



Cambridge International AS & A Level

THINKING SKILLS

9694/31

Paper 3 Problem Analysis and Solution

May/June 2022

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 2022 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 **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.

NOTES FOR MARKERS**Working**

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’.

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
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
	Individual mark of partial credit
	Double mark of partial credit
	Essential element of answer/working missing
	Judged to be not good enough to earn the relevant credit
	Benefit of doubt
	Correct follow through
	Transcription error
	Special case
	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)	<p>The most she can pay is $\\$6 + \\$17 + \\$5 = \\28. The least she can pay is $\\$4 + \\$12 + \\$3 = \\19. And $\\$28 - \\$19 = \\$9$. AG</p> <p><i>May also be presented with per-item differences as $\\$2 + \\$5 + \\$2$.</i></p>	1
1(b)	<p>She can spend \$5, \$15 and \$3 in 2 ways. She can spend \$5, \$13 and \$5 in $2 \times 3 = 6$ ways. She can spend \$6, \$12 and \$5 in $2 \times 3 = 6$ ways. So there is a total of $2 + 6 + 6 = 14$ different combinations.</p> <p><i>Award 2 marks for the three combinations of dollars and no extras OR for any two of the 2, 6 and 6 ways.</i></p> <p><i>Award 1 mark for two of the combinations of dollars OR for any one of the 2, 6 and 6 ways.</i></p>	3
1(c)	<p>Special Offer 1: $6 + 17 - 20$ = \$3 Special Offer 2: $6 + 17 + 5 - 24$ = \$4</p>	1
1(d)	<p>They can save $\\$16 - \\$12 = \\$4$ on the starter, $\\$44 - \\$36 = \\$8$ on the main and $\\$13 - \\$9 = \\$4$ on the dessert, making a total saving of <u>\$16</u>.</p> <p><i>Award 1 mark for any two of the \$4, \$8 and \$4 OR for calculating the costs for any two of the three best-case courses (\$16, \$44, \$13) OR \$57 seen OR \$19 identified as cheapest</i></p>	2
1(e)	<p>Special Offer 1: Doughballs \$4 and Mushroom Crostata \$12 can be paired for \$16, cheaper than using the special offer. The other dishes would then be $2 \times \\$20 + \\$10 + \\$3$. Total \$69.</p> <p>Special Offer 2: Doughballs \$4, Mushroom Crostata \$12 and Raspberry Sorbet \$3 can be combined for \$19, cheaper than using the special offer. The other dishes would then be $2 \times \\$24$. Total \$67.</p> <p>So Special Offer 2 is cheaper.</p> <p><i>1 mark for the \$16 in SO1 1 mark for the \$19 in SO2. 1 mark for concluding Special Offer 2 from \$69 and \$67.</i></p> <p><i>SC: 1 mark for Special Offer 2 justified with \$72 v. \$73 (assumes three applications of each special offer, and then offer 1 gives no saving).</i></p>	3

Question	Answer	Marks
2(a)	Obstacle: 210s, so points = $500 - 210 = 290$ Number of complete 2m thrown = 16, so points = $16 \times 40 = 640$ 4 Easy + 5 Medium, so points = $4 \times 10 + 5 \times 20 = 140$ Total points = $290 + 640 + 140 = 1070$ AG <i>1 mark for two events correct</i> <i>1 mark for all three correct and added</i>	2
2(b)	<u>24 m & 25.9 m</u> Obstacle: 4 minutes, so 240 s, so $500 - 240 = 260$ points and GK $8 \times 30 = 240$ points, total 500 points [1] This leaves 480 points for the throw, which is $480/40 = 12$ complete 2 m. Least throw is 24 m [1] Greatest throw is 25.9 m [1] <i>SC: 2 marks for 23.95 to 25.95 – using actual rather than recorded distance.</i>	3
2(c)	3E, 1M, 6H 2E, 3M, 5H 1E, 5M, 4H (0E,) 7M, 3H <i>3 marks for all 4 correct and no extras</i> <i>2 marks for 3 correct</i> <i>1 mark for 1 correct</i> <i>SC: 2 marks for all four correct unlabelled but in a consistent order.</i>	3
2(d)	Tony is 34 seconds faster than Matt, which gives him 384 points [1] Matt throws 38.0 to 39.9 m, so Tony throws 35.0 to 36.9 m, scoring 680 (or 720 points) [1] So overall Tony needs more than (either 106 points or) 146 points to overtake Matt [1] So Tony might need to answer 8 (Medium) questions correctly [1] <i>4 marks for answer 8 with at least 680 or 146/147 seen.</i>	4
2(e)	With the change, Van would have $362 + 184 + 300 = 846$ points. [1] Matt threw 38.0 to 39.9 m, so new points would be from 380 (to 399). [1] Matt might only have 830, so Yes, Van could have more points [1] (if Matt's throw was no longer than 39.5 metres).	3

Question	Answer	Marks
3(a)	Before: \$9900 earned so \$9405 taken home After: \$10 100 earned so \$9090 taken home So they will take home <u>\$9405</u> – <u>\$9090</u> = \$315 less AG	1
3(b)	\$40 000 earned so \$36 000 taken home [1] 80% of her new income must be more than \$36 000. So over \$36 000 ÷ 0.8 = \$45 000 OR <u>\$45 001</u>	2
3(c)	The upper boundary is \$9500 / 0.9 = \$10 555.55... (\$10 001) to <u>\$10 555</u>	1
3(d)	She paid between 10% and 20% of her earnings in tax, so must be in the lower end of income bracket III. Therefore her take-home pay will be \$36 000 [1] \$36 000 ÷ 5/6 = <u>\$43 200</u> .	2
3(e)	At the II / III boundary, an increase in take-home pay from \$36 000 to \$36 152 [1] occurs when \$200 is added to earnings of \$44 990. [1] At the I / II boundary, an increase in take-home pay from \$9348 [1] to \$9500 occurs when \$200 is added to earnings of \$9840. [1]	4

Question	Answer	Marks
4(a)	The maximum one player can score in a round is 15 (5×3), so the minimum number of rounds needed to score 40 is <u>3</u> .	1
4(b)	<u>11</u>	1
4(c)(i)	<u>4</u> ($0 + 3 + 0 + 0 + 1$)	1
4(c)(ii)	<u>5</u> and <u>8</u>	1
4(d)	In the second column (/second row) [1] She placed the 2 [1 <i>dependent on first mark</i>] Rowan does not get a point two 2s in the row, and column total is 21. [1]	3
4(e)(i)	8 would score 3 points (for both) the row or the column. [1] The other available tiles (2, 7, 9) would give 0. [1]	2
4(e)(ii)	2 in the top row/second column [1] 7 in the fourth row/third column [1] <i>1 mark for 2 and 7 without positions</i>	2
4(f)	She must place the 2 at the bottom of the middle column (even though it scores no points for Colette and gives away 1 point to Rowan). [1] <i>1 mark for each of the following (maximum 3):</i> <ul style="list-style-type: none"> • (Colette knows that) the two tiles left are 1 and 7. • Rowan could use the 2 on his turn to win (by scoring 3 points on the second or fourth row). • As the 2 isn't available to him, Rowan will only be able to score 1 point (by placing the 9 in either the second or fourth row) • Either 1 or 7 will be available to Collette, which she can use to win with 3 points 	4