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# MARK SCHEME NOTES

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

## Types of mark

M       Method marks, awarded for a valid method applied to the problem.

A       Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. For accuracy marks to be given, the associated Method mark must be earned or implied.

B       Mark for a correct result or statement independent of Method marks.

When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. The notation '**dep**' is used to indicate that a particular M or B mark is dependent on an earlier mark in the scheme.

## Abbreviations

| | |
|---|---|
| awrt | answers which round to |
| cao | correct answer only |
| dep | dependent |
| FT | follow through after error |
| isw | ignore subsequent working |
| nfww | not from wrong working |
| oe | or equivalent |
| rot | rounded or truncated |
| SC | Special Case |
| soi | seen or implied |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| **A** | **INVESTIGATION**          **NUMBER WALLS** | | |
| 1(a) | 9<br>4       5 | **1** | |
| 1(b) | 3 is added two times oe<br>or<br>3 [and not 2] is added to 1 oe | **1** | |
| 2(a) | 20<br>   8       12<br>3       5       7 | **1** | |
| 2(b) | A correct *Number wall* with total<br> > *their* 20 | **1** | |
| 2(c) | ▢<br>14     17<br>▢    ▢     7<br>−3   ▢    3     ▢ | **1** | |
| 3(a) | $a + 3b + 3c + d$<br>$a + 2b + c$      $b + 2c + d$<br>$b + c$    $c + d$ | **1** | |
| 3(b) | *their* $(a + 3b + 3c + d) = 34$ oe<br>and<br>4.25 oe or is not an integer | **1** | **C** opportunity |
| 3(c) | 3   5   1   2   6<br>and<br>4   4   2   1   7 | **2** | **B1** for each<br>Numbers may be in reverse order<br>**C** opportunity |
| 4(a) | Row 3 gives the coefficients of *a*, *b*, *c* and *d* | **1** | |
| 4(b) | $[1]a + 4b + 6c + 4d + [1]e$ oe | **1** | |
| 4(c) | $[1 \times]3 + 4 \times 5 + 6[\times 1] + 4\times2 + [1 \times]6 = [43]$<br>or<br>$[1 \times]4 + 4 \times 4 + 6 \times 2 + 4[\times 1] + [1 \times]7 = [43]$ | **1** | Pairs of multiplications may be in any order |
| 5(a) | $4a$<br>$8a$<br><br>$2^{(h-1)}a$ oe | **1** | |
| 5(b) | 3 | **1** | **C** opportunity |
| 5(c) | 23 | **2** | **M1** for *their* $2^{(h-1)}a = 20\,971\,520$ soi<br>or **B1** for 22<br>**C** opportunity |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 6 | 3 and 5 only | **3** | Ignore answer of 1 <br> **B1** for 3 or 5 only <br> **B1** for $x$, $x + 1$, $x + 2$, [...] Allow other letters for $x$ <br><br> **C** opportunity |
| Communication: seen in three of the following questions | | **1** | |
| 3(b) | *their* $8a = 34$ or $34 \div 8$ <br> or a correct trial for $a = 4.25$ | | |
| 3(c) | Completing all empty bricks with 23, 20, 11, 8, 3, 8 <br> or working with equations | | |
| 5(b) | $2^{6-1}a = 96$ or better or *their* expression, with $h = 6$, $= 96$ <br> or $32a = 96$ or $96 \div 32$ <br> or wall, height 6, 96 at top, 3 in bottom cells | | |
| 5(c) | $(h{-}1)\log 2 = \log(20\,971\,520 \div 5)$ oe <br> or $h - 1 = \log_2 4194304$ oe <br> or <br> T & I using $h$ with more than one trial | | |
| 6 | Construction of wall with consecutive numbers in bottom row with total 70 to 90 or use $x$, $x + 1$, $[x + 2, \ldots]$ to set up one correct equation $= 80$ | | |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| **B** | **MODELLING      RANGES** | | |
| 1(a) | Correct curve | **3** | Polygon scores 0<br>**B2** for 9 or 10 points correctly plotted<br>or **B1** for 7 or 8 points correctly plotted |
| 1(b) | 25 to 27<br>and<br>63 to 65 | **1** | |
| 1(c) | 45 | **1** | |
| 1(d) | $[r =]$ 10.2 $[\sin 2x]$ | **2** | **B2** for 10.15 to 10.3<br>or **B1** for 10 only seen<br>or **M1** for correct substitution of $x$ and $r$<br>($x$ and $r \neq 0$) into model<br><br>**C** opportunity |
| 1(e) | –3.52… to –3.42…<br><br>The shot lands behind him oe | **2** | **B1** for each<br><br>**B1FT** if value negative<br>Accept backwards for behind |
| 2(a) | It would land on him oe or<br>it would have range 0 oe | **1** | Ignore extra comments that are not<br>contradictory |
| 2(b) | Correct curve | **2** | **B1** for 6, 7 or 8 points correctly plotted<br>Ignore curve for $0 \leqslant x < 10$ and<br>$80 < x \leqslant 90$ |
| 2(c) | The ranges are close oe | **1** | |
| 3(a) | n shaped curve | **1** | From (0, 0) to above 80<br><br>**C** opportunity |
| 3(b) | n shaped curve<br>and<br>Correct interpretation of two sketches | **2** | If sketch in part **(a)** correct then curve<br>should be below sketch<br>**B1** for curve from $x = 10$ to $x = 80$<br>always above $x$-axis<br><br>**B1FT** e.g. (for correct sketches), not<br>good for angles from approx. 30 to 60<br>oe or good at low and high angles oe or<br>the graphs give similar results at the<br>beginning and the end [but not the<br>middle] or the model always<br>overestimates the range oe<br>e.g. (for incorrect sketches), similar<br>interpretation as above but related to<br>their two curves |

| Question | Answer | Marks | Partial Marks |
|---|---|---|---|
| 4(a) | Correct sketch | 1 | Ignore to the left of approx. (1, 0.1) <br> **C** opportunity |
| 4(b) | [0].25 | 1 | Accept [0].249… to [0].250… <br> **C** opportunity |
| 4(c) | Unsuitable for velocities beyond approx 20 because range begins to reduce oe | 1 | **FT** $0 \leqslant k \leqslant 0.3$ |
| Communication: seen in two of the following questions | | 1 | |
| 1(d) | Showing rearrangement e.g. $a = \dfrac{3.5}{\sin 20}$ <br> or indicating $a$ = maximum on the graph | | |
| 3(a) | Appropriate scale on $r$ axis to allow maximum to be shown | | |
| 4(a) | Appropriate scale on $R$ axis to allow 43.26 to be shown | | |
| 4(b) | Substitution of 15 in three places and 19.85 (i.e. $\dfrac{15^2}{9.81} - \dfrac{15^2 \times 2^{15k}}{981} = 19.85$ ) | | |