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

Not every chart tells the truth. Spot truncated axes, inconsistent scales, 3D distortion and cherry-picked ranges, then judge whether the conclusions

REVISE
.wales

3.26 – Misleading graphs & drawing conclusions

Spec 4.2.21 – Unit 3 (calculator allowed)

Not every chart tells the truth. Spot truncated axes, inconsistent scales, 3D distortion and cherry-picked ranges, then judge whether the conclusions drawn from a graph are fair. 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: ~34 minutes

Derived from the GCSE Higher pace of ~1.5 min/mark (23 marks across 14 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).

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Misleading graphs & drawing conclusions – what the new spec asks

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

Misleading graphs & drawing conclusions 4.2.21

- Identify misleading features: truncated axes, inconsistent scales, 3D distortion, missing labels, biased samples, cherry-picked ranges.
- Explain how a misleading feature distorts the conclusion drawn from the graph.
- Read off values accurately and quote evidence from the axes when justifying a conclusion.
- Distinguish valid conclusions from over-claims, especially around causation, generalisation and sample size.

Misleading graphs & drawing conclusions in one page

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

Truncated axes

Y-axis that doesn't start at zero exaggerates differences.

A bar twice as tall as another may represent only a 5% difference if the axis starts high up.

Always check the bottom of the axis first.

Inconsistent scales

Unequal gaps between tick marks make trends look smoother or steeper than they really are.

Watch for jumps from '0, 10, 20, 50, 100'. Convert to evenly-spaced ticks mentally to judge the real shape.

3D distortion

3D bars, pies and area charts make the front items look bigger than the back ones.

The eye reads *volume*, but the data is one-dimensional.

Flat 2D versions show proportions honestly.

Missing or unclear labels

No axis label, no units, or no key – the graph is unfalsifiable.

A bar '200' with no units could be people, pounds, or percent.

If labels are missing, say so explicitly in your critique.

Cherry-picked range

Showing only the years that suit the argument hides the bigger picture.

A 'rising trend' over 2 years can be part of a 20-year decline.

Ask: *why this range?*

Misleading icons / pictograms

If both *height* and *width* of an icon scale with the quantity, area grows as the square – the difference looks bigger than it is.

Honest pictograms should use a row of identical icons, not scale a single one.

Sample size & bias

A graph based on 12 people, or on volunteers, may not represent the population.

Conclusions like 'most people prefer X' need a fair sample – large, random and relevant.

Always ask: *who was asked?*

Critiquing in words

To answer 'is this fair?':

1. Identify what the graph shows.
2. Point out the specific misleading feature.
3. Explain how it distorts the conclusion.

Cite the y-axis start, the class widths, the sample, etc.

Drawing valid conclusions

Stick to what the graph actually shows.

Quote numbers off the axes, name the comparison, and avoid causation language unless the data supports it.

'Sales rose in May' \neq 'the campaign caused the rise'.

Examiner
only

3.

Stylish computer desk
 Made of laminate wood.
 Non-scratch top.
Length is exactly 2000mm



Luc wants this new desk for his bedroom.

The desk is to fit on the straight wall between his wardrobe and his bookcase.

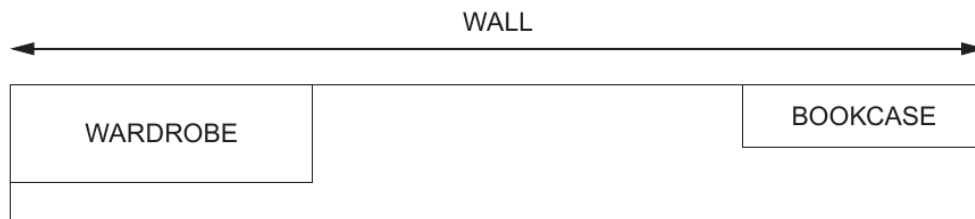


Diagram not drawn to scale

Luc has measured the length of

- the wall, which is 600 cm, correct to the nearest 10 cm,
- the bookcase, which is 147 cm, correct to the nearest 1 cm,
- the wardrobe, which is 250 cm, correct to the nearest 1 cm.

- (a) What is the greatest possible length of the wall?
 Circle your answer.

[1]

600 cm 605 cm 645 cm 610 cm 650 cm

- (b) What is the least possible length of the wardrobe?
 Circle your answer.

[1]

249 cm 249.45 cm 249.49 cm 249.5 cm 250 cm

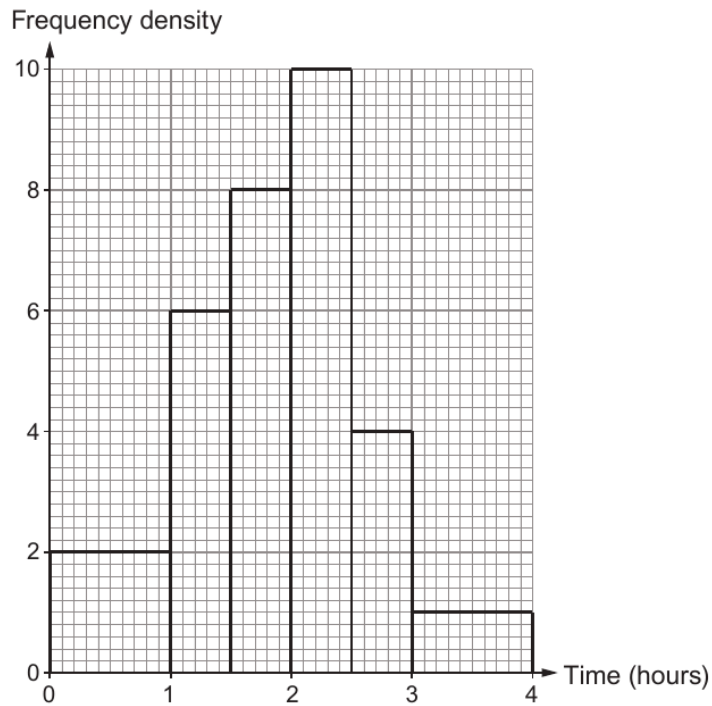


Examiner only

8. The *Big Fish Cymru* annual fishing competition is held on the west coast of Wales. Information about **last year's** competition is displayed in the *Big Fish Cymru* booklet. A section of this booklet is shown below.

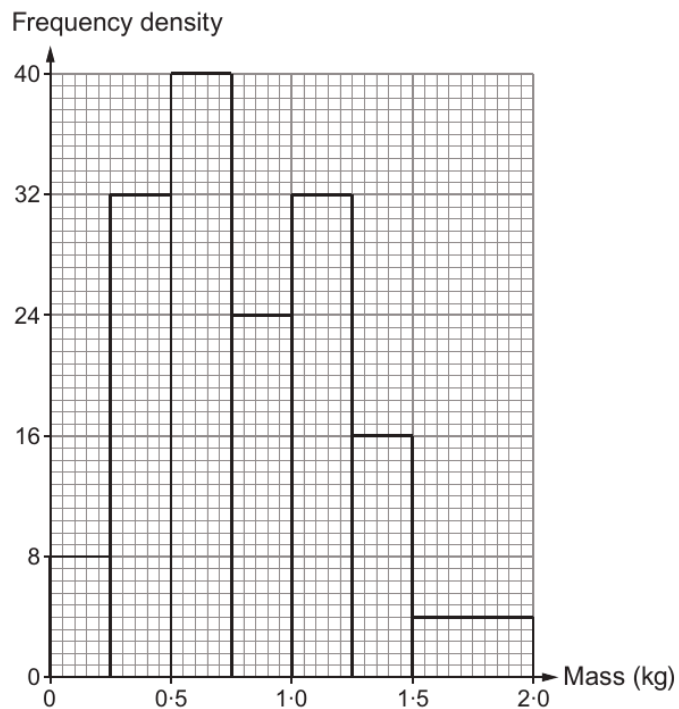
The competition organisers recorded the time taken for **each** angler to catch their **first** fish.

This is shown in the histogram on the right.



The competition organisers also recorded the mass of every fish caught.

This is shown in the histogram on the right.



Examiner
only

(a) Last year, how many of the fish caught had a mass of less than 250 g? [1]

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(b) Last year, the final angler to catch their first fish did so after $3\frac{1}{2}$ hours.
How many **other** anglers took more than 3 hours to catch their first fish? [1]

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(c) The number of anglers taking part this year was three times as many as took part last year.
How many anglers took part in the competition this year? [4]

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Number of anglers this year was

(d) The median mass of the fish caught this year was 0.9 kg.
What is the difference, in kg, between the median mass of the fish caught this year and the median mass of the fish caught last year? [5]

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Difference in mass is kg



Examiner
only

(e) Approximately 10% of the anglers this year caught their first fish within 1 hour.

(i) How does this percentage compare with last year's percentage?
You must show all your working.

[3]

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(ii) Do you think it is fair to compare last year's competition results with this year's competition results?
You must give a reason for your answer.

[1]

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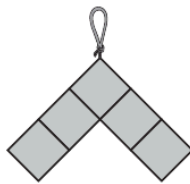
Examiner only

4. Josef has a job in a workshop that makes decorations.

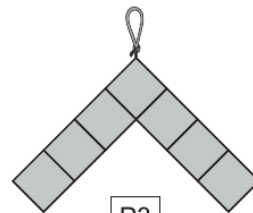
He has made the following three decorations using small squares of stained glass.



P1



P2



P3

Josef labels these patterns P1, P2 and P3 in order.

Josef continues to make decorations following the pattern he has started.

(a) How many **more** squares would he need to make pattern P22 than to make pattern P18? [1]

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(b) Josef has 22 squares.

Josef states,

'I think I can make one complete decoration using **all** 22 squares, with none left over.'

Is Josef correct?

Yes

No

Give a reason for your answer.

[1]

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- (c) Each small square of stained glass measures 0.5 cm by 0.5 cm.
The perimeter of one of Josef's decorations is 10 cm.
Complete the label that Josef would use for this decoration.

[2]

P

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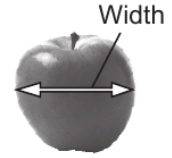
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Examiner
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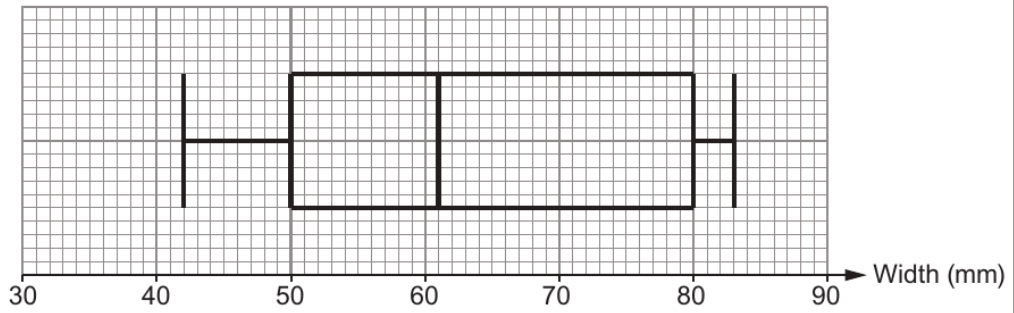
Examiner only

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.

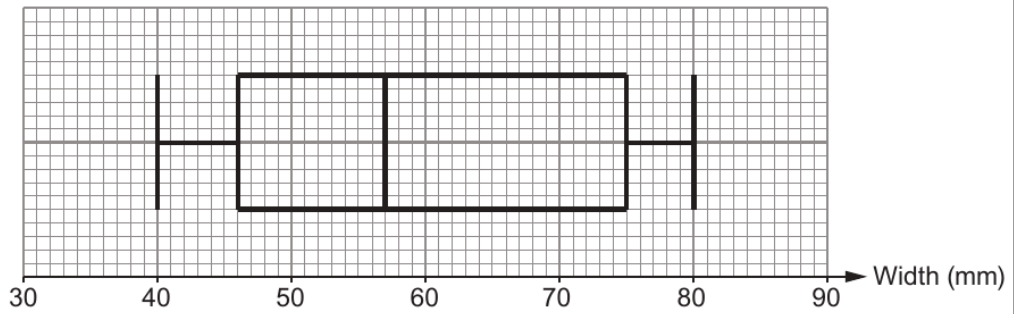


Lena constructs box and whisker diagrams for the widths of the apples collected from each of the three trees.

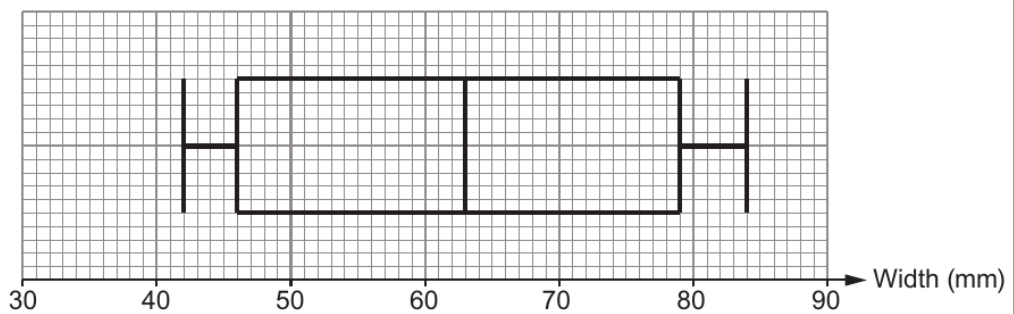
Gala apple tree



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]

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

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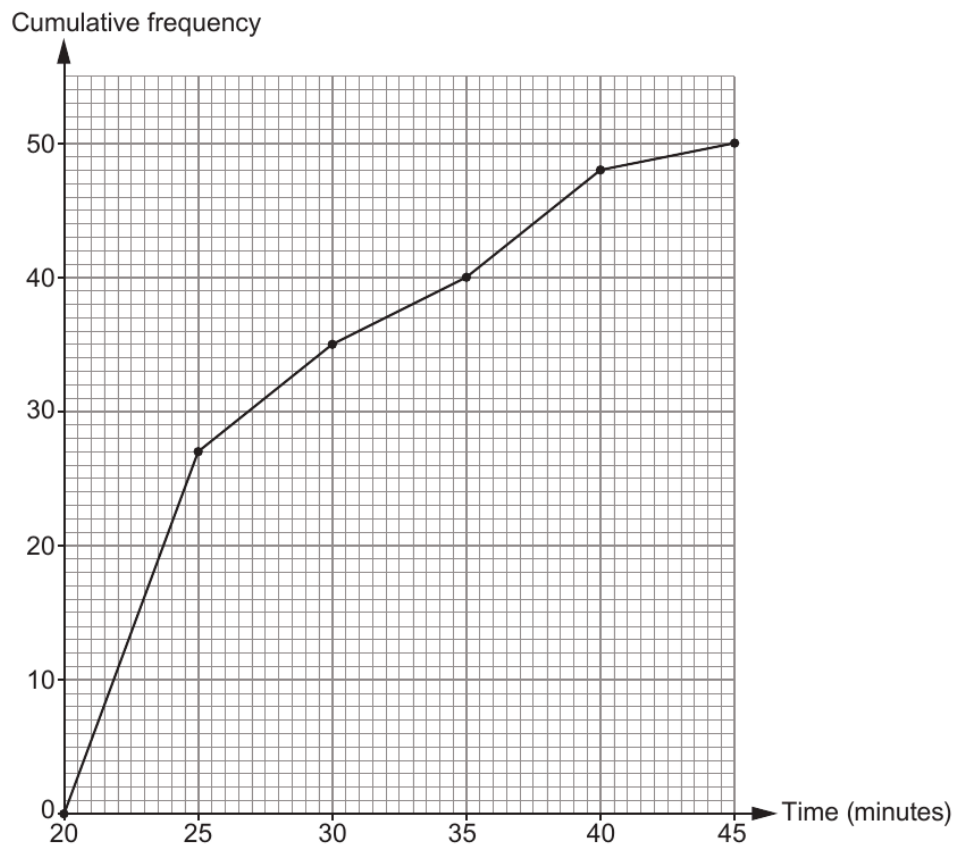
3310U501
13



Examiner
only

6. This year, 50 runners took part in a 5 km race in the Brecon Beacons. All 50 runners finished the race.

The cumulative frequency diagram below shows the times taken by the runners to finish the race.



- (a) Which is the modal group?
Circle your answer.

[1]

20 to 25 minutes

25 to 30 minutes

30 to 35 minutes

35 to 40 minutes

40 to 45 minutes

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Examiner
only

(b) Is it certain that the last runner's finish time was 45 minutes?
You must give a reason for your answer.

[1]

Yes

No

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(c) The organisers hoped that 80% of the runners would finish the race within 30 minutes.

Complete the following two statements.

[2]

'..... % of runners finished the race within 30 minutes.'

'80% of runners finished the race within minutes.'

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(d) Last year, the median finish time was 26 minutes.
By how many minutes was the median time better this year?
You must show all your working.

[2]

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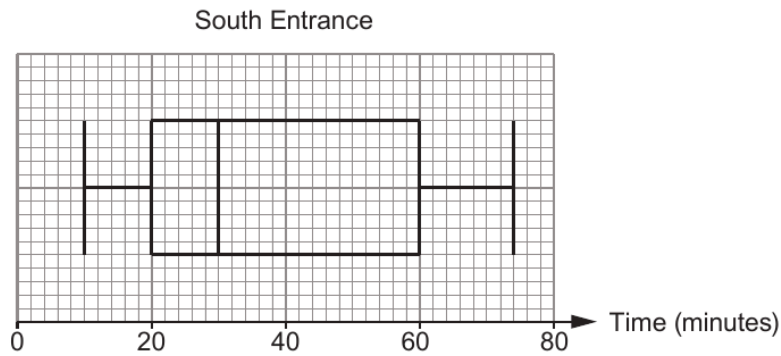
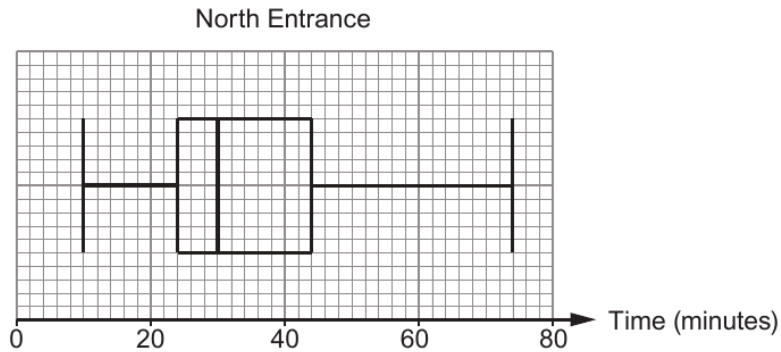
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Examiner only

7. There are two entrances to a stadium, North Entrance and South Entrance. At each entrance, 3000 people queued to pass through security. The length of time each of these people spent in the queue was recorded. The box-and-whisker diagrams show the results.



- (a) At the **North Entrance**, how many people had to queue for more than 44 minutes? You must show all your working. [2]

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Number of people is



Examiner
only

- (b) For the **South Entrance**, calculate an estimate of the number of people who had to queue there for between 40 and 60 minutes.
You must show all your working. [3]

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Number of people is

- (c) At which entrance did the security team seem to be more effective at getting people into the stadium quickly?
You must give a reason for your answer. [1]

North Entrance South Entrance

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Examiner
only

3. Mrs Butler asked all her friends how many pairs of shoes they own. Here are the results.

Number of pairs of shoes	1 to 6	7 to 12	13 to 18
Number of people	1	5	8

- (a) Mrs Butler says,
 'Most people in Wales own more than 12 pairs of shoes.'

Is Mrs Butler correct in using this data to come to this general conclusion?
 You must give a reason for your answer.

[1]

Yes No

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- (b) Write down **different groups** Mrs Butler could have chosen so that all of the data can be analysed more accurately.

[2]

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3310U501
05



Examiner only

5. (a) *Kenworth Electrical* specialises in wiring new houses. The monthly wages of all *Kenworth Electrical* employees are summarised in the frequency table below.

Monthly wage, £ x	Frequency
$1800 \leq x < 2000$	64
$2000 \leq x < 2100$	50
$2100 \leq x < 2400$	2
$2400 \leq x < 5800$	0
$5800 \leq x < 7800$	4

- (i) In which group does the median monthly wage lie?
Circle your answer.

[1]

$1800 \leq x < 2000$

$2000 \leq x < 2100$

$2100 \leq x < 2400$

$2400 \leq x < 5800$

$5800 \leq x < 7800$

.....

- (ii) Alysia is an accountant working for *Kenworth Electrical*. She knows the exact wage of each employee.

Alysia says,

It would be misleading to use the mean monthly wage as an average.

Explain why Alysia has reached this conclusion.

[1]

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3310U601
11



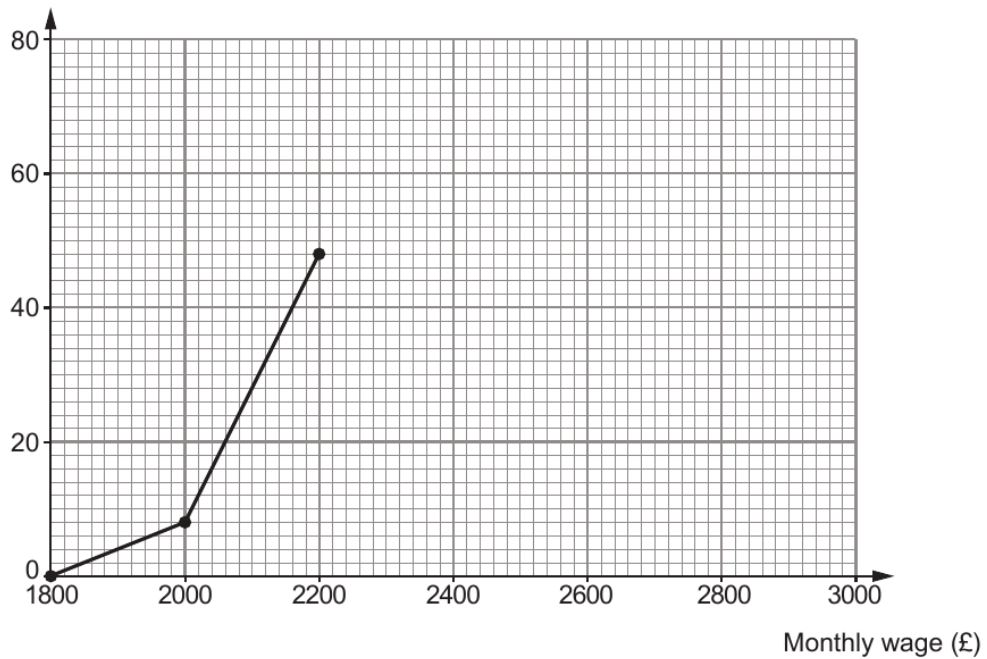
Examiner only

- (b) *Maesteg Electrical* also specialises in wiring new houses. The monthly wages of all *Maesteg Electrical* employees are summarised in the frequency table below.

Monthly wage, £ x	Frequency
$1800 \leq x < 2000$	8
$2000 \leq x < 2200$	40
$2200 \leq x < 2400$	24
$2400 \leq x < 3000$	8

- (i) Use the frequency table to complete the following cumulative frequency diagram to display the monthly wages of all *Maesteg Electrical* employees. [2]

Cumulative frequency



Use the cumulative frequency diagram to answer each of the following questions.

- (ii) Which of the following is the best estimate for the median monthly wage of *Maesteg Electrical* employees? Circle your answer. [1]

£2100 £2160 £2200 £2360 £3000

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- (iii) Calculate an estimate of the percentage of *Maesteg Electrical* employees who have a monthly wage of less than £2050.
You must show all your working. [2]

Examiner
only

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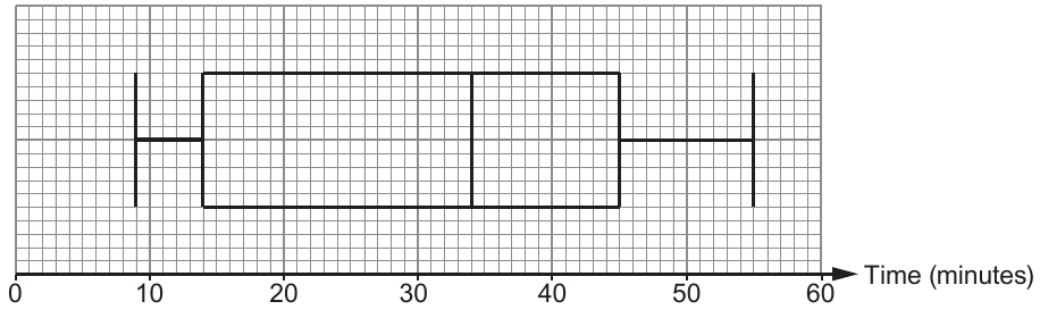
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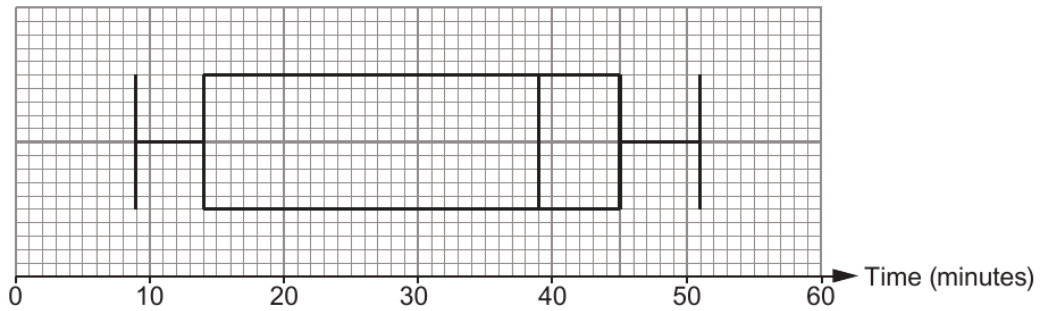
Examiner only

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.

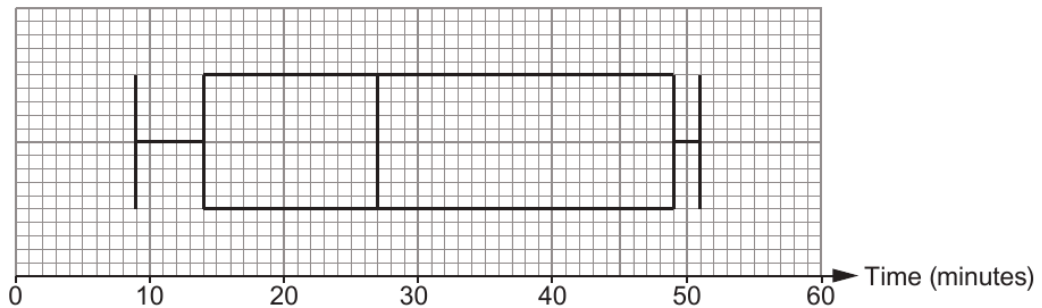
Maesystrad



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:

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(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]

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..... 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]

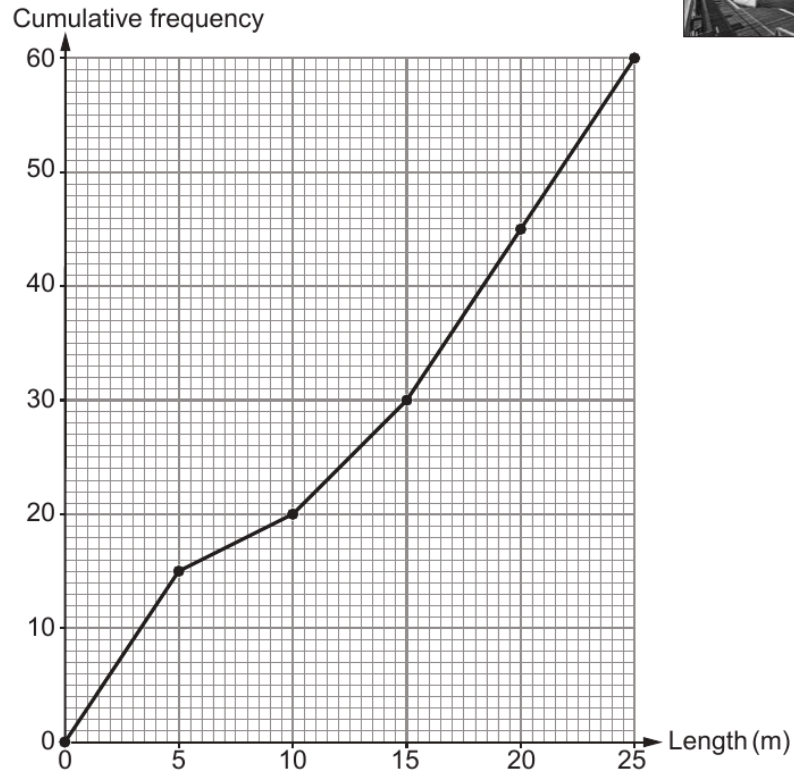
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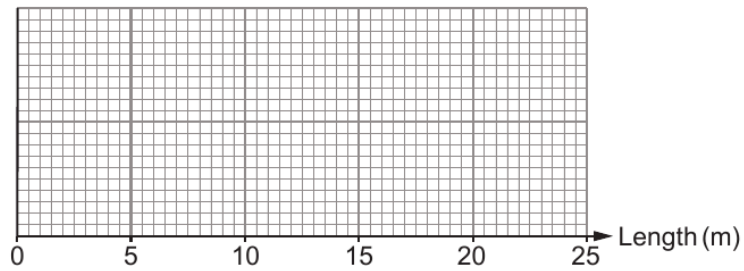
Examiner only

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]



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]

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..... 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]

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(iii) In which marina is the longest yacht?

Eog Marina Clwyd Marina Can't tell

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

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3310U501
09



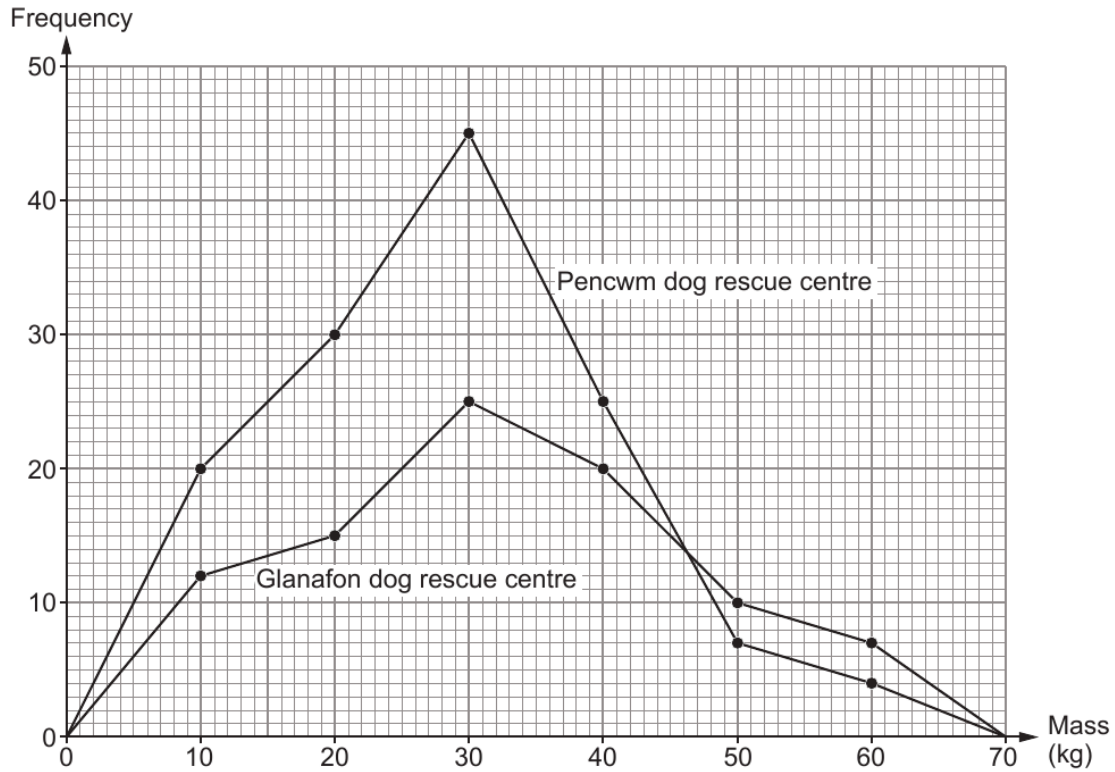
Examiner only

2. Glanafon and Pencwm dog rescue centres take in unwanted dogs.
 The mass of each dog in the two dog rescue centres was recorded.
 Groups of width 10 kg were used:



$$5 \text{ kg} \leq \text{mass} < 15 \text{ kg}, \quad 15 \text{ kg} \leq \text{mass} < 25 \text{ kg}, \quad \dots, \quad 55 \text{ kg} \leq \text{mass} < 65 \text{ kg}$$

The results are shown in the frequency polygons below.



- (a) Doreen, Rory and Muzhir look at these frequency polygons.
 (i) Doreen says,

"The modal group of the masses of dogs in each dog rescue centre is the same."

Is Doreen correct?

Yes No Can't tell

You must give a reason for your answer.

[1]

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Examiner
only

(ii) Rory says,
"28 of the dogs in Pencwm each have a mass of 18 kg."

Is Rory correct?

Yes No Can't tell

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

(iii) Muzhir says,
"There is a higher proportion of dogs that are heavier than 35 kg in Glanafon than in Pencwm."

Without doing any calculations, decide if Muzhir is correct.

Correct Incorrect Can't tell

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

(b) The estimate of the mean mass of the dogs in Glanafon was 32.5 kg.
How much less was the estimate of the mean mass of the dogs in Pencwm?
You must show all your working. [5]

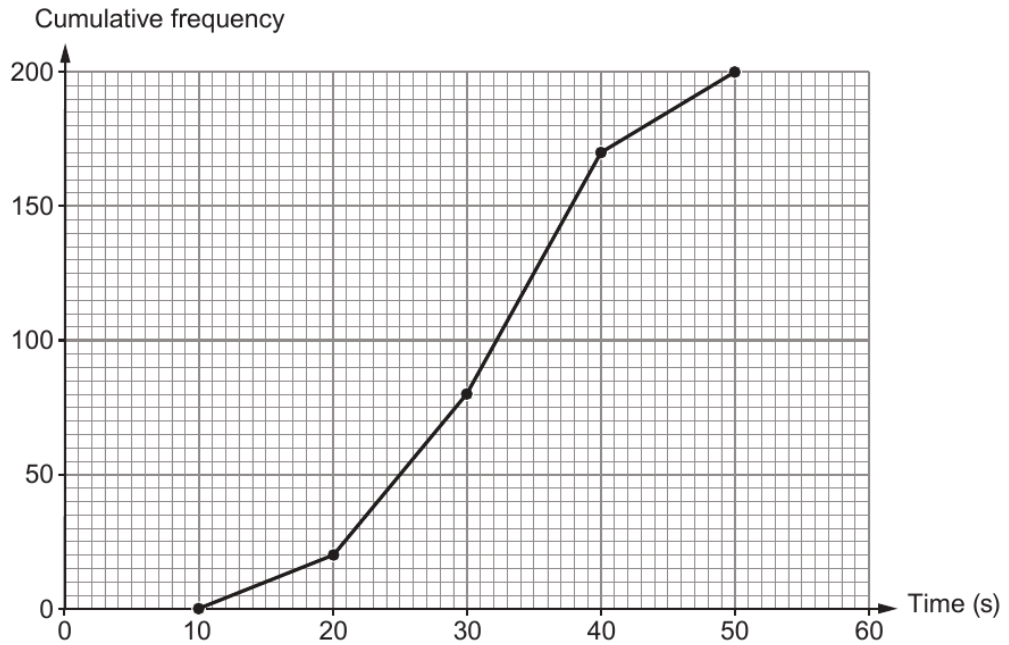
Estimate of the mean mass of the dogs in Pencwm is kg less than in Glanafon.



3310U601
05

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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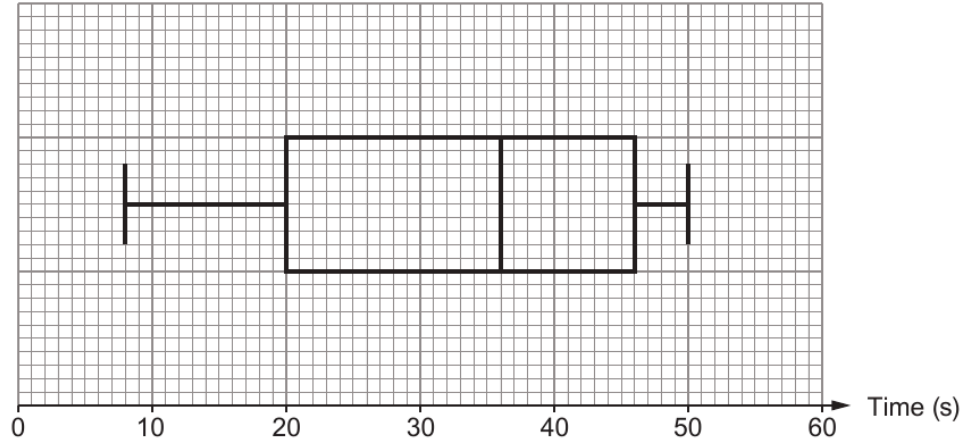
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Examiner only

- (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]

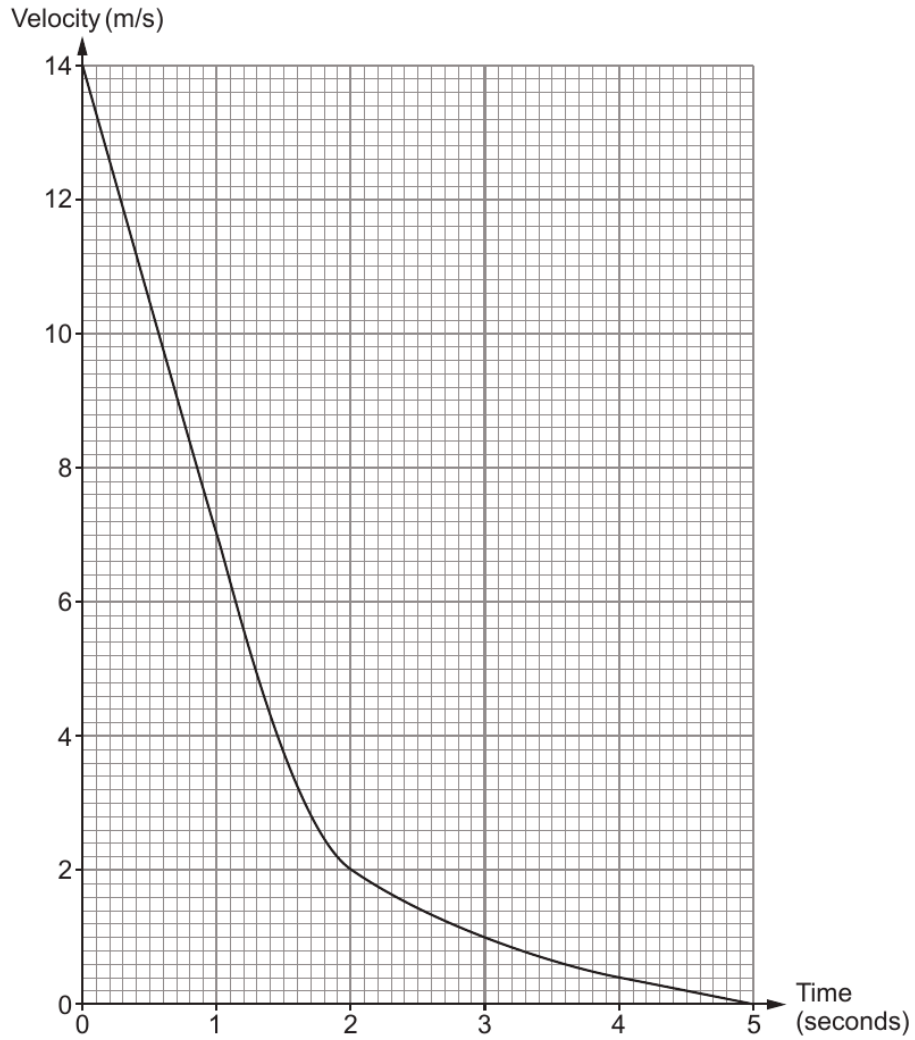
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3310U501
09

11. Ravi is driving his car to work.
He brakes sharply to stop at a set of traffic lights.

The velocity-time graph below shows the last 5 seconds of his journey before the car stops at the lights.



Examiner
only

- (a) (i) Using 5 strips of equal width, calculate an estimate of the distance the car travelled in these 5 seconds. [3]

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- (ii) Is your answer to part (a)(i) an overestimate or an underestimate? You must give a reason for your answer. [1]

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- (b) Estimate the deceleration of Ravi's car at time 2 seconds. Give your answer in its simplest form. [3]

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