

Topic 2 Part 2 [165 marks]

1a. [1 mark]

Markscheme

Median = 25 mins (AI) (CI)

[1 mark]

Examiners report

This question was well answered with many candidates gaining full marks. Some received a unit penalty in part (a) for omitting the minutes.

1b. [2 marks]

Markscheme

$32 - 16$ (AI)

$= 16$ (AI)(ft) (C2)

Notes: Award (AI) for identifying correct quartiles, (AI)(ft) for correct answer to subtraction of their quartiles.

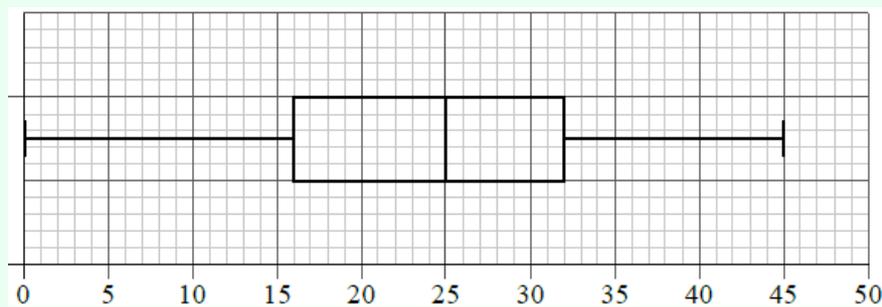
[2 marks]

Examiners report

This question was well answered with many candidates gaining full marks.

1c. [3 marks]

Markscheme



median shown (AI)(ft)

box with ends at their quartiles (AI)(ft)

end points at 0 and 45 joined to box with straight lines (AI) (C3)

Note: Award (AI)(ft)(AI)(ft)(A0) if lines go right through the box.

[3 marks]

Examiners report

This question was well answered with many candidates gaining full marks. Most of the candidates knew how to draw the box and whisker plot. A mark was deducted if the whiskers were drawn all the way through the box.

2a. [2 marks]

Markscheme

$$\frac{8+5+5+10+8+4+9+7+p+q}{10} = 6.8 \text{ or equivalent } \quad (M1)(A1) \quad (C2)$$

Note: Award (M1) for correct substituted mean formula, (A1) for correct substitution.

[2 marks]

Examiners report

A large number of candidates gained full marks on this question. Many correct variations of the equation were given and the values of p , q and the median could then be found. Some candidates neglected the extra information of p less than q and lost a mark for having these values the wrong way around. Follow through marks could be awarded for the median, if working was shown, with incorrect values of p and q . It was pleasing to see that most candidates realised that a list had to be ordered, before finding the middle value.

2b. [1 mark]

Markscheme

$$p = 5 \quad (A1)(ft)$$

[1 mark]

Examiners report

A large number of candidates gained full marks on this question. Many correct variations of the equation were given and the values of p , q and the median could then be found. Some candidates neglected the extra information of p less than q and lost a mark for having these values the wrong way around. Follow through marks could be awarded for the median, if working was shown, with incorrect values of p and q . It was pleasing to see that most candidates realised that a list had to be ordered, before finding the middle value.

2c. [1 mark]

Markscheme

$$q = 7 \quad (A1)(ft) \quad (C2)$$

Note: Follow through from their answers to parts (a) and (b) (i).

[1 mark]

Examiners report

A large number of candidates gained full marks on this question. Many correct variations of the equation were given and the values of p , q and the median could then be found. Some candidates neglected the extra information of p less than q and lost a mark for having these values the wrong way around. Follow through marks could be awarded for the median, if working was shown, with incorrect values of p and q . It was pleasing to see that most candidates realised that a list had to be ordered, before finding the middle value.

2d.

[2 marks]

Markscheme

7 (MI)(AI)(ft) (C2)

Notes: Award (MI) for an attempt to order their numbers.

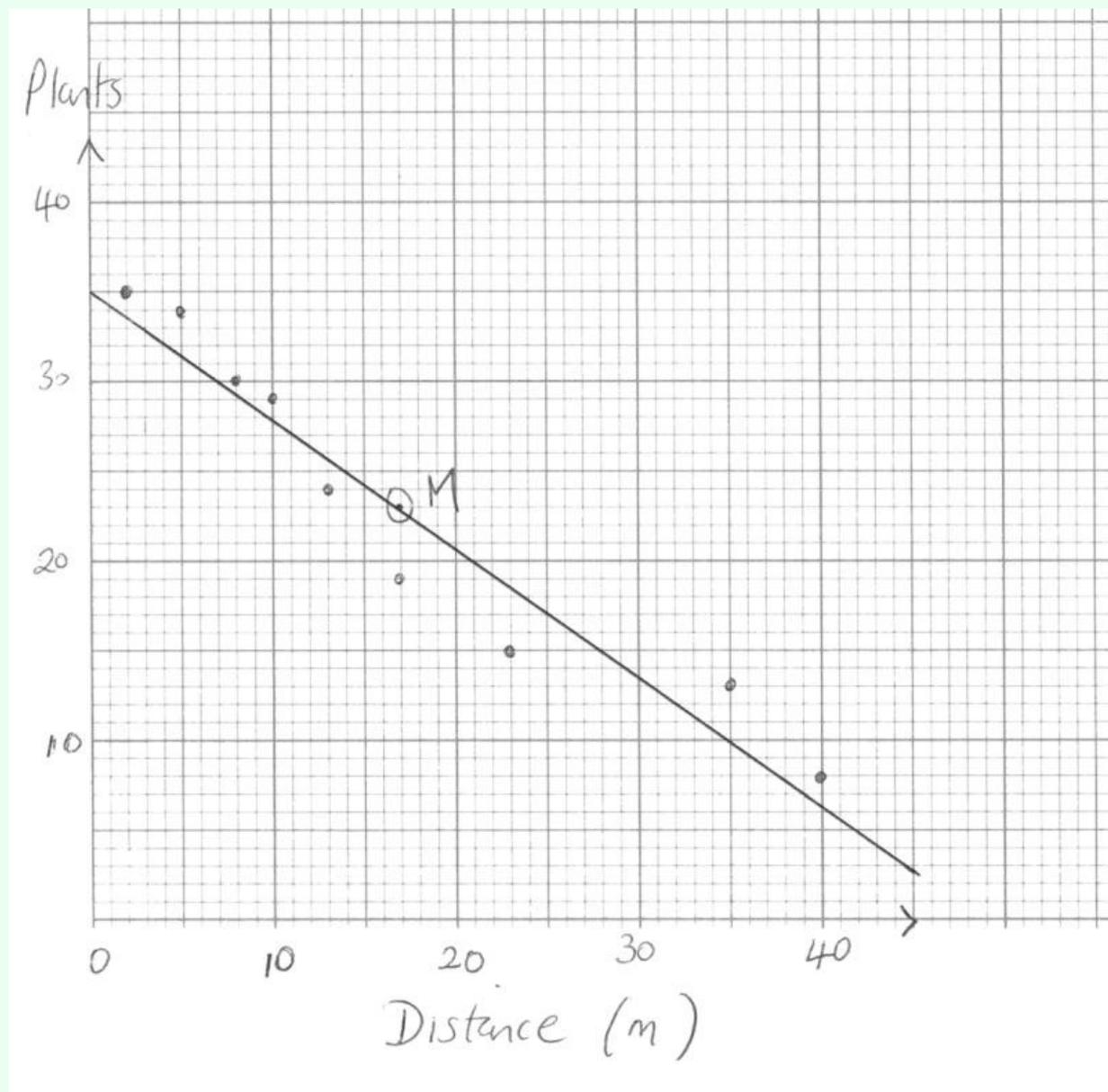
Follow through from their answers to parts (b)(i) and (ii).

[2 marks]

Examiners report

A large number of candidates gained full marks on this question. Many correct variations of the equation were given and the values of p , q and the median could then be found. Some candidates neglected the extra information of p less than q and lost a mark for having these values the wrong way around. Follow through marks could be awarded for the median, if working was shown, with incorrect values of p and q . It was pleasing to see that most candidates realised that a list had to be ordered, before finding the middle value.

Markscheme



(A1)(A3)

Notes: Award (A1) for scales and labels (accept x/y).

Award (A3) for all points correct.

Award (A2) for 7 or 8 points correct.

Award (A1) for 5 or 6 points correct.

Award at most (A1)(A2) if points are joined up.

If axes are reversed award at most (A0)(A3)(ft).

[4 marks]

Examiners report

This question, by far, was the most accessible to the great majority of candidates. However, far too many candidates do not (1) use the scale as required by the question, (2) use a scale at all, (3) either draw or label axes, (4) use a ruler at all (5) use the provided graph paper. Accurate plotting of points can not be assessed unless graph paper has been used; the diagram is not a graph.

Many candidates did not seem aware that the regression line must pass through the mean point. Others, though they had obtained the equation of the regression line, did not use it to identify its y intercept.

3b. [1 mark]

Markscheme

Negative (AI)

[1 mark]

Examiners report

This question, by far, was the most accessible to the great majority of candidates. However, far too many candidates do not (1) use the scale as required by the question, (2) use a scale at all, (3) either draw or label axes, (4) use a ruler at all (5) use the provided graph paper. Accurate plotting of points can not be assessed unless graph paper has been used; the diagram is not a graph.

Many candidates did not seem aware that the regression line must pass through the mean point. Others, though they had obtained the equation of the regression line, did not use it to identify its y intercept.

3c. [1 mark]

Markscheme

17 (GI)

[1 mark]

Examiners report

This question, by far, was the most accessible to the great majority of candidates. However, far too many candidates do not (1) use the scale as required by the question, (2) use a scale at all, (3) either draw or label axes, (4) use a ruler at all (5) use the provided graph paper. Accurate plotting of points can not be assessed unless graph paper has been used; the diagram is not a graph.

Many candidates did not seem aware that the regression line must pass through the mean point. Others, though they had obtained the equation of the regression line, did not use it to identify its y intercept.

3d. [1 mark]

Markscheme

23 (GI)

[1 mark]

Examiners report

This question, by far, was the most accessible to the great majority of candidates. However, far too many candidates do not (1) use the scale as required by the question, (2) use a scale at all, (3) either draw or label axes, (4) use a ruler at all (5) use the provided graph paper. Accurate plotting of points can not be assessed unless graph paper has been used; the diagram is not a graph.

Many candidates did not seem aware that the regression line must pass through the mean point. Others, though they had obtained the equation of the regression line, did not use it to identify its y intercept.

3e. [2 marks]

Examiners report

This question, by far, was the most accessible to the great majority of candidates. However, far too many candidates do not (1) use the scale as required by the question, (2) use a scale at all, (3) either draw or label axes, (4) use a ruler at all (5) use the provided graph paper. Accurate plotting of points can not be assessed unless graph paper has been used; the diagram is not a graph.

Many candidates did not seem aware that the regression line must pass through the mean point. Others, though they had obtained the equation of the regression line, did not use it to identify its y intercept.

3f.

[2 marks]

Markscheme

$$y = -0.708x + 35.0 \quad (G1)(G1)$$

Note: Award at most $(G1)(G0)$ if $y =$ not seen. Accept 35.

[2 marks]

Examiners report

This question, by far, was the most accessible to the great majority of candidates. However, far too many candidates do not (1) use the scale as required by the question, (2) use a scale at all, (3) either draw or label axes, (4) use a ruler at all (5) use the provided graph paper. Accurate plotting of points can not be assessed unless graph paper has been used; the diagram is not a graph.

Many candidates did not seem aware that the regression line must pass through the mean point. Others, though they had obtained the equation of the regression line, did not use it to identify its y intercept.

3g.

[2 marks]

Markscheme

Regression line drawn that passes through M and (0, 35) $(A1)(ft)(A1)(ft)$

Note: Award $(A1)$ for straight line that passes through M, $(A1)$ for line (extrapolated if necessary) that passes through (0, 35) (accept error of ± 1).

If ruler not used, award a maximum of $(A1)(A0)$.

[2 marks]

Examiners report

This question, by far, was the most accessible to the great majority of candidates. However, far too many candidates do not (1) use the scale as required by the question, (2) use a scale at all, (3) either draw or label axes, (4) use a ruler at all (5) use the provided graph paper. Accurate plotting of points can not be assessed unless graph paper has been used; the diagram is not a graph.

Many candidates did not seem aware that the regression line must pass through the mean point. Others, though they had obtained the equation of the regression line, did not use it to identify its y intercept.

3h.

[2 marks]

Markscheme

$$y = -0.708(30) + 35.0 \quad (M1)$$

$$= 14 \quad (\text{Accept } 13) \quad (A1)(ft)(G2)$$

OR

Using graph: *(M1)* for some indication on graph of point, *(A1)(ft)* for answers. Final answer must be consistent with their graph.
(M1)(A1)(ft)(G2)

Note: The final answer must be an integer.

[2 marks]

Examiners report

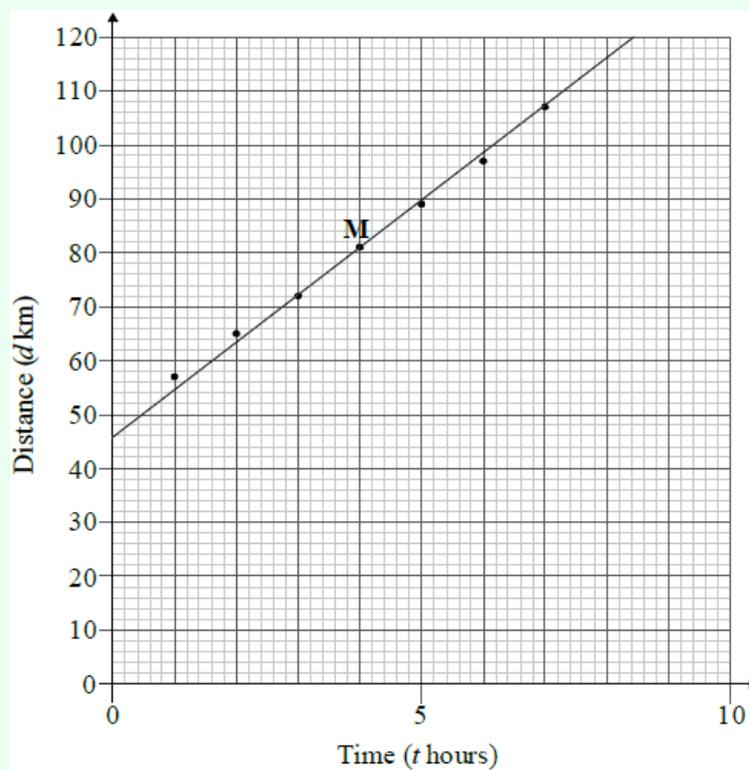
This question, by far, was the most accessible to the great majority of candidates. However, far too many candidates do not (1) use the scale as required by the question, (2) use a scale at all, (3) either draw or label axes, (4) use a ruler at all (5) use the provided graph paper. Accurate plotting of points can not be assessed unless graph paper has been used; the diagram is not a graph.

Many candidates did not seem aware that the regression line must pass through the mean point. Others, though they had obtained the equation of the regression line, did not use it to identify its y intercept.

4a.

[3 marks]

Markscheme

*(A1)(A2)*

Notes: Award *(A1)* for axes labelled with d and t and correct scale, *(A2)* for 6 or 7 points correctly plotted, *(A1)* for 4 or 5 points, *(A0)* for 3 or less points correctly plotted. Award at most *(A1)(A1)* if points are joined up. If axes are reversed award at most *(A0)(A2)*

[3 marks]

Examiners report

This question was well answered by most of the candidates. Diagrams were in general well drawn except for some students that reversed the axes or did not use the stated scales. They were able to use the GDC to find the means and the equation of the regression line. Very few students could take the correct decision in (g) (ii) by stating that the value was outside the range of the data set. The majority inclined their answers towards the context of the question and forgot what they had been taught about how wrong extrapolation can be.

4b. [1 mark]

Markscheme

$$\bar{t} = 4 \quad (GI)$$

[1 mark]

Examiners report

This question was well answered by most of the candidates. Diagrams were in general well drawn except for some students that reversed the axes or did not use the stated scales. They were able to use the GDC to find the means and the equation of the regression line. Very few students could take the correct decision in (g) (ii) by stating that the value was outside the range of the data set. The majority inclined their answers towards the context of the question and forgot what they had been taught about how wrong extrapolation can be.

4c. [1 mark]

Markscheme

$$\bar{d} = 81.1 \left(\frac{568}{7} \right) \quad (GI)$$

Note: If answers are the wrong way around award in (i) (G0) and in (ii) (GI)(ft).

[1 mark]

Examiners report

This question was well answered by most of the candidates. Diagrams were in general well drawn except for some students that reversed the axes or did not use the stated scales. They were able to use the GDC to find the means and the equation of the regression line. Very few students could take the correct decision in (g) (ii) by stating that the value was outside the range of the data set. The majority inclined their answers towards the context of the question and forgot what they had been taught about how wrong extrapolation can be.

4d. [2 marks]

Markscheme

Point marked and labelled with M or

\bar{t} ,

\bar{d} on their graph (AI)(ft)(AI)(ft)

[2 marks]

Examiners report

This question was well answered by most of the candidates. Diagrams were in general well drawn except for some students that reversed the axes or did not use the stated scales. They were able to use the GDC to find the means and the equation of the regression line. Very few students could take the correct decision in (g) (ii) by stating that the value was outside the range of the data set. The majority inclined their answers towards the context of the question and forgot what they had been taught about how wrong extrapolation can be.

4e. [2 marks]

Markscheme

Line of best fit drawn that passes through their M and (0, 48) (AI)(ft)(AI)(ft)

Notes: Award (AI)(ft) for straight line that passes through their M, (AI) for line (extrapolated if necessary) that passes through (0, 48).

Accept error of ± 3 . If ruler not used award a maximum of (AI)(ft)(A0).

[2 marks]

Examiners report

This question was well answered by most of the candidates. Diagrams were in general well drawn except for some students that reversed the axes or did not use the stated scales. They were able to use the GDC to find the means and the equation of the regression line. Very few students could take the correct decision in (g) (ii) by stating that the value was outside the range of the data set. The majority inclined their answers towards the context of the question and forgot what they had been taught about how wrong extrapolation can be.

4f. [2 marks]

Markscheme

4.5h (their answer ± 0.2) (MI)(AI)(ft)(G2)

Note: Follow through from their graph. If method shown by some indication on graph of point but answer is incorrect, award (MI)(A0).

[2 marks]

Examiners report

This question was well answered by most of the candidates. Diagrams were in general well drawn except for some students that reversed the axes or did not use the stated scales. They were able to use the GDC to find the means and the equation of the regression line. Very few students could take the correct decision in (g) (ii) by stating that the value was outside the range of the data set. The majority inclined their answers towards the context of the question and forgot what they had been taught about how wrong extrapolation can be.

4g.

[2 marks]

Markscheme

$$d = 8.25t + 48.1 \quad (G1)(G1)$$

Notes: Award *(G1)* for 8.25, *(G1)* for 48.1.

Award at most *(G1)(G0)* if $d = (\text{or } y =)$ is not seen.

Accept $d - 81.1 = 8.25(t - 4)$ or equivalent.

[2 marks]

Examiners report

This question was well answered by most of the candidates. Diagrams were in general well drawn except for some students that reversed the axes or did not use the stated scales. They were able to use the GDC to find the means and the equation of the regression line. Very few students could take the correct decision in (g) (ii) by stating that the value was outside the range of the data set. The majority inclined their answers towards the context of the question and forgot what they had been taught about how wrong extrapolation can be.

4h.

[2 marks]

Markscheme

$$d = 8.25 \times 10.3 + 48.1 \quad (M1)$$

$$d = 133 \text{ km} \quad (A1)(ft)(G2)$$

[2 marks]

Examiners report

This question was well answered by most of the candidates. Diagrams were in general well drawn except for some students that reversed the axes or did not use the stated scales. They were able to use the GDC to find the means and the equation of the regression line. Very few students could take the correct decision in (g) (ii) by stating that the value was outside the range of the data set. The majority inclined their answers towards the context of the question and forgot what they had been taught about how wrong extrapolation can be.

4i.

[2 marks]

Markscheme

No *(A1)*

Outside the set of values of t or equivalent. *(R1)*

Note: Do not award *(A1)(R0)*.

[2 marks]

Examiners report

This question was well answered by most of the candidates. Diagrams were in general well drawn except for some students that reversed the axes or did not use the stated scales. They were able to use the GDC to find the means and the equation of the regression line. Very few students could take the correct decision in (g) (ii) by stating that the value was outside the range of the data set. The majority inclined their answers towards the context of the question and forgot what they had been taught about how wrong extrapolation can be.

5a. [3 marks]

Markscheme

$$\frac{7+4+5+4+8+T+14+4}{8} = 7 \quad (AI)(AI)$$

Note: Award *(AI)* for sum + *T*, *(AI)* for 56 or 7×8 or 8 in the denominator and 7 seen.

$$T = 10 \quad (AI) \quad (C3)$$

[3 marks]

Examiners report

This question was well answered by most candidates.

5b. [1 mark]

Markscheme

$$4 \quad (AI) \quad (C1)$$

[1 mark]

Examiners report

This question was well answered by most candidates.

5c. [2 marks]

Markscheme

$$4, 4, 4, 5, 7, 8, 10, 14 \quad (MI)$$

Note: Award *(MI)* for arranging their numbers in order.

$$\text{Median} = 6 \quad (AI)(ft) \quad (C2)$$

[2 marks]

Examiners report

This question was well answered by most candidates.

6a. [1 mark]

Markscheme

$$170 \quad (AI) \quad (C1)$$

[1 mark]

Examiners report

The box and whisker plot was well done, even when the students had incorrect values. Most candidates found the correct median but a few could not find the 25th and 75th percentiles.

6b. [1 mark]

Markscheme

163 (AI) (CI)

[1 mark]

Examiners report

The box and whisker plot was well done, even when the students had incorrect values. Most candidates found the correct median but a few could not find the 25th and 75th percentiles.

6c. [1 mark]

Markscheme

172 (AI) (CI)

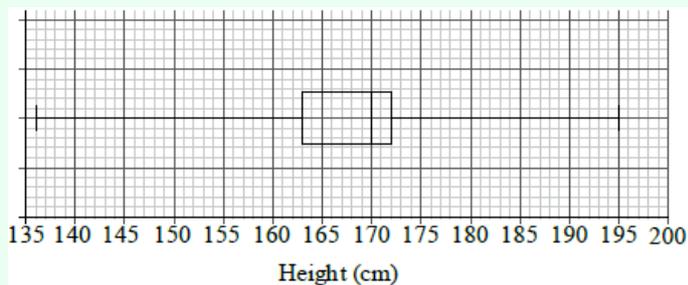
[1 mark]

Examiners report

The box and whisker plot was well done, even when the students had incorrect values. Most candidates found the correct median but a few could not find the 25th and 75th percentiles.

6d. [3 marks]

Markscheme



(AI)(ft)(AI)(ft)(AI) (C3)

Notes: Award (AI)(ft) for correct median, (AI)(ft) for correct quartiles and box (AI) for correct end points of whiskers.

Award at most (AI)(AI)(A0) if lines go right through the box.

[3 marks]

Examiners report

The box and whisker plot was well done, even when the students had incorrect values. Most candidates found the correct median but a few could not find the 25th and 75th percentiles.

7a. [1 mark]

Markscheme

UP applies in this question

(UP) XM = 5 cm (AI)

[1 mark]

Examiners report

This part proved accessible to the great majority of candidates. The common errors were (1) the inversion of the tangent ratio (2) the omission of the units and (3) the incorrect rounding of the answer; with 58° being all too commonly seen.

7b. [1 mark]

Markscheme

16.8 (GI)

[1 mark]

Examiners report

A straightforward question that saw many fine attempts. Given its nature – where much of the work was done on the GDC – it must be emphasised to candidates that incorrect entry of data into the calculator will result in considerable penalties; they must check their data entry most carefully.

The use of the inappropriate standard deviation was seen, but infrequently.

7c. [2 marks]

Markscheme

UP applies in this question

$$VM^2 = 5^2 + 8^2 \quad (M1)$$

Note: Award (M1) for correct use of Pythagoras Theorem.

$$(UP) \quad VM = \sqrt{89} = 9.43 \text{ cm} \quad (A1)(ft)(G2)$$

[2 marks]

Examiners report

This part proved accessible to the great majority of candidates. The common errors were (1) the inversion of the tangent ratio (2) the omission of the units and (3) the incorrect rounding of the answer; with 58° being all too commonly seen.

7d. [2 marks]

Markscheme

$$\tan VMX = \frac{8}{5} \quad (M1)$$

Note: Other trigonometric ratios may be used.

$$\hat{VMX} = 58.0^\circ \quad (A1)(ft)(G2)$$

[2 marks]

Examiners report

This part proved accessible to the great majority of candidates. The common errors were (1) the inversion of the tangent ratio (2) the omission of the units and (3) the incorrect rounding of the answer; with 58° being all too commonly seen.

Markscheme

UP applies in this question

$$l^2 = 290^2 + 550^2 - 2 \times 290 \times 550 \times \cos 115^\circ \quad (M1)(A1)$$

Note: Award (M1) for substituted cosine rule formula, (A1) for correct substitution.

$$l = 722 \quad (A1)(G2)$$

$$(UP) = 720 \text{ m} \quad (A1)$$

Note: If 720 m seen without working award (G3).

The final (A1) is awarded for the correct rounding of their answer.

[4 marks]

Examiners report

Again, this part proved accessible to the majority with a large number of candidates attaining full marks. However, there were also a number of candidates who seemed not to have been prepared in the use of trigonometry in non right-angled triangles. Also, failing to round the answer in (a) to the nearest 10m was a common omission.

Markscheme

UP applies in this question

$$\text{Area} = \frac{1}{2} \times 290 \times 550 \times \sin 115 \quad (M1)(A1)$$

Note: Award (M1) for substituted correct formula (A1) for correct substitution.

$$(UP) = 72\,300 \text{ m}^2 \quad (A1)(G2)$$

[3 marks]

Examiners report

Again, this part proved accessible to the majority with a large number of candidates attaining full marks. However, there were also a number of candidates who seemed not to have been prepared in the use of trigonometry in non right-angled triangles. Also, failing to round the answer in (a) to the nearest 10 m was a common omission.

7g. [4 marks]

Markscheme

$$\frac{180}{\sin B} = \frac{230}{\sin 53} \quad (MI)(AI)$$

Note: Award *(MI)* for substituted sine rule formula, *(AI)* for correct substitution.

$$B = 38.7^\circ \quad (AI)(G2)$$

$$\hat{A}CB = 180 - (53^\circ + 38.7^\circ)$$

$$= 88.3^\circ \quad (AI)(ft)$$

[4 marks]

Examiners report

Again, this part proved accessible to the majority with a large number of candidates attaining full marks. However, there were also a number of candidates who seemed not to have been prepared in the use of trigonometry in non right-angled triangles. Also, failing to round the answer in (a) to the nearest 10 m was a common omission.

8a. [1 mark]

Markscheme

$$50 \quad (G1)$$

[1 mark]

Examiners report

A straightforward question that saw many fine attempts. Given its nature – where much of the work was done on the GDC – it must be emphasised to candidates that incorrect entry of data into the calculator will result in considerable penalties; they must check their data entry most carefully.

The use of the inappropriate standard deviation was seen, but infrequently.

8b. [1 mark]

Markscheme

$$30.5 \quad (G1)$$

[1 mark]

Examiners report

A straightforward question that saw many fine attempts. Given its nature – where much of the work was done on the GDC – it must be emphasised to candidates that incorrect entry of data into the calculator will result in considerable penalties; they must check their data entry most carefully.

The use of the inappropriate standard deviation was seen, but infrequently.

8c. [1 mark]

Markscheme

$$12.3 \quad (G1)$$

Note: Award *(AI)(ft)* for 13.0 in (iv) but only if 17.7 seen in (a)(ii).

[1 mark]

Examiners report

A straightforward question that saw many fine attempts. Given its nature – where much of the work was done on the GDC – it must be emphasised to candidates that incorrect entry of data into the calculator will result in considerable penalties; they must check their data entry most carefully.

The use of the inappropriate standard deviation was seen, but infrequently.

8d. [2 marks]

Markscheme

$$r = \frac{188.5}{(16.79 \times 12.33)} \quad (M1)$$

Note: Award (M1) for using their values in the correct formula.

$$= 0.911 \text{ (accept 0.912, 0.910)} \quad (A1)(ft)(G2)$$

[2 marks]

Examiners report

A straightforward question that saw many fine attempts. Given its nature – where much of the work was done on the GDC – it must be emphasised to candidates that incorrect entry of data into the calculator will result in considerable penalties; they must check their data entry most carefully.

It is expected that the GDC is used to calculate the correlation coefficient; the covariance was given to aid those candidates for whom the reset process removes this function from the display. It is anticipated that this hint will not be given in future papers.

8e. [2 marks]

Markscheme

$$y = 0.669x - 2.95 \quad (G1)(G1)$$

Note: Award (G1) for 0.669x, (G1) for -2.95. If the answer is not in the form of an equation, award at most (G1)(G0).

[2 marks]

Examiners report

A straightforward question that saw many fine attempts. Given its nature – where much of the work was done on the GDC – it must be emphasised to candidates that incorrect entry of data into the calculator will result in considerable penalties; they must check their data entry most carefully.

8f. [2 marks]

Markscheme

$$\text{Depth} = 0.669 \times 55 - 2.95 \quad (M1)$$

$$= 33.8 \quad (A1)(ft)(G2)(ft)$$

Note: Follow through from their (c) even if no working seen.

[2 marks]

Examiners report

A straightforward question that saw many fine attempts. Given its nature – where much of the work was done on the GDC – it must be emphasised to candidates that incorrect entry of data into the calculator will result in considerable penalties; they must check their data entry most carefully.

8g. [1 mark]

Markscheme

64.0 (accept 63.95, 63.9) (AI)(ft)(GI)(ft)

Note: Follow through from their (c) even if no working seen.

[1 mark]

Examiners report

A straightforward question that saw many fine attempts. Given its nature – where much of the work was done on the GDC – it must be emphasised to candidates that incorrect entry of data into the calculator will result in considerable penalties; they must check their data entry most carefully.

8h. [2 marks]

Markscheme

It is not valid. It lies too far outside the values that are given. *Or equivalent.* (AI)(RI)

Note: Do not award (AI)(R0).

[2 marks]

Examiners report

A straightforward question that saw many fine attempts. Given its nature – where much of the work was done on the GDC – it must be emphasised to candidates that incorrect entry of data into the calculator will result in considerable penalties; they must check their data entry most carefully.

The dangers of extrapolation should be clearly explained to students.

8i. [1 mark]

Markscheme

28 (AI)

[1 mark]

Examiners report

Once again, a straightforward question on chi-squared testing that was either highly successful (for the majority) or showed a lack of syllabus coverage.

8j.

[2 marks]

Markscheme

$$\frac{28 \times 45}{100} \left(\frac{28}{100} \times \frac{45}{100} \times 100 \right) \quad (MI)(AI)(ft)$$

Note: Award (MI) for correct formula, (AI) for correct substitution.

$$= 12.6 \quad (AG)$$

Note: Do not award (AI) unless 12.6 seen.

[2 marks]

Examiners report

Once again, a straightforward question on chi-squared testing that was either highly successful (for the majority) or showed a lack of syllabus coverage. A surprising number of candidates lacked knowledge of the theory underlying the test and were thus unable to attempt (b).

8k.

[1 mark]

Markscheme

the favourite car colour is **independent** of gender. (AI)

Note: Accept there is no association between gender and favourite car colour.

Do not accept 'not related' or 'not correlated'.

[1 mark]

Examiners report

Once again, a straightforward question on chi-squared testing that was either highly successful (for the majority) or showed a lack of syllabus coverage. In (c)(i) it is worth stressing that the test is for the mathematical **independence** of two characteristics and this determines the null hypothesis.

8l.

[1 mark]

Markscheme

2 (AI)

[1 marks]

Examiners report

Once again, a straightforward question on chi-squared testing that was either highly successful (for the majority) or showed a lack of syllabus coverage.

8m. [2 marks]

Markscheme

Accept the null hypothesis since
 $1.367 < 5.991$ (AI)(ft)(RI)

Note: Allow “Do not reject”. Follow through from their null hypothesis and their critical value.

Full credit for use of
 p -values from GDC [
 $p = 0.505$].

Do not award (AI)(R0). Award (RI) for valid comparison.

[2 marks]

Examiners report

Once again, a straightforward question on chi-squared testing that was either highly successful (for the majority) or showed a lack of syllabus coverage. A number of candidates confuse the critical value and p -value approach to the test and thus lost marks in (c)(iv).

9a. [1 mark]

Markscheme

F (AI)

[1 mark]

Examiners report

It was expected that candidates would use the GDC for this question.

9b. [1 mark]

Markscheme

T (AI)

[1 mark]

Examiners report

It was expected that candidates would use the GDC for this question.

9c. [1 mark]

Markscheme

F (AI)

[1 mark]

Examiners report

It was expected that candidates would use the GDC for this question.

9d. [1 mark]

Markscheme

F (A1) (C4)

[1 mark]

Examiners report

It was expected that candidates would use the GDC for this question.

It was pleasing to note that most candidates were able to choose the appropriate standard deviation.

9e. [2 marks]

Markscheme

$IQR = 6 - 4$ (M1)

Note: Award (M1) for identifying correct quartiles.

$IQR = 2$ (A1)(ft) (C2)

[2 marks]

Examiners report

It was expected that candidates would use the GDC for this question.

A common error was writing the IQR as an interval.

10a. [1 mark]

Markscheme

Unit penalty (UP) applies in this part

(UP) median = 13 seconds (A1)

[1 mark]

Examiners report

Most of the students knew the definition of the median, quartiles and inter-quartile range though some confused variables and worked with the frequencies instead. Few could use their calculator to estimate the mean and standard deviation from grouped data. It cannot be said that the calculator was misused but that frequencies and midpoints were ignored when doing the calculations.

10b. [2 marks]

Markscheme

Unit penalty (UP) applies in this part

(UP) 16 seconds and 10 seconds (A1)(A1)

Note: Accept 16.1 or 16.2 for the upper quartile value.

[2 marks]

Examiners report

Most of the students knew the definition of the median, quartiles and inter-quartile range though some confused variables and worked with the frequencies instead. Few could use their calculator to estimate the mean and standard deviation from grouped data. It cannot be said that the calculator was misused but that frequencies and midpoints were ignored when doing the calculations.

10c. [1 mark]

Markscheme

$$\text{IQR} = 6 \text{ seconds} \quad (AI)(ft)$$

Note: (ft) from reasonable answers to (ii).

[1 mark]

Examiners report

Most of the students knew the definition of the median, quartiles and inter-quartile range though some confused variables and worked with the frequencies instead. Few could use their calculator to estimate the mean and standard deviation from grouped data. It cannot be said that the calculator was misused but that frequencies and midpoints were ignored when doing the calculations.

10d. [3 marks]

Markscheme

$$\text{value seen } 650 \quad (AI)$$

$$2000 - \text{value} = 2000 - 650 \quad (MI)$$

$$= 1350 \quad (AI)(G2)$$

[3 marks]

Examiners report

Most of the students knew the definition of the median, quartiles and inter-quartile range though some confused variables and worked with the frequencies instead. Few could use their calculator to estimate the mean and standard deviation from grouped data. It cannot be said that the calculator was misused but that frequencies and midpoints were ignored when doing the calculations.

10e. [2 marks]

Markscheme

$$55 \% \text{ of } 2000 = 1100 \quad (AI)$$

$$p = 13.5 \quad (AI)(G2)$$

[2 marks]

Examiners report

Most of the students knew the definition of the median, quartiles and inter-quartile range though some confused variables and worked with the frequencies instead. Few could use their calculator to estimate the mean and standard deviation from grouped data. It cannot be said that the calculator was misused but that frequencies and midpoints were ignored when doing the calculations.

10f. [1 mark]

Markscheme

$$a = 500 \quad (AI)$$

[1 mark]

Examiners report

Most of the students knew the definition of the median, quartiles and inter-quartile range though some confused variables and worked with the frequencies instead. Few could use their calculator to estimate the mean and standard deviation from grouped data. It cannot be said that the calculator was misused but that frequencies and midpoints were ignored when doing the calculations.

10g. [1 mark]

Markscheme

$$b = 150 \quad (A1)$$

[1 mark]

Examiners report

Most of the students knew the definition of the median, quartiles and inter-quartile range though some confused variables and worked with the frequencies instead. Few could use their calculator to estimate the mean and standard deviation from grouped data. It cannot be said that the calculator was misused but that frequencies and midpoints were ignored when doing the calculations.

10h. [2 marks]

Markscheme

Unit penalty (UP) applies in this part

(UP)

$$\bar{t} = 13.25 \text{ seconds (13.3 seconds)} \quad (G2)$$

OR

$$\bar{t} = \frac{7.5 \times 500 + 12.5 \times 850 + 17.5 \times \text{their } a + 22.5 \times \text{their } b}{2000} \quad (M1)$$

(UP)

$$\bar{t} = 13.25 \text{ seconds (13.3 seconds)} \quad (A1)(ft)$$

Note: Award (ft) from their *a* and their *b* only if working is seen.

[2 marks]

Examiners report

Most of the students knew the definition of the median, quartiles and inter-quartile range though some confused variables and worked with the frequencies instead. Few could use their calculator to estimate the mean and standard deviation from grouped data. It cannot be said that the calculator was misused but that frequencies and midpoints were ignored when doing the calculations.

10i. [1 mark]

Markscheme

$$\sigma = 4.41 \text{ seconds} \quad (G1)$$

[1 mark]

Examiners report

Most of the students knew the definition of the median, quartiles and inter-quartile range though some confused variables and worked with the frequencies instead. Few could use their calculator to estimate the mean and standard deviation from grouped data. It cannot be said that the calculator was misused but that frequencies and midpoints were ignored when doing the calculations.

10j. [3 marks]

Markscheme

$$\bar{x} - \sigma = 8.84 \quad (A1)(ft)$$

Their

$$\bar{x} - \sigma \text{ compared to } 9.5 \quad (R1)$$

Pedro does not receive the bonus $(A1)(ft)$

Note: Do not award $(R0)(A1)$.

[3 marks]

Examiners report

Most of the students knew the definition of the median, quartiles and inter-quartile range though some confused variables and worked with the frequencies instead. Few could use their calculator to estimate the mean and standard deviation from grouped data. It cannot be said that the calculator was misused but that frequencies and midpoints were ignored when doing the calculations. Part (f) acted as a good discriminator. Follow through marks were awarded in (f) when working was shown.

11a. [1 mark]

Markscheme

Discrete $(A1) (C1)$

[1 mark]

Examiners report

This question was not well answered by a number of candidates. In this part, many did not know that the data was discrete.

11b. [2 marks]

Markscheme

$$\frac{0+24+40+51+44}{100} = \frac{159}{100} = 1.59 \quad (M1)(A1) \quad (C2)$$

Notes: Award $(M1)$ for correctly substituted formula.

Award $(M1)(A1)$ for 1 or 2 if 1.59 is seen.

Award $(M0)(A0)$ for 1 or 2 seen with no working.

[2 marks]

Examiners report

This question was not well answered by a number of candidates. The most common error in this part was $(0 + 1 + 2 + 3 + 4) / 5 = 2$.

11c. [2 marks]

Markscheme

1 (MI)(A1) (C2)

Note: Award (MI) for attempt to order raw data (if frequency table not used) or (MI) for indicating halfway between 50th and 51st result or (MI) for 50th percentile seen.

[2 marks]

Examiners report

This question was not well answered by a number of candidates.

11d. [1 mark]

Markscheme

0 (A1) (C1)

[1 mark]

Examiners report

This question was not well answered by a number of candidates.

Many candidates did not know how to find the median and the most common incorrect answer for this part was 11.

12a. [2 marks]

Markscheme

Grade	Frequency
1	1
2	4
3	(2)
4	3
5	(4)
6	5
7	(1)

(A2) (C2)

Notes: Award (A1) for three correct. Award (A0) for two or fewer correct.

[2 marks]

Examiners report

Parts (a) and (b) were well done by the vast majority of candidates.

12b. [1 mark]

Markscheme

Mode = 6 (A1)(ft) (C1)

[1 mark]

Examiners report

Parts (a) and (b) were well done by the vast majority of candidates.

12c. [2 marks]

Markscheme

Median = 4.5 (MI)(AI)(ft) (C2)

Note: (MI) for attempt to order raw data (if frequency table not used) or (MI) halfway between 10th and 11th result.

[2 marks]

Examiners report

Part (c) caused problems to many – with (1) the mean of the two grades not being taken (2) the mean being calculated instead of the median.

12d. [1 mark]

Markscheme

$\frac{7}{20}$ (0.35, 35%) (AI)(ft) (CI)

[1 mark]

Examiners report

Part (d) was successfully completed by those candidates who did the question by counting. Those who tried to use the probability laws were not successful.

Much of the question could have been checked by inputting the data into the GDC.

13a. [1 mark]

Markscheme

Median
= 11 m (AI) (CI)

Note: Award A0 for “11” without units; correct units must be included for the AI to be awarded.

[1 mark]

Examiners report

Candidates showed less facility in this question compared to question 2.

(a) was generally answered well. There were a number of inaccurate readings from the graph.

13b. [2 marks]

Markscheme

Interquartile range = 14 – 10 (AI)
= 4 (AI)(ft) (C2)

Note: (MI) for taking a sensible difference or for both correct quartile values seen.

[2 marks]

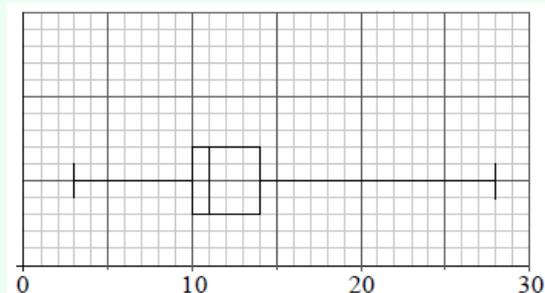
Examiners report

Candidates showed less facility in this question compared to question 2.

(b) Errors came from candidates who either used the x coordinates for the quartiles or who wrote the quartiles as an interval, rather than subtracting these.

13c. [3 marks]

Markscheme



correct median (AI)(ft)

correct quartiles and box (AI)(ft)

endpoints at

3 and

28, joined to box by straight lines (AI) (C3)

Notes: Award (A0) if the lines go right through the box. Award final (AI) if the whisker goes to 20 with an outlier at

28.

[3 marks]

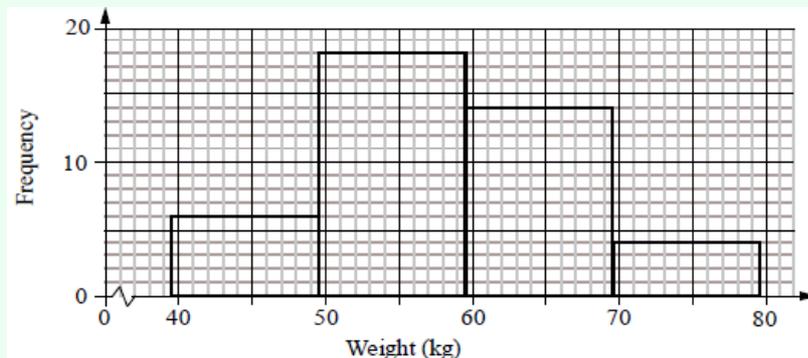
Examiners report

Candidates showed less facility in this question compared to question 2.

(c) was well attempted from the candidates' (a) and (b).

14a. [2 marks]

Markscheme



(AI)(AI) (C2)

Notes: (AI) for all correct heights, (AI) for all correct end points (

39.5,

49.5 etc.).

Histogram must be drawn with a ruler (straight edge) and endpoints must be clear.

Award (AI) only if both correct histogram and correct frequency polygon drawn.

[2 marks]

Examiners report

The class boundaries needed to be correctly identified to permit full credit to be given. Weight being a continuous variable and given to the nearest kg meant that the lowest class boundary was 39.5. Thereafter, the use of midpoints is standard.

(a) The endpoints of the bars caused problems for all but a very few candidates. Diagrams drawn without a ruler were also penalized.

14b. [1 mark]

Markscheme

44.5 (A1) (C1)

Note: If (b) is given as 45 then award

(b)

45 (A0)

(c)

58.8 kg (M1)(A1)(ft) or (C2)(ft) if no working seen.

(d)

8.44 (C1)

[1 mark]

Examiners report

The class boundaries needed to be correctly identified to permit full credit to be given. Weight being a continuous variable and given to the nearest kg meant that the lowest class boundary was 39.5. Thereafter, the use of midpoints is standard.

(b) This was well attempted by the majority; it acted as a prompt for the following parts.

14c. [2 marks]

Markscheme

Unit penalty (UP) applies in this question.

$$\text{Mean} = \frac{44.5 \times 6 + 54.5 \times 18 + \dots}{42} \quad (M1)$$

Note: (M1) for a sum of frequencies multiplied by midpoint values divided by 42.

$$= 58.3 \text{ kg} \quad (A1)(ft) \quad (C2)$$

Note: Award (A1)(A0)(AP) for 58.

Note: If (b) is given as 45 then award

(b)

45 (A0)

(c)

58.8 kg (M1)(A1)(ft) or (C2)(ft) if no working seen.

(d)

8.44 (C1)

[2 marks]

Examiners report

The class boundaries needed to be correctly identified to permit full credit to be given. Weight being a continuous variable and given to the nearest kg meant that the lowest class boundary was 39.5. Thereafter, the use of midpoints is standard.

(c) (d) resulted in many incorrect answers; it was expected that the GDC would be used for these parts of the question, though a number calculated the mean by hand.

14d. [1 mark]

Markscheme

Standard deviation = 8.44 (AI) (CI)

Note: If (b) is given as 45 then award

(b)

45 (A0)

(c)

58.8 kg (M1)(A1)(ft) or (C2)(ft) if no working seen.

(d)

8.44 (CI)

[1 mark]

Examiners report

The class boundaries needed to be correctly identified to permit full credit to be given. Weight being a continuous variable and given to the nearest kg meant that the lowest class boundary was 39.5. Thereafter, the use of midpoints is standard.

(c) (d) resulted in many incorrect answers; it was expected that the GDC would be used for these parts of the question, though a number calculated the mean by hand.

15a. [1 mark]

Markscheme

Median = 45 (AI) (CI)

Accept

45.5

[1 mark]

Examiners report

Accuracy reading the graph in part (a) was a problem with little allowance given. A number read the maximum as 130 instead of 120.

15b. [2 marks]

Markscheme

53 – 37 for identifying correct quartiles (A1)

= 16 for correct answer to subtraction (A1)(ft) (C2)

(ft) on their quartiles

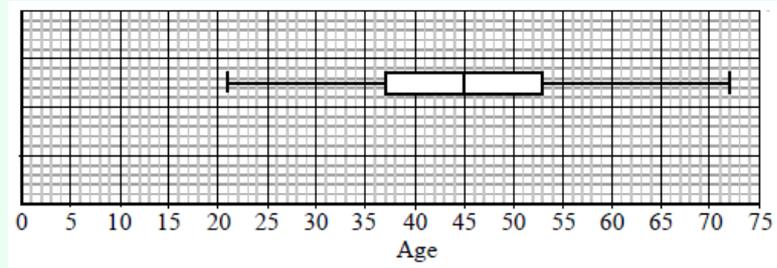
[2 marks]

Examiners report

Part (b) was poorly done. Many candidates did not know how to find the quartile values from the graph.

15c. [3 marks]

Markscheme



Median marked correctly. (AI)(ft)
Box with ends at candidate's quartiles. (AI)(ft)
End points at
21 and
72 joined to box with straight lines. (AI) (C3)

Note: Award (A0) if lines go right through the box.

[3 marks]

Examiners report

Accuracy reading the graph in part (a) was a problem with little allowance given. A number read the maximum as 130 instead of

120. Part (b) was poorly done. Many candidates did not know how to find the quartile values from the graph. Many candidates gained follow through marks for the box and whisker plot by writing down their values for part (b). Some candidates did lose a mark for drawing the whiskers through the box.

16. [4 marks]

Markscheme

Mode = 171 (AI)

Median 148, 151, 158, 163, 171, 171, 184

= 163 (AI)

Mean = 64.7 (AI)

Standard deviation = 13.3 (AI) (C4)

Note: If both mean and standard deviation given to 2 significant figures

Mean 65, (A0)(AP)

Standard deviation 13 (AI)(ft) ((AP) already deducted).

[4 marks]

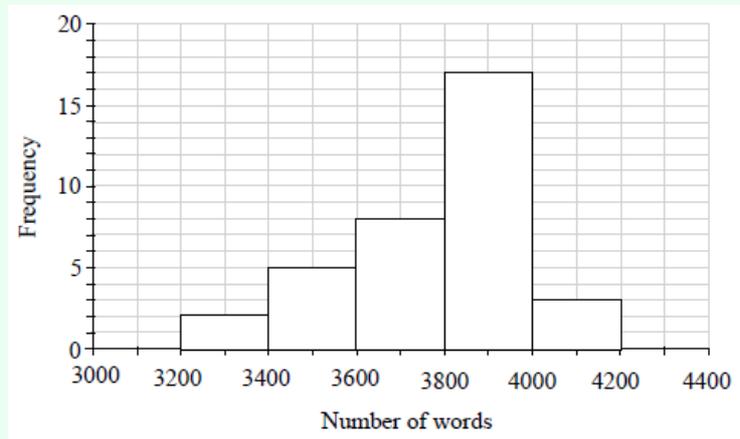
Examiners report

Part (a) was well answered, albeit with some choosing the wrong value (

14.3) for the standard deviation. The majority of candidates had the correct stem and leaf plot, though many lost a mark through not including a key and a few used a single digit in the stem. Some tried to draw two stem and leaf plots for the heights and weights in part (a) without realizing that part (b) had the ages written above.

17a. [3 marks]

Markscheme



(A3) (C3)

Notes: (A3) for correct histogram, (A2) for one error, (A1) for two errors, (A0) for more than two errors.
Award maximum (A2) if lines do not appear to be drawn with a ruler.
Award maximum (A2) if a frequency polygon is drawn.

[3 marks]

Examiners report

A surprising number of the candidates did not appear to have brought a ruler/straight edge and so lost a mark in this question as they were asked to **draw** a histogram which means the lines must be drawn using a ruler/straight edge. Some candidates drew a frequency polygon. Parts (b) and (c) were generally answered well though 20/35 was seen occasionally in part (c).

17b. [1 mark]

Markscheme

Modal group = $3800 \leq w < 4000$ (A1) (C1)

[1 mark]

Examiners report

A surprising number of the candidates did not appear to have brought a ruler/straight edge and so lost a mark in this question as they were asked to **draw** a histogram which means the lines must be drawn using a ruler/straight edge. Some candidates drew a frequency polygon. Parts (b) and (c) were generally answered well though 20/35 was seen occasionally in part (c).

17c. [2 marks]

Markscheme

Probability = $\frac{3}{35}$ (0.0857, 8.57%) (A1)(A1) (C2)

Note: (A1) for correct numerator (A1) for correct denominator.

[2 marks]

Examiners report

A surprising number of the candidates did not appear to have brought a ruler/straight edge and so lost a mark in this question as they were asked to **draw** a histogram which means the lines must be drawn using a ruler/straight edge. Some candidates drew a frequency polygon. Parts (b) and (c) were generally answered well though 20/35 was seen occasionally in part (c).

18a. [1 mark]

Markscheme

96 (AI) (CI)

[1 mark]

Examiners report

Very few candidates could draw a frequency polygon correctly. The word 'Draw' means that a ruler should be used. Many managed to draw from the mid-point of the bar but did not extend it to

0.5 or

5.5. Most could answer the probability part of the question.

18b. [1 mark]

Markscheme

$3 \leq \text{weight} < 4 \text{ kg}$. *Accept*

3 – 4 kg (AI) (CI)

[1 mark]

Examiners report

Very few candidates could draw a frequency polygon correctly. The word 'Draw' means that a ruler should be used. Many managed to draw from the mid-point of the bar but did not extend it to

0.5 or

5.5. Most could answer the probability part of the question.

18c. [2 marks]

Markscheme

For adding three heights or subtracting

14 from

96 (MI)

$\frac{82}{96}$ (0.854 or $\frac{41}{48}$, 85.4%) (ft) from (b). (AI)(ft) (C2)

[2 marks]

Examiners report

Very few candidates could draw a frequency polygon correctly. The word 'Draw' means that a ruler should be used. Many managed to draw from the mid-point of the bar but did not extend it to

0.5 or

5.5. Most could answer the probability part of the question.

19a. [1 mark]

Examiners report

Many candidates did not use the calculator correctly to find the mean and standard deviation, trying to do all the calculations by hand with a significant number not realizing it was a frequency table – this could have been the error with those using the calculator also as few received full marks on this question. When the candidate had made an error follow through marks could be awarded for the final part *provided working had been shown*. Most knew the data was discrete.

19b. [2 marks]

Markscheme

For attempting to find

$$\sum fx / \sum f \quad (M1)$$

2.73 (A1) (C2)

Note: for (b) and (c), if both mean and standard deviation given to 2 significant figures.

Award (C1)(C0)(AP) for

2.7. Award (A1)(ft) for

1.3 ((AP) already deducted).

[2 marks]

Examiners report

Many candidates did not use the calculator correctly to find the mean and standard deviation, trying to do all the calculations by hand with a significant number not realizing it was a frequency table – this could have been the error with those using the calculator also as few received full marks on this question. When the candidate had made an error follow through marks could be awarded for the final part *provided working had been shown*. Most knew the data was discrete.

19c. [1 mark]

Markscheme

1.34 (A1) (C1)

Note: for (b) and (c), if both mean and standard deviation given to 2 significant figures.

Award (C1)(C0)(AP) for

2.7. Award (A1)(ft) for

1.3 ((AP) already deducted).

[1 mark]

Examiners report

Many candidates did not use the calculator correctly to find the mean and standard deviation, trying to do all the calculations by hand with a significant number not realizing it was a frequency table – this could have been the error with those using the calculator also as few received full marks on this question. When the candidate had made an error follow through marks could be awarded for the final part *provided working had been shown*. Most knew the data was discrete.

19d. [2 marks]

Markscheme

Attempt to find their mean

+ their standard deviation (can be implied) (M1)

23, (ft) *their mean and standard deviation*. (A1)(ft) (C2)

[2 marks]

Examiners report

Many candidates did not use the calculator correctly to find the mean and standard deviation, trying to do all the calculations by hand with a significant number not realizing it was a frequency table – this could have been the error with those using the calculator also as few received full marks on this question. When the candidate had made an error follow through marks could be awarded for the final part *provided working had been shown*. Most knew the data was discrete.