



# Mark Scheme (Results)

Summer 2015

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

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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
  - awrt – answer which rounds to

- **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.

| Apart from Questions and 15d and 19b, where the mark scheme states otherwise, the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method. |                                                                                                                                                |                          |      |                                                                                                                                                                                                                     |                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| Question                                                                                                                                                                                     | Working                                                                                                                                        | Answer                   | Mark | Notes                                                                                                                                                                                                               |                                 |
| <b>1</b> (i)                                                                                                                                                                                 |                                                                                                                                                | {i, a}                   | 2    | B1                                                                                                                                                                                                                  | Brackets and commas not needed. |
| (ii)                                                                                                                                                                                         |                                                                                                                                                | {c, h, i, n, a, t, l, y} |      | B1                                                                                                                                                                                                                  | Do not allow repetitions.       |
|                                                                                                                                                                                              |                                                                                                                                                |                          |      | <b>Total 2 marks</b>                                                                                                                                                                                                |                                 |
| <b>2</b>                                                                                                                                                                                     | $\frac{638}{2.75}$ or $\frac{638}{2\frac{3}{4}}$ or $\frac{638}{11\frac{1}{4}}$ or $\frac{638}{11} \times 4$ or $\frac{638}{165} \times 60$ oe |                          |      | M2<br>M1 for $638 \div 2.45$ or<br>$260(.408\dots)$ rounded or truncated to<br>3 or more significant figures or<br>$638 \div 165$ or<br>$3.86(6666\dots)$ rounded or truncated to<br>3 or more significant figures. |                                 |
|                                                                                                                                                                                              |                                                                                                                                                | 232                      | 3    | A1                                                                                                                                                                                                                  | cao                             |
|                                                                                                                                                                                              |                                                                                                                                                |                          |      | <b>Total 3 marks</b>                                                                                                                                                                                                |                                 |

|   |     |                                                                                                                                                                                                              |       |   |                                                                                                                                                                                          |
|---|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | (a) | Eg $\frac{7\frac{1}{2}}{100} \times 15000$ or $0.075 \times 15000$ oe or 1125 or<br>$0.075 \times 15000 + 15000$ or $15000 \times 1.075$ oe                                                                  | 16125 | 2 | M1 For finding 7.5% of 15000 or<br>for a complete method to increase<br>15000 by 7.5% (eg $1.075 \times 15000$ )<br><br>A1 cao                                                           |
|   | (b) | Eg $\frac{1800}{8} \times 108$ or $\frac{1800}{0.08} \times 1.08$ or $22500 \times 1.08$ or $\frac{1800}{0.08} + 1800$ or<br>$\frac{1800}{8} \times 100 + 1800$ or $225 \times 100 + 1800$ or $22500 + 1800$ | 24300 | 3 | M2 For a complete method<br><br>M1 for 8% = 1800 or $0.08x = 1800$ or<br>$\frac{1800}{8}$ or 225 or<br><br>$\frac{1800}{0.08}$ or 22500 or<br><br>A1 $\frac{x}{1800} = \frac{108}{8}$ oe |
|   |     |                                                                                                                                                                                                              |       |   | <b>Total 5 marks</b>                                                                                                                                                                     |

|   |     |                                                       |                                                      |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---|-----|-------------------------------------------------------|------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 | (a) | $(-2, -4), (-1, -1), (0, 2), (1, 5), (2, 8), (3, 11)$ | correct line drawn from between $x = -2$ and $x = 3$ |   | <p>B3 For a correct line between <math>x = -2</math> and <math>x = 3</math>.</p> <p>B2 If not B3, then B2 for:</p> <ul style="list-style-type: none"> <li>• at least 2 correct points plotted or</li> <li>• for a line passing through at least 2 correct points or</li> <li>• for a line drawn with positive gradient through <math>(0, 2)</math> and clear intention to use a gradient of 3 (eg. a line through <math>(0, 2)</math> and <math>(0.5, 5)</math>)</li> </ul> <p>B1 If not B2 then B1 for:</p> <ul style="list-style-type: none"> <li>• at least 2 correct points stated (may be in a table) or</li> <li>• for a line drawn with a positive gradient through <math>(0, 2)</math> or</li> <li>• for a line with gradient 3.</li> </ul> |
|   | (b) |                                                       |                                                      | 3 | <p>M1 fit for a point marked above their <math>y = 3x + 2</math> if at least B1 scored in (a) or</p> <p>for a point to the right of <math>x = 2</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|  |  |               |   |                                                                                                                                                                                                                                                    |
|--|--|---------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | correct point | 2 | <p>A1 Point marked above <math>y = 3x + 2</math> and to the right of <math>x = 2</math> (not on lines). Label <math>P</math> may be omitted if unambiguous.</p> <p>SCB1 for the correct region identified by either shading in or shading out.</p> |
|  |  |               |   | <b>Total 5 marks</b>                                                                                                                                                                                                                               |

|   |     |                                                                                                                                                                                                            |   |   |                                                                                                                                                                                                                                                                                                                                                                                    |
|---|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5 | (a) | $\frac{4+9+7+1+6+3}{2}$ or $\frac{(4+9+7+1+6+3)+1}{2}$ or $\frac{30}{2}$ or $\frac{31}{2}$ or 15 or $15\frac{1}{2}$                                                                                        | 2 | 2 | <p>M1 Condone 1 omission<br/>Eg <math>\frac{9+7+1+6+3}{2}</math></p> <p>Accept a clear intention to list the numbers in order and find the centre of the list.</p>                                                                                                                                                                                                                 |
|   | (b) | $\frac{4+9+7+1+6+3}{4}$ or $\frac{(4+9+7+1+6+3)+1}{4}$ or $\frac{30}{4}$ oe (=7.5) or $\frac{31}{4}$ oe (= 7.75) or 8 or $3 \times \frac{30}{4}$ oe (= 22.5) or $3 \times \frac{31}{4}$ oe (= 23.25) or 23 | 3 | 3 | <p>M2 For Lower quartile = 1 AND Upper quartile = 4<br/>Accept a correct ordered list of the 30 numbers with both quartiles clearly identified in the correct position.</p> <p>M1 for Lower quartile = 1 or Upper quartile = 4 or</p> <p>Accept a correct ordered list of the 30 numbers with the position of one of the quartiles clearly identified in the correct position.</p> |
|   |     |                                                                                                                                                                                                            |   |   | <b>Total 5 marks</b>                                                                                                                                                                                                                                                                                                                                                               |



|          |     |                                       |         |   |                                                          |
|----------|-----|---------------------------------------|---------|---|----------------------------------------------------------|
| <b>6</b> | (a) | $1 - 0.44 - 0.42 - 0.04$ or $1 - 0.9$ | 0.1 oe  | 2 | M1<br>A1 Accept $\frac{1}{10}$ oe or 10 %                |
|          | (b) |                                       | 0.86 oe | 1 | B1 Accept $\frac{86}{100}$ or $\frac{43}{50}$ oe or 86 % |
|          | (c) | $1200 \times 0.04$                    | 48      | 2 | M1<br>A1 Accept 48 out of 1200<br>Note: M1A0 for 48/1200 |
|          |     |                                       |         |   | <b>Total 5 marks</b>                                     |

  

|           |  |                                                 |     |   |                                 |
|-----------|--|-------------------------------------------------|-----|---|---------------------------------|
| <b>7.</b> |  | $180 + 43$ or $360 - (180 - 43)$ or $360 - 137$ | 223 | 2 | M1 For a complete method.<br>A1 |
|           |  |                                                 |     |   | <b>Total 2 marks</b>            |

|   |     |                                                                                                                                                                                   |          |   |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8 | (a) | Eg $\frac{175}{7} \times 9$                                                                                                                                                       | 225      | 2 | M1 For a complete method<br>A1                                                                                                                                                                                                                                                                                                                                                                                                             |
|   | (b) | $\frac{400}{27+14+9} \times 27$ oe or $\frac{400}{27+14+9}$ or $\frac{400}{50}$ or 8                                                                                              | 216      | 2 | M1<br>A1                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|   | (c) | $(9 : 7 =) 27 : 21$ or $9 : \frac{14}{3}$<br>Or Flaky: (flour $x$ ), fat $\frac{7}{9}x$ and Sweet: (flour $x$ ), fat $\frac{14}{27}x$<br>where $x$ may also be any positive value | 3 : 2 oe | 2 | M1 For $\frac{7}{9}x$ and $\frac{14}{27}x$ where $x$ may also be any positive value<br>Eg $\frac{7}{9}$ and $\frac{14}{27}$<br>Eg $\frac{7}{9} \times 270$ and $\frac{14}{27} \times 270$ ( $x = 270$ ) or<br>For $\frac{14}{27} \times \frac{9}{7}$ oe<br><br>A1 Eg $\frac{7}{9} : \frac{14}{27}$ or 21 : 14 or 189 : 126 or<br>$1 : \frac{2}{3}$ or 1.5 : 1<br>ISW only if answer is incorrectly simplified<br>SCB1 for answer of 2:3 oe |
|   |     |                                                                                                                                                                                   |          |   | <b>Total 6 marks</b>                                                                                                                                                                                                                                                                                                                                                                                                                       |

|    |     |                                                                  |            |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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| 9. | (a) |                                                                  | $10p - 15$ | 1 | B1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Accept $10 \times p - 15$ |
|    | (b) | $9 - 3 < 2x$ or<br>$6 < 2x$ or<br>$-2x < 3 - 9$ or<br>$-2x < -6$ | $x > 3$    | 2 | M1<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><b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|     |                                                                                                                                                                                         |      |   |               |                                                                                |                                                                                      |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|---------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 10. | $\cos 56^\circ = \frac{7.4}{x}$ or $7.4 = x \cos 56$ or<br>$\sin(90 - 56) = \frac{7.4}{x}$ or $7.4 = x \sin(90 - 56)$<br><br>$(x =) \frac{7.4}{\cos 56}$ or $\frac{7.4}{\sin(90 - 56)}$ | 13.2 | 3 | M1            | Correct equation for $x^2$<br>eg $x^2 = 7.4^2 + (7.4 \tan 56^\circ)^2$         | Correct statement of Sine rule<br>eg $\frac{x}{\sin 90} = \frac{7.4}{\sin(90 - 56)}$ |
|     |                                                                                                                                                                                         |      |   | M1            | Correct expression for $x$<br>eg<br>$x = \sqrt{7.4^2 + (7.4 \tan 56^\circ)^2}$ | Correct expression for $x$<br>eg $(x) = \frac{7.4}{\sin(90 - 56)} \times \sin(90)$   |
|     |                                                                                                                                                                                         |      |   | A1            | awrt 13.2                                                                      |                                                                                      |
|     |                                                                                                                                                                                         |      |   | Total 3 marks |                                                                                |                                                                                      |

|                      |                                                                                                                                                                                                                                 |     |   |                                                                                                                                                                                                                                                                                      |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11.                  | $2\pi \times 3.5 \times 8.2 + 2\pi \times 3.5^2$ or $57.4\pi + 24.5\pi$ or $81.9\pi$ or $180(.327..) + 76.9(690...)$ or<br>$2\pi \times 3.5 \times 8.2 + \pi \times 3.5^2$<br>or $180(.327..) + 38.4(845...)$ or $218(.81....)$ |     |   | M2<br>Allow 76.9(690...), 180(.327...), 38.4(845...) and 218(.81...) if rounded or truncated to at least 3 significant figures.<br><br>M1 for $2 \times \pi \times 3.5 \times 8.2$ or $57.4\pi$ or $180(.3274...)$ or $2 \times \pi \times 3.5^2$ or $24.5\pi$ or 77 or 76.9(690...) |
|                      |                                                                                                                                                                                                                                 | 257 | 3 | A1 awrt 257                                                                                                                                                                                                                                                                          |
| <b>Total 3 marks</b> |                                                                                                                                                                                                                                 |     |   |                                                                                                                                                                                                                                                                                      |

|     |                                                        |                            |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----|--------------------------------------------------------|----------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12. | (Gradient =) $-\frac{3}{5}$ or ( $m$ =) $-\frac{3}{5}$ | $y = -\frac{3}{5}x + 3$ oe | 3 | <p>M1 Allow (gradient or <math>m</math>) = <math>\frac{3}{5}</math> or<br/>(<math>y =</math>) <math>-\frac{3}{5}x + c</math> (<math>c</math> may be a number)</p> <p>M1 Indep<br/>(<math>y =</math>) <math>mx + 3</math><br/>(<math>m</math> may be a number except 0)<br/>Allow <math>y</math> intercept or <math>c = 3</math> stated</p> <p>A1 oe<br/>Eg Accept <math>5y + 3x = 15</math> or<br/><math>y - 3 = -\frac{3}{5}(x - 0)</math> or<br/><math>y - 0 = -\frac{3}{5}(x - 5)</math><br/>SC B2 for <math>-\frac{3}{5}x + 3</math> or <math>L = -\frac{3}{5}x + 3</math></p> |
|     |                                                        |                            |   | <b>Total 3 marks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|         |                                                                                                                                                                                                                                                                                                                                                                    |                   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13. (a) | <p>Eg. <math>\frac{12}{12+8}</math> or <math>\frac{3}{5}</math> or 0.6 or <math>\frac{12+8}{12}</math> or <math>\frac{5}{3}</math> or 1.66(66...) or</p> <p><math>\frac{MN}{13.5} = \frac{12}{12+8}</math> oe or <math>(MN =) \frac{12}{12+8} \times 13.5</math> oe</p>                                                                                            | 8.1               | 2 | <p>M1 for correct scale factor or correct equation involving <math>MN</math> or correct expression for <math>MN</math></p> <p>Allow use of 1.66(66....) in place of <math>\frac{5}{3}</math> if rounded or truncated to at least 3 significant figures</p> <p>oe</p> <p>A1</p>                                                                                                                                                                                                                                             |
| (b)     | <p>Eg <math>\frac{PQ}{9} = \frac{12+8}{12}</math> oe or <math>\frac{PQ}{9} = \frac{13.5}{\text{"8.1"}}</math> or <math>PQ = 9 \times \frac{12+8}{12}</math> oe or</p> <p><math>PQ = 9 \times \frac{13.5}{\text{"8.1"}}</math> oe or <math>PQ = 15</math></p> <p>or <math>\frac{LQ}{9} = \frac{8}{12}</math> oe or <math>(LQ =) 9 \times \frac{8}{12}</math> oe</p> | 6                 | 2 | <p>M1 Correct expression for <math>PQ</math> or <math>LQ</math> (eg <math>9 \times \frac{5}{3}</math> oe or <math>9 \times \frac{2}{3}</math> oe )</p> <p>Correct equation involving <math>PQ</math> or <math>LQ</math> ( eg <math>\frac{PQ}{9} = \frac{5}{3}</math> oe or <math>\frac{LQ}{9} = \frac{2}{3}</math> oe )</p> <p>Allow use of 1.66(66....) in place of <math>\frac{5}{3}</math> or 0.666(66...) in place of <math>\frac{2}{3}</math> if rounded or truncated to at least 3 significant figures</p> <p>A1</p> |
| (c)     |                                                                                                                                                                                                                                                                                                                                                                    | $\frac{25}{9}$ oe | 1 | <p>B1</p> <p>Accept <math>2\frac{7}{9}</math></p> <p>Accept 2.77(777...) rounded or truncated to at least 3 significant figures</p> <p>Also accept <math>\left(\frac{20}{12}\right)^2</math> or <math>\left(\frac{5}{3}\right)^2</math></p>                                                                                                                                                                                                                                                                                |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |   |                                                                                                                                                                                                                        |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (d) | <p>Eg <math>\left(\frac{25}{9}\right)A - A = 105.6</math> or <math>A\left(\left(\frac{25}{9}\right) - 1\right) = 105.6</math> or <math>A\left(\left(\frac{16}{9}\right)\right) = 105.6</math> or <math>\left(\frac{25}{9}\right)A = 105.6 + A</math> or</p> $\frac{105.6 + A}{\frac{25}{9}} = A$ <p><math>(A =) \frac{105.6}{\frac{25}{9} - 1}</math> or <math>(A =) \frac{105.6}{1.77...}</math> or <math>(A =) \frac{105.6 \times 9}{16}</math></p> | 59.4 | 3 | <p>M1 For a correct equation involving <math>A</math> ft from part (c)</p> <p>M1 For correct expression for <math>A</math>.<br/>Decimal values should be rounded or truncated correct to at least 3SF</p> <p>A1 oe</p> |
|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |   | <b>Total 8 marks</b>                                                                                                                                                                                                   |

|         |                                                                                                  |                       |   |                                                                                                                                                                                                                                                                                                                                                                          |
|---------|--------------------------------------------------------------------------------------------------|-----------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14. (a) | $V = \frac{k}{t^2}$<br><br>$28 = \frac{k}{2.5^2}$ oe or<br>$k = 28 \times 2.5^2$ or<br>$k = 175$ | $V = \frac{175}{t^2}$ | 3 | M1 Allow $Vt^2 = k$ or $t^2 = \frac{k}{V}$<br>Do not allow $V = \frac{1}{t^2}$<br><br>M1 For correct substitution in a correct equation<br>Implies first M1<br>Award M2 if $k = 175$ stated unambiguously in (a) or (b)<br><br>A1 Only award if $V$ is the subject.<br>Award M2A1 if $V = \frac{k}{t^2}$ on answer line and $k$ evaluated as 175 in part (a) or part (b) |
| (b)     | $V = \frac{"175"}{6.25^2}$                                                                       | 4.48                  | 2 | M1 ft for $k$ if $k > 1$<br><br>A1                                                                                                                                                                                                                                                                                                                                       |
|         |                                                                                                  |                       |   | <b>Total 5 marks</b>                                                                                                                                                                                                                                                                                                                                                     |



|               |     |                    |               |   |                                                                                                                          |
|---------------|-----|--------------------|---------------|---|--------------------------------------------------------------------------------------------------------------------------|
| 15.           | (a) |                    | 1, 5, 21      | 1 | B1                                                                                                                       |
|               | (b) |                    | correct curve | 1 | B1 Correct curve through (1,3), (2, 1), (3, 5), and (4, 21).                                                             |
|               | (c) |                    | -1.1          | 1 | B1 Accept $-1.15 \leq x \leq -1.05$                                                                                      |
|               | (d) | $y = 1 - 2x$ drawn |               |   | M2 Line must be long enough to cross curve and verify accuracy.<br>M1 for $x^3 - 3x^2 + 5 = -2x + 1$ or $y = -2x + 1$ oe |
|               |     |                    | -0.8          | 3 | A1 dep on M2<br>Accept $-0.9 \leq x \leq -0.7$                                                                           |
| Total 6 marks |     |                    |               |   |                                                                                                                          |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                    |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16.           | $4\left(\frac{1}{6}\right)\left(\frac{5}{6}\right)^3 + 6\left(\frac{1}{6}\right)^2\left(\frac{5}{6}\right)^2 + 4\left(\frac{1}{6}\right)^3\left(\frac{5}{6}\right) + \left(\frac{1}{6}\right)^4$ or $\left(\frac{1}{6}\right) + \left(\frac{5}{6}\right) \times \left(\frac{1}{6}\right) + \left(\frac{5}{6}\right) \times \left(\frac{5}{6}\right) \times \left(\frac{1}{6}\right) + \left(\frac{5}{6}\right) \times \left(\frac{5}{6}\right) \times \left(\frac{5}{6}\right) \times \left(\frac{1}{6}\right)$ or $1 - \left(\frac{5}{6}\right)^4$ |  |                    |   | M2                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                    |   | Accept use of 0.16(666..) in place of $\frac{1}{6}$ and 0.83(3333...) in place of $\frac{5}{6}$ rounded or truncated to at least 2 decimal places.<br><br>M1 for $\left(\frac{1}{6}\right) \times \left(\frac{5}{6}\right)^3$ or $\left(\frac{1}{6}\right)^2 \times \left(\frac{5}{6}\right)^2$ or $\left(\frac{1}{6}\right)^3 \times \left(\frac{5}{6}\right)$ or $\left(\frac{1}{6}\right)^4$ or $P(\text{no sixes}) = \left(\frac{5}{6}\right)^4$ |
|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  | $\frac{671}{1296}$ | 3 | A1 Accept awrt 0.518                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Total 3 marks |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                    |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|     |     |                                                                                                                                                                                     |    |   |                                                                                                                                                                                                                         |
|-----|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17. | (a) |                                                                                                                                                                                     | 21 | 1 | B1                                                                                                                                                                                                                      |
|     | (b) |                                                                                                                                                                                     | 62 | 1 | B1                                                                                                                                                                                                                      |
|     | (c) | $\angle KJL = 37^\circ$ or $\angle PJM = 60^\circ$ or $\angle LKM = 60^\circ$<br>or $\angle LMP = 37^\circ$ or $\angle MPJ = 58^\circ$ or $MPL = 122^\circ$<br>or $JPK = 122^\circ$ | 58 | 3 | M2<br>If not M2 then M1 for:<br>$\angle GJL = 81^\circ$ or<br>$\angle GMJ = 81^\circ$ or<br>$JKL = 81^\circ$ or<br>$JML = 99^\circ$<br><br>Angles may be marked on the diagram<br>or labelled in the working.<br><br>A1 |
|     |     |                                                                                                                                                                                     |    |   | <b>Total 5 marks</b>                                                                                                                                                                                                    |

|     |                                                                                                                                                                                       |              |   |                                                                                                                                                                                                                                                                                         |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 18. | $\frac{90}{0.6}$ or 150 or $\frac{120}{0.4}$ or 300 or $\frac{95}{0.5}$ or 190 or $\frac{45}{1.5}$ or 30<br><br>Frequency density =150, 300, 190, 30<br><br>heights 3, 6, 3.8, 0.6 cm | correct bars | 3 | M1 For one correct bar drawn or one correct frequency density, not including $0 \leq w \leq 1$ or<br>1 small square = 1 or<br>1 large (cm) square = 25<br><br>M1 For three correct bars drawn or three frequency densities, not including $0 \leq w \leq 1$<br><br>A1 All bars correct. |
|     |                                                                                                                                                                                       |              |   | Total 3 marks                                                                                                                                                                                                                                                                           |

|               |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |   |                                                                                                                                                                                                                                                                                                                                                                       |
|---------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 19.           | (a) (i)  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -3                      | 1 | B1                                                                                                                                                                                                                                                                                                                                                                    |
|               | (a) (ii) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0                       | 1 | B1                                                                                                                                                                                                                                                                                                                                                                    |
|               | (a)(iii) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | $\frac{3}{2}$           | 1 | B1<br>1.5, $1\frac{1}{2}$                                                                                                                                                                                                                                                                                                                                             |
|               | (b)      | <p>Eg <math>\sqrt{245} = \sqrt{49} \times \sqrt{5}</math> or <math>\sqrt{245} = \sqrt{49 \times 5}</math> or</p> $\frac{14}{\sqrt{49 \times 5}} \text{ or } \frac{14}{\sqrt{49} \times \sqrt{5}}$ $\frac{14}{\sqrt{245}} \times \frac{\sqrt{245}}{\sqrt{245}} \text{ or } \frac{14\sqrt{245}}{245} \text{ or } \frac{14 \times 7\sqrt{5}}{245}$ <p>Note:</p> <p>To rationalise <math>\frac{14}{\sqrt{245}}</math> accept <math>\frac{14}{\sqrt{245}} \times \frac{\sqrt{245}}{\sqrt{245}}</math> or <math>\frac{14\sqrt{245}}{245}</math></p> <p>To rationalise <math>\frac{2}{\sqrt{5}}</math> or <math>\frac{14}{7\sqrt{5}}</math>, etc, only accept</p> $\frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} \text{ or } \frac{14}{7\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} \text{ etc.}$ | $\frac{2\sqrt{5}}{5}$   | 2 | <p>M1 For simplifying <math>\sqrt{245}</math> or for rationalising the denominator.</p> <p>A1 For simplifying <math>\sqrt{245}</math> and for rationalising the denominator.<br/>NB: The solution must be fully correct (cso)<br/>NB: Do not accept <math>\frac{2}{\sqrt{5}} = \frac{2\sqrt{5}}{5}</math> as sufficient method for rationalising the denominator.</p> |
|               | (c)      | $e^2 - 2e\sqrt{3} - 2e\sqrt{3} + (2\sqrt{3})^2$ or<br>$e^2 - 4e\sqrt{3} + 12$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $e = 5$<br><br>$f = 37$ | 3 | <p>M1 Expand brackets with 3 correct terms with correct signs<br/>Eg <math>e^2 - 4e\sqrt{3}</math> or <math>e^2 - 2e\sqrt{3} - 2e\sqrt{3}</math> or <math>e^2 - 2e\sqrt{3} + 12</math>, etc or all 4 correct terms with signs missing eg <math>e^2, 4e\sqrt{3}, 12</math> or <math>e^2, 2e\sqrt{3}, 2e\sqrt{3}, 12</math></p> <p>A1 cao</p> <p>A1 cao</p>             |
| Total 8 marks |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |   |                                                                                                                                                                                                                                                                                                                                                                       |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |   |                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20. | $(AC^2 =) 8^2 + 8^2 - 2 \times 8 \times 8 \cos 120^\circ$ or $(AC^2 =) 192$ oe or<br>$\frac{AC}{\sin 120^\circ} = \frac{8}{\sin 30^\circ}$ oe or<br>$8 \cos(30^\circ)$ or $8 \sin(60^\circ)$ or $4\sqrt{3}$ or 6.92(820...) oe<br>$(AC =) 2 \times 8 \sin(60^\circ)$ oe or $(AC =) 2 \times 8 \cos(30^\circ)$ oe or<br>$(AC =) \frac{8}{\sin 30^\circ} \times \sin 120^\circ$ oe or<br>$(AC =) \sqrt{8^2 + 8^2 - 2 \times 8 \times 8 \cos 120^\circ}$ or $\sqrt{128 + 64}$ or<br>$\sqrt{192}$ or $8\sqrt{3}$ or 13.8(56...) oe<br>$(\text{arc } ABC) = \frac{120}{360} \times 2\pi \times 8$ or<br>$(\text{arc } ABC) = \frac{120}{360} \times \pi \times 16$ or<br>$(\text{arc } ABC) = \frac{2\pi \times 8}{3}$ or $\frac{\pi \times 16}{3}$ oe or 16.7(55...)<br>“13.8(56...)” + “16.7(55...)” | 30.6 | 5 | M1 Allow 6.92(820...) rounded or truncated to at least 3 significant figures.<br><br>M1 Allow 13.8(5640646) rounded or truncated to at least 3 significant figures.<br>Implies first M1<br><br>M1 For attempting to find the length of arc $ABC$<br>Allow 16.7(5516082) rounded or truncated to at least 3 significant figures.<br><br>M1 dep on first and third method marks<br>A1 Accept 30.6 - 30.7 inclusive |
|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |   | <b>Total 5 marks</b>                                                                                                                                                                                                                                                                                                                                                                                             |

|         |                                                                         |                       |   |                                                                                                                                                                                                                                                                                                              |
|---------|-------------------------------------------------------------------------|-----------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 21. (a) | $(-)\frac{16}{x} = (-)16x^{-1}$                                         | $2x + \frac{16}{x^2}$ | 3 | <p>M1 For <math>16x^{-1}</math> or <math>-16x^{-1}</math></p> <p>M1 For <math>\pm 16x^{-2}</math> or <math>\pm \frac{16}{x^2}</math> or <math>2x</math></p> <p>A1 Allow <math>2x + 16x^{-2}</math><br/>M2A0 for an incorrect answer that includes <math>16x^{-2}</math></p>                                  |
| (b)     | $2x + \frac{16}{x^2} = 0$<br>$2x^3 = -16$ or $x^3 = -8$<br><br>$x = -2$ | $(-2, 12)$            | 4 | <p>M1 ft from (a)<br/>Do not accept <math>x^2 - 16x^{-1} = 0</math> oe</p> <p>M1 For a correct equation in <math>x^3</math><br/>NB: No ft allowed</p> <p>A1 For <math>x = -2</math><br/>Accept as part of an incorrect coordinate, eg <math>(-2, 10)</math></p> <p>A1 Accept <math>x = -2, y = 12</math></p> |
|         |                                                                         |                       |   | <b>Total 7 marks</b>                                                                                                                                                                                                                                                                                         |

