Cambridge International AS & A Level

THINKING SKILLS	**9694/31**
Paper 3 Problem Analysis and Solution	**May/June 2024**
MARK SCHEME	
Maximum Mark: 50	

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **9** printed pages.

[Turn over

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

NOTES FOR MARKERS

Working

Where a final answer is underlined in the mark scheme, full marks are awarded for a correct answer, regardless of whether there is any supporting working, unless an exception is noted in the mark scheme.

Supporting working is **not** needed to gain full marks, unless otherwise stated in the mark scheme.

If working clearly shows, beyond any doubt, that a correct answer derives purely from incorrect reasoning, that answer may be invalidated, unless otherwise stated in the mark scheme.

For partial credit, the evidence needed to award the mark will usually be shown on its own line in the mark scheme, or else will be defined in italic text.

For explanations and verbal justifications, apply the principle of 'words to that effect'.

Units

Unless required by the question or mark scheme, units such as $ do not need to be seen to award the marks.

Incorrectly labelled work

If the candidate has labelled their work with the wrong Question/part number, highlight the label(s) and add a comment to flag it. This will help avoid confusion for anyone checking the script later on.

No response

If there is any attempt at a solution award 0 marks not NR. '-' or '?' constitute no attempt at a solution.

Abbreviations

The following abbreviations may be used in a mark scheme:
AG   answer given (on question paper)
awrt   answer which rounds to
dep   mark depends on earlier, asterisked (*), mark
ft   follow through (from earlier error)
oe   or equivalent
SC   special case
soi   seen or implied

Annotations

Where the answer is underlined in the mark scheme, and a candidate's correct final answer is both clear and clearly identified (encircled, underlined etc.), it is not necessary to annotate that item; nor is it necessary to annotate when there is No Response.

Where there is a response that scores 0, either SEEN should be used, or some other annotation(s) to indicate why no marks can be awarded (Caret, TE, NGE, Cross).

Partial credit should be indicated with a 1 (or, occasionally, a 2) at the point at which that mark has been earned.

The highlighter should be used anywhere it is helpful to clarify the marking.

✔	Correct item
✘	Incorrect item
1	Individual mark of partial credit
2	Double mark of partial credit
∧	Essential element of answer/working missing
NGE	Judged to be not good enough to earn the relevant credit
BOD	Benefit of doubt
FT	Correct follow through
TE	Transcription error
SC	Special case
SEEN	Working seen but no credit awarded; blank page checked
Highlight	Use anywhere it is helpful to clarify the marking

There must be at least one annotation on each page of the answer booklet.

Question	Answer	Marks
1(a)	4 small and 6 big rides require 4 + 12 **[1]** = 16 tokens Least cost $10 + 6 × $1.20 = $17.20 which is <u>$5.20</u> more than $12	**2**
1(b)(i)	3 × $12 = $36 available, 35 tokens costs $36, so number of tokens must be less than 35 **[1]** Greatest number of rides (all small) < 35/3, so <u>11</u> *Alternatively:* The largest number of tokens obtainable for less than $12 is 11 (cost $11.20) **[1]**, which could all be used to have <u>11</u> goes on small rides	**2**
1(b)(ii)	Number of big rides < 35/6 (for all) OR < 11/2 (each) Least number of rides maximises big rides, so 5, using 30 tokens (all) OR 10 tokens (each) **[1]** This leaves 5 tokens which gives a small ride each, total number of rides <u>6</u> *SC: 1 mark for final answer of 5*	**2**
1(c)	Small + big ride takes (5 + 10) + (10 + 20) = 45 mins **[1]** Time is 5.5 hrs = 330 mins, and 330/45 = 7 with 15 mins to spare, but walking time would be 13 × 2 = 26 mins, so only time for 12 rides **[1]** Time required is 270 + 11× 2 = 292 mins, so <u>20:52</u> *SC: 2 marks for final answer of 20:54* *SC: 3 marks for final answer of 21:17*	**3**
1(d)	Time required for 2 more rides is 49 mins Time available is 38 + 11 = 49 mins So Pete is correct	**1**

Question	Answer	Marks
2(a)	<u>7</u>	**1**
2(b)	<u>25</u>	**1**
2(c)(i)	<u>9</u>	**1**
2(c)(ii)	*1 mark for each of the following (max. 2):* • The total value of the discs is 112 • One disc will not be used – the total will be maximised if a 1 is omitted • The total will be maximised if all four sevens are placed on shaded squares, (generating an extra 28 points) <u>139</u> points *SC: 2 marks for final answer of 111 OR 140*	**3**
2(d)(i)	<u>17 on Ec</u>	**1**
2(d)(ii)	Lara could play on Dc OR Df OR Ee	**1**

Question	Answer	Marks
2(e)(i)	14 **[1]** Ca; Dc; Df; Ee; Fa **[1]**	**2**
2(e)(ii)	Dc, Dd, De (in any order) **[1]** 10 **[1]** (two possibilities on row C)	**2**
2(f)	The number on Bb x 2 + the number on Cb = 11 – 2 = 9 **[1]** The possibilities are (1, 7), (2, 5), (3, 3) and (4,1) No trayle can contain a repeated number, so (2, 5) and (3, 3) are not possible All 4s are already on the board, so (4, 1) is not possible *1 mark for evidence that at least one pair has been eliminated* The two numbers must be <u>1 (on Bb)</u> and <u>7 (on Cb)</u>	**3**

Question	Answer	Marks
3(a)	In total 11 + 4 + 12 + 14 + 16 + 9 + 8 + 4 = 78 points were scored **[1]** If no bonus points were awarded the total would be 16 + 14 + 12 + 10 + 8 + 6 + 4 + 2 = 72, so <u>3</u> people were awarded 2 bonus points *Alternatively:* In descending order the scores are 16, 14, 12, 11, 9, 8, 4, 4 The 9 and 11 must have been from a tie for 4th place with one (A) receiving 2 bonus points The 8 must have been achieved from 6 points plus 2 bonus points One of the 4s must have been achieved by adding 2 bonus points to 2 *1 mark for any two identified*	**2**
3(b)	<u>Beau</u>	**1**
3(c)	A, D, E and F (received bonus points) **[1]** *1 mark for each of the following (max 2):* Maximum is 14 so A must have received a bonus E's 13 points must have come from a tie (with B) leading to 11 points each, plus a bonus D's 8 points and F's 10 points can only have come from them each being awarded a bonus (because there is no 6 in the table)	**3**
3(d)	A, C, F **[1]** A, D, F **[1]** A, E, F **[1]** C, D, F **[1]** *Max 3 if 5 answers offered* *Max 2 if 6 answers offered* *Max 1 if 7 answers offered* *0 marks if more than 7 answers offered* *If no marks scored, award 1 mark for identifying that F must get a bonus* *SC: 2 marks for answer A, C, D, E, F*	**4**

Question	Answer	Marks
4(a)	1 laptop repair @ 6 hours = $350 **[1]** + 2 services @ $60 = $120 <u>$470</u>	**2**
4(b)	3 laptop repairs @ 1 hour each = $300 **[1]** + 3 tablet repairs @ 1 hour each = $270 + 2 services @ $60 = $120 <u>$690</u> *SC: 1 mark for answer of $800*	**2**
4(c)	<u>Yes with $250 and $360 seen</u> 5 8-hour days: least profit per day is '$470' – $100 – 8 × $40 = $50, so weekly profit = $250 4 10-hour days: least income comes from 1 laptop repair taking 6 hours + 4 services = $590 Profit per day = $590 – $100 – 10 × $40 = $90, so weekly profit $360 *OR since salary unchanged:* <u>Yes with $1850 and $1960 seen</u> $470 – $100 = $370 and $590 – $100 = $490 per day so 5 × $370 = $1850 and 4 × $490 = $1960 *Award 1 mark for $250 OR $590 OR $360* *OR* *$1850 OR $490 OR $1960* *Award 2 marks for $250 AND ($590 OR $360)* *OR* *$1850 AND ($490 OR $1960)* *Alternative methods may look at weekly income v. cost:* <u>Yes with $2350 and $110 seen</u> *$2350 → $2360, income +$10; cost –$100; so weekly profit increase by $110* *Award 1 mark for $2350 or $2360 or $110* *Award 2 marks for $2350 and ($2360 or $110)* *SC: 2 marks for stating Jez is correct based on $250 compared with $400* *OR* *stating Jez is correct based on $1850 compared with $2000*	**3**

Question	Answer	Marks
4(d)	Least income = \$590 (Jez) + 10 × \$48 (Becky) = \$1070 Outgoings are \$150 + 10 × \$40 + 10 × \$25 = \$800 *1 mark for either* Profit = \$1070 – \$800 = <u>\$270</u> *Alternatively:* Jez profit = \$590 – 10 × \$40 = \$190 Becky profit = 10 × \$48 – 10 × \$25 = \$230 *1 mark for either* Other outgoings are \$150 Profit = \$190 + \$230 – \$150 = <u>\$270</u> *SC: 2 marks for \$280 if \$600 for Jez seen in 4(c)*	2
4(e)	*Follow through incorrect value of \$600 in 4(c) OR their \$270 in 4(d) except for final answer* Becky can do one service per hour, at a profit of \$23 **[1]** Profit at 10 hours is \$270, so can reduce profit by up to \$70 **[1]** 70 / 23, so 3 hours reduction So 7 hours **[1]** *Alternatively:* Least income = \$590 + \$48x Outgoings = \$150 + 10 × \$40 + \$25x Profit per day = \$(590 + 48x – 550 – 25x) = \$(40 + 23x) **[1]** 40 + 23x ⩾ 200 **[1]** requires x to be at least 6.95, so Becky needs to work 7 hours **[1]** *Alternatively:* Becky can do one repair per hour, at a profit of \$23 **[1]** Calculation of profit for Becky working a number of hours in the range [5,9] **[1]** 7 hours **[1]**	3

Question	Answer	Marks
4(f)	Least income from Jez is still $590 Least income from Becky: 10 × routine service = $600 (before discount) so $<u>480</u> once 20% discount applied **[1]** Minimum total income is therefore $590 + $<u>480</u> = $1070 For $200 profit, outgoings must be at most $<u>870</u> **[1]** Jez pays himself $400 Other costs are $150 Maximum amount that Becky can be paid is $<u>320</u> for 10 hours $<u>32</u> per hour *Alternatively:* Least income from Becky: 10 × routine service = $600 (before discount) so $<u>480</u> once 20% discount applied **[1]** Which is the same as before, so the profit is still $270 if Becky earns $25 per hour Maximum possible increase to Becky's rate of pay is $70/10 **[1]** New rate of pay is $<u>32</u> per hour	**3**