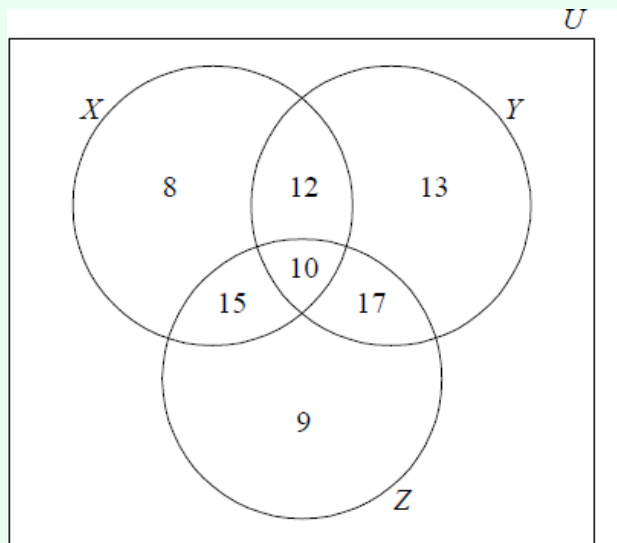


Topic 4 Part 2 [189 marks]

1a.

[4 marks]

Markscheme



(A1) for rectangle and three intersecting circles

(A1) for 10, (A1) for 8, 13 and 9, (A1) for 12, 15 and 17 (A4)

[4 marks]

Examiners report

This question was in general well done. Candidates began the paper well by drawing the Venn diagram correctly. Some students omitted the rectangle (universal set) around the three circles. There were quite a few errors in (c) as some students forgot to convert their answers to percentages. Also describing in words what the students in

$X \cap Y'$ had for breakfast seemed to be difficult for the majority of the candidates. Some misread what Y was and even more missed the complement sign. However, the main problem in answering this question seemed to be the lack of knowledge in the relationship between set theory and logic (use of "and" and "or"). Combining probabilities caused problems to many. Common wrong answers were

$$\frac{10}{100}, \frac{10}{100} \times \frac{10}{100} \text{ or } \frac{10}{100} + \frac{9}{99}.$$

1b.

[2 marks]

Markscheme

$$100 - (9 + 12 + 13 + 15 + 10 + 17 + 8) = 16 \quad (M1)(A1)(ft)(G2)$$

Note: Follow through from their diagram.

[2 marks]

Examiners report

This question was in general well done. Candidates began the paper well by drawing the Venn diagram correctly. Some students omitted the rectangle (universal set) around the three circles. There were quite a few errors in (c) as some students forgot to convert their answers to percentages. Also describing in words what the students in

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were
 $\frac{10}{100}$,
 $\frac{10}{100} \times \frac{10}{100}$ or
 $\frac{10}{100} + \frac{9}{99}$.

1c.

[2 marks]

Markscheme

$$\frac{51}{100}(0.51) \quad (A1)(ft)$$

$$= 51\% \quad (A1)(ft)(G2)$$

Note: Follow through from their diagram.

[2 marks]

Examiners report

This question was in general well done. Candidates began the paper well by drawing the Venn diagram correctly. Some students omitted the rectangle (universal set) around the three circles. There were quite a few errors in (c) as some students forgot to convert their answers to percentages. Also describing in words what the students in

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were
 $\frac{10}{100}$,
 $\frac{10}{100} \times \frac{10}{100}$ or
 $\frac{10}{100} + \frac{9}{99}$.

1d.

[2 marks]

Markscheme

Note: The following statements are correct. Please note that the connectives are important. It is not the same (had cereal) and (not bread) and (had cereal) or (not bread). The parentheses are not needed but are there to facilitate the understanding of the propositions.

(had cereal) and (did not have bread)

(had cereal only) or (had cereal and fruit only)

(had either cereal or (fruit and cereal)) and (did not have bread) $(A1)(A1)$

Notes: If the statements are correct but the connectives are wrong then award at most $(A1)(A0)$. For the statement (had only cereal) and (cereal and fruit) award $(A1)(A0)$. For the statement had cereal and fruit award $(A0)(A0)$.

[2 marks]

Examiners report

This question was in general well done. Candidates began the paper well by drawing the Venn diagram correctly. Some students omitted the rectangle (universal set) around the three circles. There were quite a few errors in (c) as some students forgot to convert their answers to percentages. Also describing in words what the students in

$X \cap Y'$ had for breakfast seemed to be difficult for the majority of the candidates. Some misread what Y was and even more missed the complement sign. However, the main problem in answering this question seemed to be the lack of knowledge in the relationship between set theory and logic (use of "and" and "or"). Combining probabilities caused problems to many. Common wrong answers

were
 $\frac{10}{100}$,
 $\frac{10}{100} \times \frac{10}{100}$ or
 $\frac{10}{100} + \frac{9}{99}$.

1e.

[2 marks]

Markscheme

$\frac{54}{100}$ (0.54, 54 %) (AI)(ft)(AI)(ft)(G2)

Note: Award (AI)(ft) for numerator, follow through from their diagram, (AI)(ft) for denominator. Follow through from total or denominator used in part (c).

[2 marks]

Examiners report

This question was in general well done. Candidates began the paper well by drawing the Venn diagram correctly. Some students omitted the rectangle (universal set) around the three circles. There were quite a few errors in (c) as some students forgot to convert their answers to percentages. Also describing in words what the students in

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were
 $\frac{10}{100}$,
 $\frac{10}{100} \times \frac{10}{100}$ or
 $\frac{10}{100} + \frac{9}{99}$.

1f.

[3 marks]

Markscheme

$\frac{10}{100} \times \frac{9}{99} = \frac{1}{110}$ (0.00909, 0.909 %) (AI)(ft)(MI)(AI)(ft)(G2)

Notes: Award (AI)(ft) for their correct fractions, (MI) for multiplying two fractions, (AI)(ft) for their correct answer. Answer 0.009 with no working receives no marks. Follow through from denominator in parts (c) and (e) and from their diagram.

[3 marks]

Examiners report

This question was in general well done. Candidates began the paper well by drawing the Venn diagram correctly. Some students omitted the rectangle (universal set) around the three circles. There were quite a few errors in (c) as some students forgot to convert their answers to percentages. Also describing in words what the students in

$X \cap Y'$ had for breakfast seemed to be difficult for the majority of the candidates. Some misread what Y was and even more missed the complement sign. However, the main problem in answering this question seemed to be the lack of knowledge in the relationship between set theory and logic (use of "and" and "or"). Combining probabilities caused problems to many. Common wrong answers

were
 $\frac{10}{100}$,
 $\frac{10}{100} \times \frac{10}{100}$ or
 $\frac{10}{100} + \frac{9}{99}$.

1g.

[1 mark]

Markscheme

H_0 : The (average) number of meals per day a student has and gender are independent (AI)

Note: For “independent” accept “not associated” but do not accept “not related” or “not correlated”.

[1 mark]

Examiners report

In general this part question was well answered. The major concerns of the examining team were the following:

- In (f) many students wrote down the expected values table (from the GDC) and highlighted the correct expected value, 12.6. As this is a "show that" question the use of the GDC is not expected and therefore no marks are awarded for this working. Instead it is expected the use of the formula for the expected value with the correct substitutions.
- In (e) surprisingly many candidates found the χ^2_{calc} through the use of the formula. Unfortunately this led to some incorrect answers and also to a bad use of time. The question clearly says "use your graphic display calculator" and it is worth 2 marks therefore a student should not spend more than 2 minutes to answer this part question. Time management is essential in this type of examinations and the IB rule is one minute – one mark.

1h.

[1 mark]

Markscheme

2 (AI)

[1 mark]

Examiners report

In general this part question was well answered. The major concerns of the examining team were the following:

- In (f) many students wrote down the expected values table (from the GDC) and highlighted the correct expected value, 12.6. As this is a "show that" question the use of the GDC is not expected and therefore no marks are awarded for this working. Instead it is expected the use of the formula for the expected value with the correct substitutions.
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1i.

[1 mark]

Examiners report

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1j.

[2 marks]

Markscheme

$$\frac{28 \times 45}{100} = 12.6 = 13 \text{ or } \frac{28}{100} \times \frac{25}{100} \times 100 = 12.6 = 13 \quad (M1)(A1)(AG)$$

Notes: Award **(M1)** for correct formula and **(A1)** for correct substitution. Unrounded answer must be seen for the **(A1)** to be awarded.

[2 marks]

Examiners report

In general this part question was well answered. The major concerns of the examining team were the following:

- In (f) many students wrote down the expected values table (from the GDC) and highlighted the correct expected value, 12.6. As this is a "show that" question the use of the GDC is not expected and therefore no marks are awarded for this working. Instead it is expected the use of the formula for the expected value with the correct substitutions.
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1k.

[2 marks]

Markscheme

$$0.0321 \quad (G2)$$

Note: For 0.032 award **(G1)(G1)(AP)**. For 0.03 with no working award **(G0)**.

[2 marks]

Examiners report

In general this part question was well answered. The major concerns of the examining team were the following:

- In (f) many students wrote down the expected values table (from the GDC) and highlighted the correct expected value, 12.6. As this is a "show that" question the use of the GDC is not expected and therefore no marks are awarded for this working. Instead it is expected the use of the formula for the expected value with the correct substitutions.
- In (e) surprisingly many candidates found the χ^2_{calc} through the use of the formula. Unfortunately this led to some incorrect answers and also to a bad use of time. The question clearly says "use your graphic display calculator" and it is worth 2 marks therefore a student should not spend more than 2 minutes to answer this part question. Time management is essential in this type of examinations and the IB rule is one minute – one mark.

11.

[2 marks]

Markscheme

$0.0321 < 5.99$ or $0.984 > 0.05$ (RI)

accept H_0 (AI)(ft)

Note: If reason is incorrect both marks are lost, do not award (R0)(AI).

[2 marks]

Examiners report

In general this part question was well answered. The major concerns of the examining team were the following:

- In (f) many students wrote down the expected values table (from the GDC) and highlighted the correct expected value, 12.6. As this is a "show that" question the use of the GDC is not expected and therefore no marks are awarded for this working. Instead it is expected the use of the formula for the expected value with the correct substitutions.
- In (e) surprisingly many candidates found the χ^2_{calc} through the use of the formula. Unfortunately this led to some incorrect answers and also to a bad use of time. The question clearly says "use your graphic display calculator" and it is worth 2 marks therefore a student should not spend more than 2 minutes to answer this part question. Time management is essential in this type of examinations and the IB rule is one minute – one mark.

2a.

[8 marks]

$$\frac{100}{400} \left(\frac{1}{4}, 0.25, 25\% \right)$$

$$\frac{90}{400} \left(\frac{9}{40}, 0.225, 22.5\% \right)$$

$$\frac{20}{400} \left(\frac{1}{20}, 0.05, 5\% \right)$$

$$\frac{120}{400} \left(\frac{3}{10}, 0.3, 30\% \right)$$

$$\frac{30}{110} \left(\frac{3}{11}, 0.273, 27.3\% \right)$$

0.272727...

0.27

0.272

0.3

Examiners report

The simple probabilities beginning this question were successfully attempted by the great majority. Most errors in the latter parts occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table. Probability questions in this course are, in the main, contextual and the reliance of formulas is not always beneficial to the candidates. Only the best candidates realized the significance of part (b) as a link to the chi-squared test.

This was well attempted by the majority, the weakness being the sole reliance of the calculator to calculate expected value. However, there still remains confusion between critical and p -values as the basis for accepting the null hypothesis.

2b.

[2 marks]

Markscheme

$$\frac{1}{20} \neq \frac{1}{4} \times \frac{9}{40} \quad (RI)(ft)$$

Note: The fractions must be used as part of the reason. Follow through from (a)(i), (a)(ii) and (a)(iii).

Pam is not correct. $(AI)(ft)$

Notes: Do not award $(R0)(AI)$. Accept the events are not independent (dependent).

[2 marks]

Examiners report

The simple probabilities beginning this question were successfully attempted by the great majority. Most errors in the latter parts occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table. Probability questions in this course are, in the main, contextual and the reliance of formulas is not always beneficial to the candidates. Only the best candidates realized the significance of part (b) as a link to the chi-squared test.

This was well attempted by the majority, the weakness being the sole reliance of the calculator to calculate expected value. However, there still remains confusion between critical and p -values as the basis for accepting the null hypothesis.

2c.

[3 marks]

Markscheme

(i) The mathematics course and language of examination are independent. (AI)

Notes: Accept “There is no association between Mathematics course and language”. Do not accept “not related”, “not correlated”, “not influenced”.

$$(ii) \quad \frac{110}{400} \times \frac{150}{400} \times 400 \quad \left(= \frac{110 \times 150}{400} \right) \quad (MI)$$

$$= 41.25 \quad (AI)$$

$$= 41.3 \quad (AG)$$

Note:

41.25 and

41.3 must be seen to award final (AI) .

[3 marks]

Examiners report

The simple probabilities beginning this question were successfully attempted by the great majority. Most errors in the latter parts occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table. Probability questions in this course are, in the main, contextual and the reliance of formulas is not always beneficial to the candidates. Only the best candidates realized the significance of part (b) as a link to the chi-squared test.

This was well attempted by the majority, the weakness being the sole reliance of the calculator to calculate expected value. However, there still remains confusion between critical and p -values as the basis for accepting the null hypothesis.

2d.

[4 marks]

Markscheme

(i)

7.67 (
 7.67003...) (G2)

Note: Accept

7.7, do not accept

8 or

7.6. Award (G1) if formula with all nine terms seen but their answer is not one of those above.

(ii)

4 (G1)

(iii)

9.488 (A1)(ft)

Notes: Accept

9.49 or

9.5, do not accept

9.4 or

9. Follow through from their degrees of freedom.

[4 marks]

Examiners report

The simple probabilities beginning this question were successfully attempted by the great majority. Most errors in the latter parts occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table. Probability questions in this course are, in the main, contextual and the reliance of formulas is not always beneficial to the candidates. Only the best candidates realized the significance of part (b) as a link to the chi-squared test.

This was well attempted by the majority, the weakness being the sole reliance of the calculator to calculate expected value. However, there still remains confusion between critical and p -values as the basis for accepting the null hypothesis.

2e.

[2 marks]

Markscheme

$7.67 < 9.488$ (RI)

OR

$p = 0.104 \dots, p > 0.05$ (RI)

Accept (Do not reject)

H_0 (Pam's belief is correct) (AI)(ft)

Notes: Follow through from part (d). Do not award (R0)(AI).

[2 marks]

Examiners report

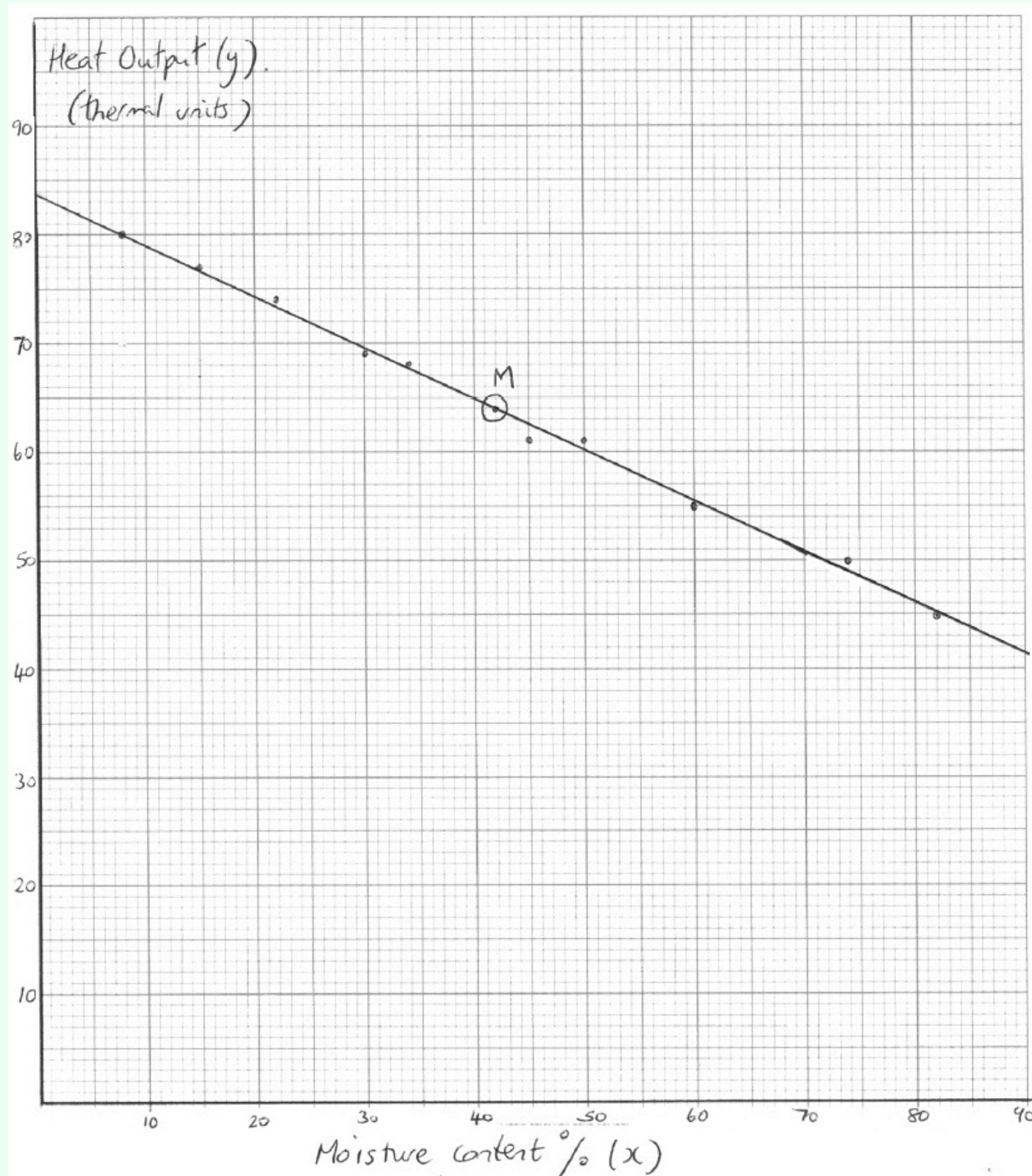
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This was well attempted by the majority, the weakness being the sole reliance of the calculator to calculate expected value. However, there still remains confusion between critical and p -values as the basis for accepting the null hypothesis.

3a.

[4 marks]

Markscheme



(A1) for correct scales and labels

(A3) for all ten points plotted correctly

(A2) for eight or nine points plotted correctly

(A1) for six or seven points plotted correctly (A4)

Note: Award at most (A0)(A3) if axes reversed.

[4 marks]

Examiners report

The great majority of candidates found this question to be a good start to the paper. The common errors were (1) incorrect scales being used; SI units are standard in this course and candidates are expected to know the difference between centimetres and millimetres (2) the lack of r on the GDC (3) not knowing that the regression line y on x passes through the mean point and (4) not realising that the value of r determines the validity of using the regression line y on x .

3b.

[2 marks]

Markscheme

(i)

$$\bar{x} = 42 \quad (AI)$$

(ii)

$$\bar{y} = 64 \quad (AI)$$

[2 marks]

Examiners report

The great majority of candidates found this question to be a good start to the paper. The common errors were (1) incorrect scales being used; SI units are standard in this course and candidates are expected to know the difference between centimetres and millimetres (2) the lack of r on the GDC (3) not knowing that the regression line y on x passes through the mean point and (4) not realising that the value of r determines the validity of using the regression line y on x .

3c.

[2 marks]

Markscheme

(\bar{x}, \bar{y}) plotted on graph and labelled, M (AI)(ft)(AI)

Note: Award (AI)(ft) for position, (AI) for label.

[2 marks]

Examiners report

The great majority of candidates found this question to be a good start to the paper. The common errors were (1) incorrect scales being used; SI units are standard in this course and candidates are expected to know the difference between centimetres and millimetres (2) the lack of r on the GDC (3) not knowing that the regression line y on x passes through the mean point and (4) not realising that the value of r determines the validity of using the regression line y on x .

3d.

[2 marks]

Markscheme

-0.998 (G2)

Note: Award (GI) for correct sign, (GI) for correct absolute value.

[1 mark]

Examiners report

The great majority of candidates found this question to be a good start to the paper. The common errors were (1) incorrect scales being used; SI units are standard in this course and candidates are expected to know the difference between centimetres and millimetres (2) the lack of

r on the GDC (3) not knowing that the regression line

y on

x passes through the mean point and (4) not realising that the value of

r determines the validity of using the regression line

y on

x .

3e.

[2 marks]

Markscheme

line on graph (AI)(ft)(AI)

Notes: Award (AI)(ft) for line through their M, (AI) for approximately correct intercept (allow between 83 and

85). It is not necessary that the line is seen to intersect the y -axis. The line must be straight for any mark to be awarded.

[2 marks]

Examiners report

The great majority of candidates found this question to be a good start to the paper. The common errors were (1) incorrect scales being used; SI units are standard in this course and candidates are expected to know the difference between centimetres and millimetres (2) the lack of

r on the GDC (3) not knowing that the regression line

y on

x passes through the mean point and (4) not realising that the value of

r determines the validity of using the regression line

y on

x .

3f.

[2 marks]

Markscheme

$y = -0.470(25) + 83.7$ (MI)

Note: Award (MI) for substitution into formula or some indication of method on their graph.

$y = -0.470(0.25) + 83.7$ is incorrect.

$= 72.0$ (accept

71.95 and

72) (AI)(ft)(G2)

Note: Follow through from graph only if they show working on their graph. Accept

72 ± 0.5 .

[2 marks]

Examiners report

The great majority of candidates found this question to be a good start to the paper. The common errors were (1) incorrect scales being used; SI units are standard in this course and candidates are expected to know the difference between centimetres and millimetres (2) the lack of r on the GDC (3) not knowing that the regression line y on x passes through the mean point and (4) not realising that the value of r determines the validity of using the regression line y on x .

3g.

[2 marks]

Markscheme

Yes since
25% lies within the data set and
 r is close to
-1 (RI)(AI)

Note: Accept Yes, since
 r is close to
-1

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

[2 marks]

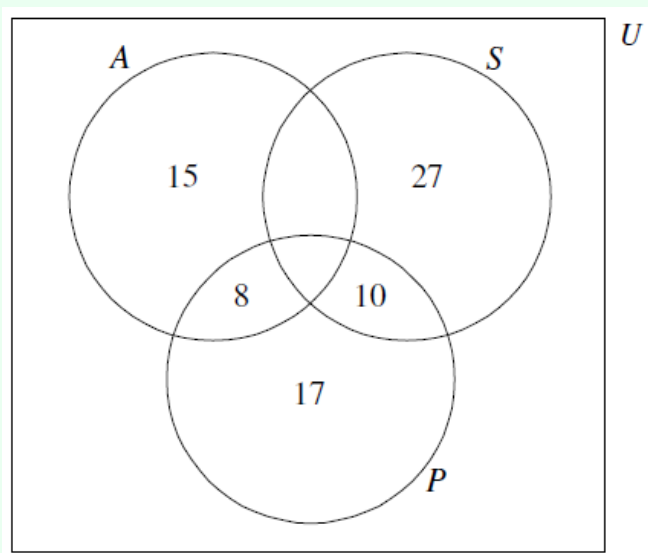
Examiners report

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4a.

[3 marks]

Markscheme



(A1) for rectangle and three labelled intersecting circles

(A1) for

15,

27 and

17

(A1) for

10 and

8 (A3)

[3 marks]

Examiners report

Part A

This part was successfully attempted by the great majority. A common mistake was the failure to intersect all three sets.

4b.

[2 marks]

Markscheme

$48 - (8 + 10 + 17)$ or equivalent (M1)

$= 13$ (A1)(ft)(G2)

[2 marks]

Examiners report

Part A

This part was successfully attempted by the great majority. A common mistake was the failure to intersect all three sets.

4c.

[3 marks]

Markscheme

$$50 - (27 + 10 + 13) \quad (M1)$$

Note: Award *(M1)* for working seen.

$$= 0 \quad (A1)$$

number of elements in A

$$= 36 \quad (A1)(ft)(G3)$$

Note: Follow through from (b).

[3 marks]

Examiners report

Part A

This part was successfully attempted by the great majority. A common mistake was the failure to intersect all three sets.

4d.

[1 mark]

Markscheme

$$21 \quad (A1)(ft)$$

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

[1 mark]

Examiners report

Part A

This part was successfully attempted by the great majority. A common mistake was the failure to intersect all three sets.

4e.

[2 marks]

Markscheme

$$54 \quad (M1)(A1)(ft)(G2)$$

Note: Award *(M1)* for

17,

10,

27 seen. Follow through from (a).

[2 marks]

Examiners report

Part A

This part was successfully attempted by the great majority. A common mistake was the failure to intersect all three sets.

A surprising number seemed unfamiliar with set notation in (e) and thus did not attempt this part.

4f.

[2 marks]

Markscheme

$$\frac{40}{120} \left(\frac{1}{3}, 0.333, 33.3\% \right) \quad (AI)(AI)(G2)$$

Note: Award *(AI)* for numerator, *(AI)* for denominator.

[2 marks]

Examiners report

Part B

The work on probability also proved accessible to the great majority with a large number of candidates attaining full marks. Most errors occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table.

4g.

[2 marks]

Markscheme

$$\frac{34}{120} \left(\frac{17}{60}, 0.283, 28.3\% \right) \quad (AI)(AI)(G2)$$

Note: Award *(AI)* for numerator, *(AI)* for denominator.

[2 marks]

Examiners report

Part B

The work on probability also proved accessible to the great majority with a large number of candidates attaining full marks. Most errors occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table.

4h.

[2 marks]

Markscheme

$$\frac{8}{28} \left(\frac{2}{7}, 0.286, 28.6\% \right) \quad (AI)(AI)(G2)$$

Note: Award *(AI)* for numerator, *(AI)* for denominator.

[2 marks]

Examiners report

Part B

The work on probability also proved accessible to the great majority with a large number of candidates attaining full marks. Most errors occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table.

4i.

[1 mark]

Markscheme

customer satisfaction is **independent** of café (AI)

Note: Accept “customer satisfaction is **not associated with** the café”.

[1 mark]

Examiners report

Part B

The work on probability also proved accessible to the great majority with a large number of candidates attaining full marks. Most errors occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table.

The chi-squared test was well done by the great majority, however, it was clear that a number of centres do not teach this subject, since there were a number of scripts which either were left blank or showed no understanding in the responses seen.

4j.

[1 mark]

Markscheme

2 (AI)

[1 mark]

Examiners report

Part B

The work on probability also proved accessible to the great majority with a large number of candidates attaining full marks. Most errors occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table.

The chi-squared test was well done by the great majority, however, it was clear that a number of centres do not teach this subject, since there were a number of scripts which either were left blank or showed no understanding in the responses seen.

4k.

[2 marks]

Markscheme

0.754 (G2)

Note: Award (G1)(G1)(AP) for

0.75 or for correct answer incorrectly rounded to 3 s.f. or more, (G0) for 0.7.

[2 marks]

Examiners report

Part B

The work on probability also proved accessible to the great majority with a large number of candidates attaining full marks. Most errors occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table.

The chi-squared test was well done by the great majority, however, it was clear that a number of centres do not teach this subject, since there were a number of scripts which either were left blank or showed no understanding in the responses seen.

41.

[2 marks]

Markscheme

since $\chi^2_{\text{calc}} < \chi^2_{\text{crit}} 5.991$ accept (or Do not reject) H_0 **(RI)(AI)(ft)**

Note: Follow through from their value in (e).

OR

Accept (or Do not reject) H_0 as

p -value

$(0.686) > 0.05$ **(RI)(AI)(ft)**

Notes: Do not award **(AI)(R0)**. Award the **(RI)** for comparison of appropriate values.

[2 marks]

Examiners report

Part B

The work on probability also proved accessible to the great majority with a large number of candidates attaining full marks. Most errors occurred due to candidates trying to use the algebraic form of laws of probability, rather than by interpreting the contingency table.

The chi-squared test was well done by the great majority, however, it was clear that a number of centres do not teach this subject, since there were a number of scripts which either were left blank or showed no understanding in the responses seen.

5a.

[1 mark]

Markscheme

H_0 : Choice of language is independent of gender. **(AI)**

Notes: Do not accept “not related” or “not correlated”.

[1 mark]

Examiners report

Part A: Chi-square test

This question part was answered well by most candidates. The null hypothesis and degrees of freedom were mostly correct. Some candidates offered a conclusion supported by good justifications, but others still showed lack of the necessary knowledge to do that. Some responses to part d) incurred an accuracy penalty for not adhering to the required accuracy level.

5b.

[1 mark]

Markscheme

2 **(AI)**

[1 mark]

Examiners report

Part A: Chi-square test

This question part was answered well by most candidates. The null hypothesis and degrees of freedom were mostly correct. Some candidates offered a conclusion supported by good justifications, but others still showed lack of the necessary knowledge to do that. Some responses to part d) incurred an accuracy penalty for not adhering to the required accuracy level.

5c.

[2 marks]

Markscheme

$$\frac{50 \times 69}{150} = 23 \quad (M1)(A1)(G2)$$

Notes: Award *(M1)* for correct substituted formula, *(A1)* for 23.

[2 marks]

Examiners report

Part A: Chi-square test

This question part was answered well by most candidates. The null hypothesis and degrees of freedom were mostly correct. Some candidates offered a conclusion supported by good justifications, but others still showed lack of the necessary knowledge to do that. Some responses to part d) incurred an accuracy penalty for not adhering to the required accuracy level.

5d.

[2 marks]

Markscheme

$$\chi^2 = 4.77 \quad (G2)$$

Notes: If answer is incorrect, award *(M1)* for correct substitution in the correct formula (all terms).

[2 marks]

Examiners report

Part A: Chi-square test

This question part was answered well by most candidates. The null hypothesis and degrees of freedom were mostly correct. Some candidates offered a conclusion supported by good justifications, but others still showed lack of the necessary knowledge to do that. Some responses to part d) incurred an accuracy penalty for not adhering to the required accuracy level.

5e.

[2 marks]

Markscheme

Accept
H₀ since

$$\chi^2_{calc} < \chi^2_{crit}(5.99) \text{ or } p\text{-value}$$

$$(0.0923) > 0.05 \quad (R1)(A1)(ft)$$

Notes: Do not award *(R0)(A1)*. Follow through from their (d) and (b).

Examiners report

Part A: Chi-square test

This question part was answered well by most candidates. The null hypothesis and degrees of freedom were mostly correct. Some candidates offered a conclusion supported by good justifications, but others still showed lack of the necessary knowledge to do that. Some responses to part d) incurred an accuracy penalty for not adhering to the required accuracy level.

5f.

[4 marks]

Markscheme

Award **(A1)** for correct scale and labels.

Award **(A3)** for all seven points plotted correctly, **(A2)** for 5 or 6 points plotted correctly, **(A1)** for 3 or 4 points plotted correctly.

(A4)

[4 marks]

Examiners report

Part B: Scatter plot and Regression line

Many candidates reversed the axes in a), but the points were mostly plotted well. The values of the coefficients of the equation of the regression line

$y = ax + b$ were often given not to the required 3 significant figure accuracy, and incurred a penalty. The regression line was often drawn not passing through point M and the y-intercept. The responses to the last part of the question were particularly weak, and many candidates were not able to offer a satisfactory reason to support their conclusion.

5g.

[2 marks]

Markscheme

(i)

$$\bar{S} = 49.9, \quad (G1)$$

(ii)

$$\bar{F} = 47.3 \quad (G1)$$

[2 marks]

Examiners report

Part B: Scatter plot and Regression line

Many candidates reversed the axes in a), but the points were mostly plotted well. The values of the coefficients of the equation of the regression line

$y = ax + b$ were often given not to the required 3 significant figure accuracy, and incurred a penalty. The regression line was often drawn not passing through point M and the y-intercept. The responses to the last part of the question were particularly weak, and many candidates were not able to offer a satisfactory reason to support their conclusion.

5h.

[1 mark]

Markscheme

M(49.9, 47.3) plotted on scatter diagram **(A1)(ft)**

Notes: Follow through from (a) and (b).

[1 mark]

Examiners report

Part B: Scatter plot and Regression line

Many candidates reversed the axes in a), but the points were mostly plotted well. The values of the coefficients of the equation of the regression line

$y = ax + b$ were often given not to the required 3 significant figure accuracy, and incurred a penalty. The regression line was often drawn not passing through point M and the y-intercept. The responses to the last part of the question were particularly weak, and many candidates were not able to offer a satisfactory reason to support their conclusion.

5i.

[2 marks]

Markscheme

$$F = -0.619S + 78.2 \quad (G1)(G1)$$

Notes: Award (G1) for

$-0.619S$, (G1) for

78.2. If the answer is not in the form of an equation, award (G1)(G0). Accept

$$y = -0.619x + 78.2.$$

OR

$$(F - 47.3 = -0.619(S - 49.9)) \quad (G1)(G1)$$

Note: Award (G1) for

-0.619 , (G1) for the coordinates of their midpoint used. Follow through from their values in (b).

[2 marks]

Examiners report

Part B: Scatter plot and Regression line

Many candidates reversed the axes in a), but the points were mostly plotted well. The values of the coefficients of the equation of the regression line

$y = ax + b$ were often given not to the required 3 significant figure accuracy, and incurred a penalty. The regression line was often drawn not passing through point M and the y-intercept. The responses to the last part of the question were particularly weak, and many candidates were not able to offer a satisfactory reason to support their conclusion.

5j.

[2 marks]

Markscheme

line drawn on scatter diagram (A1)(ft)(A1)(ft)

Notes: The drawn line **must** be straight for any marks to be awarded. Award (A1)(ft) passing through their M plotted in (c). Award

(A1)(ft) for correct

y-intercept. Follow through from their

y-intercept found in (d).

[2 marks]

Examiners report

Part B: Scatter plot and Regression line

Many candidates reversed the axes in a), but the points were mostly plotted well. The values of the coefficients of the equation of the regression line

$y = ax + b$ were often given not to the required 3 significant figure accuracy, and incurred a penalty. The regression line was often drawn not passing through point M and the y-intercept. The responses to the last part of the question were particularly weak, and many candidates were not able to offer a satisfactory reason to support their conclusion.

5k. [2 marks]

Markscheme

$$F = -0.619 \times 44 + 78.2 \quad (M1)$$

= 51.0 (allow

51 or

50.9) (A1)(ft)(G2)(ft)

Note: Follow through from their equation.

OR

(M1) any indication of an acceptable graphical method. (M1)

(A1)(ft) from their regression line. (A1)(ft)(G2)(ft)

[2 marks]

Examiners report

Part B: Scatter plot and Regression line

Many candidates reversed the axes in a), but the points were mostly plotted well. The values of the coefficients of the equation of the regression line

$y = ax + b$ were often given not to the required 3 significant figure accuracy, and incurred a penalty. The regression line was often drawn not passing through point M and the y-intercept. The responses to the last part of the question were particularly weak, and many candidates were not able to offer a satisfactory reason to support their conclusion.

5l. [2 marks]

Markscheme

not reliable (A1)

Monique's score in Science is outside the range of scores used to create the regression line. (R1)

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

[2 marks]

Examiners report

Part B: Scatter plot and Regression line

Many candidates reversed the axes in a), but the points were mostly plotted well. The values of the coefficients of the equation of the regression line

$y = ax + b$ were often given not to the required 3 significant figure accuracy, and incurred a penalty. The regression line was often drawn not passing through point M and the y-intercept. The responses to the last part of the question were particularly weak, and many candidates were not able to offer a satisfactory reason to support their conclusion.

6a. [1 mark]

Markscheme

Chosen profession is independent of gender. (A1)

OR

There is no association between gender and chosen profession. (A1) (CI)

Note: Do not accept “not related”, “not correlated” or “not influenced”.

[1 mark]

Examiners report

The first two parts of this question were very well answered but a number of students found calculating the required expected value in part c) difficult. Very few knew how to use the given p -value in order to decide whether to reject or retain the null hypothesis. There were some candidates who did not attempt this question at all which might be indicating that this topic had not been discussed in some schools.

6b. [1 mark]

Markscheme

2 (A1) (C1)

[1 mark]

Examiners report

The first two parts of this question were very well answered but a number of students found calculating the required expected value in part c) difficult. Very few knew how to use the given p -value in order to decide whether to reject or retain the null hypothesis. There were some candidates who did not attempt this question at all which might be indicating that this topic had not been discussed in some schools.

6c. [2 marks]

Markscheme

$$\frac{180 \times 80}{400} \quad (M1)$$

OR

$$\frac{180}{400} \times \frac{80}{400} \times 400 \quad (M1)$$

$$= 36 \quad (A1) \quad (C2)$$

[2 marks]

Examiners report

The first two parts of this question were very well answered but a number of students found calculating the required expected value in part c) difficult. Very few knew how to use the given p -value in order to decide whether to reject or retain the null hypothesis. There were some candidates who did not attempt this question at all which might be indicating that this topic had not been discussed in some schools.

6d. [2 marks]

Markscheme

p -value > 0.05 (R1)

Accept H_0 (A1) (C2)

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

[2 marks]

Examiners report

The first two parts of this question were very well answered but a number of students found calculating the required expected value in part c) difficult. Very few knew how to use the given p -value in order to decide whether to reject or retain the null hypothesis. There were some candidates who did not attempt this question at all which might be indicating that this topic had not been discussed in some schools.

7a.

[1 mark]

Markscheme

Type of coffee drunk is **independent** of gender. (A1)

Note: Accept is “not associated”. Do not accept “not related”, “not correlated” or “not influenced”.

[1 mark]

Examiners report

Many candidates gained full marks on this question. However, a number of candidates did not answer at all or stopped after either correctly or incorrectly defining H_0 and/or H_1 . Many incorrect versions of ‘independent’ were seen and candidates should be advised that the terms not related, not correlated and not influenced will not be awarded marks. There were an encouraging number of full marks gained on this question.

7b.

[1 mark]

Markscheme

Type of coffee drunk is **not independent** of gender. (A1)(ft) (C2)

Note: If hypotheses are reversed award (A0)(A1)(ft).

[1 mark]

Examiners report

Many candidates gained full marks on this question. However, a number of candidates did not answer at all or stopped after either correctly or incorrectly defining H_0 and/or H_1 . Many incorrect versions of ‘independent’ were seen and candidates should be advised that the terms not related, not correlated and not influenced will not be awarded marks. There were an encouraging number of full marks gained on this question.

7c.

[1 mark]

Markscheme

4 (A1) (C1)

[1 mark]

Examiners report

Many candidates gained full marks on this question. However, a number of candidates did not answer at all or stopped after either correctly or incorrectly defining H_0 and/or H_1 . Many incorrect versions of ‘independent’ were seen and candidates should be advised that the terms not related, not correlated and not influenced will not be awarded marks. There were an encouraging number of full marks gained on this question.

7d.

[1 mark]

Markscheme

$$\chi^2(\text{crit}) = 9.488 \quad (AI)(ft) \quad (CI)$$

Note: Accept 9.49.

[1 mark]

Examiners report

Many candidates gained full marks on this question. However, a number of candidates did not answer at all or stopped after either correctly or incorrectly defining H_0 and/or H_1 . Many incorrect versions of ‘independent’ were seen and candidates should be advised that the terms not related, not correlated and not influenced will not be awarded marks. There were an encouraging number of full marks gained on this question.

7e.

[2 marks]

Markscheme

$$\chi^2(\text{calc}) < \chi^2(\text{crit}), 8.73 < 9.488 \quad (RI)$$

Accept the null hypothesis (Accept type of coffee is independent of gender). $(AI)(ft) \quad (C2)$

Notes: Follow through from their answer to part (c).

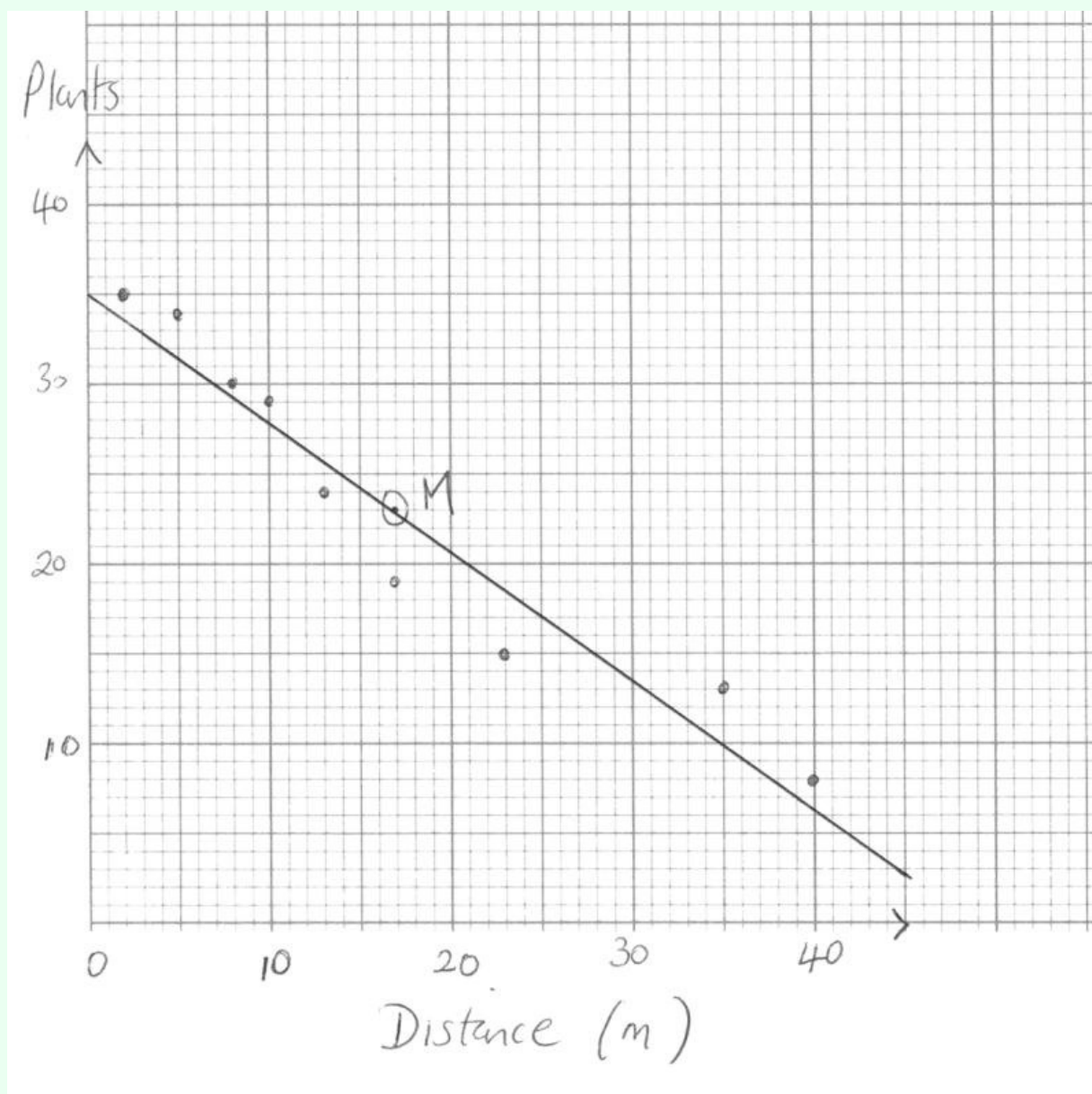
Do not award $(R0)(AI)$.

[2 mark]

Examiners report

Many candidates gained full marks on this question. However, a number of candidates did not answer at all or stopped after either correctly or incorrectly defining H_0 and/or H_1 . Many incorrect versions of ‘independent’ were seen and candidates should be advised that the terms not related, not correlated and not influenced will not be awarded marks. There were an encouraging number of full marks gained on this question.

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.

8b. [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.

8c. [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.

8d. [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.

8e. [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.

8f.

[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.

8g.

[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.

8h.

[2 marks]

Markscheme

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

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

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

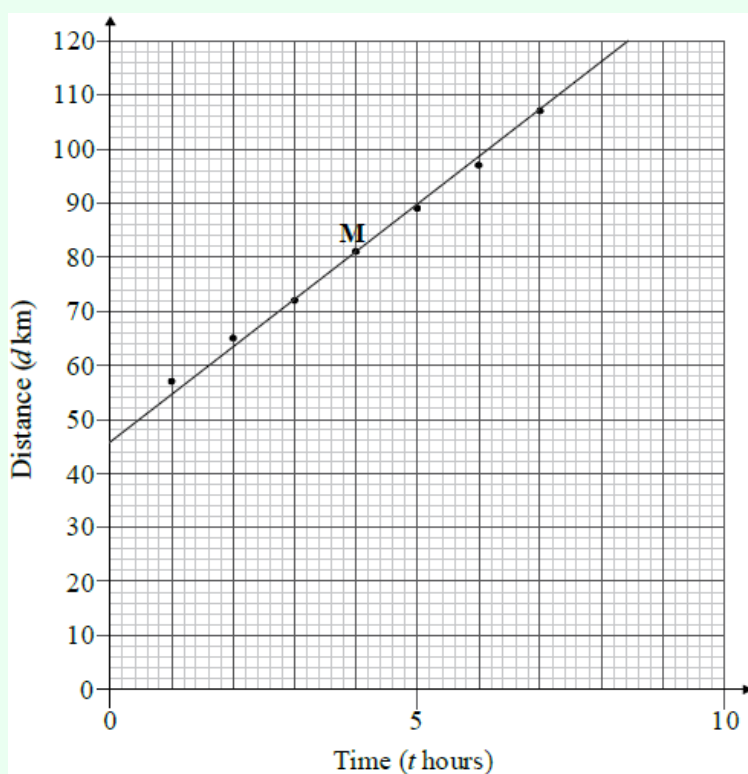
This question, by far, was the most accessible to the great majority of candidates. However, far too many candidates do not (1) use the scale as required by the question, (2) use a scale at all, (3) either draw or label axes, (4) use a ruler at all (5) use the provided graph paper. Accurate plotting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

9a.

[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.

9b. [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.

9c. [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.

9d. [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.

9e.

[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.

9f.

[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.

9g. [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 $d =$ (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.

9h. [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.

9i. [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.

10a. [1 mark]

Markscheme

50 (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.

10b. [1 mark]

Markscheme

30.5 (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.

10c. [1 mark]

Markscheme

12.3 (GI)

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.

10d. [2 marks]

Markscheme

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

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

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

[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.

10e. [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.

10f. [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.

10g. [1 mark]

Markscheme

$$64.0 \text{ (accept 63.95, 63.9)} \quad (A1)(ft)(G1)(ft)$$

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.

10h. [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.

10i. [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.

10j. [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).

10k. [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.

10l. [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.

10m. [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).

11a. [2 marks]

Markscheme

H_0 : The height of the rice plants is independent of the use of a fertilizer. (AI)

Notes: For independent accept “not associated”, can accept “the use of a fertilizer has no effect on the height of the plants”.

Do not accept “not correlated”.

H_1 : The height of the rice plants is not independent (dependent) of the use of fertilizer. (AI)(ft)

Note: If H_0 and H_1 are reversed award (A0)(AI)(ft).

[2 marks]

Examiners report

It was clear that the candidates who performed poorly in part (i) lacked the basic knowledge of chi-squared analysis. Some mixed up the null and alternate hypotheses and also were not able to correctly demonstrate the way of finding the expected value. There were many errors in finding the critical value of χ^2 at the 1% level of significance.

11b. [3 marks]

Markscheme

$$\frac{180 \times 195}{360} \text{ or } \frac{180}{360} \times \frac{195}{360} \times 360 \quad (AI)(AI)(MI) \\ = 97.5 \quad (AG)$$

Notes: Award (AI) for numerator, (AI) for denominator (MI) for division.

If final 97.5 is not seen award at most (AI)(A0)(MI).

[3 marks]

Examiners report

It was clear that the candidates who performed poorly in part (i) lacked the basic knowledge of chi-squared analysis. Some mixed up the null and alternate hypotheses and also were not able to correctly demonstrate the way of finding the expected value. There were many errors in finding the critical value of χ^2 at the 1% level of significance.

11c. [2 marks]

Markscheme

$$\chi^2_{calc} = 14.01(14.0, 14) \quad (G2)$$

OR

If worked out by hand award (MI) for correct substituted formula with correct values, (AI) for correct answer. (MI)(AI)

[2 marks]

Examiners report

It was clear that the candidates who performed poorly in part (i) lacked the basic knowledge of chi-squared analysis. Some mixed up the null and alternate hypotheses and also were not able to correctly demonstrate the way of finding the expected value. There were many errors in finding the critical value of χ^2 at the 1% level of significance.

11d. [1 mark]

Markscheme

2 (AI)

[1 mark]

Examiners report

It was clear that the candidates who performed poorly in part (i) lacked the basic knowledge of chi-squared analysis. Some mixed up the null and alternate hypotheses and also were not able to correctly demonstrate the way of finding the expected value. There were many errors in finding the critical value of χ^2 at the 1% level of significance.

11e. [2 marks]

Markscheme

$$\chi_{calc}^2 > \chi_{crit}^2 \quad (R1)$$

The manufacturer's claim is justified. (or equivalent statement) (AI)

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

[2 marks]

Examiners report

It was clear that the candidates who performed poorly in part (i) lacked the basic knowledge of chi-squared analysis. Some mixed up the null and alternate hypotheses and also were not able to correctly demonstrate the way of finding the expected value. There were many errors in finding the critical value of χ^2 at the 1% level of significance.

11f. [1 mark]

Markscheme

$$p = 4 \quad (G1)$$

[1 mark]

Examiners report

Candidates found this part rather easy, with some making arithmetic mistakes and thus losing one or more marks. The graph was well done with a high percentage scoring full marks. Some candidates did not label the axes, others had an incorrect scale and a few lost one mark for not drawing a smooth curve.

11g.

[2 marks]

Markscheme

$$q = 4(2)^{\frac{16}{4}} \quad (M1)$$

$$= 64 \quad (A1)(G2)$$

[2 marks]

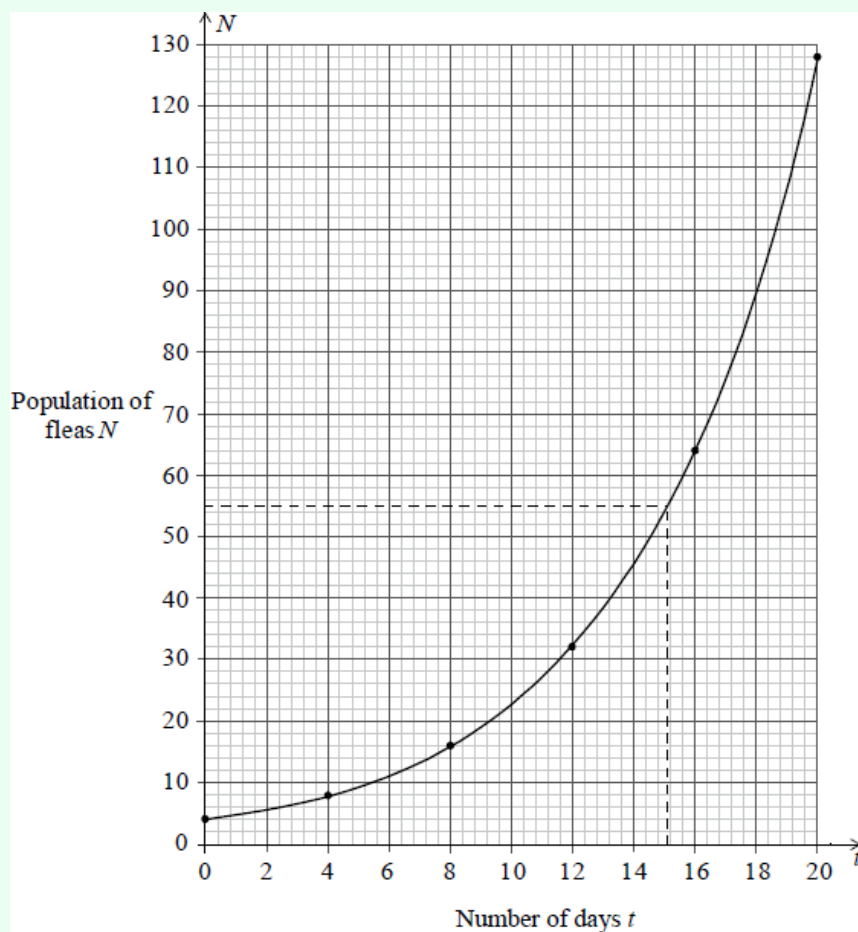
Examiners report

Candidates found this part rather easy, with some making arithmetic mistakes and thus losing one or more marks. The graph was well done with a high percentage scoring full marks. Some candidates did not label the axes, others had an incorrect scale and a few lost one mark for not drawing a smooth curve.

11h.

[6 marks]

Markscheme



(A1)(A1)(A1) (A3)

Notes: Award (A1) for x axis with correct scale and label, (A1) for y axis with correct scale and label.

Accept x and y for labels.

If x and y axis reversed award at most (A0)(A1)(ft).

(A1) for smooth curve.

Award (A3) for all 6 points correct, (A2) for 4 or 5 points correct, (A1) for 2 or 3 points correct, (A0) otherwise.

[6 marks]

Examiners report

Candidates found this part rather easy, with some making arithmetic mistakes and thus losing one or more marks. The graph was well done with a high percentage scoring full marks. Some candidates did not label the axes, others had an incorrect scale and a few lost one mark for not drawing a smooth curve.

11i. [2 marks]

Markscheme

15 (± 0.8) *(MI)(AI)(ft)(G2)*

Note: Award *(MI)* for line drawn shown on graph, *(AI)(ft)* from candidate's graph.

[2 marks]

Examiners report

Candidates found this part rather easy, with some making arithmetic mistakes and thus losing one or more marks. The graph was well done with a high percentage scoring full marks. Some candidates did not label the axes, others had an incorrect scale and a few lost one mark for not drawing a smooth curve.