Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

THINKING SKILLS **9694/31**

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

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

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Question	Answer	Marks
1(a)	1 round and 5 squares; 5 rounds and 2 squares *Award 1 mark for each one of these.* *If no reference to the shapes, award 1 mark for complete correct numerical working (1 × 6 + 5 × 8) and (5 × 6 + 2 × 8).*	**2**
1(b)	The best he can do is 4 rounds and 3 squares, which provides 48 seats at a cost of $380. *Award 1 mark for either of the other two, more expensive, combinations which provide at least 46 seats, with a correct cost:* *4 rounds and 4 squares = $440* *OR 3 rounds and 4 squares = $390*	**2**
1(c)	Reducing the total number of people to 44 would enable him to use 2 rounds and 4 squares at a cost of $340.	**1**
1(d)	For 46 people, the cheapest way is to pay for the drinks at the whole room rate but the decorations per person, giving a total of 130 + 46 × 1 = $176. For 44 people, the cheapest way is to pay for both items per table, giving a total of 6 × 20 + 6 × 7 = $162. So the difference is $14. *Award 1 mark for at least two of the bracketed values:* *(1 × 130) + (46 × 1)= 176* *(6 × 20) + (6 × 7) = 162* *Alternative construal: (1 × 130) – (6 × 20) = 10; (46 × 1) – (6 × 7) = 4* *Award 2 marks for three of the bracketed values appropriately combined, including one pair in which different rates are used.*	**3**
1(e)	The cheapest method overall for 46 people is at the whole room rate: 130 + 50 = $180 The cheapest method overall for 44 people is per table: 120 + 42 = $162. So the difference is $18. *If $18 not seen, award 1 mark for $180*	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>$60 if three $60 books are bought.</td><td>1</td></tr>
<tr><td>2(b)</td><td>Voucher L applied to $33, $40, $50 = $33 discount

1 mark for (S: $160 total; 20% discount = $)32</td><td>2</td></tr>
<tr><td>2(c)(i)</td><td>1 mark for vouchers correctly applied to any collection of Brodie’s books.
1 mark for vouchers correctly applied in the other order.

If vouchers and prices do not lead to a change of price after the order of discounts is altered, then no marks should be awarded.

Allow prices instead of discounts (given in square brackets in the table)
SC1: if prices used are not from Brodie’s list of five, award 1 mark for correct selection and application of discounts (in both orders).

<table>
<tr><th>Voucher 1</th><th>Voucher 2</th><th>Price</th><th>1 then 2</th><th>2 then 1</th></tr>
<tr><td>S</td><td>A</td><td>20 + 33
[50 < price ⩽ 55]</td><td>[$38.16]
$14.84</td><td>[$47.70]
$5.30</td></tr>
<tr><td>S</td><td>L</td><td>3+ books price > 50
more expensive < 50
not possible with Brodie’s books</td><td></td><td></td></tr>
<tr><td>S</td><td>E</td><td>Any books with price > 50
e.g. 40 + 50</td><td>[$52]
$38</td><td>[$56]
$34</td></tr>
<tr><td>A</td><td>E</td><td>Any books incl. one>30
e.g. 17 + 33</td><td>[$45]
$5</td><td>[$27]
$23</td></tr>
<tr><td>L</td><td>E</td><td>17 + 20 + 33
OR
33 + 40+ 50</td><td>[$33] $37
OR
[$70] $53</td><td>[$37] $33
OR
[$73] $50</td></tr>
</table></td><td>2</td></tr>
<tr><td>2(c)(ii)</td><td>A & L is the only pair.

No mark if any other pairs included.</td><td>1</td></tr>
</table>

Question	Answer	Marks
2(d)	If $50, $40 and $33 are bought first $123: cheapest book free = $90 20% off = $72 10% off = $64.80 $20 off = $44.80 remaining books = $37 TOTAL = $81.80 (discount of $78.20) *Award 4 marks for a correct solution (division of books, and order of application) yielding a total of $81.80 or discount of $78.20.* If all bought together $160: cheapest book free = $143 (can be applied later) 20% off = $114.40 10% off = $102.96 $20 off = $82.96 TOTAL = $82.96 (discount of $77.04) *Award 3 marks for correct application of 4 vouchers if all bought together (total of $82.96 or discount of $77.04).* *Award 2 marks for a clear and correct application of 4 vouchers to the 5 books, with S & A not after E (allow one processing error).* *Award 1 mark for a clear and correct application of 4 vouchers to the 5 books in any order (allow one processing error).* *SC3: $81.80 without any clear direction as to how the vouchers are applied.* *SC2: $82.96 without any clear direction as to how the vouchers are applied.* *If no total prices or discounts calculated:* *award 1 mark for clear order of application of all vouchers that avoids putting E before A and/or S and avoids applying L to fewer than 3 books.*	**4**

Question	Answer	Marks
3(a)(i)	6	**1**
3(a)(ii)	15 + (10 × 5) + 15 = 80 cm *1 mark for 65 cm (forgets piece at end* *OR* *1 mark for FT from (a)(i)*	**2**
3(b)	124 *Award 1 mark for 123 or 125* *OR* *Award 1 mark for an algebraic representation: 0.4x + 0.25 or 40x + 25*	**2**
3(c)	8 flags	**1**
3(d)	Any design that has 5 stripes, with ratio of lengths of blue: white as 2 : 1 and a total length of 30 cm For example: Lengths 5, 5, 10, 5, 5  *If 2 marks not awarded, award 1 mark for evidence that the blue and white stripes have lengths in the ratio 2 : 1* *OR* *for a correct design shown on lined paper but with no lengths indicated* *OR a flag with 5 labelled lengths, with 3 blue and 2 white stripes of total length 15 cm each (misreading 'equal numbers of (his and) Andy's flags')*	**2**
3(e)	With two joins, cheaper by $2.50 No joins: 185 cm needed, 4 flags Cost = 1.85 × $10 + $2 × 4 = $26.50 Two joins: 80 cm white (+ 60 cm blue) needed, so 140 cm Cost = 1.4 × $10 + 4 × 2 × $1.25 = $24.00 *If 3 marks cannot be awarded* *Award 1 mark for $26.50* ***oe*** *Award 1 mark for $24.00* ***oe*** *Award 0 marks for $2.50 on its own*	**3**

Question	Answer	Marks
3(f)	83 flags *(with supporting working)* If the maximum number of flags are made without any joins, then $((40*n* + 25)/10 + *n* × 2) = $(6*n* + 2.5) = 500, giving *n* = 82.92. This enables 82 flags to be made, but the initial white section of the roll has not been used; with 1 join a further flag can be stitched ($494.50 + $2). *If 4 marks cannot be awarded:* • *award 3 marks for 82.92 (seen), or 82 flags with supporting working* • *award 2 marks for 82 or 83 flags (without clear working)* • *award 1 mark for 80 or 81 flags (with some demonstration that these are possible)* *If no marks earned, then award 1 mark for either expression:* *n* flags: with joins, cost = $10(0.4*n* – 2) + 2*n* × 1.25) = $(6.5*n* – 2) with no joins, cost = $10(0.4*n* + 2.5) + 2n = $(6*n* + 2.5)	**4**

Question	Answer	Marks
4(a)	249 (points) ($1^2 + 7^2 + 6^2 + 2^2$ and $7^2 + 6^2 + 7^2 + 5^2$) *If 3 marks cannot be awarded, award 1 mark for each of the following:* • Identification of all three lines (and no others) that add up to square number totals: (4,6,3,3) (1,7,6,2) and (7,6,7,5). • Correct calculation of the value of at least one of the three lines: 70, 90 and 159 points respectively.	**3**
4(b)	2 and 4 with justification *Award 1 mark the correct pair chosen* *Award 1 mark each for recognition of the following:* • 0 would have allowed him to make a Square Deal. • 7 would have produced a column value of 90 points (or "greater than 84")	**3**
4(c)(i)	352 ($8^2 + 8^2 + 7^2 + 2^2$ and $8^2 + 7^2 + 7^2 + 3^2$) *Award 2 marks for an answer of 340 or more.* *(340 fails to appreciate that one of the 8s can be used in a row **and** a column, and is made up of $8^2 + 8^2 + 7^2 + 2^2$ and $7^2 + 7^2 + 6^2 + 5^2$.)* *Award 1 mark for sight of 181 or identification of (8,8,7,2) as the best possible line* *OR* *for a row and a column that each add up to 25.*	**3**

Question	Answer	Marks
4(c)(ii)	*Award 1 mark for any complete grid that does not contain any numbers that would not be allowed (e.g. three 0s, four 1s, one or more 9s etc.).* *Award 1 mark for any grid (even if incomplete) that would produce 352 or the candidate's answer to* ***(c)(i)*** *– provided it is more than 158.*	**2**
4(d)	1 placed in third row of Russell's grid and 5 placed in bottom row of Gordon's grid + explanation *Award 1 mark for stating (or indicating clearly in some other way) that the 1 should be placed in the third row down (or other suitable description) of Russell's grid* ***and*** *the 5 should be placed in the bottom row of Gordon's grid.* *Award 1 mark each (up to a maximum of 3) for any of the following observations:* • The four tiles left in the bag are 3, 4, 4 and 6. OR There is still a 3 in the bag, but no 2 or 8. • (So) placing 5 in Gordon's bottom row guarantees that his score for the round will be 0. • 1 on Russell's grid (in third row/second column) guarantees a score for the round ($0^2 + 6^2 + 1^2 + 2^2 = 41$). • Unless Gordon takes the 3 from the bag, he will have to place a number in Russell's last square (4 or 6) that will create a row that scores points ($8^2 + 6^2 + 7^2 + 4^2 = 165$) OR a column that is better than the one already in place ($5^2 + 6^2 + 1^2 + 4^2 = 78$). *SC1: if no other marks can be awarded, award 1 mark for stating that tile 1 should be placed in the third row of Russell's grid, AND tile 5 can go in either of Gordon's empty spaces.*	**4**