Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students’ responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students’ scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

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

Further copies of this Mark Scheme are available from aqa.org.uk
Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

**M**  Method marks are awarded for a correct method which could lead to a correct answer.

**A**  Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.

**B**  Marks awarded independent of method.

**ft**  Follow through marks. Marks awarded for correct working following a mistake in an earlier step.

**SC**  Special case. Marks awarded for a common misinterpretation which has some mathematical worth.

**M dep**  A method mark dependent on a previous method mark being awarded.

**B dep**  A mark that can only be awarded if a previous independent mark has been awarded.

**oe**  Or equivalent. Accept answers that are equivalent.

  e.g. accept 0.5 as well as \( \frac{1}{2} \)

**[a, b]**  Accept values between \( a \) and \( b \) inclusive.

**[a, b)**  Accept values \( a \leq \) value < \( b \)

**3.14...**  Accept answers which begin 3.14 e.g. 3.14, 3.142, 3.1416

**Q**  Marks awarded for quality of written communication

**Use of brackets**  It is not necessary to see the bracketed work to award the marks.
Examiners should consistently apply the following principles

**Diagrams**

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

**Responses which appear to come from incorrect methods**

Whenever there is doubt as to whether a candidate has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the candidate. In cases where there is no doubt that the answer has come from incorrect working then the candidate should be penalised.

**Questions which ask candidates to show working**

Instructions on marking will be given but usually marks are not awarded to candidates who show no working.

**Questions which do not ask candidates to show working**

As a general principle, a correct response is awarded full marks.

**Misread or miscopy**

Candidates often copy values from a question incorrectly. If the examiner thinks that the candidate has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

**Further work**

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

**Choice**

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

**Work not replaced**

Erased or crossed out work that is still legible should be marked.

**Work replaced**

Erased or crossed out work that has been replaced is not awarded marks.

**Premature approximation**

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
</table>
| 1(a) | $6x - 3 + 2x - 6$  
or  $8x$ or $-9$ | M1 | Allow one error |
|     | $8x - 9$ | A1 | Do not ignore $\text{fw}$ |

**Additional Guidance**

$8x + -9$

4 correct terms seen

$8x - 9$, followed by an equation solved or unsolved

eg $8x - 9 = -x$ or $8x - 9 = 0$, $8x = 9$, $x = \frac{9}{8}$

| 1(b) | $\frac{3}{2} < n \leq 5$  
or  $2, 3, 4$  
or  $2, 4, 5$  
or  $2, 3, 5$  
or  $3, 4, 5$  
or  $1, 2, 3, 4, 5$  
or  $2, 3, 4, 5, 6$ | M1 | |
|     | 2, 3, 4, 5 | A1 | SC1 for 4, 5, 6, 7, 8, 9 and 10 |

**Additional Guidance**

4, 5, 6

Embedded answers are ambiguous so M0

M0
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(c)</td>
<td>$12x - 20$</td>
<td>B1 oe $\frac{22}{4}$ or 5.5 or $3x - 5 = \frac{22}{4}$ or $x - \frac{5}{3} = \frac{22}{12}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$12x = 22 + 20$ or their $12x = 22 + their$ 20</td>
<td>M1 oe $3x = their \frac{22}{4} + 5$ or $x = \frac{22}{12} + \frac{5}{3}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\frac{42}{12}$ or $\frac{7}{2}$ or 3.5</td>
<td>A1ft oe ignore fw On ft accept answers to 1dp or better</td>
<td></td>
</tr>
</tbody>
</table>

**Additional Guidance**

- $12x - 5 = 22$, $12x = 22 + 5$, $x = \frac{27}{12}$ B0M1A1ft
- $12x - 20 = 22$, $12x = 22 + 20$, $x = \frac{44}{12}$ B1M1A0
- $7x - 9 = 22$, $7x = 22 + 9$, $x = \frac{31}{7}$ B0M1A1ft
- $12x - 20 = 22$, $12x = 44$, $x = \frac{44}{12}$ B1M0A0
- T&I scores 3 or 0
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2(a)</td>
<td>$360 \div 8$ or 135 seen</td>
<td>M1 oe $180 - \left[ \left( 8 - 2 \right) \times 180 \right] \div 8$</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>A1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Additional Guidance**

$90 \div 2 = 45$ is a valid method using symmetry  
M1A1

| 2(b) | Angle $ABD$ is 90  
or angle $ABD = w$ seen or implied  
or angle $ABD = \text{angle } CBD$ seen or implied  
or angle $BCD$ is 65  
or angle $ABC$ is $180 - 65$ or 115  
or angle $ADC$ is $180 - 65$ or 115  
or 155 seen | M1 oe $(360 - 65 - 65 - 90 - 90)$  
or 50  
May be on diagram  
| 180 - 65 - 90  
or 180 - 155  
or 115 - 90  
or angle $ABD$ is 25 | M1dep oe $(360 - 65 - 65 - 90 - 90) \div 2$  
or 50 \div 2  
or 90 - 65  
| 25 | A1 |

**Additional Guidance**

For the first M1 angles must be clearly identified either in the diagram or in the working  
Use of the right angle symbol is acceptable for 90  
May extend side to obtain a valid angle  
Working space takes precedence over diagram
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>$850 \times 1.18$ or $1003$</td>
<td>M1</td>
<td>$\text{oe} (990 + 15) \div 1.18$ or $990 \div 1.18$ or $838.9(\ldots)$</td>
</tr>
<tr>
<td>3</td>
<td>$1003$ and $1005$ or $2$</td>
<td>A1</td>
<td>$851.(\ldots)$ or $852$ or $1.(\ldots)$</td>
</tr>
<tr>
<td>3</td>
<td>Laura and $1003$ and $1005$ or Laura and $2$ or UK and $1003$ and $1005$ or UK and $2$ or Laura and $851.(\ldots)$ or $852$ or Laura and $1.(\ldots)$ or UK and $851.(\ldots)$ or $852$ or UK and $1.(\ldots)$</td>
<td>Q1ft</td>
<td>Strand (iii) decision to match their calculation ft their comparison of values with M1 scored, both values must be in the same currency</td>
</tr>
</tbody>
</table>

**Additional Guidance**

Accept name, country or price (eg the (£)850 saddle) for final answer

990 ÷ 1.18 = 838.(\ldots), Steve (or Holland)

990 ÷ 1.18 = 838.(\ldots), 15 ÷ 1.18 = 12.(\ldots), 838 + 12 = 850, they both cost the same

Laura with no valid working

For the Q mark, follow through their comparison of values with M1 scored, but both values must be in the same currency and one of the values used in the comparison must be from the M1 that was awarded
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4(a)</td>
<td>– 4 and 2</td>
<td>B2</td>
<td>B1 for each value in correct place in table</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Additional Guidance</td>
</tr>
<tr>
<td></td>
<td>– 4 when ( x = – 2 ) and 2 when ( x = 1 )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4(b)</td>
<td>6 or 7 of their points plotted correctly</td>
<td>M1</td>
<td>tolerance ± ( \frac{1}{2} ) square</td>
</tr>
<tr>
<td></td>
<td>Fully correct smooth curve</td>
<td>A1</td>
<td>tolerance ± ( \frac{1}{2} ) square</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Additional Guidance</td>
</tr>
<tr>
<td></td>
<td>Two curves drawn: Mark the better curve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4(c)</td>
<td>( y = –3 ) correctly drawn</td>
<td>B1</td>
<td>Any length &gt; 2 cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>tolerance ± ( \frac{1}{2} ) square</td>
</tr>
<tr>
<td>4(d)</td>
<td>–1.8 and 2.8</td>
<td>B1ft</td>
<td>ft their graph or correct</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>tolerance ± ( \frac{1}{2} ) square</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Additional Guidance</td>
</tr>
<tr>
<td></td>
<td>If quadratic formula used, answers are –1.79 and 2.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Do not accept embedded answers or coordinates</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Must have two answers for ft</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If 3 or more answers on ft treat as choice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>Answer</td>
<td>Mark</td>
<td>Comments</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------</td>
<td>------</td>
<td>---------------------------------</td>
</tr>
</tbody>
</table>
| 5 | \[
\frac{150}{800} \times 100 \\
\text{or } \frac{150}{650+150} \times 100 \\
\text{or } 0.1875
\] | M1   | oe                              |
|   | 18.75 or 18.8 or 19                             | A1   | oe SC1 for 81.25 or 81 or 81.3 |

**Additional Guidance**

\[
\frac{800}{150}
\]

19 with no working
19 is incorrect only if clearly from wrong working
Build up methods score 0 or 2

M0
M1A1
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6(a)</td>
<td>720 ÷ 6 or 120</td>
<td>M1</td>
<td>720 ÷ 6 × 5 or 600</td>
</tr>
<tr>
<td></td>
<td>600 and 120</td>
<td>A1</td>
<td></td>
</tr>
</tbody>
</table>

**Additional Guidance**

120 and 600 (order reversed) | M1A0 |

| 6(b) | 135 + 70 + 35 or 240 | M1 | |
|   | *their* 240 ÷ 6 or 40 | M1dep | |
|   | 2 × *their* 40 or 80 | M1dep | |
|   | 10 | A1 | ignore fw |

**Additional Guidance**

Gemma 10, Beth 5, answer 15 scores full marks | M1M1M1A1 |

(120 and) 80 and 40 may be written next to the 3 : 2 : 1 in the question | M1M1M1A0 |

**Beware of 10 from incorrect working**

eg 135 ÷ 3 = 45, 70 ÷ 2 = 35, 35 ÷ 1 = 35, answer 10 scores 0 | M0M0M0A0 |
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
</table>
| 7(a) | \( \frac{1}{3} \) or \( \frac{2}{6} \) or 0.33(…)
or \( 72 + 6 \) or 12
or \( 72 + 6 \times 2 \) | M1 oe | |
| | 24 | A1 oe | |

**Additional Guidance**

24 out of 72

\[
\frac{24}{72} = \frac{2}{6} \text{ or } \frac{1}{3}
\]

M1A1

M1A0

M0

<table>
<thead>
<tr>
<th>7(b)</th>
<th>( 250 - 25 - 53 - 62 ) or 110</th>
<th>M1</th>
<th>( \frac{250}{140} ) or 0.56</th>
</tr>
</thead>
</table>
| | \( \text{their } 110 \div 2 \) or 55 | M1dep | \( 1 - \text{their } \frac{140}{250} \)
or 1 – 0.56 or 0.44 |
| | \( \frac{55}{250} \) or 0.22 or 22% | A1 | ignore fw
oe
\[
\frac{11}{50}
\] |

**Additional Guidance**

\[
\frac{55}{250} \text{ followed by error eg } = 0.2
\]

M1M1A1

55 in table

M1M1A0

Do not allow misreads for 250
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>(Diameter or side of square =) $\sqrt{36}$ or 6 or (radius =) 3</td>
<td>M1</td>
<td>$6 \times 6 = 36$</td>
</tr>
<tr>
<td></td>
<td>$\pi \times 6$ or $2 \times \pi \times 3$</td>
<td>M1dep</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[18.8, 18.9] or 6 $\pi$</td>
<td>A1</td>
<td>Accept 19 with working shown</td>
</tr>
</tbody>
</table>

**Additional Guidance**

Accept [3.14, 3.142] for $\pi$

Ignore further working after $6 \pi$, that is if they incorrectly work $6 \pi$ out award full marks

Do not accept $\pi 6$ for the A mark

6 or 3 may be on diagram but must be correct, eg radius must be 3, not 6
### Mark Scheme

**Q 9**

<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$2x + 2x - 10 + x + 25 + 2x + 30$ or $ax + 45$ or $7x + b$</td>
<td>M1</td>
<td>Allow one error in <em>their</em> 7 terms oe $25 + 30 - 10$ or 45</td>
</tr>
<tr>
<td></td>
<td>$2x + 2x - 10 + x + 25 + 2x + 30 = 360$ or $7x + 45$ or <em>their</em> $ax + 45 = 360$ or <em>their</em> $7x + b = 360$</td>
<td>M1dep</td>
<td>oe $360 - <em>their</em> 45 or 315</td>
</tr>
<tr>
<td></td>
<td>$7x + 45 = 360$</td>
<td>M1dep</td>
<td>oe <em>their</em> $315 + 7$</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>A1</td>
<td></td>
</tr>
</tbody>
</table>

### Additional Guidance

- $x = 45$ with no working
- $45 + 315 = 360$, $\frac{315}{7} = 45$
- $2x = 90$, $x = 45$ (no incorrect working seen)
- $360 - 45 = 215$, $\frac{215}{7} = 30.714$
- $45 + 215 = 360$, $\frac{215}{7} = 30.714$
- Embedded answer
- Beware of $25 + 30 - 10 = 45$
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>10(a)</td>
<td>30(y) + 120(w) or 30((y) + 4(w))</td>
<td>B2</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>B1 for 30(y) or 120(w) or 0.3(y) + 1.2(w)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Do not ignore (fw) for B2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SC1 for 30(p) + 120(c)</td>
</tr>
</tbody>
</table>

**Additional Guidance**

<table>
<thead>
<tr>
<th></th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>30(yp) + 120(wp)</td>
<td>B2</td>
</tr>
<tr>
<td>30(p) + 120(w)</td>
<td>B1</td>
</tr>
<tr>
<td>30(y) = 120(w)</td>
<td>B1</td>
</tr>
<tr>
<td>0.3(y) + 120(w)</td>
<td>B1</td>
</tr>
<tr>
<td>30(y) + 1.20(w)</td>
<td>B1</td>
</tr>
<tr>
<td>30(y) + (w)120</td>
<td>B1</td>
</tr>
<tr>
<td>30(y) + 120(w) = 150(yw)</td>
<td>B1</td>
</tr>
<tr>
<td>30(w) + 120(y)</td>
<td></td>
</tr>
<tr>
<td>30(a) + 120(b)</td>
<td>B0</td>
</tr>
<tr>
<td>(y)30 + (w)120</td>
<td>B0</td>
</tr>
<tr>
<td>30(p) + 120(p)</td>
<td>B0</td>
</tr>
<tr>
<td>30(py) + 120(pw)</td>
<td>B0</td>
</tr>
</tbody>
</table>

Use of letters other than \(y\) or \(w\) is B0
Ignore \(p\) as units
### Alternative method 1

\[
2p + r = 265 \text{ or } p + 5r = 200 \\
or \quad 3p + 6r = 465
\]

M1 May work in pence or pounds

(2\(p + r = 265\))  
\[
10p + 5r = 1325 \\
\text{or } p + 5r = 200
\]

M1 Equating coefficients oe

9\(r = 135\)  
\[
or \quad r = 15 \\
9p = 1125 \\
or \quad p = 125
\]

A1 Eliminating a variable oe

Pen = (£)1.25 and Ruler = £0.15 A1 Condone 15p on answer line

### Alternative method 2

\[
2p + r = 265 \text{ or } p + 5r = 200 \\
or \quad 3p + 6r = 465
\]

M1 May work in pence or pounds

\[
r = 265 - 2p \\
or \quad r = \frac{200 - p}{5} \\
2p + 10r = 400
\]

M1 Making \(p\) or \(r\) the subject oe

9\(p = 1125\)  
\[
or \quad p = 125 \\
9r = 135 \\
or \quad r = 15
\]

A1 Eliminating a variable oe

Pen = (£)1.25 and Ruler = £0.15 A1 Condone 15p on answer line

### Additional Guidance

Accept: £0.15p or 125p with £ sign crossed out

Do not accept: 0.15p with £ sign crossed out or £125p

Answers reversed M1M1A1

2 × pens + 1 ruler = 265 with no further working M0

T&I scores 0 or 4

Use any two different letters, eg \(x\) and \(y\), \(p\) and \(r\)

Letters not words required for the first M mark, but can be recovered by showing correct working for following M mark(s)
### Q11

<table>
<thead>
<tr>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of tan</td>
<td>M1</td>
<td>( \sqrt{40^2 + 55^2} ) and use of sin, cos, sine rule or cosine rule</td>
</tr>
<tr>
<td>( \tan^{-1} \left( \frac{55}{40} \right) ) or ( \tan^{-1} \left( \frac{40}{55} \right) )</td>
<td>M1</td>
<td>oe</td>
</tr>
<tr>
<td>or ( \tan A = \left( \frac{55}{40} \right) ) or ( \tan B = \left( \frac{40}{55} \right) )</td>
<td>M1</td>
<td>eg ( \sin^{-1} \left( \frac{55}{\sqrt{40^2 + 55^2}} \right) )</td>
</tr>
<tr>
<td>53.9(...) or 54 or 54.0 or 36(...) or 36.0</td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td>143.9(...) or 144</td>
<td>A1</td>
<td>SC3 for 324 or 323.9...</td>
</tr>
</tbody>
</table>

### Additional Guidance

Scale drawing can score 0, 3 or 4 but must be accurate

\[
\tan = \frac{55}{40} \text{ or } \tan = \frac{40}{55}
\]  
M1M1

\[
\tan \frac{55}{40} \text{ or } \tan \frac{40}{55} \text{ or } \tan A = \frac{40}{55} \text{ or } \tan B = \frac{55}{40} \text{ recovered}
\]  
M1M1

\[
\tan \frac{55}{40} \text{ or } \tan \frac{40}{55} \text{ or } \tan A = \frac{40}{55} \text{ or } \tan B = \frac{55}{40} \text{ not recovered}
\]  
M1M0
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>12(a)</td>
<td>Four correct cumulative frequencies</td>
<td>B1</td>
<td>23, 48, 87 and 100</td>
</tr>
<tr>
<td></td>
<td>Five correct heights plotted</td>
<td>B1</td>
<td>(…, 12), (…, 23), (…, 48), (…, 87) and (…, 100)</td>
</tr>
<tr>
<td></td>
<td>Five points plotted at correct upper boundaries</td>
<td>B1</td>
<td>(15, …), (20, …), (40, …), (55, …) and (70, …) Must be an increasing function</td>
</tr>
<tr>
<td></td>
<td>Straight lines or smooth curve going through the five points</td>
<td>B1ft</td>
<td>ft <em>their</em> 5 plotted points. Must be an increasing function</td>
</tr>
</tbody>
</table>

**Additional Guidance**

- Ignore anything to the left of *their* (15, 12)
- Ignore anything to the right of *their* (70, 100), must be an increasing function tolerance $\pm \frac{1}{2}$ square
- Accept histograms / bars for heights plotted but upper boundary points must be identified either by plots or curve / polygon
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>12(b)</td>
<td>their LQ plotted and their median plotted and their UQ plotted</td>
<td>B2ft</td>
<td>ft their cf graph provided increasing function tolerance ± $\frac{1}{2}$ square (± 1) B1ft for 2 correctly plotted</td>
</tr>
<tr>
<td></td>
<td>Box plot with 8 and 69 correct</td>
<td>B1</td>
<td>Correct diagrammatic representation</td>
</tr>
</tbody>
</table>

**Additional Guidance**

Allow values plotted as points for B2ft

| 13 | Arc drawn from intersection of wall and fence cutting wall and fence or Arc drawn from D radius hedge length | M1 | |
| Complete angle bisector with all construction arcs | A1 | |
| Point marked in correct place, with all arcs for both constructions shown | A1 | May be indicated by intersection of angle bisector and arc SC1 Point marked in correct place but no arcs |

**Additional Guidance**

Tree need not be labelled

<table>
<thead>
<tr>
<th>14(a)</th>
<th>108</th>
<th>B1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Opposite angle of a cyclic quadrilateral (add up to 180)</td>
<td>Q1</td>
<td>Strand (i) Must have 108</td>
<td></td>
</tr>
</tbody>
</table>

**Additional Guidance**

Must see “opposite” and “cyclic” (oe eg quadrilateral in a circle)
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>14(b)</td>
<td>125</td>
<td>B1</td>
<td></td>
</tr>
</tbody>
</table>
| 15(a)| $2x^2 - 6x + x - 3$ | M1 | Must be 4 terms  
Allow one error  
May be in a grid |
|      | $2x^2 - 5x - 3$ | A1 | Do not ignore $xw$ |

**Additional Guidance**

| **15(a)** |  |  
|------------|-----------------|----------------|
| $2x^2 - 5x + 3$ | | M1A0 |
| $2x^2 - 5x + - 3$ | | M1A0 |
| $2x^2 - 4x - 3$ | | M0A0 |

For method mark the four terms may be eg in a grid with correct negative signs

| **15(b)** |  |  
|------------|-----------------|----------------|
| $(y - 4)(y + 6)$ | | B2 |
| | | B1 for $(y + a)(y + b)$ such that $ab = -24$ or $a + b = 2$  
or B1 for $y(y + 6) - 4(y + 6)$  
or $y(y - 4) + 6(y - 4)$ |

**Additional Guidance**

| $(y + 4)(y - 6)$ | B1 |
| $(y - 12)(y + 2)$ | B1 |
| $(y + 13)(y - 11)$ | B1 |
| $y(y + 6)$ | B0 |

Condone use of $x$ or another letter
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>15(c)</td>
<td>$32x^5 \cdot y^{15}$</td>
<td>B2</td>
<td>B1 for two terms correct in a product</td>
</tr>
</tbody>
</table>

**Additional Guidance**

- Penalise multiplication signs for B2
- + sign(s) in answer scores B0
- Mark final answer
  - $32 \times x^5 \cdot y^{15}$ B1
  - $32 \times 5x^5 \cdot y^{15}$ B1
  - $32x^5 \cdot y^8$ B1
  - $32x^{15}$ B1
  - $32 + x^5 + y^{15}$ B0
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>75 ÷ 50 or (\frac{3}{2}) or 1.5 seen or implied or 50 ÷ 75 or (\frac{2}{3}) seen or implied</td>
<td>M1</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td>((75 ÷ 50)^2) or (\left(\frac{3}{2}\right)^2) or 1.5(^2) or 2.25 or (\frac{9}{4}) or ((50 ÷ 75)^2) or (\left(\frac{2}{3}\right)^2) or (\frac{4}{9})</td>
<td>M1dep</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td>6000 × 2.25 or 13 500 or 80 × 6000</td>
<td>M1</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td>their 13 500 ÷ 10 000 or 80 ÷ 10 000 or their 13 500 ÷ 10 000 × 80 or 80 × 6000 ÷ 10 000 or 6000 ÷ 10 000 × 2.25</td>
<td>M1dep</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td>108</td>
<td>A1</td>
<td>Digits 108 seen M1M1M1M1A0</td>
</tr>
</tbody>
</table>

**Additional Guidance**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6000 × (\frac{3}{2}) × 80</td>
<td>M1M0M1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>720 000 implies (\frac{3}{2}) and 6000 × 80 from (6000 × (\frac{3}{2}) × 80)</td>
<td>M1M0M1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9000 implies (\frac{3}{2})</td>
<td>M1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ignore assumptions about the shape</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>Answer</td>
<td>Mark</td>
<td>Comments</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>17</td>
<td>49 (%) seen or implied</td>
<td>B1</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>their</em> $3.22 \times 10^7 + 51 (= 1%)$</td>
<td>M1</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td>or <em>their</em> $3.22 \times 10^7 + 51 \times 2 (= 2%)$</td>
<td></td>
<td>[631 372, 631 373]</td>
</tr>
<tr>
<td></td>
<td>or <em>their</em> $3.22 \times 10^7 \times \frac{66}{360}$</td>
<td></td>
<td>1 262 745</td>
</tr>
<tr>
<td></td>
<td>or <em>their</em> $3.22 \times 10^7 \div 51 \times 49$</td>
<td></td>
<td>5 903 333</td>
</tr>
<tr>
<td></td>
<td>or <em>their</em> $3.22 \times 10^7 - \frac{3.22 \times 2}{51}$</td>
<td>M1dep</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td>or <em>their</em> $3.22 \times 10^7 \times \frac{66}{360} + 51$</td>
<td></td>
<td>[30 937 254, 30 937 255]</td>
</tr>
<tr>
<td></td>
<td>or <em>(their</em> $3.22 - \frac{3.22 \times 2}{51}) \times \frac{66}{360}$</td>
<td>M1dep</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td>5 671 830 or [5 500 000, 5 700 000]</td>
<td>A1</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td>5.67 $\times 10^6$ or $6 \times 10^6$</td>
<td>B1ft</td>
<td>ft <em>their</em> answer which may be rounded and given in standard form</td>
</tr>
<tr>
<td></td>
<td>or [5.5 $\times 10^6$, 5.7 $\times 10^6$]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Additional Guidance**

$\times 10^7$ not required for method marks

Accept decimals to 2 dp or better
### Q: 18(a)

- **Answer:**
  - 0.53846
  - or 0.538461

- **Mark:** B1

**Additional Guidance**

Mark final answer

### Q: 18(b)

- **Answer:**
  - \( \frac{37}{90} \)

- **Mark:** B1

### Q: 19

- **Answer:**
  - 5 \times 6 \text{ or } 30
  - or 20 \times 2 \text{ or } 40
  - or 1 \text{ (cm) square} = 10 \text{ students}
  - or 1 \text{ (small) square} = 0.4 \text{ students}

- **Mark:** M1

- **Answer:**
  - 5 \times 6 + 20 \times 2
  - or 7 \times 10
  - or 0.4 \times 175 \text{ or } 70
  - or (10 \times 8) + (5 \times 12) + (10 \times 6) \text{ or } 200

- **Mark:** M1dep

- **Answer:**
  - \( \frac{70}{270} \times 100 \)
  - \( \frac{200}{270} \times 100 \)

- **Mark:** M1

- **Answer:**
  - \( 270 - (10 \times 8) - (5 \times 12) - (10 \times 6) \text{ or } 70 \)

- **Mark:** oe

- **Answer:**
  - 25.9(\ldots) \% \text{ or } 26 \%
  - 200 \text{ and } 74(.1\ldots)

- **Mark:** A1

- **Answer:**
  - No and 25.9(\ldots)
  - or No and 26
  - or No and 200 and 74(.1\ldots)
  - or No and 70 \text{ and } 81
  - or No and 200 \text{ and } 189

- **Mark:** Q1ft

**Additional Guidance**

Strand (iii)

ft *their* 25.9\% provided all method marks have been awarded

ft *their* 81 provided all method marks have been awarded
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>( \frac{x-1}{(x-2)(x-1)} - \frac{x-2}{(x-2)(x-1)} ) or ( x - 1 - (x - 2) ) or ( 2(x-2)(x-1) ) or ( x^2 - 2x - x + 2 )</td>
<td>M1 oe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( their \ [x - 1 - (x - 2) ] = 2(x - 1)(x - 2) ) or ( x - 1 - x + 2 ) or ( 2(x^2 - 2x - x + 2) )</td>
<td>M1dep oe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( 2x^2 - 6x + 3 (= 0) )</td>
<td>A1 oe</td>
<td>Must be three terms</td>
</tr>
<tr>
<td></td>
<td>( -6 \pm \sqrt{(-6)^2 - (4 \times 2 \times 3)} ) ( 2 \times 2 ) or ( 6 \pm \sqrt{12} ) ( 4 )</td>
<td>M1 oe</td>
<td>Allow one error, ft ( their ) quadratic</td>
</tr>
<tr>
<td></td>
<td>( -6 \pm \sqrt{(-6)^2 - (4 \times 2 \times 3)} ) ( 2 \times 2 ) or ( 6 \pm \sqrt{12} ) ( 4 )</td>
<td>A1ft oe</td>
<td>ft ( their ) quadratic, fully correct</td>
</tr>
<tr>
<td></td>
<td>2.37 and 0.63</td>
<td>A1ft</td>
<td>2.366(…) and 0.633(…)</td>
</tr>
<tr>
<td>Additional Guidance</td>
<td>T&amp;I with two correct answers to 2 dp scores full marks</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T&amp;I with two correct answers to 3 dp or more loses final A mark</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ft is from ( their ) quadratic (must have three terms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>One error is an incorrect substitution in one position or a short divisor line</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A negative discriminant can score M1A1ftA0ft for an attempt at a solution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>Answer</td>
<td>Mark</td>
<td>Comments</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>21</td>
<td>285 or 284.9 or 275</td>
<td>B1</td>
<td>oe their 285 as part of trapezium equation</td>
</tr>
<tr>
<td></td>
<td>or 12.5 or 13.5 or 13.49</td>
<td></td>
<td>or ( \left( \frac{\text{their } 12.5 + \text{their } 17.5}{2} \right) h )</td>
</tr>
<tr>
<td></td>
<td>or 18.5 or 18.49 or 17.5</td>
<td></td>
<td>oe their 285 = (280, 290)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>their 12.5 = [12.5, 13)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>their 17.5 = [17.5, 18)</td>
</tr>
<tr>
<td></td>
<td>285 = ( \left( \frac{12.5 + 17.5}{2} \right) h )</td>
<td>A1</td>
<td>oe fully correct</td>
</tr>
<tr>
<td></td>
<td>19 with no incorrect bounds used</td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>Answer</td>
<td>Mark</td>
<td>Comments</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Alternative method 1</strong></td>
<td>red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42 seen or used</td>
<td></td>
<td>B1</td>
<td>oe</td>
</tr>
<tr>
<td>or probability (red and red) = ( \frac{42}{90} )</td>
<td></td>
<td></td>
<td>0.46 or 0.466... or 0.47</td>
</tr>
<tr>
<td>or ( \frac{r}{10} \times \frac{r-1}{9} )</td>
<td></td>
<td></td>
<td>or 46% or 46.6... or 47%</td>
</tr>
<tr>
<td>or ( 1 - (\frac{r}{10} \times \frac{r-1}{9}) )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \frac{7}{10} \times \frac{6}{9} ) or 42 = 7 \times 6</td>
<td></td>
<td>M1</td>
<td>oe</td>
</tr>
<tr>
<td>or ( \frac{r}{10} \times \frac{r-1}{9} ) = ( \frac{42}{90} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or ( 1 - (\frac{r}{10} \times \frac{r-1}{9}) ) = ( \frac{48}{90} )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or ( r(r-1) = 42 )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or ( r^2 - r = 42 )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 red</td>
<td></td>
<td>A1</td>
<td></td>
</tr>
</tbody>
</table>

| **Alternative method 2** | blue | | |
| \( \frac{b}{10} \times \frac{b-1}{9} + 2 \times \frac{b}{10} \times \frac{10-b}{9} \) | | B1 | oe |
| \( \frac{b}{10} \times \frac{b-1}{9} + 2 \times \frac{b}{10} \times \frac{10-b}{9} = \frac{48}{90} \) | | M1 | oe |
| or \( b^2 - 19b = -48 \) | | | |
| or \( b^2 - 19b + 48 = 0 \) | | | |
| or \( b = 3 \) | | | |
| 7 red | | A1 | |

**Additional Guidance**

7 with no working scores full marks
<table>
<thead>
<tr>
<th>Q</th>
<th>Answer</th>
<th>Mark</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>$4^2 + 4^2$ or $16 + 16$ or $32$ or $2^2 + 2^2$ or $4 + 4$ or $8$</td>
<td>M1</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td>$\sqrt{32}$ or $4\sqrt{2}$ or $\sqrt{8}$ or $2\sqrt{2}$</td>
<td>M1</td>
<td>Allow use of decimals to 2 dp or better</td>
</tr>
<tr>
<td></td>
<td>$\cos x = \frac{\sqrt{8}}{6}$ or $0.47...$</td>
<td>M1</td>
<td>oe</td>
</tr>
<tr>
<td></td>
<td>$\cos x = \frac{6^2 + 32 - 6^2}{2 \times 6 \times \sqrt{32}}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$[61.8, 61.9]$ or $62$</td>
<td>A1</td>
<td></td>
</tr>
</tbody>
</table>