Cambridge Assessment International Education

Cambridge International AS & A Level

THINKING SKILLS **9694/31**

Paper 3 Problem Analysis and Solution **May/June 2021**

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.

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This document consists of **8** printed pages.

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 descriptors 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.

Abbreviations

The following abbreviations may be used in a mark scheme:

AG	answer given (on question paper)
awrt	answer which rounds to
cao	correct answer only
ft	follow through (from earlier error)
oe	or equivalent
SC	special case
soi	seen or implied

Question	Answer	Marks
1(a)	$50 \times 5 + 30 = 280$ km each week. 4 complete weeks plus 3 days in August: total = $280 \times 4 + 150 = 1270$ km **AG**	1
1(b)	Cycles the remaining distance of 290 km in September. This is one complete week plus one day for the remaining 10 km. Thursday **[1]** 8 September **[1]**	2
1(c)	Eric cycles on 27 days in August. Extra 11 km a day means 297 km extra 1270 + 297 = 1567 > 1560, so completes in August [Alternatively 297 > 290 so completes in August] *1 mark for 27 or 297 or 1567* ***soi***	2
1(d)(i)	He cycles 400 km in 9 days. $(40 + 80 + 0 + 60) \times 2 + 40 = 400$, so <u>40</u> km	1
1(d)(ii)	In next 10 days, he will cycle (80 + 0 + 60 + 40) × 2 + 80 + 0 = <u>440</u> km **ft** from **(d)(i):** 80: 360 + 0 + 60 = 420 0: 360 + 60 + 40 = 460 60: 360 + 40 + 80 = 480	1
1(e)	$1560 = (60 + 40 + 80 + 0) \times 8 + 120$ **[1]** 120 is achieved by 3 more days (60 + 40 + 80) 35 days in total needed **[1]** Start must be 35 days before 31 August <u>27 July</u> OR Cycles maximum of 30 days in August: distance = $(40 + 80 + 0 + 60) \times 7 + 40 + 80 = 1380$ km Therefore, cycles 1560 – 1380 = 180 km in July 31 July is 60 km, which leads to 28 July for 180 km (40 + 80 + 0 + 60) But, starts with a 60 km day, so <u>27 July</u> *1 mark for 1380 km in August or 180 km in July* *SC: 1 mark for July 28th*	3

Question	Answer	Marks
2(a)	59	**1**
2(b)	23:49 Max 2 from Travelling time is 74 minutes **[1]** Maximum total time stationary at intermediate stations is (6 × 50 secs =) 5 minutes **[1]** Add the two times to last departure (22:30) **[1]** *SC: 2 marks 23:49:50 final answer*	**3**
2(c)	The difference between the maximum and minimum total stationary times is 3 minutes (6 × 30 secs) **[1]** OR ***ft:** Minimum time is difference between 76 m and the figure in **2(b) [1]**.* (When trains are starting off at 15-minute intervals,) two could arrive only 12 minutes apart	**2**
2(d)	Travelling time is 20 min 50 sec / 1250 seconds, which is 125 × 10 seconds **[1]** Cost of the journey is (40¢ + 125 × 2¢ =) 290¢ / $2.90 *SC: 1 mark $3.30 final answer*	**2**
2(e)	Cost of day's travel is (2 × $1.80 =) $3.60 **[1]** Credit after top up is $2.20 + $50.00 + $10.00 **[1]** = $62.20 Credit is enough for 17 days	**3**
2(f)	A cost of $5.56 would be for a travelling time of (556 – 40)/2 = 258 **[1]**, so 2580 seconds = 43 minutes. The only journey of this length is between Murdstone and Littimer. *1 mark for correct cumulative list of journey times* *1 mark for correct calculation of any **one** of:* *Trotwood and Endell = 42 minutes* *Endell and Wickfield = 32 minutes* *Chillip and Dartle = 43 minutes 50 seconds* *Spenlow and Wickfield = 42 minutes 30 seconds* OR Using cumulative costs 128, 228, 378, 504, 644, 754, 888 **[1]** One correct cost difference for above cases. **[1]**	**4**

Question	Answer	Marks
3(a)(i)	Lisbet, Elizabeth, Liza, Libby (in any order) *1 mark for any three correct and no more than four given.*	**2**
3(a)(ii)	$0.0 < x \leqslant 2.0$, $70 < y \leqslant 80$ – Lisbet $2.0 < x \leqslant 3.0$, $60 < y \leqslant 70$ – Elizabeth $3.0 < x \leqslant 4.5$, $55 < y \leqslant 60$ – Liza $4.5. < x \leqslant 7.3$, $0 < y \leqslant 55$ – Libby *1 mark for any suitable x, y* *1 mark for second suitable x, y from a different range* *1 mark for both the matching hotels*	**3**
3(b)	<u>Liza & Elizabeth</u>	**1**
3(c)(i)	*Award up to 2 marks for* Algebraic Inequality between any pair of hotels **[1]** The fixed charge is constant for all cases and can be ignored explicitly identified **[1]**. The (cheapest) nearest is always included, in this case Lisbet. **[1]** The steepest rate of change (is from there to Elizabeth:) $10 for 1 km **[1]** The critical combination is Lisbet and Elizabeth. **[1]** There are two trips, so $<u>5 per km.</u> *SC: 2 marks for $10 (per km) final answer*	**3**
3(c)(ii)	<u>Elizabeth</u>	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)(i)</td><td>The maximum round score for a player after five turns is 8 + 8 + 8 + 7 + 7 = 38. A sixth turn is therefore needed to reach 40.</td><td>1</td></tr>
<tr><td>4(a)(ii)</td><td>If the player achieving 40 has played first, the other player may only have had five turns, scoring at least 1 + 1 + 1 + 2 + 2 = 7.

1 mark for an answer of 9, which assumes that both will have the same number of turns
OR
1 mark ft from (i): 5→5, 7→9, 8→12 only.</td><td>2</td></tr>
<tr><td>4(b)</td><td>A grid with the numbers 1–8 three times each, with no number appearing twice in the same row or column. [1] (Excluding the example in the QP)
A grid with a different number (1–8) in each of the squares shown below with a number in bold. [1]
e.g.
<table>
<tr><td>3</td><td>1</td><td>4</td><td>2</td><td>8</td></tr>
<tr><td>8</td><td>2</td><td>7</td><td>6</td><td>3</td></tr>
<tr><td>5</td><td>4</td><td>XY</td><td>1</td><td>6</td></tr>
<tr><td>7</td><td>5</td><td>3</td><td>8</td><td>4</td></tr>
<tr><td>2</td><td>6</td><td>1</td><td>5</td><td>7</td></tr>
</table></td><td>2</td></tr>
<tr><td>4(c)(i)</td><td>The numbers missing from the grid are: 4, 5, 5, 6, 6 and 7. These add up to 33, so Max's round score is 33 – 16 = 17.

1 mark for identification of 4, 5, 5, 6, 6 and 7 scored so far, or that the grid total would have been 108 to begin with and is now 75.</td><td>2</td></tr>
<tr><td>4(c)(ii)</td><td>5 & 6 are in the same column as Y and 7 & 8 are in the same row as Y, Bc must have contained a 4.</td><td>1</td></tr>
<tr><td>4(c)(iii)</td><td>First turn: 7 from square Ed [1]
Second turn: 5 from square Ce [1]
OR
Ed then Ce [1]

If [0], award 1 mark for clear evidence that Katy's three scores must have been 4, 5 and 7 (or Max's three scores must have been 5, 6 and 6).</td><td>2</td></tr>
<tr><td>4(c)(iv)</td><td>Max / X has 3 squares to choose from (Aa, Dd, Ec); Katy / Y has 6 squares to choose from (Aa, Ae, Ca, Db, Dd, Ec). $3 \times 6 = 18$, but this includes 3 appearances that cannot occur because they would require both X and Y to occupy the same square [1],
so the number of possibilities is 15.

1 mark for 3×6 (implied by 18) OR subtracting 3 at end</td><td>2</td></tr>
</table>

Question	Answer	Marks
4(d)	Lydia must move to square Cd, to force Trixie to move to square Eb, which will force her to go to Ee on her next turn, from where no further moves are possible. Lydia can only win the game this round if she scores the bonus of 20 / has a *round score* of (exactly) 40. She can reach 40 by scoring / moving to, in order: 1 / Cd, 4 / Ec, 6 / Cb, 3 / Ea (or 2 / Bd, 1 / Ba). *3 marks for fully correct solution.* *2 marks for first three moves correct.* *1 mark for L must move first to Cd.* *OR* *1 mark for recognition that Lydia must score 40 exactly.*	**3**