Cambridge International A Level

Cambridge Assessment International Education
Cambridge International Advanced Level

THINKING SKILLS **9694/33**

Paper 3 Problem Analysis and Solution **October/November 2017**

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.

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Question	Answer	Marks
1(a)	The final journey could be 70 minutes long either way, and so will not be embarked on after (7 hours – 150 minutes =) 4.5 hours (or 270 minutes) [1 mark] In which case only 6 paid journeys possible (40+10+40 + 10+40+10+40 + 10+40+10+40 = 290) 6 × $32 = $192 Condone $256 (8 journeys **soi** [1 mark] at $32) *1 mark for max journeys for their time limit.*	**2**
1(b)	270 minutes last time to set out; 4 journeys each over 60 minutes (and three rests) would exceed this, so total fare cannot be less than 4 × ($28 + (7 × 0.6)) = 4 × $32.20 = $128.80 *If 3 marks not awarded, award 1 mark each for the following (max 2):* • Time threshold 270 mins **oe** (may be seen in **(a)**) • Acknowledgement that **minimum** paid time is what's certain • Correctly deducing number of returns for their threshold • Pays in both directions *(dependent on previous mark)* *SC:* *2 marks for 61 or over 60 minutes seen* *OR 1 mark for 51 minutes seen* *OR* *2 marks for $224 or $131.20 or $136 or $168* *OR 1 mark for $68 or $112*	**3**
1(c)	Maximum journey time = 84 minutes (20% greater than 70 minutes) charge = $28 plus (15 × $0.60) = $37	**1**
1(d)(i)	2 journeys of 84 minutes plus 4 journeys of 65 minutes. Time = 84 + 10 + 84 + 10 + 65 +10 + 65 + 30 = 358 minutes plus (65 + 10 + 65) = 498 minutes = 8 hours 18 minutes. *1 mark for 6 journeys (supported) OR arriving at 358 minutes for the section of his shift up to his first extended break* **soi**. *SC: 1 mark for 508 – from wrongly including an extra 10 minutes at end*	**2**
1(d)(ii)	Greatest = $37 × 2 + 4 × $33.40 = $207.60 Least = 3 × 65 minute journeys =$100.20 Difference = $107.40 *Award 1 mark for $207.60 or $100.20*	**2**

Question	Answer	Marks
2(a)	He can fit in $2 \times 4 \times 10 = 80$ or $3 \times 4 \times 7 = \underline{84}$ boxes. *1 mark for either calculation.*	**2**
2(b)	If he places the 50 cm side horizontal and 80 cm side vertical he can fit in $4 \times 3 \times 10 = \underline{120}$ boxes. *1 mark for $12 \times 3 \times 3 = 108$ boxes* *OR $7 \times 4 \times 4 = 112$ boxes* *OR $2 \times 12 \times 4 = 96$ boxes seen.*	**2**
2(c)	For example, 96 boxes can be placed as $2 \times 4 \times 12$, leaving a space $60 \times 240 \times 600$, into which a further 36 boxes can be placed, with the 60 cm side horizontal and the 80 cm side vertical. This makes a total of 132 boxes (so 130 is obviously possible). *3 marks for any demonstration of $\geqslant$130 boxes* *If 3 marks not awarded, award 1 mark each for the following (max 2):* • *Volume calculation to show sufficient* • *Splitting the 220 into a combination of 50s, 60s and 80s* • *Covering a side with 220 end*	**3**
2(d)	For example, with 160 horizontally, he can fit $1 \times 4 \times 12$; this leaves room for $1 \times 1 \times 12$ with 60 horizontally. On top of this second set can be fitted another $1 \times 1 \times 3$, making a total of 63. **AG** *1 mark for filling an entire face OR for room volume = 66 boxes (if not given in **(c)**)* *OR 2 marks for obtaining at least 60 (with supporting working)* *OR 3 marks for (at least) 63 (with supporting working)*	**3**

Question	Answer	Marks
3(a)	20 people in one minute: 560/20 = 28 minutes. She will reach the front at <u>06:28</u> am.	**1**
3(b)	06:28 – 06:56 – 07:24 – 07:52 – 08:20 <u>08:20</u>am	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(c)</td><td>
<table>
<tr><th>Time joined</th><th>Number of people</th><th>Minutes wait</th></tr>
<tr><td>06:00:00</td><td>560</td><td>560/20 = 28</td></tr>
<tr><td>06:28:00</td><td>588</td><td>588/20 = 29.4</td></tr>
<tr><td>06:58:00</td><td>618</td><td>618/20 = 30.9</td></tr>
<tr><td>07:29:00</td><td>649</td><td>649/20 = 32.45</td></tr>
</table>
She reaches the operator at 08:01:27 AG

Award 1 mark for converting 588 into minutes wait or time joined
Award 1 mark for 618 seen
Award 1 mark for accurate application: implied by sight of 07:29 and 649/20 oe
</td><td>3</td></tr>
<tr><td>3(d)(i)</td><td>Award 2 marks for the correct time (07:28) and the correct time that the front of the queue is reached (08:00:24).

If 2 marks cannot be awarded, award 1 mark for either the following:
• at 07:28 the queue has 648 people in it, which means a 32.4 minute wait;
• at 07:27 the queue has 647 people in it, which means a 32.35 minute wait, arriving at the front at 07:59:21.</td><td>2</td></tr>
<tr><td>3(d)(ii)</td><td>100 discounts at 20 per minute suggests that the last ones will go to the caller getting through just before 8.05 am.
Joining at 07.33, there will be 653 people in the queue.
653/20 = 32 m 39 s, leading to 08:05:39 seconds: too late.
Therefore 07:32 is the latest time, from which she gets to the front at 08:04:36.

Award 2 marks for the correct time (07:32) and the correct time that the front of the queue is reached (08:04:36).
If 2 marks cannot be awarded, award 1 mark for either of the following:
• at 07.32 am the queue has 652 people in it, which means a 32.6 minute wait;
• at 07.33 am the queue has 653 people in it, which means a 32.65 minute wait, arriving at the front at 08:05:39.</td><td>2</td></tr>
<tr><td>3(e)(i)</td><td>Of the 560 callers, only 280 re-join.
So 588 – 280 = 308 have joined in the meantime.
308 over 28 minutes: 11 per minute

1 mark for 308 soi</td><td>2</td></tr>
</table>

Question	Answer	Marks
3(e)(ii)	08:03:12 (07:30:00 + 33.2 minutes wait), so Yes *If 4 marks cannot be awarded:* *Award 1 mark for clearly calculating the three components for any case: minutes wait (queue/20), number re-starting (queue/2) and number arriving (minute × (their) 11).* *Award 1 mark for correctly applying the process iteratively once (implied by 06:28:00 as second time of starting).* *Award 1 mark for a second iteration applied correctly (implied by either 06:58 or 07:30 AND the number of people in the queue at those times).*	**4**

Question	Answer	Marks
4(a)	Maximum for *Piggyback* is 2 × \$100 ("double" & "piggyback") + 3 × \$50 = \$350 [1 mark] Maximum for *Freeze* is 10 × \$25 = \$250 \$600 × 20 = \$12 000	**2**
4(b)(i)	Ben's prize pot: \$335 (\$295 + 2 × \$25 – \$10) [1 mark] Olivia's prize pot: \$365 (\$280 + 5 × \$25 – 4 × \$10) [1 mark]	**2**
4(b)(ii)	If Olivia had selected an incorrect answer and Ben had selected the correct answer, Ben would have won (by \$5), whereas not attempting the question was the only way she was guaranteed to win by at least \$5.	**1**
4(c)(i)	In *Piggyback*, History and Geography must have been her "double" and "piggyback" categories (to be able to add more than \$50 to her prize pot). She must have answered 8 questions correctly in one of the two categories and not taken part in the other. Her total number of correct answers in *Piggyback* was therefore 8 + 8 + 7 + 9 = 32. 32 (in *Piggyback*) + 5 (in *Freeze*) + 12 (in *Multiplier*) = 49 *If 2 marks cannot be awarded, award 1 mark for evidence of appreciation that she answered 32 questions correctly in* Piggyback *OR for an answer of 57 (counting piggyback answers as her own)*	**2**
4(c)(ii)	Her prize pot after the ninth *Freeze* question was \$365, then \$325 after she did not attempt the last question. This was reduced by \$180 during *Multiplier* (7 × \$20 + 1 × \$40) before multiplication by 12. 12 × \$145 = \$1740 *If 2 marks cannot be awarded, award 1 mark for evidence of appreciation that her prize pot was reduced by \$180 during* Multiplier.	**2**
4(c)(iii)	If she had answered the last question correctly, \$25 would have been added to her prize pot instead of \$40 deducted. \$65 × 12 = \$780 *If 2 marks cannot be awarded, award 1 mark for an answer of \$300 (which fails to reinstate the deducted \$40) OR for sight of \$2520*	**2**

Question	Answer	Marks
4(d)	Any amount over $50 must be due to a "double" or a "piggyback". Only Olivia recorded over $50 in round 1, so: Olivia: history/round 1 "double"; geography/round 4 "piggyback" [1 mark] Olivia must have piggybacked Ben's $80 in round 4, so: Ben: geography/round 4 "double"; music/round 2 "piggyback" [1 mark] Ben must have piggybacked Toby's $90 in round 2, and, of the other rounds, only in round 3 is Toby's amount equal to the greatest amount, so: Toby: music/round 2 "double"; sport/round 3 "piggyback" [1 mark] "Double" must result in a multiple of $10, and only in round 5 is Jodie's amount equal to the greatest amount, so: Jodie: sport/round 3 "double"; science/round 5 "piggyback" [1 mark]	**4**