

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0607 CAMBRIDGE INTERNATIONAL MATHEMATICS

0607/61

Paper 6 (Extended), maximum raw mark 40

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.

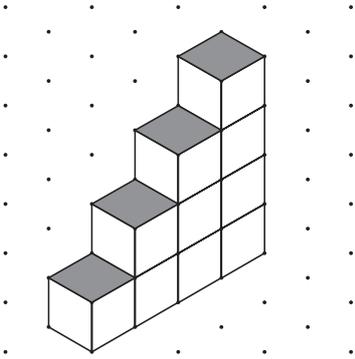
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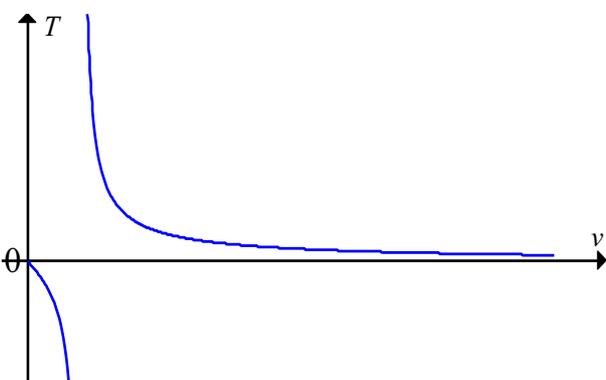
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Abbreviations

- cao correct answer only
 dep dependent
 FT follow through after error
 isw ignore subsequent working
 oe or equivalent
 SC Special Case
 nfw not from wrong working
 soi seen or implied

| A INVESTIGATION STAIRCASES | | | | | | | | | | | | | | | | | |
|----------------------------|------------------------------------|---|--|---|----|----|----|---|---|-------|---|---|---|----|----|----|---|
| 1 | (a) | 3 | 1 | | | | | | | | | | | | | | |
| | (b) |  | 1 | | | | | | | | | | | | | | |
| | (c) | <table border="1"> <tr> <td>Height</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td>Cubes</td> <td>1</td> <td>3</td> <td>6</td> <td>10</td> <td>15</td> <td>21</td> </tr> </table> | Height | 1 | 2 | 3 | 4 | 5 | 6 | Cubes | 1 | 3 | 6 | 10 | 15 | 21 | 1 |
| | Height | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | |
| | Cubes | 1 | 3 | 6 | 10 | 15 | 21 | | | | | | | | | | |
| (d) | $\frac{1}{2}n^2 + \frac{1}{2}n$ oe | 1 | C opportunity | | | | | | | | | | | | | | |
| (e) | 55 | 1FT | FT <i>their</i> (d) provided an expression in n with numerical coefficients C opportunity | | | | | | | | | | | | | | |
| 2 | (a) | 16 | 1 | | | | | | | | | | | | | | |
| | (b) | <table border="1"> <tr> <td>Height</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td>Cubes</td> <td>1</td> <td>4</td> <td>9</td> <td>16</td> <td>25</td> <td>36</td> </tr> </table> | Height | 1 | 2 | 3 | 4 | 5 | 6 | Cubes | 1 | 4 | 9 | 16 | 25 | 36 | 1 |
| | Height | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | |
| | Cubes | 1 | 4 | 9 | 16 | 25 | 36 | | | | | | | | | | |
| (c) | n^2 | 1 | oe | | | | | | | | | | | | | | |
| (d) | 100 | 1 | | | | | | | | | | | | | | | |

| 3 | (a) | <table border="1"> <tr> <th>Height</th> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <th>Cubes</th> <td>2</td> <td>6</td> <td>12</td> <td>20</td> <td>30</td> <td>42</td> </tr> </table> | Height | 1 | 2 | 3 | 4 | 5 | 6 | Cubes | 2 | 6 | 12 | 20 | 30 | 42 | 1FT | FT of all values double <i>their</i> 1(c) | |
|--|--------------------------------------|---|---|-----------------------------|---------------------------|-----|----|----|---------|-------|----|--------|----|----|----------|-----|-----|---|---|
| | Height | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | | | |
| | Cubes | 2 | 6 | 12 | 20 | 30 | 42 | | | | | | | | | | | | |
| | (b) | $n^2 + n$ oe | 1 | C opportunity | | | | | | | | | | | | | | | |
| (c) | 110 | 1FT | FT <i>their</i> (b) provided an expression in n of correct order with numerical coefficients C opportunity | | | | | | | | | | | | | | | | |
| (d) | 15 | 1 | C opportunity | | | | | | | | | | | | | | | | |
| 4 | (a) | <table border="1"> <tr> <th>Height</th> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <th>Cubes</th> <td>1</td> <td>6</td> <td>18</td> <td>40</td> <td>75</td> <td>126</td> </tr> </table> | Height | 1 | 2 | 3 | 4 | 5 | 6 | Cubes | 1 | 6 | 18 | 40 | 75 | 126 | 2 | B1FT for any two | |
| | Height | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | | | |
| Cubes | 1 | 6 | 18 | 40 | 75 | 126 | | | | | | | | | | | | | |
| (b) | $\frac{1}{2}n^3 + \frac{1}{2}n^2$ oe | 1 | C opportunity | | | | | | | | | | | | | | | | |
| 5 | | <table border="1"> <thead> <tr> <th>Type of staircase</th> <th>Max height using 1800 cubes</th> <th>Number of cubes left over</th> </tr> </thead> <tbody> <tr> <td>UP</td> <td>59</td> <td>30</td> </tr> <tr> <td>UP/DOWN</td> <td>42</td> <td>36</td> </tr> <tr> <td>DOUBLE</td> <td>41</td> <td>78</td> </tr> <tr> <td>MULTIPLE</td> <td>15</td> <td>0</td> </tr> </tbody> </table> | Type of staircase | Max height using 1800 cubes | Number of cubes left over | UP | 59 | 30 | UP/DOWN | 42 | 36 | DOUBLE | 41 | 78 | MULTIPLE | 15 | 0 | 3FT | <p>FT</p> <p><i>their</i> UP $(\frac{1}{2}n^2 + \frac{1}{2}n)$,</p> <p><i>their</i> DOUBLE $(n^2 + n)$,</p> <p><i>their</i> MULTIPLE $(\frac{1}{2}n^3 + \frac{1}{2}n^2)$</p> <p>if expression in n with numerical coefficients of correct order with at least two terms</p> <p>B1 for each pair (row)</p> <p>if B0 then allow B1 for correct column of maximum heights</p> <p>C opportunity</p> |
| | Type of staircase | Max height using 1800 cubes | Number of cubes left over | | | | | | | | | | | | | | | | |
| | UP | 59 | 30 | | | | | | | | | | | | | | | | |
| | UP/DOWN | 42 | 36 | | | | | | | | | | | | | | | | |
| | DOUBLE | 41 | 78 | | | | | | | | | | | | | | | | |
| MULTIPLE | 15 | 0 | | | | | | | | | | | | | | | | | |
| Communication seen in three of 1(d), 1(e), 3(b), 3(c), 3(d), 4(b), 5 | | | 1 | | | | | | | | | | | | | | | | |

| B MODELLING BOAT TRIPS | | | | |
|------------------------|---------|--|---|--|
| 1 | (a) | 40 | 1 | C opportunity |
| | (b) | 6 | 1 | C opportunity |
| 2 | (a) | 46.1[53...] or 46.2 seen or $\frac{10}{13} \times 60 = 46$ oe | 1 | may convert to metres per min etc; condone e.g. ... = 46 seconds; allow $\times 60$ to be implied by units stated |
| | (b) | 4.33[3...] or $4\frac{1}{3}$ isw | 1 | C opportunity |
| | (c) | 13.0[3...] or $13\frac{1}{30}$ | 1 | C opportunity |
| 3 | (a) (i) | $[T =] \frac{20}{v+2} + \frac{20}{v-2}$ oe isw | 1 | B1 for either correct numerator or denominator/left hand side or right hand side; must be from correct two partial fractions B1 correct shape with 2 branches B1 asymptote at $v = 2$ only soi |
| | (ii) | $[T =] \frac{20(v-2) + 20(v+2)}{(v+2)(v-2)}$ oe isw or $T(v-2)(v+2) = 20(v-2) + 20(v+2)$ oe isw | 2 | |
| | (iii) |  | 2 | |
| | (iv) | $[k =] 2$ with valid reason in context | 1 | |
| | (b) | 2.25 oe | 1 | not for e.g. T would be negative |
| | (c) | 13.6[2...] to 13.63 isw | 1 | isw halving after correct answer seen |

| | | | |
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| | | | | |
|--|----------------|--|------------|---|
| 4 | (a) (i) | $[T =] \frac{40v}{v^2 - 9}$ | 1 | or $[T =] \frac{40v}{v^2 - 3^2}$ isw |
| | (ii) | 13.9[7...] to 14.0 | 1FT | FT from <i>their</i> 9; FT correct to at least 3 sf |
| | (b) | 5 | 1 | C opportunity |
| 5 | (a) | Valid explanation | 1 | e.g. total distance travelled is now 80 [km] or it now travels 40 [km] each way oe |
| | (b) | Stretch, [scale factor =] 2, v -axis invariant | 2 | B1 for stretch with either factor 2 or v -axis invariant |
| Communication seen in two of 1(a) , 1(b) , 2(b) , 2(c) , 3(c) , 4(b) | | | 1 | |