

# Mark Scheme (Results)

June 2016

Pearson Edexcel International GCSE  
Mathematics A (4MA0)  
Paper 4H

Pearson Edexcel Level 1/Level 2 Certificate  
Mathematics A (KMA0)  
Paper 4H

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## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- **Types of mark**
  - M marks: method marks
  - A marks: accuracy marks
  - B marks: unconditional accuracy marks (independent of M marks)
- **Abbreviations**
  - cao – correct answer only
  - ft – follow through
  - isw – ignore subsequent working
  - SC - special case
  - oe – or equivalent (and appropriate)
  - dep – dependent
  - indep – independent
  - eeo – each error or omission

- **No working**

If no working is shown then correct answers normally score full marks

If no working is shown then incorrect (even though nearly correct) answers score no marks.

- **With working**

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

If there is no answer on the answer line then check the working for an obvious answer.

- **Ignoring subsequent work**

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **Parts of questions**

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

| <b>International GCSE Maths June 2016 – Paper 4H Mark scheme</b>  |                |               |             |  |
|---|----------------|---------------|-------------|--|
| <b>Apart from Questions 2, 15(c), 19, 20 and 22(b) (where the mark scheme states otherwise), the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.</b> |                |               |             |  |
| <b>Q</b>  | <b>Working</b> | <b>Answer</b> | <b>Mark</b> | <b>Notes</b>   |
| <b>1</b>  |                | $3n + 4$      | 2           | M1 For $an + 4$ where $a$ is an integer and $a \neq 0$ or for $3n + b$ where $b$ is an integer<br>A1 Fully correct expression<br>ScB1 for $n = 3n + 4$<br>ScB1 for $3t + 4$ , etc. |
|   |                |               |             | <b>Total 2 marks</b>   |

|                 |   |               |          |  |
|-----------------|---|---------------|----------|--|
| <p><b>2</b></p> | <p><math>(8y - 18 =) 3y + 9</math><br/> <math>8y - 3y = 9 + 18</math> or <math>5y = 27</math> oe</p>  | <p>5.4 oe</p> | <p>3</p> | <p>M1 For correct expansion of bracket<br/> M1 For collecting terms in <math>y</math> on one side and constant terms on the other (as part of a correct equation)<br/><br/> A1 Eg <math>\frac{27}{5}</math> or <math>5\frac{2}{5}</math><br/> Dep on at least M1<br/> ScB1 for<br/> <math>8y - 18 = 3y + 3</math> <b>AND</b> <math>8y - 3y = 3 + 18</math> or<br/> <math>8y - 18 = 3y + 3</math> <b>AND</b> <math>5y = 21</math></p> |
|                 | <p><b>Alternative Method</b><br/> <math>\frac{8y - 18}{3} = y + 3</math> or <math>\frac{8y}{3} - \frac{18}{3} = y + 3</math> oe<br/><br/> <math>\frac{8y}{3} - y = 3 + \frac{18}{3}</math> or <math>5y = 27</math> oe</p> | <p>5.4 oe</p> | <p>3</p> | <p>M1 For dividing both sides of the equation by 3 as part of a correct equation<br/> M1 For collecting terms in <math>y</math> on one side and constant terms on the other (as part of a correct equation)<br/><br/> A1 Eg <math>\frac{27}{5}</math> or <math>5\frac{2}{5}</math><br/> Dep on at least M1</p>   |
|                 |   |               |          | <p><b>Total 3 marks</b></p>  |

|       |   |     |   |  |
|-------|---|-----|---|--|
| 3 (a) | $0.8 \times 485$ or $485 - 0.2 \times 485$ or $485 - "97"$ oe                           | 388 | 3 | <p>M2 For a complete method<br/>If not M2 then:<br/>M1 for <math>0.2 \times 485</math> or 97 oe</p> <p>A1 cao</p>  |
| (b)   | $\frac{79}{0.2}$ or $\frac{79}{20} \times 100$ or $3.95 \times 100$ or $79 \times 5$ oe | 395 | 3 | <p>M2 For a complete method<br/>If not M2 then:</p> <p>M1 For 20% = 79 or<br/><math>0.2x = 79</math> or<br/><math>\frac{79}{20}</math> or 3.95 or<br/><math>\frac{x}{79} = \frac{100}{20}</math> oe</p> <p>A1 cao<br/>ScB2 for 316</p> |
|       |   |     |   | <b>Total 6 marks</b>   |

|                      |     |  |    |   |  |
|----------------------|-----|--|----|---|--|
| <b>4</b>             | (a) |  | 63 | 1 | B1   |
|                      | (b) |  | 50 | 1 | B1   |
|                      | (c) | Eg $(6 - 2) \times 180$ or $4 \times 180$ or 720 oe<br><br>Eg $3x + x + 164 + 139 + 97 + 156 = 720$ or $4x + 556 = 720$ oe or<br><br>$\frac{"720" - (164 + 139 + 97 + 156)}{4}$ or $\frac{"720" - 556}{4}$ or $\frac{164}{4}$ oe | 41 | 3 | M1 For complete method to find the total of interior angles or 720<br>M1 Dep<br>For a correct equation using their 720 or<br>For a complete numerical method<br><br>A1 |
|                      |     | <b>Alternative Method</b><br>Eg $180 - 156 + 180 - 139 + 180 - 164 + 180 - 97 + 180 - x + 180 - 3x = 360$ or<br>$24 + 41 + 16 + 83 + 180 - x + 180 - 3x = 360$ or<br>$1080 - 556 - 4x = 360$                                     | 41 | 3 | M2 For an equation coming from the correct method relating to the sum of exterior angles.<br><br>A1  |
| <b>Total 5 marks</b> |     |  |    |   |  |

|                      |     |                     |            |   |  |
|----------------------|-----|---------------------|------------|---|--|
| <b>5</b>             | (a) |                     | $m^7$      | 1 | B1   |
|                      | (b) |                     | $c^8$      | 1 | B1   |
|                      | (c) |                     | $a^{15}$   | 1 | B1   |
|                      | (d) | $8x + 12 + 2x + 10$ | $10x + 22$ | 2 | M1 Any three terms correct out of four.<br>A1 Allow $2(5x + 11)$<br>Do not ISW |
| <b>Total 5 marks</b> |     |                     |            |   |  |



|                      |   |     |   |   |
|----------------------|---|-----|---|---|
| 6                    | Eg $(3 \times 4) + (9 \times 6) + (15 \times 8) + (21 \times 9) + (27 \times 3)$ or<br>$12 + 54 + 120 + 189 + 81$ | 456 | 3 | <p>M1 <math>f \times x</math> for 4 products with <math>x</math> used consistently within interval (including end points) &amp; intention to add.</p> <p>M1 (dep) for use of all correct half-way values</p> <p>A1 Do not ISW<br/>ScB2 for 15.2</p> |
| <b>Total 3 marks</b> |   |     |   |   |

|                      |  |                              |   |  |
|----------------------|--|------------------------------|---|--|
| 7 (a)                |  | 7, (2), -1, (-2), (-1), 2, 7 | 2 | B2 B1 for at least 2 correct   |
| (b)                  | $(-1, 7), (0, 2), (1, -1), (2, -2), (3, -1), (4, 2), (5, 7)$ | Correct curve                | 2 | <p>B2 For the correct smooth curve through all 7 points (<math>\pm \frac{1}{2}</math> sq)</p> <p>B1 ft for at least 6 points from their table plotted correctly (<math>\pm \frac{1}{2}</math> sq) provided at least B1 scored in (a)</p> |
| <b>Total 4 marks</b> |  |                              |   |  |

|       |  |   |   |  |
|-------|--|---|---|--|
| 8 (a) |  | Enlargement<br>Scale factor 2<br>Centre (1, 0)    | 3 | B1 For Enlargement<br>B1 For (Scale factor =) 2<br>B1 For (Centre) (1, 0)<br>NB if more than one transformation mentioned then no marks. |
| (b)   |  | Correct triangle at<br>(10, -2), (7, -2), (7, -1) | 1 | B1 Correct triangle in correct place   |
| (c)   |  | Correct triangle at<br>(1, 0), (2, 0), (2, 3)     | 2 | M1 Triangle congruent to <b>D</b> and with correct orientation<br>A1<br>ScB1 for triangle with vertices at (4, 2), (5, 2) and (4, -1)    |
|       |  |   |   | <b>Total 6 marks</b>   |

|                 |   |            |          |  |
|-----------------|---|------------|----------|--|
| <p><b>9</b></p> | $13.5^2 + 60^2$ or $182.25 + 3600$ or $3782.25$<br>$\sqrt{3782.25}$ or awrt 61.5<br>$13.5 + 60 + \sqrt{3782.25}$ or $13.5 + 60 + 61.5$  | <p>135</p> | <p>4</p> | <p>M1 For squaring and adding<br/> M1 (Dep) for square root<br/> M1 Dep<br/> A1 cao<br/> NB: A0 if 61.5 is rounded from an inexact value (eg 61.505...)</p>  |
|                 | <p><b>Alternative method – using Trigonometry</b><br/> Eg <math>A = 77.3(196\dots)</math> and <math>\sin 77.3^\circ = \frac{60}{AC}</math><br/> <math>(AC =) \frac{60}{\sin 77.3^\circ}</math> or awrt 61.5<br/> <math>13.5 + 60 + \frac{60}{\sin 77.3^\circ}</math> or <math>13.5 + 60 + 61.5</math></p> | <p>135</p> | <p>4</p> | <p>M1 For finding a correct angle <b>AND</b> a correct trig statement<br/> M1 (Dep) For an expression for AC<br/> <br/> M1 Dep<br/> A1 cao<br/> NB: A0 if 61.5 is rounded from an inexact value (eg 61.505...)</p> |
|                 |   |            |          | <p><b>Total 4 marks</b></p>  |

|                      |   |  |  |  |  |
|----------------------|---|--|--|--|--|
| <b>10</b>            | $20 = 2, 2, 5$<br>$140 = 2, 2, 5, 7$<br>$420 = 2, 2, 3, 5, 7$ |  |  |  | M1 For identifying the prime factors for 2 of the 3 numbers 20,140,420 (can be implied by a factor tree, repeated division or Venn diagram) or<br><br>For a complete Venn diagram for $x$ and 140 with 20 in the intersection or<br>$x = 20 \times 3$ or<br>$20 \times 7 \times y = 420$ or $\frac{420}{20 \times 7}$ or<br>At least the 1 <sup>st</sup> 3 multiples of 20 or<br>$140x = 420 \times 20$ oe |
|                      |   |  |  |  | 60   |
| <b>Total 2 marks</b> |   |  |  |  |  |

|                      |     |   |                    |   |   |
|----------------------|-----|---|--------------------|---|---|
| <b>11</b>            | (a) |   | 97 000 000         | 1 | B1  |
|                      | (b) |   | $1.4 \times 10^8$  | 1 | B1 Accept, for example, $1.40 \times 10^8$  |
|                      | (c) | $1.4 \times 10^9 - 3.2 \times 10^8$ or<br>1 400 000 000 – 320 000 000 or 1 080 000 000            | $1.08 \times 10^9$ | 2 | M1 For $1.4 \times 10^9 - 3.2 \times 10^8$ or digits 108<br>A1 Accept $1.1 \times 10^9$ |
|                      | (d) | $(1.3 \times 10^9) \div (1.2 \times 10^8)$ or<br>1 300 000 000 $\div$ 120 000 000 or 10.8(333...) | 11                 | 2 | M1 Condone missing brackets<br>A1 Accept $1.1 \times 10^1$                              |
| <b>Total 6 marks</b> |     |   |                    |   |   |

|        |  |     |   |   |
|--------|--|-----|---|---|
| 12 (a) | Eg $\frac{13.5}{6}$ or $\frac{9}{4}$ or 2.25 or $\frac{6}{13.5}$ or $\frac{4}{9}$ or 0.444(444...) or<br>$(AB =) 11.7 \div \frac{9}{4}$ or $(AB =) 11.7 \times \frac{4}{9}$ or $(AB =) 6 \times \frac{11.7}{13.5}$ oe<br>$\frac{AB}{11.7} = \frac{4}{9}$ or $\frac{AB}{6} = \frac{11.7}{13.5}$ oe  | 5.2 | 2 | M1 For correct scale factor or correct equation involving $AB$ or correct expression for $AB$<br>Accept 0.444(444...) rounded to at least 3SF<br><br>A1 |
| (b)    | Eg $(AD =) \frac{9}{4} \times 4$ or $(AD =) \frac{4}{\text{"5.2"}} \times 11.7$ or<br>$(ED) = [\frac{9}{4} \times 4] - 4$ or $(ED) = \frac{4}{\text{"5.2"}} \times (11.7 - \text{"5.2"})$ or<br>$\frac{AD}{4} = \frac{9}{4}$ or $\frac{AD}{11.7} = \frac{4}{\text{"5.2"}}$ or<br>$ED + 4 = \frac{9}{4} \times 4$ or $\frac{ED}{11.7 - \text{"5.2"}} = \frac{4}{\text{"5.2"}}$ or<br>$AD = 9$ | 5   | 2 | M1 For a correct expression for $ED$ or $AD$ or<br><br>For a correct equation involving $ED$ or $AD$<br><br>A1  |
|        |  |     |   | <b>Total 4 marks</b>  |

|                      |  |               |          |  |
|----------------------|--|---------------|----------|--|
| <p><b>13</b> (a)</p> | $M = k \times p^3$<br><br>$128 = k \times 8^3$ | $M = 0.25p^3$ | <p>3</p> | <p>M1 For <math>M = kp^3</math> or <math>p^3 = \frac{M}{k}</math> oe<br/>Do not allow <math>M = p^3</math> oe</p> <p>M1 For a correct substitution into a correct equation.<br/>Implies first M1.<br/>Award M2 if <math>k = 0.25</math> stated unambiguously in (a) or (b).</p> <p>A1 Award 3 marks if answer is <math>M = kp^3</math> but <math>k</math> is evaluated in part (b)</p> |
| <p>(b)</p>           |  | <p>31.25</p>  | <p>1</p> | <p>B1ft for their value of <math>k</math> only for equations of the form <math>M = kp^3</math> oe and if <math>k \neq 1</math></p>   |
|                      |  |               |          | <p><b>Total 4 marks</b></p>  |

|                  |                                  |                    |          |   |
|------------------|----------------------------------|--------------------|----------|---|
| <p><b>14</b></p> | $\frac{(x-5)(x+5)}{(2x+1)(x-5)}$ | $\frac{x+5}{2x+1}$ | <p>3</p> | <p>M1 For <math>(x+5)(x-5)</math><br/>M1(indep) For <math>(2x+1)(x-5)</math> or <math>2(x+0.5)(x-5)</math> or <math>2(2x+1)(0.5x-2.5)</math></p> <p>A1 cao<br/>No ISW</p> |
|                  |                                  |                    |          | <p><b>Total 3 marks</b></p>   |

|                             |  |                   |          |  |
|-----------------------------|--|-------------------|----------|--|
| <p><b>15</b> (a)</p>        | <p>Eg <math>\frac{3(x+3)}{3 \times 5} + \frac{5(x-2)}{3 \times 5}</math> or <math>\frac{3(x+3)+5(x-2)}{3 \times 5}</math> oe</p> <p>Eg <math>\frac{3x+9+5x-10}{3 \times 5}</math> or <math>\frac{3x+9}{3 \times 5} + \frac{5x-10}{3 \times 5}</math> oe</p>  | $\frac{8x-1}{15}$ | <p>3</p> | <p>M1 For a common denominator as part of 1 or 2 fractions (must be a correct expression)</p> <p>M1 For a correct expansion of brackets as part of 1 or 2 fractions (must be a correct expression)</p> <p>A1 cao<br/>Do not ISW</p>  |
| <p>(b)</p>                  |  | $2a^3e^2$         | <p>2</p> | <p>M1 For two of 2, <math>a^3</math>, <math>e^2</math> in a product with three terms</p> <p>A1 Do not ISW</p>  |
| <p>(c)</p>                  | <p>Eg <math>\frac{16+9}{24}y (= 5)</math> or <math>\frac{16}{24}y + \frac{9}{24}y (= 5)</math> or <math>\frac{25}{24}y (= 5)</math> or <math>y(\frac{2}{3} + \frac{3}{8}) (= 5)</math> or <math>y(0.6 + 0.375) (= 5)</math> or <math>1.041\dot{6}y (= 5)</math> or <math>24 \times \frac{2}{3}y + 24 \times \frac{3}{8}y = 24 \times 5</math></p> <p>Eg <math>25y = 5 \times 24</math> or <math>25y = 120</math> or <math>y = 5 \div 1\frac{1}{24}</math> or <math>y = \frac{5}{1.041\dot{6}}</math> or <math>y = \frac{5}{\frac{2}{3} + \frac{3}{8}}</math></p> | <p>4.8</p>        | <p>3</p> | <p>M1 For simplifying the LHS or multiplying both sides by 24</p> <p>M1 Dep on 1<sup>st</sup> M1 gained<br/>For the removal of the denominator(s) as part of a correct equation or for correctly isolating y</p> <p>A1oe Dep on 1<sup>st</sup> M1 gained.<br/>ScM2 for <math>16y + 9y = 120</math><br/>M0A0 for trial and improvement<br/>NB: Decimals must be exact to gain any credit:<br/>Eg Award M0 for <math>y(0.667 + 0.375)</math></p> |
| <p><b>Total 8 marks</b></p> |  |                   |          |  |

|                      |  |   |          |  |
|----------------------|--|---|----------|--|
| <p><b>16</b> (a)</p> |  | $\frac{6}{20}, \frac{4}{20}$ $\frac{9}{19} \frac{6}{19} \frac{4}{19} \frac{10}{19} \frac{5}{19} \frac{4}{19} \frac{10}{19} \frac{6}{19} \frac{3}{19}$ | <p>2</p> | <p>B1 For <math>\frac{6}{20}, \frac{4}{20}</math> correct on LH branches</p> <p>B1 For all other branches correct</p>  |
| <p>(b)</p>           | $\frac{4}{20} \times \frac{3}{19}$   | $\frac{12}{380} \text{ oe}$   | <p>2</p> | <p>M1ft From their Tree diagram</p> <p>A1ft From their Tree diagram<br/>oe. Eg <math>\frac{3}{95}</math><br/>Accept 0.031(57...) rounded or truncated to at least 3 decimal places.</p>  |
| <p>(c)</p>           | $\frac{6}{20} \times \frac{5}{19} \text{ or } 0.078(947 \dots) \text{ or } \frac{6}{20} \times \frac{4}{19} \text{ or } 0.063(157 \dots) \text{ or } \frac{4}{20} \times \frac{3}{19} \text{ or } 0.031(578\dots)$ $\frac{6}{20} \times \frac{5}{19} + \frac{6}{20} \times \frac{4}{19} + \frac{4}{20} \times \frac{6}{19} + \frac{4}{20} \times \frac{3}{19}$ | $\frac{90}{380} \text{ oe}$   | <p>3</p> | <p>M1ft For one correct product from their Tree diagram</p> <p>M1ft For sum of all correct products from their Tree diagram</p> <p>A1 For <math>\frac{9}{38}</math> oe or 0.236(842...)<br/>NB: Accept use of decimals if rounded or truncated to at least 3 decimal places.</p> |



|  |  |                     |   |   |
|--|--|---------------------|---|---|
|  | <b>With Replacement</b>  |                     |   | M1  |
|  | $\frac{6}{20} \times \frac{6}{20}$ or 0.09 or $\frac{6}{20} \times \frac{4}{20}$ or 0.06 or $\frac{4}{20} \times \frac{4}{20}$ or 0.04   |                     |   |   |
|  | $\frac{6}{20} \times \frac{6}{20} + \frac{6}{20} \times \frac{4}{20} + \frac{4}{20} \times \frac{6}{20} + \frac{4}{20} \times \frac{4}{20}$ or $\frac{100}{400}$ or 0.25 oe  |                     |   | M1  |
|  | <b>Alternative method</b>  |                     |   |   |
|  | Eg 1 – $\left(\frac{10}{20} \times \frac{9}{19} + \frac{10}{20} \times \frac{6}{19} + \frac{10}{20} \times \frac{4}{19} + \frac{6}{20} \times \frac{10}{19} + \frac{4}{20} \times \frac{10}{19}\right)$<br>or $\frac{10}{20} \times \frac{9}{19}$ oe |                     |   | M2 For a complete method.<br>Ft from their Tree diagram   |
|  |  | $\frac{90}{380}$ oe |   | A1 For $\frac{9}{38}$ oe or 0.236(842...)<br>NB: Accept use of decimals if rounded or truncated to at least 3 decimal places. |
|  |  |                     | 3 |   |
|  |  |                     |   | <b>Total 7 marks</b>  |

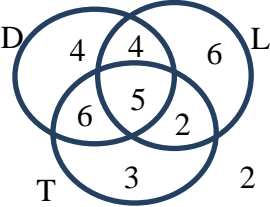
|    |     |  |                      |   |   |
|----|-----|--|----------------------|---|---|
| 17 | (a) |  | 3                    | 1 | B1  |
|    | (b) |  |                      |   | M1 For $2((-4)^2 - 10) - 5$ oe or<br>$(-4)^2 - 10$ or 6   |
|    |     |  | 7                    | 2 | A1  |
|    | (c) | $2x = y + 5$ or $2y = x + 5$ or $\frac{1}{2}(y + 5)$   | $\frac{1}{2}(x + 5)$ |   | M1<br>A1 oe   |
|    | (d) | $(2x - 5)^2 - 10 (= -1)$ or<br>$4x^2 - 10x - 10x + 25 - 10 (= -1)$<br><br>$4x^2 - 20x + 16 (= 0)$ or<br>$2x^2 - 10x + 8 (= 0)$ or<br>$x^2 - 5x + 4 (= 0)$ or<br>$(2x - 5)^2 = 9$<br><br>$(4x - 4)(x - 4) (= 0)$ or<br>$(2x - 2)(x - 4) (= 0)$ or<br>$(x - 4)(x - 1) (= 0)$ or<br>$2x - 5 = \pm 3$<br>$\frac{-5 \pm \sqrt{(-5)^2 - 4(1)(4)}}{2(1)}$ (may be partially evaluated;<br>condone lack of brackets around negative numbers) |                      |   | M1 For a correct expression for gf(x)<br><br>M1 For a correct 3 part quadratic or<br>For $(2x - 5)^2 = 9$<br><br>M1 For factorising a correct equation<br>or for use of quadratic formula<br>with a correct equation or<br>For $2x - 5 = \pm 3$ |
|    |     |  | $x = 1, x = 4$       | 4 | A1  |

|  |                           |                |   |    |  |
|--|---------------------------|----------------|---|----|--|
|  | <b>Alternative method</b> |                |   |    |  |
|  | Eg $a^2 - 10 = -1$ oe     |                |   | M1 | For a correct equation relating to $g(a) = -1$ |
|  | $a^2 = 9$                 |                |   | M1 | For $a^2 = 9$                                  |
|  | $2x - 5 = \pm 3$          |                |   | M1 | For $2x - 5 = \pm 3$                           |
|  |                           | $x = 1, x = 4$ | 4 | A1 |  |
|  |                           |                |   |    | <b>Total 9 marks</b>                           |

|           |     |             |                   |   |    |    |   |
|-----------|-----|-------------|-------------------|---|----|----|---|
| <b>18</b> | (a) | $2 + 4 + 9$ |                   |   |    | M1 | For $\frac{9}{15}$ or 0.6 or $0.2 \times 10 + 0.8 \times 5$ or $2 + 4$ or 6<br>For at least 1 correct frequency density on scale without incorrect values (1cm = 0.1 fd) or<br>For 1 cm square = 0.5 person oe stated |
|           |     |             | 15                | 2 | A1 |    |   |
|           | (b) |             | Correct bar drawn | 2 | A1 | M1 | $\frac{12}{25}$ or 0.48 or $\frac{24}{5}$ or 4.8 or<br>a bar drawn with the correct height  |
|           |     |             |                   |   | A1 |    | 4.8 cm high   |
|           |     |             |                   |   |    |    | <b>Total 4 marks</b>  |

|                      |  |                                      |          |   |
|----------------------|--|--------------------------------------|----------|---|
| <p><b>19</b></p>     | <p>Eg <math>7 \times 5 - 7 \times 2 \times \sqrt{2} + 5 \times 2 \times \sqrt{50} - 2 \times 2 \times \sqrt{50} \times \sqrt{2}</math> or<br/> <math>35 - 14\sqrt{2} + 10\sqrt{50} - 4\sqrt{100}</math> or<br/> <math>35 - 14\sqrt{2} + 10\sqrt{50} - 40</math> or <math>35 - 14\sqrt{2} + 50\sqrt{2} - 20 \times 2</math></p> | <p><math>-5 + 12\sqrt{18}</math></p> | <p>3</p> | <p>M1 For brackets expanded correctly (need not be simplified)</p> <p>M1 <math>a = -5</math> or <math>b = 12</math><br/>Dep on scoring the first M1</p> <p>A1 Dep on M1</p> |
| <b>Total 3 marks</b> |  |                                      |          |   |

|                      |   |                         |          |   |
|----------------------|---|-------------------------|----------|---|
| <p><b>20</b></p>     | <p><math>\pi \times 20 \times 10</math> or <math>200\pi</math> or 628.(318...) oe</p> <p><math>\sqrt{10^2 + 10^2}</math> or <math>10\sqrt{2}</math> or 14.1(421...) oe</p> <p><math>\pi \times 10 \times 10\sqrt{2}</math> or <math>100\pi\sqrt{2}</math> or 444.(288...) or<br/> <math>141.(421...) \pi</math> oe</p> <p>Eg <math>100\pi + 200\pi + \pi \times 10 \times 10\sqrt{2}</math></p> | <p>Correct solution</p> | <p>4</p> | <p>M1 For the curved surface area of the cylinder</p> <p>M1 For the slant height of the cone</p> <p>M1dep For the curved surface area of the cone</p> <p>A1 cso<br/>For a correct exact expression for the total surface area that will lead to <math>(300 + 100\sqrt{2})\pi</math><br/>Dep on M3</p> |
| <b>Total 4 marks</b> |   |                         |          |   |

|                      |  |   |          |  |
|----------------------|--|---|----------|--|
| <p><b>21</b> (a)</p> |  |  | <p>3</p> | <p>M1 For 5 in the middle and 1 from <math>4(D \cap L \cap T')</math> or <math>2(L \cap T \cap D')</math> or <math>6(D \cap T \cap L')</math><br/> M1 For any 4 correct entries<br/> A1 For all correct including 2 outside the circles inside the rectangle</p> |
| <p>(b)</p>           |  | <p><math>\frac{5}{9}</math></p>   | <p>1</p> | <p>B1 ft from incorrect diagram</p>  |
|                      |  |   |          | <p><b>Total 4 marks</b></p>  |

|    |         |   |   |   |
|----|---------|---|---|---|
| 22 | (a) (i) | $2\mathbf{q} - 4\mathbf{p}$ oe          | 1 | B1 Eg $2(\mathbf{q} - 2\mathbf{p})$   |
|    | (ii)    | $\mathbf{q} - \frac{1}{2}\mathbf{p}$ oe | 1 | B1 Eg $0.5(-\mathbf{p} + 2\mathbf{q})$  |
|    | (b)     | Shown                                   | 2 | <p>M1 For <math>(\overrightarrow{QR}) = \frac{1}{2}\mathbf{p}</math> or<br/>         For <math>(\overrightarrow{QR}) = -\mathbf{q} + \mathbf{p}</math> + “their a(ii)”<br/>         or <math>(\overrightarrow{QR}) = \mathbf{q}</math> - “their a(ii)”</p> <p>A1 For <math>(\overrightarrow{QR}) = \frac{1}{2}\mathbf{p}</math> <b>and</b> a valid conclusion such as:<br/> <math>\overrightarrow{QR} = 0.5\overrightarrow{OP}</math> or <math>\overrightarrow{OP} = 2\overrightarrow{QR}</math> or<br/> <math>\mathbf{p}</math> is a multiple of <math>\frac{1}{2}\mathbf{p}</math> or<br/>         They have the same direction but <math>OP</math> is twice as long or<br/>         They have the same vector component.</p> |
|    |         |   |   | <b>Total 4 marks</b>  |

