

GCSE MATHEMATICS (linear)

4365/2H

Mark scheme

4365

November 2014

Version 2.0: Final

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.

| | |
|------------------------|--|
| 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. |
| Q | Marks awarded for quality of written communication. |
| 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. |
| 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. |
| 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 $a \leq \text{value} < b$ |
| 25.3 ... | Allow answers which begin 25.3 e.g. 25.3, 25.31, 25.378. |
| 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.

Paper 2 Higher Tier

| Q | Answer | Mark | Comments |
|---|---|-------|----------|
| 1 | 9×9 or 81 or 9×3 or 27 or $\frac{1}{2} \times 9 \times 6$ or 27 or $\frac{1}{2} \times \frac{9}{2} \times 6$ or 13.5 or $\frac{1}{2} \times (3 + 9) \times \frac{9}{2}$ or 27 | M1 | |
| | $9 \times 3 + \frac{1}{2} \times 9 \times 6$ or $27 + 27$ or $9 \times 9 - 2 \times \frac{1}{2} \times \frac{9}{2} \times 6$ or $81 - 27$ or $2 \times \frac{1}{2} \times (3 + 9) \times \frac{9}{2}$ or 2×27 | M1dep | |
| | 54 | A1 | |

| Q | Additional Guidance | Mark |
|---|--|------------------|
| 1 | Beware of 27 from wrong working, e.g. $9 + 3 + 3 + 6 + 6$ $9 \times 3 = 27$, $9 \times 6 = 54$ Just $9 \times 6 = 54$ The second M1 is for a fully correct method A fully correct method with further working loses the second M1 | M1M0A0 M0M0A0 |

| | | | |
|------|------------------------------|----|----|
| 2(a) | 0.3 or $\frac{3}{10}$ or 30% | B1 | oe |
|------|------------------------------|----|----|

| Q | Answer | Mark | Comments |
|------|---------------------------------|------|----------|
| 2(b) | 0.11 or $\frac{11}{100}$ or 11% | B1 | oe |

| | | | |
|------|---------------------------------------|----|----|
| 2(c) | 200×0.15 or $\frac{30}{200}$ | M1 | oe |
| | 30 | A1 | |

| Q | Additional Guidance | Mark |
|------|---|------|
| 2(c) | $\frac{30}{200}$ (do not allow any other fractions) e.g. $\frac{3}{20}$ scores M0 No misreads allowed | M1A0 |

| | | | |
|---|--|-------|-----------------------------------|
| 3 | $0.15 \times 65.5(0)$ or 9.825 or 9.82 or 9.83 or $6.55 + 3.27(5)$ or $6.55 + 3.28$ or $6.5... + 3.2...$ | M1 | oe 0.85 or 85% seen or implied |
| | 55.675 or $65.5(0) - \text{their } 9.825$ | M1dep | 0.85×65.5 |
| | 55.67 or 55.68 | Q1 | strand (i) correct money notation |

| Q | Additional Guidance | Mark |
|---|---|------|
| 3 | Do not accept £55.67p for the Q mark If they use the wrong value with a fully correct method they can score M1M0Q0, e.g. $0.15 \times 15.50 = 2.325$ $15.50 - 2.33 = 13.17$ | |

| Q | Answer | Mark | Comments |
|---|---|------|---------------------------------------|
| 4 | Alternative Method 1 | | |
| | $D = 260$ | B1 | May be on diagram |
| | $A = 30$ | B1 | May be on diagram |
| | $360 - (30 + \text{their } 260 + \text{their } 30)$ | M1 | oe |
| | 40 | A1ft | ft their 260 and 30 |
| | Alternative Method 2 | | |
| | $S = 50$ (and $R = 150$) | B2 | B1 for $R = 150$ May be on diagram |
| | $180 - (90 + \text{their } 50)$ | M1 | oe |
| | 40 | A1ft | ft their 150 and 50 |

| Q | Additional Guidance | Mark |
|---|--|------|
| 4 | <p>MARK THE BEST EFFORT</p> <p>Beware of 30, this must be linked to angle A unless clear method shown, e.g. $90 - 60 = 30$ is clearly angle A</p> <p>Answer 40 from no working is zero marks</p> <p>No ft from R to S</p> <p>Beware of an incorrect method for finding S, e.g. $R = 160$ and $S = 50$ scores B0</p> | |

| | | | |
|---|--|----|--|
| 5 | <div> <div>Emily</div> <div>Ben</div> <div>Cath</div> <div>Adam</div> <div>Darren</div> <div></div> </div> | B3 | <p>B2 for 2 conditions met</p> <p>B1 for 1 condition met</p> |
|---|--|----|--|

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| Q | Additional Guidance | Mark |
|---|---|------|
| 5 | <div style="display: flex; flex-wrap: wrap;"> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px;"></div> <div style="border: 1px solid black; padding: 2px; margin: 5px;">Emily</div> <div style="border: 1px solid black; padding: 2px; margin: 5px;">Ben</div> </div> <div style="display: flex; flex-wrap: wrap; margin-top: 10px;"> <div style="border: 1px solid black; width: 40px; height: 40px; margin: 5px;"></div> <div style="border: 1px solid black; padding: 2px; margin: 5px;">Adam</div> <div style="border: 1px solid black; padding: 2px; margin: 5px;">Darren</div> </div> <p>Ben is 045 from Adam Darren is 135 from Emily</p> <p>It's ok for students to put their answer at the top of the page but the bottom plan takes precedence</p> <p>Allow abbreviated names</p> <p>If a name appears twice then conditions involving that person can't be met</p> | B2 |

| | | | |
|------|--|------|---|
| 6(a) | Appropriate key | B1 | |
| | Stem 1, 2, 3, 4 | B1 | |
| | Leaves correct and ordered 1 3 1 4 5 8 9 0 3 5 9 1 4 7 8 | B1 | |
| | Appropriate alignment of leaves | Q1ft | ft their single digit leaves Strand (ii) Consistent gaps so that row length represents the number of data it contains |

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| Q | Additional Guidance | Mark |
|------|--|------|
| 6(a) | <p>To award Q1ft there must be at least 2 leaves in at least 3 rows</p> <p>Ignore commas between numbers</p> <p>Ignore 0 and/or 5 on the stem for the stem mark</p> <p>Ignore 0 and/or 5 on the stem unless there are leaves for the third B mark</p> <p>If stem is 4, 3, 2, 1 then the order can be increasing or decreasing, if the stem is 1, 2, 3, 4 then the order should be increasing</p> <p>Key can be 0 / 4 to represent 4 people but not ... / 4 for example</p> <p>2 digit leaves cannot score the third B1 or the Q mark</p> | |

| | | | |
|------|----|----|--|
| 6(b) | 32 | B1 | |
|------|----|----|--|

| | | | |
|------|------|----|---|
| 7(a) | 15ab | B2 | <p>B1 for $3a \times 5b$</p> <p>B1 for partially simplified answer</p> <p>B1 for $15 \times ab$</p> |
|------|------|----|---|

| Q | Additional Guidance | Mark |
|------|---|---|
| 7(a) | <p>Penalise further working, e.g. $3a \times 5b = 15ab = 3(5ab)$ gets B1</p> <p>15ba</p> <p>A = 15ab</p> <p>A(15ab)</p> <p>15ab cm²</p> <p>A(3a × 5b)</p> <p>(3a)(5b)</p> <p>3a5b</p> <p>15(ab)</p> <p>3(5ab)</p> <p>ab15</p> <p>(15ab)²</p> <p>15ab²</p> <p>(3a × 5b)²</p> <p>3a × 5b²</p> | <p>B2</p> <p>B2</p> <p>B2</p> <p>B2</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B0</p> <p>B0</p> <p>B0</p> <p>B0</p> |

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| | | | |
|------|--------------------------|----|----------------------------------|
| 7(b) | $315 \div 15$ or 21 seen | M1 | |
| | 7 and 3 in any order | A1 | SC1 for 15 and 21 or 9 and 35 |

| Q | Additional Guidance | Mark |
|------|-----------------------------|------|
| 7(b) | 1 and 21 on the answer line | M1A0 |

| | | | |
|------|----------|----|-------------|
| 8(a) | -4 and 5 | B2 | B1 for each |
|------|----------|----|-------------|

| | | | |
|------|---|----|---|
| 8(b) | 5 correctly plotted coordinates | M1 | ft their -4 and their 5 tolerance $\pm \frac{1}{2}$ square |
| | Smooth curve passing through their 5 points | A1 | ft their plotted points tolerance $\pm \frac{1}{2}$ square |

| | | | |
|------|------------|----|-------------|
| 8(c) | -1 and 2.5 | B2 | B1 for each |
|------|------------|----|-------------|

| Q | Additional Guidance | Mark |
|------|---------------------------|------|
| 8(c) | Do not accept coordinates | |

| | | | |
|------|---|-------|------------------------------|
| 9(a) | $\pi \times 15^2$ or [706, 707] | M1 | oe |
| | $\pi \times 15^2 \times 50$ or [706, 707] $\times 50$ | M1dep | oe Accept [35 300, 35325) |
| | [35 325, 35 350] | A1 | 11 250 π |

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| Q | Additional Guidance | Mark |
|------|--|--------|
| 9(a) | <p>Sight of $\pi \times 15^2$ anywhere in the working is at least M1, e.g. $2 \times \pi \times 15 \times 15 = 1413.7$ scores 1 mark</p> <p>If a student gives the answer 11250π and then works this out then they must work it out correctly for the final A mark, e.g. $11250\pi = 35342.9$ scores full marks but $11250\pi = 33750$ scores two marks</p> | M1M0A0 |

| | | | |
|------|------------------------------------|----|---------------------------------|
| 9(b) | Alternative method 1 | | |
| | 33 000 \div 1000 or 33 | M1 | oe 0.22 \times 1000 or 220 |
| | their 33 \div 0.22 or 150 | M1 | oe 33 000 \div their 220 |
| | their 150 \div 60 | M1 | oe |
| | 2.5 | A1 | |
| | Alternative method 2 | | |
| | 0.22 \times 60 or 13.2 | M1 | 0.22 \times 60 or 13.2 |
| | their 13.2 \times 1000 or 13 200 | M1 | 33 000 \div 1000 or 33 |
| | 33 000 \div their 13 200 | M1 | 33 \div their 13.2 |
| | 2.5 | A1 | |
| | Alternative method 3 | | |
| | 0.22 \times 1000 or 220 | M1 | |
| | their 220 \times 60 or 13 200 | M1 | |
| | 33 000 \div 13 200 | M1 | |
| | 2.5 | A1 | |

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| Q | Additional Guidance | Mark |
|------|---|---|
| 9(b) | <p>The three M marks can be done in any order</p> <p>Alternative method: $33\,000 \div 0.22$ or $150\,000$ $150\,000 \div 1000$ or 150 $150 \div 60$ 2.5</p> <p>An initial step of 33000×0.22 or 7260 cannot score any marks</p> | <p>M1 M1 M1 A1</p> <p>MOMOMO A0</p> |

| | | | |
|----|--|-------|--|
| 10 | $13^2 - 10^2$ | M1 | oe $169 - 100$ or 69 |
| | $\sqrt{13^2 - 10^2}$ or $\sqrt{69}$ | M1dep | |
| | $8.3(\dots)$ or 8 | A1 | Accept 3 rd side > 8 or > 7 |
| | $31(\dots)$ and 33 and 29 or > 30 and 33 and 29 | A1ft | ft their $8.3(\dots) + 10 + 13$ Accept 3 rd side > 8 or > 7 or perimeter > 30 |
| | $\frac{1}{3}$ | A1ft | oe ft their 31.3 and their 33 and their 29 (at least 2 correct) SC1 for 33 and 29 |

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| Q | Additional Guidance | Mark |
|----|---|----------------|
| 10 | <p>Students must use Pythagoras' Theorem (or an accurate scale drawing of the middle triangle) to score any method marks on this question</p> <p>Do not accept 1 in 3, 1 out of 3, unlikely, etc.</p> <p>Accept $\frac{1}{3}$ plus words unless contradictory, e.g. $\frac{1}{3}$, unlikely is ok</p> <p>$\frac{1}{3}$ with no working scores no marks</p> <p>An accurate scale drawing of the middle triangle with a statement that the third side is greater than 7 is at least three marks</p> <p>Correct use of Pythagoras' Theorem with 31.(...) and an answer of $\frac{1}{3}$ but no 33 or 29 scores 4 marks</p> | M1M1A1A0 A1 |

| | | | |
|----|---|------|---|
| 11 | <p>250 ÷ 5 or 50</p> <p>or 250 × 3 or 750</p> <p>or 250 × 2 ÷ 5 or 100</p> <p>or 0.12 × 250 or 30</p> | M1 | oe |
| | <p>$\frac{250 \times 3}{5}$ or 150</p> <p>or 250 – their 100 or 150</p> <p>or their 30 ÷ 5 or 6</p> <p>or their 30 × 3 or 90</p> | M1 | oe |
| | <p>$0.12 \times \frac{250 \times 3}{5}$</p> <p>or 0.12 × 150</p> <p>or their 30 ÷ 5 × 3</p> | M1 | oe |
| | 18 | A1 | |
| | 20 | B1ft | ft 360 ÷ their 18 (rounded up if non integer) |

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| Q | Additional Guidance | Mark |
|----|---|---|
| 11 | <p>For their final answer, if their 20 is not a whole number then must round answer up correctly to get the final B mark</p> <p>For those who work out 88% of 150 giving an answer of 132 they will score M1M1 for the 150</p> <p>150, 18, 132, 3 weeks</p> <p>150, 18, 132</p> | <p>M1M1M0 A0B1ft</p> <p>M1M1M0 A0B0</p> |

| | | | |
|----|--|----|---|
| 12 | <p>$2700 \div 180$ or 15 seen or Posts = 16 or Beams = 30</p> | M1 | |
| | Posts = 16 and Beams = 30 | A1 | |
| | $5(30 + 2 \times 16)$ | M1 | |
| | 310 | A1 | <p>SC2 for 15 seen and $5(\text{their } 30 + 2 \times \text{their } 16)$ correctly evaluated</p> <p>SC1 for $5(\text{their } 30 + 2 \times \text{their } 16)$ correctly evaluated</p> |

| Q | Additional Guidance | Mark |
|----|---|------|
| 12 | Their 310 must be in correct money notation | |

| Q | Answer | Mark | Comments |
|----|--|------|--|
| 13 | Correctly evaluated trial | M1 | e.g. $2^4 - 10 = 6$ |
| | Obtains $3 \leq x \leq 4$ | M1 | |
| | Obtains $3.3 \leq x \leq 3.4$ or Two correct trials [3.25, 3.35] which bracket 0 | A1 | |
| | Test 3.35 and concludes 3.3 or Two correct trials [3.25, 3.35] which bracket 0 and 3.3 for final answer | Q1 | Strand (ii) Using 2 dp to ensure 1 dp |

| Q | Additional Guidance | Mark |
|----|---|------|
| 13 | <p>CORRECT ANSWER WITH NO WORKING SCORES ZERO</p> <p> 3 → -2 3.1 → -1.4(...) 3.2 → -0.8(...) 3.3 → -0.15(...) or -0.2 3.4 → 0.556(...) or 0.56 or 0.6 3.5 → 1.3(...) 3.6 → 2.1(...) 3.7 → 2.996(...) or 3 3.8 → 3.9(...) 3.9 → 4.9(...) 4 → 6 </p> <p> 3.3 → -0.15(...) or -0.2 3.31 → -0.082 3.32 → -0.013 3.33 → 0.056 3.34 → 0.126 3.35 → 0.196 3.36 → 0.267 3.37 → 0.339 3.38 → 0.411 3.39 → 0.483 3.4 → 0.556(...) or 0.56 or 0.6 </p> <p>Also useful 3.25 → -0.486</p> | |

| Q | Answer | Mark | Comments |
|-------|-------------------------------|------|------------------------------------|
| 14 | $\frac{5}{6}$ costs (£)1.2(0) | B1 | oe |
| | $\frac{1.2 \times 6}{5}$ | M1 | oe |
| | 1.44 | A1 | 144p SC2 for answer 0.72 or 72p |
| 15(a) | $\frac{3+x}{4} = \frac{9}{5}$ | B1 | |

| Q | Answer | Mark | Comments |
|-------|---|-------|--------------------------------|
| 15(b) | Alternative Method 1 | | |
| | $9(3 + x) = 4 \times 5$ | M1 | $3 + x = 4 \times \frac{5}{9}$ |
| | $27 + 9x = 20$ | M1dep | $3 + x = \frac{20}{9}$ |
| | $9x = 20 - 27$ | M1dep | $x = \frac{20}{9} - 3$ |
| | $-\frac{7}{9}$ or $-0.77...$ or -0.78 | A1 | oe |
| | Alternative Method 2 | | |
| | $4(3 + x) = 5 \times 9$ | M1 | $3 + x = 9 \times \frac{5}{4}$ |
| | $12 + 4x = 45$ | M1dep | $3 + x = \frac{45}{4}$ |
| | $4x = 45 - 12$ | M1dep | $x = \frac{45}{4} - 3$ |
| | $\frac{33}{4}$ or 8.25 | A1 | oe |
| | Alternative Method 3 | | |
| | $4(3 + x) = 5 \times 9$ | M1 | $3 + x = 5 \times \frac{9}{4}$ |
| | $12 + 4x = 45$ | M1dep | $3 + x = \frac{45}{4}$ |
| | $4x = 45 - 12$ | M1dep | $x = \frac{45}{4} - 3$ |
| | $\frac{33}{4}$ or 8.25 | A1 | oe |

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| | | | |
|------------------------|-----------------------------|-------|--------------------------------|
| 15(b) Cont. | Alternative Method 4 | | |
| | $5(3 + x) = 4 \times 9$ | M1 | $3 + x = 4 \times \frac{9}{5}$ |
| | $15 + 5x = 36$ | M1dep | $3 + x = \frac{36}{5}$ |
| | $5x = 36 - 15$ | M1dep | $x = \frac{36}{5} - 3$ |
| | $\frac{21}{5}$ or 4.2 | A1 | oe |

| Q | Additional Guidance | Mark |
|--------------|--|--|
| 15(b) | $\frac{3}{4} + \frac{x}{4} = \frac{9}{5}$ $\frac{x}{4} = \frac{9}{5} - \frac{3}{4}$ $x = \left(\frac{9}{5} - \frac{3}{4} \right) \times 4$ $x = \frac{21}{5}$ <p>If students use a different equation than that chosen in part (a) they can only score a maximum of 3 out of 4, unless they choose the correct equation</p> | M1 M1dep M1dep A1 |

| Q | Answer | Mark | Comments |
|----|--|-------|--|
| 16 | Alternative Method 1 | | |
| | $\tan 50 = \frac{h}{24}$ | M1 | $\tan 40 = \frac{24}{h}$ |
| | $24 \times \tan 50$ or [28.5, 29] | M1dep | $24 \div \tan 40$ or [28.5, 29] |
| | $\frac{1}{2} \times 24 \times 24 \tan 50$ | M1dep | $\frac{1}{2} \times 24 \times (24 \div \tan 40)$ |
| | [342, 348] | A1 | |
| | 340 or 350 | B1ft | Must ft from their 3sf answer if seen |
| | Alternative Method 2 | | |
| | $\cos 50 = \frac{24}{x}$ | M1 | $\sin 40 = \frac{24}{x}$ |
| | $24 \div \cos 50$ or [37.3, 37.5] | M1dep | $24 \div \sin 40$ or [37.3, 37.5] |
| | $\frac{1}{2} \times 24 \times \text{their } 37.3 \times \sin 50$ | M1dep | |
| | [342, 348] | A1 | |
| | 340 or 350 | B1ft | Must ft from their 3sf answer if seen |
| | Alternative Method 3 | | |
| | $\frac{x}{\sin 50} = \frac{24}{\sin 40}$ | M1 | $\frac{x}{\sin 90} = \frac{24}{\sin 40}$ |
| | $\frac{24 \sin 50}{\sin 40}$ or [28.5, 29] | M1dep | $\frac{24}{\sin 40}$ or [37.3, 37.5] |
| | $\frac{1}{2} \times 24 \times 24 \tan 50$ | M1dep | $\frac{1}{2} \times 24 \times \text{their } 37.3 \times \sin 50$ |
| | [342, 348] | A1 | |
| | 340 or 350 | B1ft | Must ft from their 3sf answer if seen |

| Q | Answer | Mark | Comments |
|-------|--|------|------------------|
| 17(a) | Fully correct box plot with minimum = 65 LQ = 70 median = 80 UQ = 85 maximum = 95 | B2 | B1 for 3 correct |

| Q | Additional Guidance | Mark |
|-------|---|------|
| 17(a) | Minimum and maximum values can be marked with a cross or a plus | |

| | | | |
|-------|--|----|---------------------|
| 17(b) | LQ = 75 | B1 | Need not be plotted |
| | UQ = 90 | B1 | Need not be plotted |
| | Minimum = 60 or maximum = 100 or median = [75,90] | B1 | Need not be plotted |
| | Minimum = 60 and maximum = 100 and median = [75,90] and correct box plot drawn | B1 | |

| Q | Additional Guidance | Mark |
|-------|--|------|
| 17(b) | Box plot takes precedence over any written answers | |

| | | | |
|----|--|-------|--------------|
| 18 | $45^2 + 60^2 - 2 \times 45 \times 60 \times \cos 110$ | M1 | [7461, 7472] |
| | $\sqrt{45^2 + 60^2 - 2 \times 45 \times 60 \times \cos 110}$ | M1dep | |
| | [86.3, 86.5] or 86 | A1 | |

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| Q | Additional Guidance | Mark |
|----|--|-------------------------------|
| 18 | <p>If they extend the base to form a right-angled triangle then the mark scheme still works, i.e.</p> <p>$AD = 45 \cos 70 = 15.3909$</p> <p>$DC = 45 \sin 70 = 42.2861$</p> <p>$BD = 15.3909 + 60 = 75.3909$</p> <p>$BC^2 = 75.3909^2 + 42.2861^2$ (first M1 here)</p> <p>$BC^2 = 5683.78 + 1788.11 = 7471.89$</p> <p>$BC = \sqrt{7471.89}$ (second M1 here)</p> <p>$BC = 86.44$ (full marks)</p> | <p>M1</p> <p>M1</p> <p>A1</p> |

| | | | |
|----|---|----|--|
| 19 | Alternative method 1 | | |
| | 39.5 or 24.5 or 40.5 or 25.5 or 965 or 975 | B1 | |
| | One correctly evaluated trial using at least one bound or one correctly evaluated trial giving an answer in range 965 to 975 | M1 | <p>eg $39.5 \times 24.5 = 967(.75)$</p> <p>or $39.7 \times 24.5 = 972(.65)$</p> <p>or $40.5 \times 25.5 = 1032(.75)$</p> <p>Trial values must be in range of bounds</p> |
| | <p>Ticks cannot tell and 965 seen and</p> <p>One correctly evaluated trial giving an answer in range 965 to 970</p> <p>or</p> <p>Ticks cannot tell and 975 seen and</p> <p>One correctly evaluated trial giving an answer in range 970 to 975</p> | A1 | <p>eg 967.75</p> <p>eg 972.6</p> |

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| | | | |
|---------------------|---|-------|--|
| 19 cont. | Alternative method 2 | | |
| | One correctly evaluated trial giving an answer below 970 (or their value [965, 975]) | M1 | |
| | One correctly evaluated trial giving an answer below 970 (or their value [965, 975]) and One correctly evaluated trial giving an answer above 970 (or their value [965, 975]) | M1dep | |
| | Ticks cannot tell and One correctly evaluated trial giving an answer below 970 (or their value [965, 975]) and One correctly evaluated trial giving an answer above 970 (or their value [965, 975]) | A1 | eg 967.75 and 1032.75 or 967.75 and 1000 or $967.75 < 975 < 1032.75$ |

| Q | Additional Guidance | Mark |
|-----------|---|------|
| 19 | Trial values must be within range of bounds, e.g. $39.5 \times 26 = 1027$ scores B1M0 $25 \times 40 = 1000$ on its own scores zero but see Alt method 2 | |

| Q | Answer | Mark | Comments |
|---|--------|------|----------|
|---|--------|------|----------|

| | | | |
|----|--|-------|--|
| 20 | Alternative method 1 | | |
| | $y \propto R^2$ or $y = kR^2$ | M1 | oe |
| | $24 = k(4)^2$ or $\frac{24}{4^2}$ or 1.5 | M1dep | oe |
| | $\frac{1350}{24} \times 16$ | M1dep | oe |
| | 900 | A1 | |
| | $(R =) 30$ or -30 | A1 | Either value |
| | Alternative method 2 | | |
| | $\frac{R^2}{4^2}$ | M1 | oe $\frac{4^2}{R^2}$ |
| | $\frac{1350}{24} = \frac{R^2}{4^2}$ | M1dep | oe $\frac{24}{1350} = \frac{4^2}{R^2}$ |
| | $\frac{1350}{24} \times 16$ | M1dep | oe |
| | 900 | A1 | |
| | $(R =) 30$ or -30 | A1 | Either value |

| Q | Additional Guidance | Mark |
|----|--|----------|
| 20 | $y = kx^2$ $y \propto kR^2$ 900 scores 4 marks | M1 M1 |

| Q | Answer | Mark | Comments |
|----|--|-------|--|
| 21 | $y = 2 + x$ | B1 | $x = y - 2$ |
| | $2x^2 + 5x + 1 = \text{their } (2 + x)$ | M1 | oe $y = 2(y - 2)^2 + 5(y - 2) + 1$ $2y^2 - 8y + 8 + 5y - y - 10 + 1 = 0$ |
| | $2x^2 + 4x - 1 = 0$ | M1dep | $2y^2 - 4y - 1 = 0$ |
| | $\frac{-4 \pm \sqrt{4^2 - (4 \times 2 \times -1)}}{2 \times 2}$ or $\frac{-4 \pm \sqrt{24}}{4}$ | M1 | $\frac{- -4 \pm \sqrt{(-4)^2 - (4 \times 2 \times -1)}}{2 \times 2}$ or $\frac{4 \pm \sqrt{24}}{4}$ |
| | $x = -2.2(\dots)$ and $x = 0.2(\dots)$ or $x = -2.2(\dots)$ and $y = -0.2(\dots)$ or $x = 0.2(\dots)$ and $y = 2.2(\dots)$ | A1 | $y = 2.2(\dots)$ and $y = -0.2(\dots)$ or $y = 2.2(\dots)$ and $x = 0.2(\dots)$ or $y = -0.2(\dots)$ and $x = -2.2(\dots)$ |
| | $x = -2.2$ and $y = -0.2$ and $x = 0.2$ and $y = 2.2$ | A1 | $y = 2.2$ and $x = 0.2$ and $y = -0.2$ and $x = -2.2$ |

| Q | Additional Guidance | Mark |
|----|---|------|
| 21 | <p>BEWARE, roots of $2x^2 + 5x + 1 = 0$ are -0.22 and -2.28</p> <p>Correctly substituting their values from their quadratic scores M1, e.g. $2x^2 + 5x + 1 = 0$ $\frac{-5 \pm \sqrt{5^2 - (4 \times 2 \times 1)}}{2 \times 2}$ scores M0M0M1A0A0</p> <p>All four solutions are required to score full marks</p> | |

| | | | |
|----|---|----|--------------------------------------|
| 22 | $(x - 4)(x + 4)$ | B1 | |
| | $(2x + 3)(x - 4)$ or $(2x + a)(x + b)$ | M1 | where $ab = \pm 12$ or $2b + a = -5$ |
| | $\frac{x + 4}{2x + 3}$ | A1 | |

| Q | Answer | Mark | Comments |
|----|--|------|---|
| 23 | $\frac{4}{9}$ or $\frac{5}{9}$ or $\frac{3}{8}$ or $\frac{5}{8}$ or $\frac{4}{8}$ | M1 | oe |
| | $\frac{4}{9} \times \frac{3}{8}$ or $\frac{4}{9} \times \frac{5}{8}$ or $\frac{5}{9} \times \frac{4}{8}$ | M1 | oe 0.166... or 0.277... or 0.17 or 0.28 |
| | $\frac{4}{9} \times \frac{3}{8} + \frac{4}{9} \times \frac{5}{8} + \frac{5}{9} \times \frac{4}{8}$ | M1 | $1 - \left(\frac{5}{9} \times \frac{4}{8}\right)$ |
| | $\frac{52}{72}$ or $\frac{13}{18}$ | A1 | oe 0.72(2..) |

| Q | Additional Guidance | Mark |
|----|---------------------|------|
| 23 | Accept decimals | |

| | | | |
|----|---|-------|------------------|
| 24 | $(3n + 5)(n - 1)$ or $3n \times n$ | M1 | |
| | $(3n + 5)(n - 1) - 3n \times n$ | M1dep | |
| | $\frac{3n^2 - 3n + 5n - 5 - 3n^2}{3n(n - 1)}$ or $\frac{3n^2 + 2n - 5 - 3n^2}{3n(n - 1)}$ | A1 | Denominator used |

| Q | Additional Guidance | Mark |
|----|--|------|
| 24 | Ignore repetition of right hand side – see script S3 | |

| | | | |
|-------|-----|----|--|
| 25(a) | 120 | B1 | |
|-------|-----|----|--|

| | | | |
|-------|------------|----|--------------|
| 25(b) | 240 or 300 | B1 | Either value |
|-------|------------|----|--------------|

