



General Certificate of Education

Mathematics 6360

MD01 Decision 1

Mark Scheme

2007 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Key to mark scheme and abbreviations used in marking

| | | | |
|--------------|--|-----|----------------------------|
| M | mark is for method | | |
| m or dM | mark is dependent on one or more M marks and is for method | | |
| A | mark is dependent on M or m marks and is for accuracy | | |
| B | mark is independent of M or m marks and is for method and accuracy | | |
| E | mark is for explanation | | |
| √ or ft or F | follow through from previous incorrect result | MC | mis-copy |
| CAO | correct answer only | MR | mis-read |
| CSO | correct solution only | RA | required accuracy |
| AWFW | anything which falls within | FW | further work |
| AWRT | anything which rounds to | ISW | ignore subsequent work |
| ACF | any correct form | FIW | from incorrect work |
| AG | answer given | BOD | given benefit of doubt |
| SC | special case | WR | work replaced by candidate |
| OE | or equivalent | FB | formulae book |
| A2,1 | 2 or 1 (or 0) accuracy marks | NOS | not on scheme |
| -x EE | deduct x marks for each error | G | graph |
| NMS | no method shown | c | candidate |
| PI | possibly implied | sf | significant figure(s) |
| SCA | substantially correct approach | dp | decimal place(s) |

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded. However, there are situations in some units where part marks would be appropriate, particularly when similar techniques are involved. Your Principal Examiner will alert you to these and details will be provided on the mark scheme.

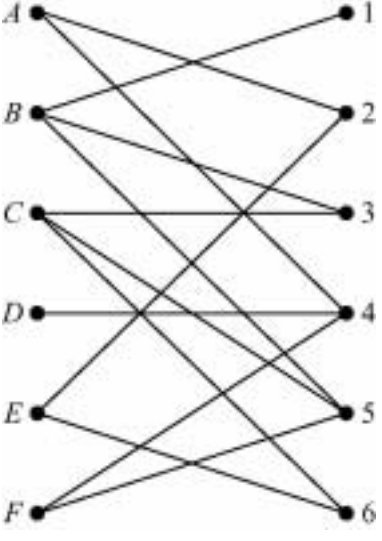
Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

Otherwise we require evidence of a correct method for any marks to be awarded.

MD01

| Q | Solution | Marks | Total | Comments | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------------|--|------------------------------|-----------|--|-----------|-----------|-----------|----------|----------|----|--|--|--|----|--|--|--|--|----|--|--|--|----|--|--|--|--|---|--|--|--|----|--|--|--|--|---|--|--|--|----|-----------|----|----------|---|-----------|----|-----------|----|---|--|----|--|----|--|----|--|--|---|--|----|--|----|--|----|---|---|----|----|----|----|----|----|---|---|----|----|----|----|----|----|------------------------------------|---|--|
| 1(a) |  | M1 A1 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (b) | <i>D</i> can only do 4 | E1 | 1 | Cannot be matched to task | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (c) | $A - 2 + E - 6 + C - 5$ $D - 4 + F - 5 + C - 3 + B - 1$ Match $A2, B1, C3, D4, E6, F5$ | M1A1 M1A1 A1 B1 | 6 | Starting with <i>A, D, 5, 1</i> First pass Second pass All Correct Alt:1 $A - 4 + F - 5$ $D - 4 + A - 2 + E - 6 + C - 3 + B - 1$ Alt: 2 $D - 4 + F - 5$ $A - 2 + E - 6 + C - 3 + B - 1$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total | | | 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2(a) | <table style="border-collapse: collapse; margin-left: 20px;"> <tr> <td style="padding: 2px 10px;"><u>28</u></td><td style="padding: 2px 10px;"><u>22</u></td><td style="padding: 2px 10px;"><u>20</u></td><td style="padding: 2px 10px;"><u>17</u></td><td style="padding: 2px 10px;"><u>14</u></td><td style="padding: 2px 10px;"><u>11</u></td><td style="padding: 2px 10px;"><u>6</u></td><td style="padding: 2px 10px;"><u>5</u></td></tr> <tr> <td style="padding: 2px 10px;">14</td><td></td><td></td><td></td><td style="padding: 2px 10px;">28</td><td></td><td></td><td></td></tr> <tr> <td></td><td style="padding: 2px 10px;">11</td><td></td><td></td><td></td><td style="padding: 2px 10px;">22</td><td></td><td></td></tr> <tr> <td></td><td></td><td style="padding: 2px 10px;">6</td><td></td><td></td><td></td><td style="padding: 2px 10px;">20</td><td></td></tr> <tr> <td></td><td></td><td></td><td style="padding: 2px 10px;">5</td><td></td><td></td><td></td><td style="padding: 2px 10px;">17</td></tr> <tr> <td style="padding: 2px 10px;"><u>14</u></td><td style="padding: 2px 10px;">11</td><td style="padding: 2px 10px;"><u>6</u></td><td style="padding: 2px 10px;">5</td><td style="padding: 2px 10px;"><u>28</u></td><td style="padding: 2px 10px;">22</td><td style="padding: 2px 10px;"><u>20</u></td><td style="padding: 2px 10px;">17</td></tr> <tr> <td style="padding: 2px 10px;">6</td><td></td><td style="padding: 2px 10px;">14</td><td></td><td style="padding: 2px 10px;">20</td><td></td><td style="padding: 2px 10px;">28</td><td></td></tr> <tr> <td></td><td style="padding: 2px 10px;">5</td><td></td><td style="padding: 2px 10px;">11</td><td></td><td style="padding: 2px 10px;">17</td><td></td><td style="padding: 2px 10px;">22</td></tr> <tr> <td style="padding: 2px 10px;">6</td><td style="padding: 2px 10px;">5</td><td style="padding: 2px 10px;">14</td><td style="padding: 2px 10px;">11</td><td style="padding: 2px 10px;">20</td><td style="padding: 2px 10px;">17</td><td style="padding: 2px 10px;">28</td><td style="padding: 2px 10px;">22</td></tr> <tr> <td style="padding: 2px 10px;">5</td><td style="padding: 2px 10px;">6</td><td style="padding: 2px 10px;">11</td><td style="padding: 2px 10px;">14</td><td style="padding: 2px 10px;">17</td><td style="padding: 2px 10px;">20</td><td style="padding: 2px 10px;">22</td><td style="padding: 2px 10px;">28</td></tr> </table> | <u>28</u> | <u>22</u> | <u>20</u> | <u>17</u> | <u>14</u> | <u>11</u> | <u>6</u> | <u>5</u> | 14 | | | | 28 | | | | | 11 | | | | 22 | | | | | 6 | | | | 20 | | | | | 5 | | | | 17 | <u>14</u> | 11 | <u>6</u> | 5 | <u>28</u> | 22 | <u>20</u> | 17 | 6 | | 14 | | 20 | | 28 | | | 5 | | 11 | | 17 | | 22 | 6 | 5 | 14 | 11 | 20 | 17 | 28 | 22 | 5 | 6 | 11 | 14 | 17 | 20 | 22 | 28 | M1 M1 A1 M1 A1 | 5 | SCA 4 sublists correct 1 st pass 2 sublists All correct |
| <u>28</u> | <u>22</u> | <u>20</u> | <u>17</u> | <u>14</u> | <u>11</u> | <u>6</u> | <u>5</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 11 | | | | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 6 | | | | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | 5 | | | | 17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <u>14</u> | 11 | <u>6</u> | 5 | <u>28</u> | 22 | <u>20</u> | 17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | 14 | | 20 | | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5 | | 11 | | 17 | | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 5 | 14 | 11 | 20 | 17 | 28 | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 6 | 11 | 14 | 17 | 20 | 22 | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (b)(i) | 4 | B1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (ii) | 4 | B1 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (c) | 28 | B1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total | | | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

MD01 (cont)

| Q | Solution | Marks | Total | Comments |
|---------|---|--|-----------|---|
| 3(a)(i) | | | | |
| (a)(i) | 71 OR Working back from L 35 at G 47 at C 44 at F 49 at I 56 at B 64 at E 71 at A } B1 × 7 | M1 A1 M1 M1 M1 A1 B1 | 7 | SCA Correct at <i>F</i> 2 values at <i>G</i> 2 values at <i>J</i> 2 values at <i>H</i> All correct |
| (ii) | <i>ABFGKL</i> | B1 | 1 | |
| (b) | <i>ADL</i> gives 62 <i>AIL</i> gives 69 ∴ <i>A to D</i> | M1 A1 A1 | 3 | OE OE Either, considering routes <i>ADL</i> or <i>AIL</i> CSO |
| | Total | | 11 | |

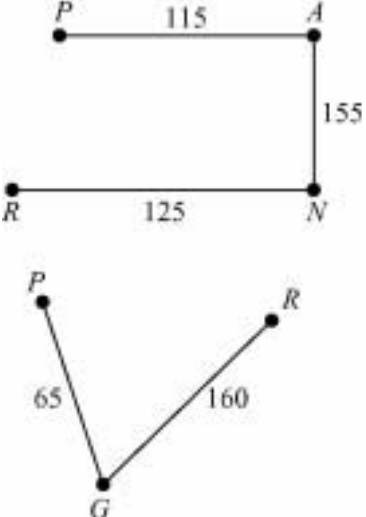
MD01 (cont)

| Q | Solution | Marks | Total | Comments |
|---------------------------|------------------------------------|-------|-----------|---|
| 4(a)(i) | <i>SD</i> 12 | M1 | 5 | Prim's (first 4 edges, allow 1 slip) 12 edges <i>HG</i> 6 th <i>EI</i> 9 th All correct |
| | <i>SC</i> 13 | B1 | | |
| | <i>SA</i> 14 | | | |
| | <i>SB</i> 16 | A1 | | |
| | <i>DH</i> 75 | | | |
| | <i>HG</i> 23 | A1 | | |
| | <i>GF</i> 22 | | | |
| | <i>FE</i> 24 | A1 | | |
| | <i>EI</i> 81 | | | |
| | <i>IJ</i> 12 | B1 | | |
| <i>GK</i> 83 | | | | |
| <i>KL</i> 16 | | | | |
| (ii) | 391 | B1 | 1 | |
| (iii) | | M1 | | MST (10 + edges) |
| | | A1 | | 12 edges |
| | | A1 | 3 | All correct |
| (iv) | <i>GF</i> 7 th (22) | B1 | 2 | |
| | <i>HG</i> 8 th (23) | B1 | | |
| (b) | Odd vertices (<i>E, H, J, K</i>) | E1 | | PI |
| | $EH + JK = 69 + 131 = (200)$ | M1 | | 2 correct sets of pairings |
| | $EJ + HK = 93 + 106 = (199)$ | A3,2, | | |
| | $EK + JH = 129 + 142 = (271)$ | 1,0 | | |
| | Repeat $EJ + HK$ | | | |
| Total $1135 + 199 = 1334$ | B1 | 6 | | |
| Total | | | 17 | |

MD01 (cont)

| Q | Solution | Marks | Total | Comments |
|--------|--|--|-----------|--|
| 5(a) | $5x + 10y \leq 1500$ (balloons) $\Rightarrow x + 2y \leq 300$ $32x + 8y \leq 4000$ (sweets) $\Rightarrow 4x + y \leq 500$ $x \geq 50, y \geq 50$, at least 50 of each $x + y \geq 140$, at least 140 in total | E1 E1 E1 E1 | 4 | |
| (b)(i) | | B1 B1 M1 A1 A1 B1 M1 A1 | 8 | $x = 50, y = 50$ $x + y = 140$ Negative gradient (either) $4x + y = 500$ $x + 2y = 300$ Feasible region Objective line drawn |
| (ii) | Maximum (100, 100) = £200 | M1 A1 | 2 | Considering extreme point on their region |
| (iii) | Minimum (90, 50) = £132 | M1 A1 | 2 | Considering extreme minimum point on their region |
| | Total | | 16 | |

MD01 (cont)

| Q | Solution | Marks | Total | Comments |
|---------|--|--------------------------|-----------|---|
| 6(a)(i) | $G \rightarrow P \rightarrow A \rightarrow N \rightarrow R \rightarrow G$ 65 115 155 125 160 Total = 620 | M1 M1 A1 B1 | 4 | Tour Visits all places Correct order |
| (ii) |  <p>The diagram consists of two parts. The top part shows a graph with four vertices: P (top-left), A (top-right), R (bottom-left), and N (bottom-right). Edges connect P to A (weight 115), A to N (weight 155), and R to N (weight 125). The bottom part shows a graph with three vertices: P (top-left), R (top-right), and G (bottom-center). Edges connect P to G (weight 65) and G to R (weight 160).</p> | M1 m1 A1 m1 | 5 | SCA (MST + extra edge(s)) MST 2 edges from G |
| | $LB = 395 + 225 = 620$ | A1 | 5 | |
| (iii) | $T = 620$ | E1F | | Their (a)(ii) $\leq T \leq$ their (a)(i) where (a)(i) \geq (a)(ii) |
| (b)(i) | 92 | B1 | 1 | |
| (ii) | 87 | B1 | 1 | |
| (iii) | 6 | B1 | 1 | |
| (iv) | $n!$ | B1 | 1 | |
| | Total | | 14 | |
| | TOTAL | | 75 | |