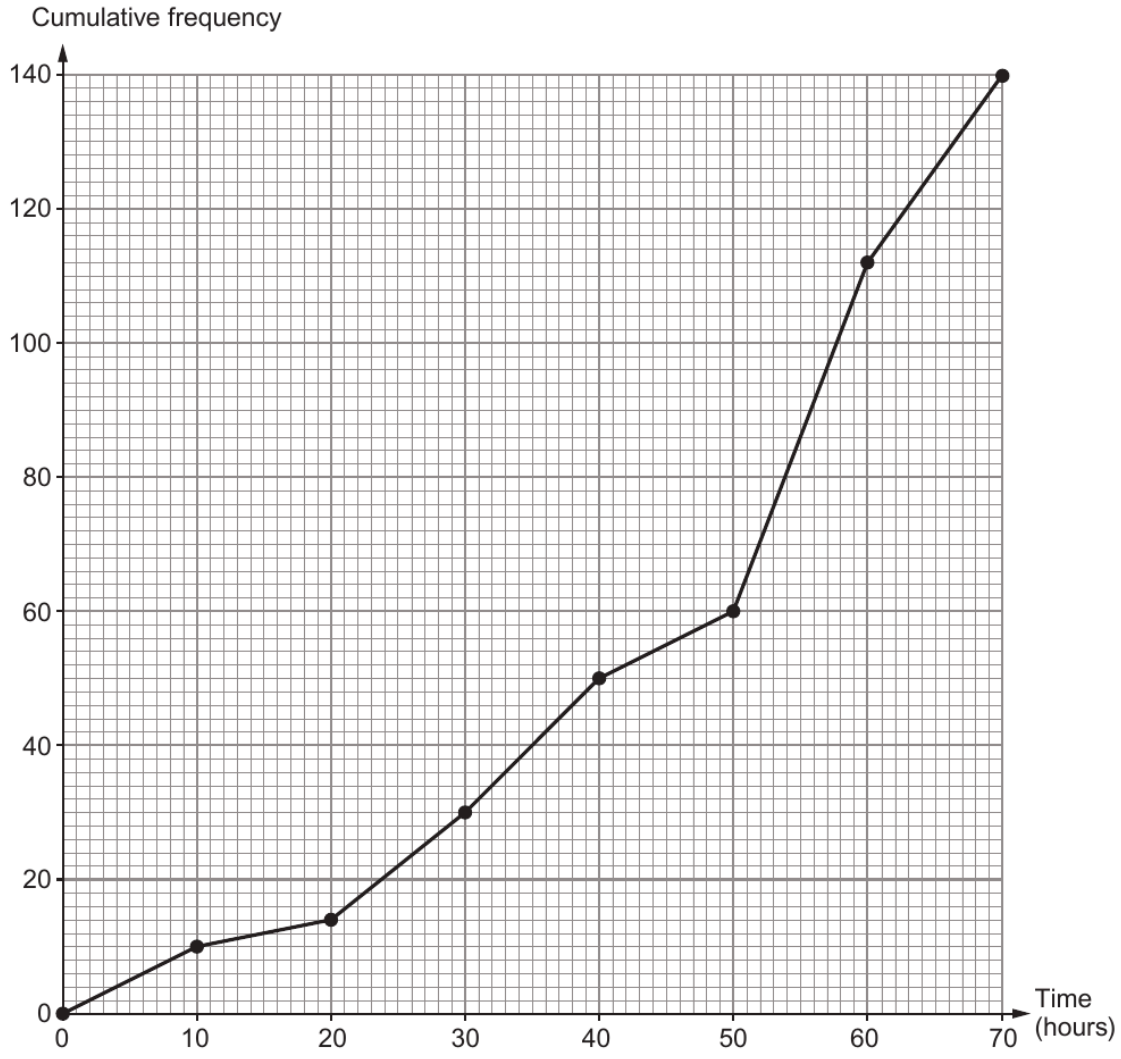
Always interpret in the context of the question, not just numerically.

Common traps

- Forgetting to *sort* the data before finding quartiles.
- Quoting IQR as a range "Q_1 to Q_3" instead of a single number.
- Reading Q_1 at $\frac{n}{4}$ on the *value* axis instead of the CF axis.
- Comparing only averages, or only spreads — mark schemes want both.

Examiner only

4. *(a)* 140 girls were asked how long they spent revising for their GCSE examinations. The cumulative frequency diagram shows the results.



(i) Estimate the median time the girls spent revising.
Circle your answer. [1]

35 hours 40 hours 48 hours 52 hours 70 hours

(ii) Calculate the number of girls who spent between 40 and 50 hours revising.
Circle your answer. [1]

0 girls 5 girls 10 girls 15 girls 20 girls

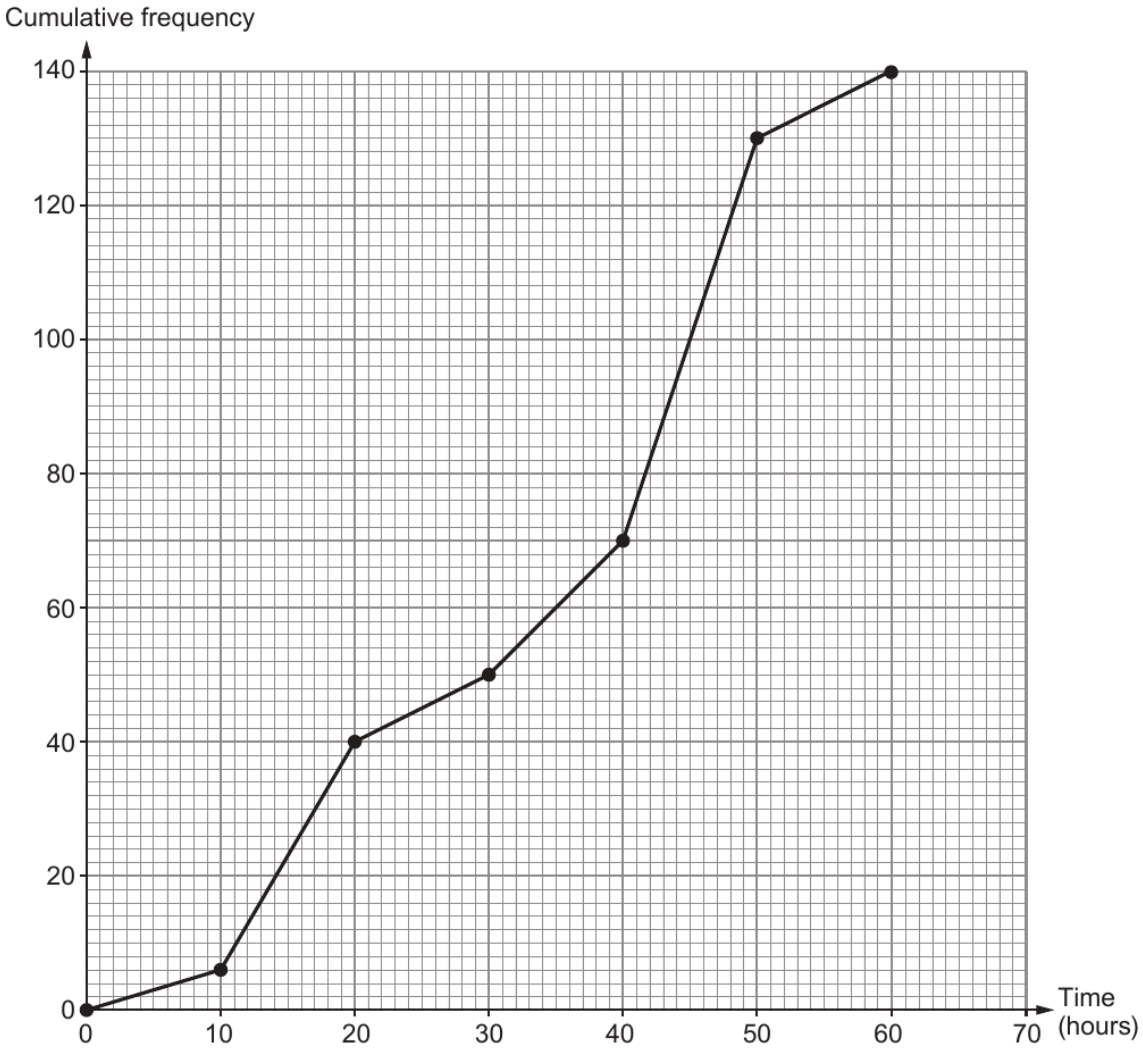
Examiner only

(iii) Circle either TRUE or FALSE for each of the following statements. [2]

25 girls spent between 30 and 50 hours revising.	TRUE	FALSE
No girls spent more than 80 hours revising.	TRUE	FALSE
The modal group is between 50 and 60 hours spent revising.	TRUE	FALSE
20 girls spent more than 60 hours revising.	TRUE	FALSE

Examiner only

(b) 140 boys were asked how long they spent revising for their GCSE examinations. The cumulative frequency diagram below shows the results.



Examiner only

Trefor makes two statements.

1. The boys' interquartile range is greater than the girls' interquartile range.

2. On average, boys spent more time revising.

Are both Trefor's statements correct?
Show calculations and give reasons to support your answers. [4]

Statement 1: .....

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Statement 2: .....

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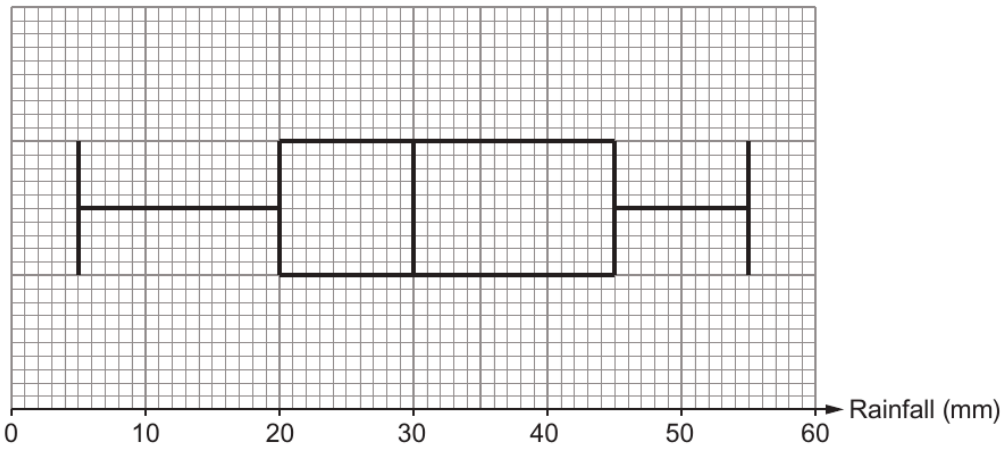
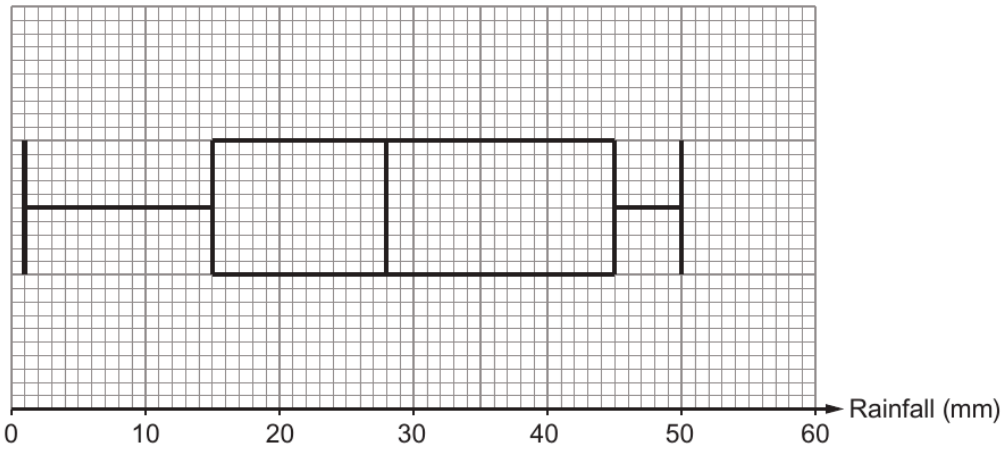
Examiner only

6. The following box-and-whisker plots illustrate the daily rainfall for April 2016 in Trefwen and in Nawrby.

April rainfall in Trefwen



April rainfall in Nawrby



Examiner only

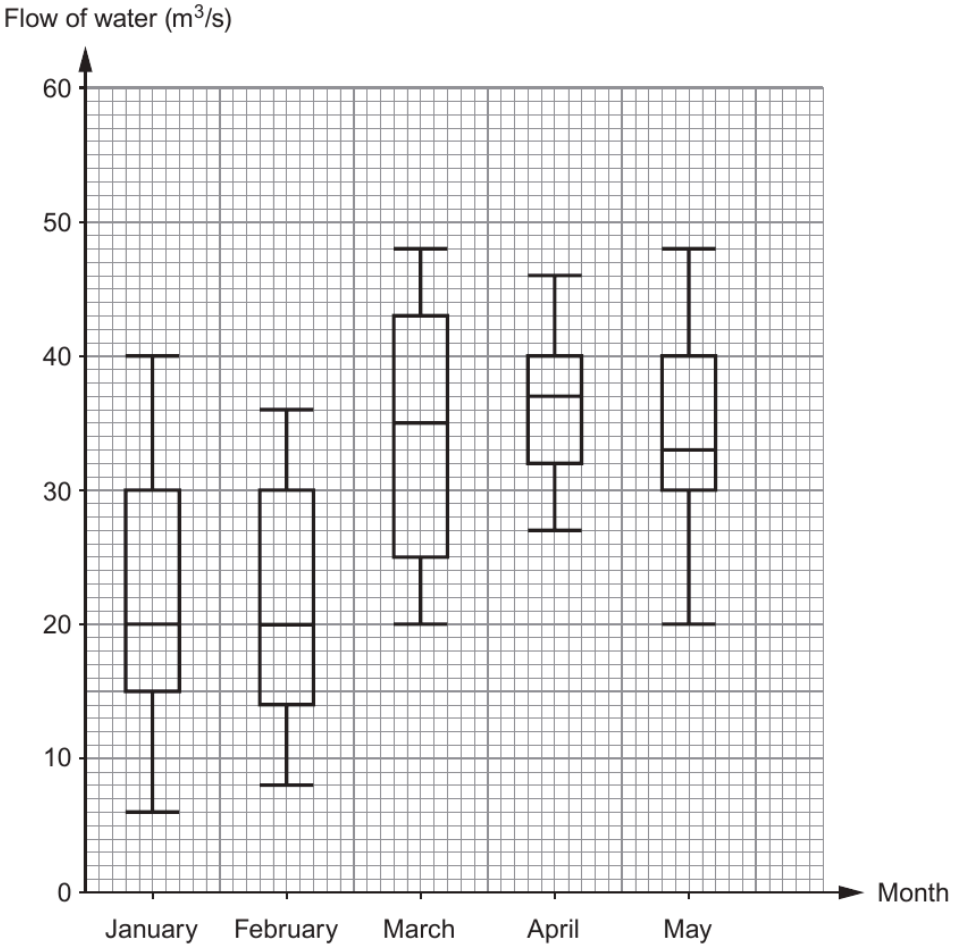
(a) Complete the following table. [4]

	Range	Median	Interquartile range
Trefwen	..... mm	..... mm	..... mm
Nawrby	..... mm	..... mm	..... mm

(b) Iona is going on holiday next April.
She is hoping for good weather, with hardly any rain.
She decides to go to Nawrby.
Give a reason to support Iona's decision.
Include values for both Trefwen and Nawrby. [1]

Examiner only

6. The following box and whisker plots show the flow of water through a drain, measured in m^3/s. The flow of water was measured at 11 a.m. each day for the first 5 months of the year.



(a) In which of the five months was the median flow of water the greatest? [1]

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Examiner only

(b) In which of the five months was the range of the flow of water the greatest? [1]

.....

.....

(c) Iona is writing some statements for a report on the flow of water through the drain. Complete each of the statements given below.

(i) 'Both the upper quartiles and medians in the months of .....

and ..... were the same.' [1]

(ii) '25% of the results in March show the flow of water was greater than

..... m^3/s.' [1]

(d) Circle either TRUE or FALSE for each of the following statements. [2]

25% of the results in January show the flow of water was less than 6 m^3/s.	TRUE	FALSE
The units, m^3/s, measure the volume of water passing through the drain each second.	TRUE	FALSE
The mean flow of water in April was **certainly** greater than 36 m^3/s.	TRUE	FALSE
The month with the greatest difference between the lower quartile and the median was May.	TRUE	FALSE

Examiner only

3.

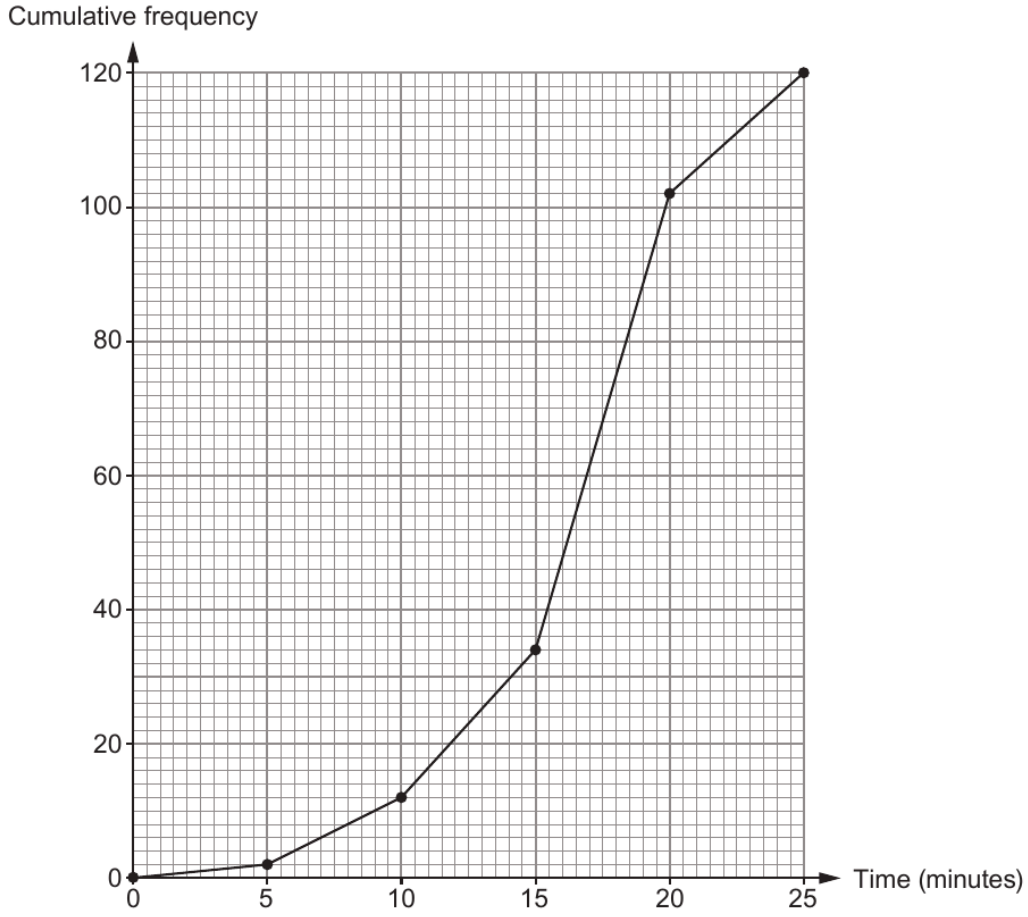
Meirion's Window Cleaning Business

No job too small!

Email: meirion@mwcb.cymru

Meirion is a window cleaner.
From Monday to Friday, he records how long he spends cleaning windows for each of his customers.

He draws a cumulative frequency diagram to display the findings.



Examiner only

(a) (i) Use Meirion's cumulative frequency diagram to find the median and interquartile range of the times he spends cleaning windows for each of his customers. [3]

Median ..... minutes

.....

Interquartile range ..... minutes

(ii) Meirion looks back at his raw data.
He finds that the median is actually 17 minutes 30 seconds.
Why is there a difference between the median from his cumulative frequency diagram and the actual median from his raw data? [1]

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(b) Meirion is looking at the time it took to clean individual customers' windows.
Find the number of customers whose windows took between 10 and 15 minutes to clean. [2]

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(c) Meirion thinks that for approximately 80% of his customers, he cleaned their windows in less than 20 minutes.
Is Meirion correct?
You must show all your working. [3]

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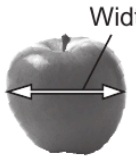
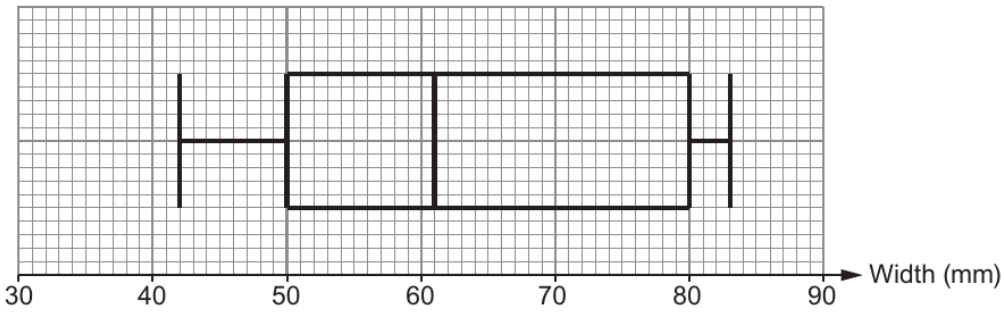
Examiner only

5. Lena has three apple trees in her garden.
She has one Gala apple tree, one Orange Pippin tree and one Pink Lady tree.
She picks 50 apples from each of the 3 trees.
She records the width of each apple, as shown.

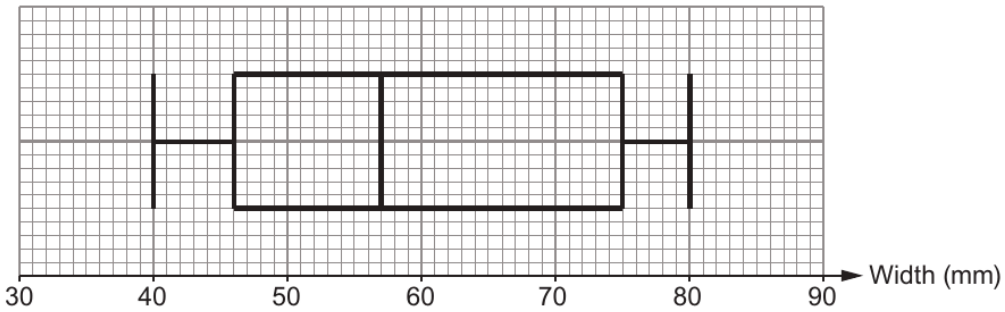


Lena constructs box and whisker diagrams for the widths of the apples collected from each of the three trees.

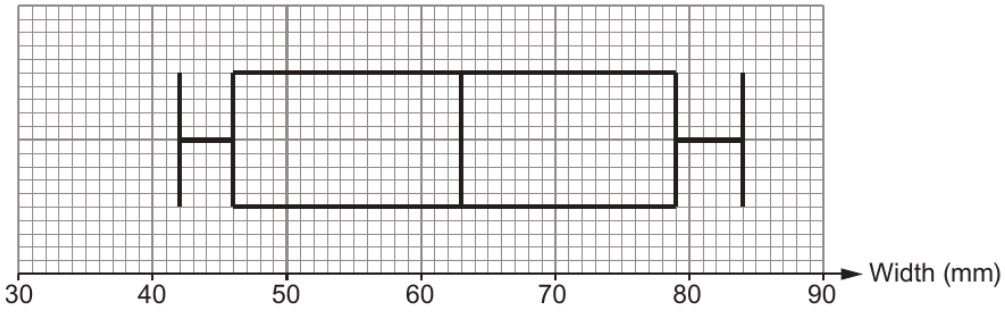
Gala apple tree



Orange Pippin apple tree



Pink Lady apple tree



Examiner only

(a) Complete each of the following statements.

(i) 'Apples from the ..... apple tree have the least median width.

The median width of apples recorded for this tree is ..... mm.' [1]

(ii) 'The range of the widths of apples recorded for the Gala apple tree

is ..... mm.' [1]

.....

(iii) 'The ..... apple tree has apples with the greatest interquartile range of widths.

The interquartile range of the widths of apples recorded for this tree

is ..... mm.' [2]

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(b) Which tree has a higher proportion of larger apples?
You must give a reason for your answer. [1]

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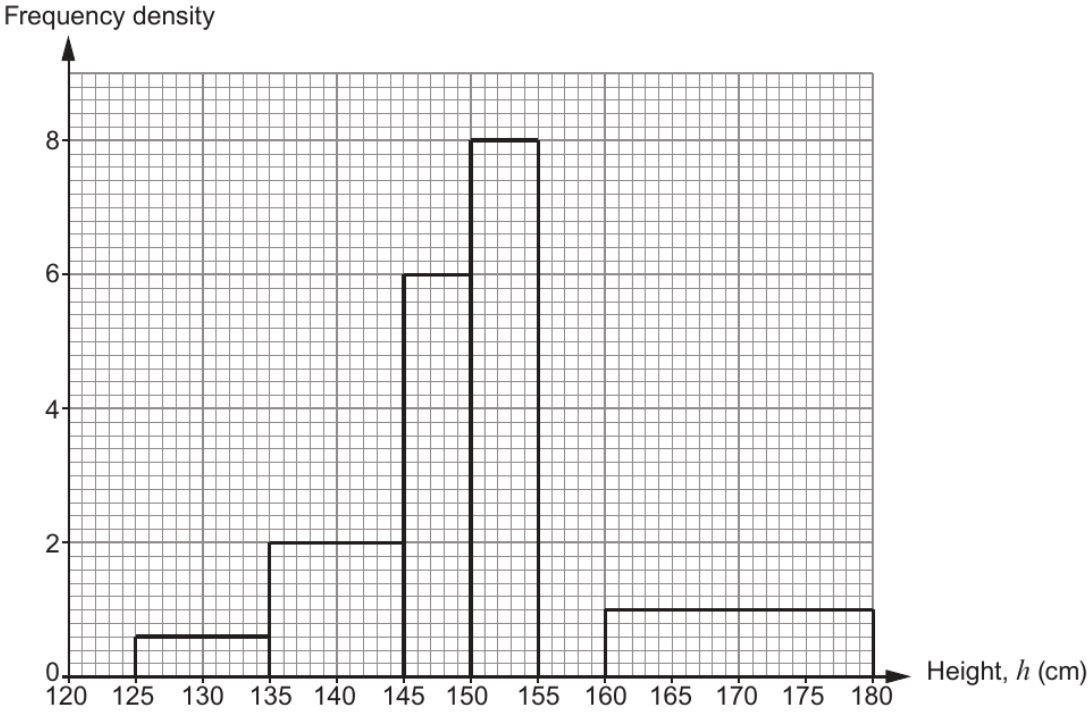
Examiner only

13. The heights of all the Year 11 girls at a school were measured.
Nia has started to draw a histogram of the results.



(a) There were 24 girls in Year 11 whose heights were in the group $155 < h \leqslant 160$ cm.
Use this information to complete Nia's histogram. [2]

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Examiner only

(b) Nia has started to do some data analysis on the heights of the Year 11 girls.
She has estimated the median and the upper quartile, as shown in the table below.

Lower quartile	Median	Upper quartile
.....	151·75 cm	156·875 cm

Use the histogram to calculate an estimate of the lower quartile of the heights of the Year 11 girls. [6]

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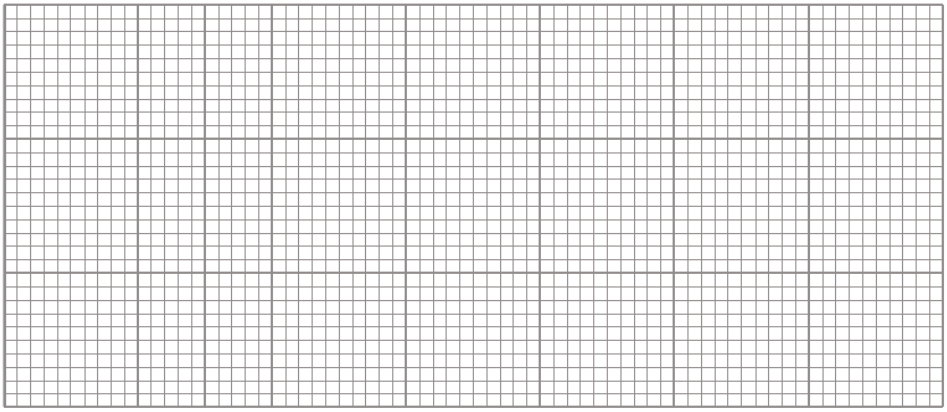
Examiner only

6. Gwen records the time she spends writing each of 240 text messages.
She finds the following.

- The greatest time is 1 minute 5 seconds.
- The range of the times is 60 seconds.
- The median is 45 seconds.
- The lower quartile is 23 seconds.
- The interquartile range is 32 seconds.

(a) Use the graph paper to draw a box-and-whisker diagram to represent Gwen's data. [5]



(b) How many of these text messages took Gwen more than 23 seconds to write? [2]

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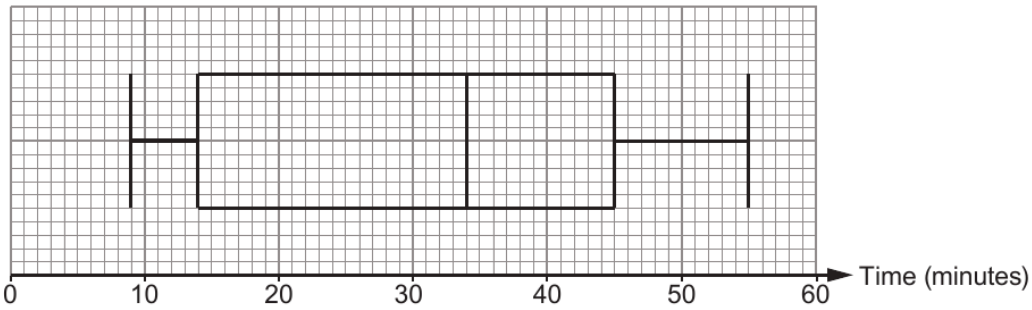
..... text messages

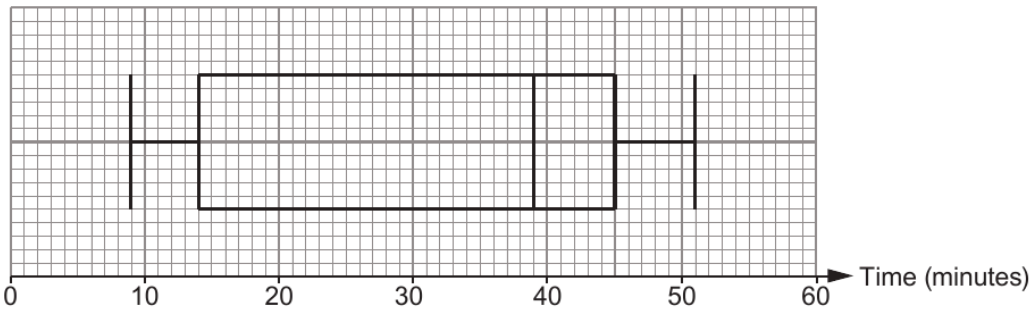
Examiner only

6. *(a)* Maesystrad, Rhewlteg and Glanmawr are three colleges.
Each college recorded the times Year 12 students took to travel to college.
The results are displayed in the box-and-whisker plots below.

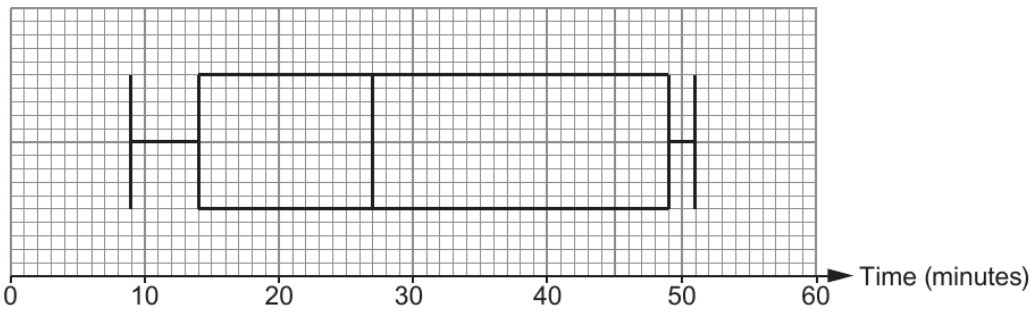
Maesystrad



Rhewlteg



Glanmawr



(i) Which of the three colleges has the greatest range of times?
What is the range of times for this college? [1]

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.....

College ..... Range ..... minutes

Examiner only

(ii) On average, in which college did Year 12 students have the longest travel times? You must give a reason for your answer. [1]

College: .....

Reason: .....

.....

(iii) Which college has the greatest difference between the median and the lower quartile?
What is this difference? [1]

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College ..... Difference ..... minutes

(iv) Which of the three colleges has the greatest number of Year 12 students?
Give a reason for your answer. [1]

Maesystrad ☐ Rhewlteg ☐ Glanmawr ☐ Don't know ☐

Reason: .....

.....

.....

(b) At another college, Wynne College, there are 240 students in Year 12.

The interquartile range of the times taken for these students to travel to college is 32 minutes.

(i) How many of these students have travel times within this interquartile range? [1]

.....

..... students

(ii) 75% of the Year 12 students at Wynne College take less than 55 minutes to travel to college.
Complete the following statement.

'25% of the Year 12 students at Wynne College take less than

..... minutes to travel to college.' [1]

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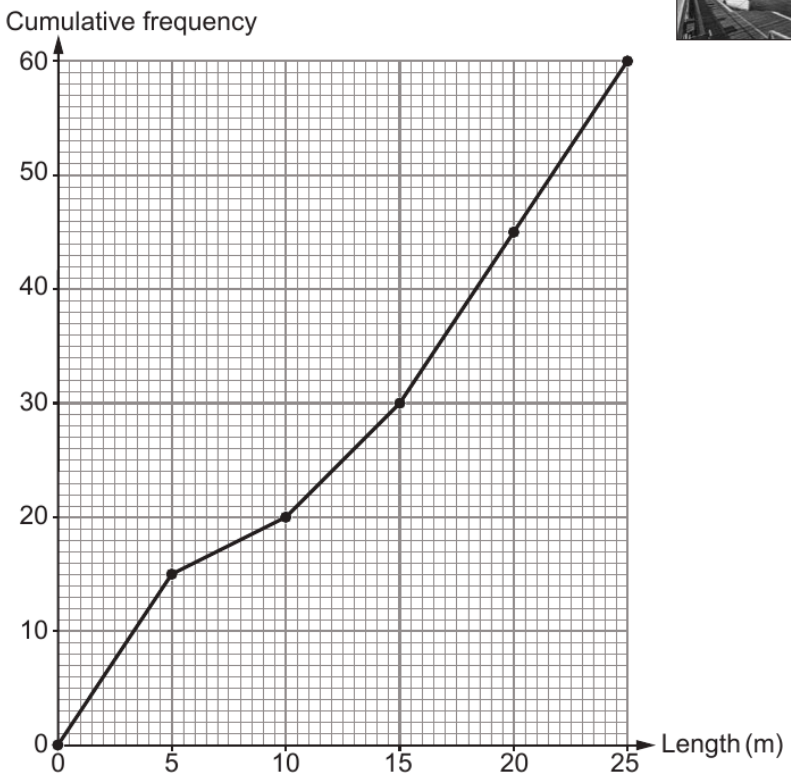
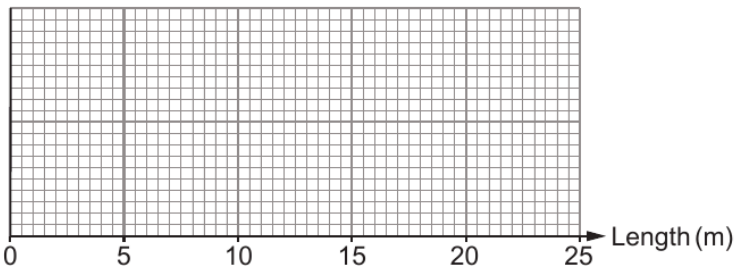
Examiner only

3. (a) The lengths of the 60 yachts in Eog Marina were measured.
The results are shown in the cumulative frequency diagram below.



The shortest yacht has a length of 3 m.
The longest yacht has a length of 22 m.

Use the information above to complete a box-and-whisker diagram on the graph paper below. [3]



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Examiner only

(b) The lengths of the 68 yachts in Clwyd Marina were measured.

For these yachts:
- the lower quartile of their lengths is 10 m
- 25% have lengths greater than 18 m
- the median length is 11·6 m.

(i) Calculate how many of the yachts in Clwyd Marina have lengths greater than 10 m. [2]

..... yachts

(ii) In which marina, Eog or Clwyd, is the interquartile range of the lengths of the yachts greater?

Eog Marina ☐ Clwyd Marina ☐

You must show all your working. [2]

(iii) In which marina is the longest yacht?

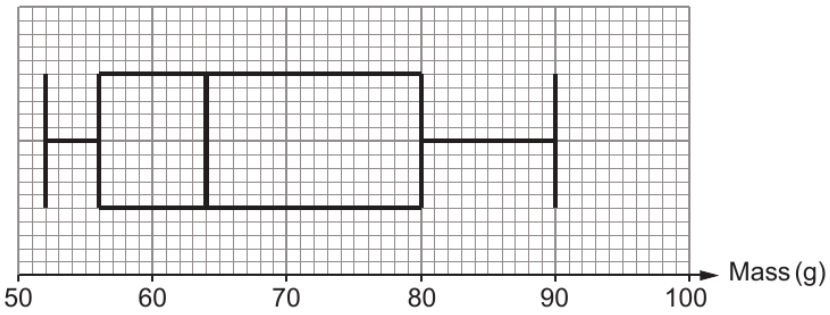
Eog Marina ☐ Clwyd Marina ☐ Can't tell ☐

You must give a reason for your answer. [1]

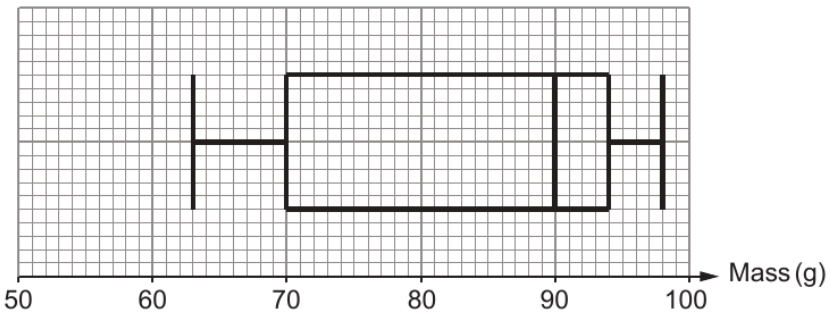
5. Eva grows three varieties of organic potato on her farm: Maris Piper, King Edward and Desiree.
She weighs and records the masses of 400 potatoes of each of the 3 varieties.

Eva constructs box-and-whisker diagrams for the masses of the potatoes weighed.

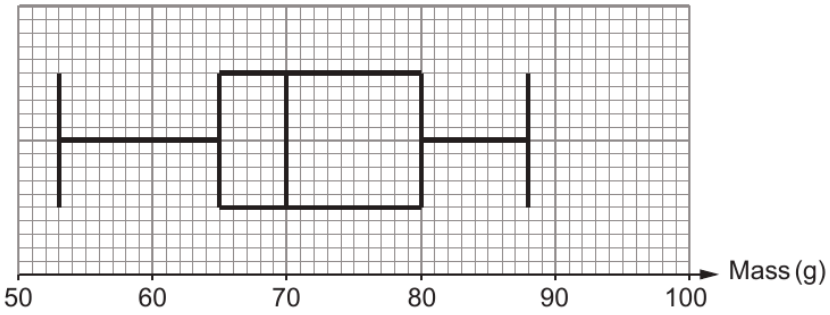
Maris Piper



King Edward



Desiree



Examiner only

(a) Complete each of the following statements.

(i) The ..... potatoes have the highest median mass.

The median mass of these potatoes is ..... g. [1]

(ii) The range of the masses recorded for the Maris Piper potatoes is ..... g. [2]

.....

(b) In the future, Eva wants to grow potatoes that are quite similar in size.

Use the box-and-whisker diagrams to advise Eva which of these three varieties of potato she should grow. [1]

Select which variety of potato she should grow.

Maris Piper ☐ King Edward ☐ Desiree ☐

Select the measure you used to help you decide.

Median ☐ Interquartile range ☐ Lower quartile ☐

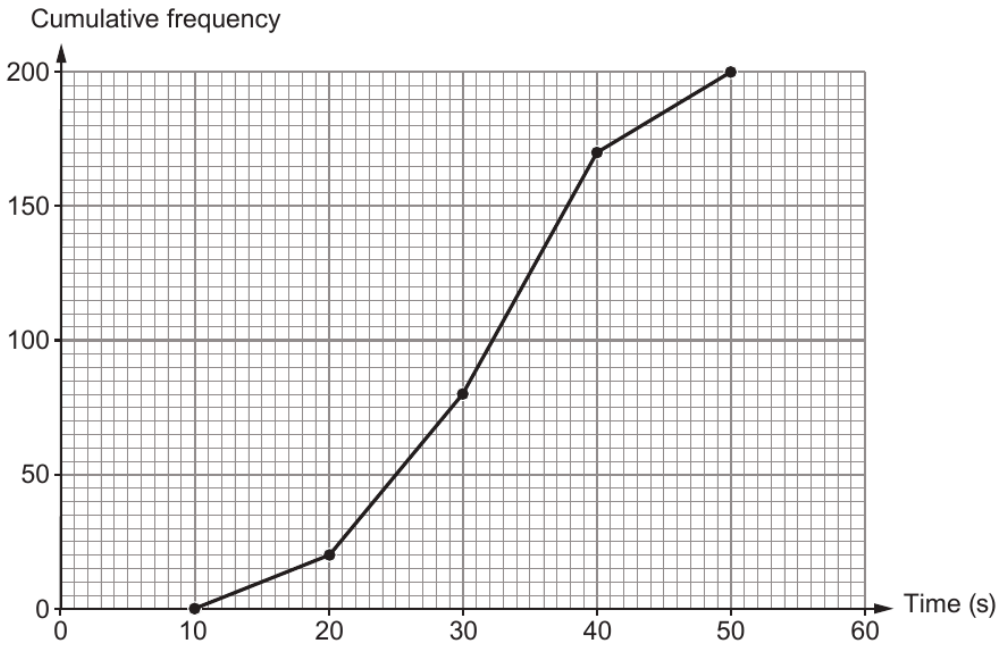
Select a reason for your choice of measure.

The measure is greater than for the other 2 varieties ☐

The measure is less than for the other 2 varieties ☐

Examiner only

4. (a) On 1st June last year, 200 customers used cash to pay at Shop Lil.
The cumulative frequency diagram represents the time each of these 200 customers waited to be given change at the checkout.



(i) How many of these customers waited between 30 and 50 seconds for their change? [2]

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(ii) Use the graph to estimate the median time these 200 customers waited for their change.
Circle your answer. [1]

24 seconds 32 seconds 38 seconds 80 seconds 100 seconds

(iii) Calculate the fraction of these 200 customers who waited 40 seconds or longer for their change.
Give your answer in its simplest form. [2]

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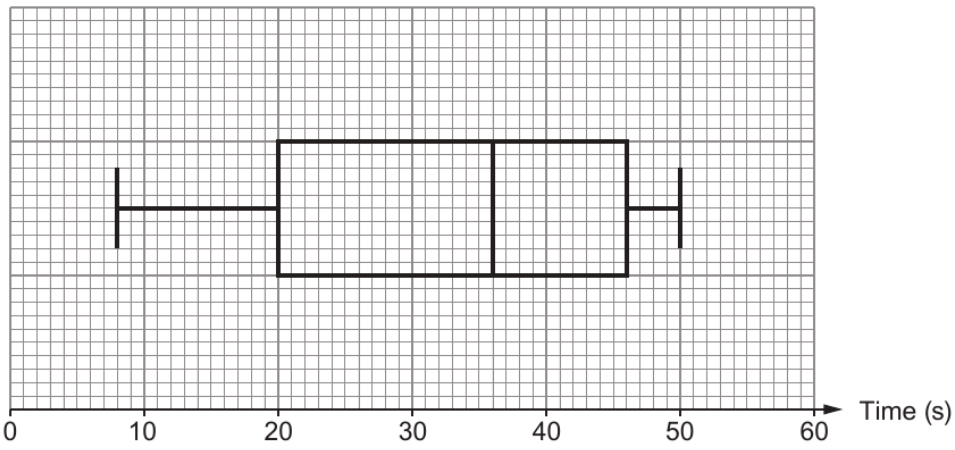
Examiner only

(b) On 1st June this year, the manager at Shop Lil drew a box-and-whisker plot of the times 200 customers waited for their change at the checkout.



Based on the results of these 200 customers, the manager made the following statements. Complete the statements.

(i) "On 1st June this year, 50% of our customers were given their change in ..... seconds or less." [1]

(ii) "On 1st June this year, the interquartile range of the times taken to give customers their change was ..... seconds." [2]

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(c) Consider the 50 customers waiting the **longest** times to get their change on 1st June last year and this year.
Has the speed of giving change at the checkout improved since last year?

Yes ☐ No ☐

You must give a reason for your answer. [1]

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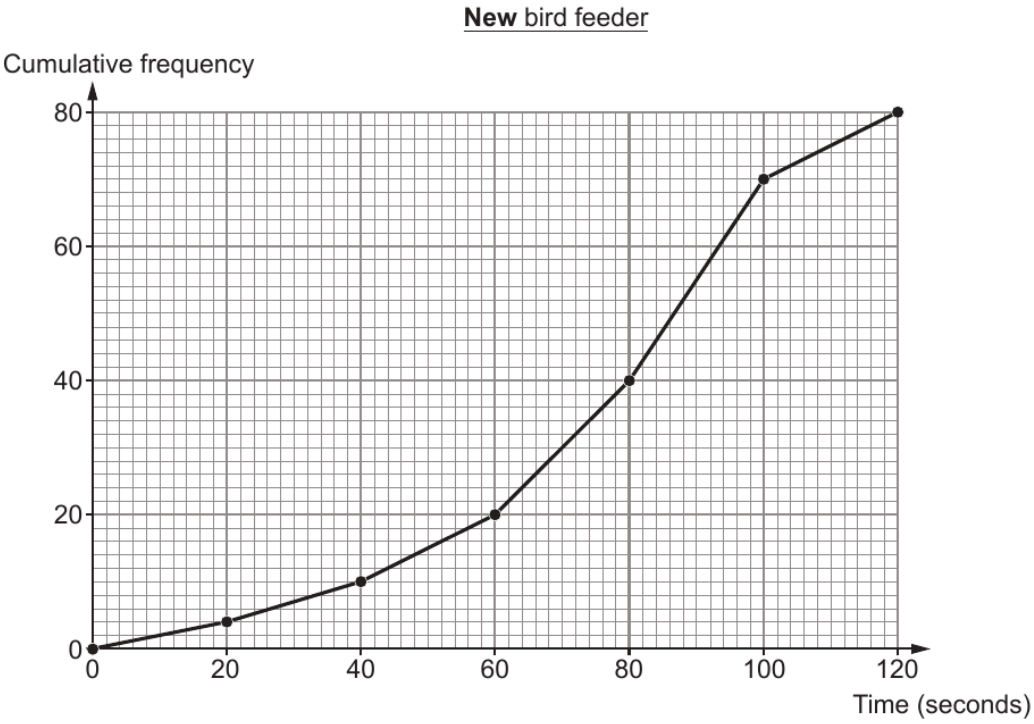
4. Aderyn is a company that makes bird feeders.

Squirrels often try to steal food from bird feeders.

To make this more difficult, Aderyn has designed a **new** bird feeder. Aderyn tests its new feeder to check how long it takes squirrels to reach the food inside.

The results are displayed in the cumulative frequency diagram below.



(a) Aderyn has the following information about the time it took squirrels to reach the food in its **original** bird feeder.

Original bird feeder	
Modal group	60 to 80 seconds
Median time	75 seconds
Interquartile range	20 seconds

Examiner only

Aderyn compared the times squirrels take to reach the food in the original bird feeder and the times they take to reach food in the new bird feeder.

(i) Complete this sentence:

'The modal group for the new bird feeder is between ..... and ..... seconds.'

Does the modal group for the new bird feeder imply that there is an improvement in the times? [1]

Yes ☐ No ☐

(ii) Use the cumulative frequency diagram and the table to give the best estimate to complete each of the following sentences.

I. 'The difference between the median times is ..... seconds.' [1]

.....

II. 'The difference between the interquartile ranges of the times is ..... seconds.' [2]

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(b) Use the cumulative frequency diagram to give the best estimate to complete the following sentence. [3]

'20% of the squirrels took ..... seconds or more to reach the food in the new bird feeder.'

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Examiner only

(c) The population density of grey squirrels in forests depends on the variety of tree that grows there.

Variety of tree	Typical population density of grey squirrels **per km^2**
Oak	1200
Chestnut	100
Pine	45

Rhian says,

I know that Maesgwyn forest has only one variety of tree: oak, chestnut or pine.

Maesgwyn forest covers an area of 21 500 m^2.
There are 24 grey squirrels living in Maesgwyn forest.

From this information, which variety of tree is most likely to be found in Maesgwyn forest?

You must show working to support your answer. [3]

Oak ☐ Chestnut ☐ Pine ☐

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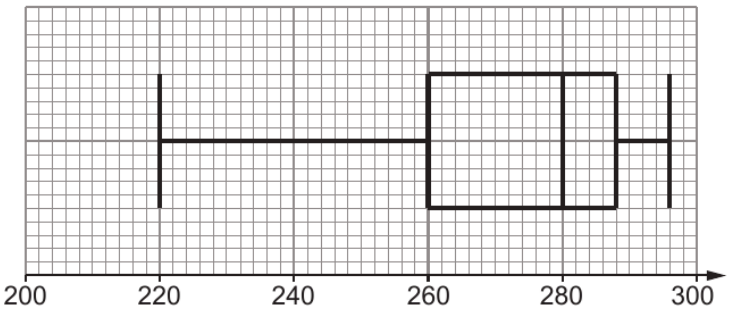
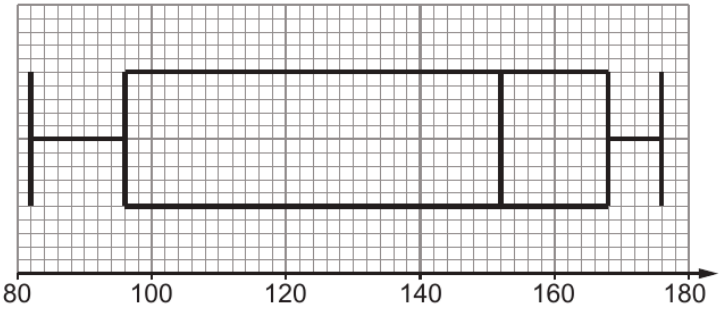
6. Geraint has collected data on some adult gulls.
He weighed 400 slender-billed gulls, 400 little gulls, and 400 black-headed gulls.

He has constructed box-and-whisker diagrams to display the masses of the gulls.

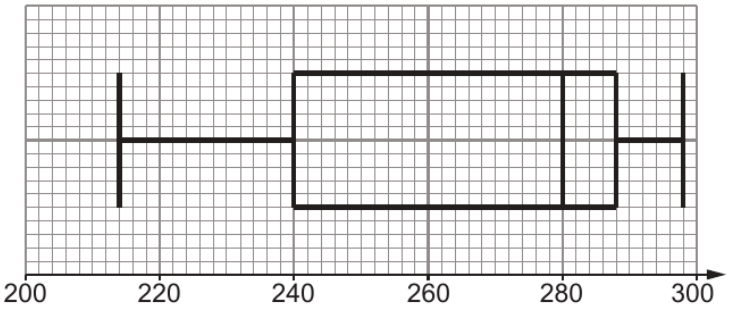
Slender-billed gulls



Little gulls



Black-headed gulls



Examiner only

(a) What is the range of the masses of the slender-billed gulls? [1]

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Range of the masses ..... g

(b) How many of the little gulls have a mass greater than or equal to 96 g? [2]

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(c) Write down the percentage of little gulls that have a mass greater than or equal to 168 g. [1]

..... %

(d) From the box-and-whisker diagrams, Geraint notices that two of the types of gull have the same median mass.
He makes the following statement about these two types of gull.

"The diagrams suggest that one of these two types of gull generally has a greater mass than the other."

(i) Which type of gull appears to have the greater mass? [1]

.....

(ii) Geraint based his statement on **one** of the following measures.
Which measure did Geraint use?
Circle your answer. [1]

Range Median Lowest mass Lower quartile Upper quartile