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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates’ scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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1. Annotations used in the detailed Mark Scheme.

<table>
<thead>
<tr>
<th>Annotation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>Correct</td>
</tr>
<tr>
<td>✗</td>
<td>Incorrect</td>
</tr>
<tr>
<td>BOD</td>
<td>Benefit of doubt</td>
</tr>
<tr>
<td>FT</td>
<td>Follow through</td>
</tr>
<tr>
<td>ISW</td>
<td>Ignore subsequent working (after correct answer obtained), provided method has been completed</td>
</tr>
<tr>
<td>M0</td>
<td>Method mark awarded 0</td>
</tr>
<tr>
<td>M1</td>
<td>Method mark awarded 1</td>
</tr>
<tr>
<td>M2</td>
<td>Method mark awarded 2</td>
</tr>
<tr>
<td>A1</td>
<td>Accuracy mark awarded 1</td>
</tr>
<tr>
<td>B1</td>
<td>Independent mark awarded 1</td>
</tr>
<tr>
<td>B2</td>
<td>Independent mark awarded 2</td>
</tr>
<tr>
<td>MR</td>
<td>Misread</td>
</tr>
<tr>
<td>SC</td>
<td>Special case</td>
</tr>
<tr>
<td>^</td>
<td>Omission sign</td>
</tr>
</tbody>
</table>

These should be used whenever appropriate during your marking.

The M, A, B etc annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate these scripts to show how the marks have been awarded. It is not mandatory to use annotations for any other marking, though you may wish to use them in some circumstances.

Subject-Specific Marking Instructions

2. M marks are for using a correct method and are not lost for purely numerical errors. A marks are for an accurate answer and depend on preceding M (method) marks. Therefore M0 A1 cannot be awarded. B marks are independent of M (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage. SC marks are for special cases that are worthy of some credit.

3. Unless the answer and marks columns of the mark scheme specify M and A marks etc, or the mark scheme is ‘banded’, then if the correct answer is clearly given and is not from wrong working full marks should be awarded.

   Do not award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen and the correct answer clearly follows from it.
4. Where follow through (FT) is indicated in the mark scheme, marks can be awarded where the candidate’s work follows correctly from a previous answer whether or not it was correct.

Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT \( 180 \times (their\ '37' + 16) \), or FT \( 300 - \sqrt{\(their\ '5^2 + 7^2\)} \). Answers to part questions which are being followed through are indicated by eg FT \( 3 \times their\ (a) \).

For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

5. Where dependent (dep) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.

6. The following abbreviations are commonly found in GCSE Mathematics mark schemes.

- *cao* means *correct answer only*.
- *figs 237*, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
- *isw* means *ignore subsequent working* (after correct answer obtained).
- *nfww* means *not from wrong working*.
- *oe* means *or equivalent*.
- *rot* means *rounded or truncated*.
- *seen* means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.
- *soi* means *seen or implied*.

7. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise, indicated for example by the instruction ‘mark final answer’.

8. As a general principle, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered, mark the poorer (poorest).

9. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate’s work and allow follow through for A and B marks. Deduct 1 mark from any A or B marks earned and record this by using the MR annotation. M marks are not deducted for misreads.
10. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.

11. If the correct answer is seen in the body and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer' or 'cao'. Place the annotation ✓ next to the correct answer.

If the answer space is blank but the correct answer is seen in the body allow full marks. Place the annotation ✓ next to the correct answer.

If the correct answer is seen in the working but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks would still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.

12. Ranges of answers given in the mark scheme are always inclusive.

13. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.

14. Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.
<table>
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<tr>
<th>Question</th>
<th>Answer</th>
<th>Marks</th>
<th>Part marks and guidance</th>
</tr>
</thead>
</table>
| 1        | 8, 8, 13 and 15 | 3     | **B2** for 3 or 4 numbers with at least two conditions met out of:  
At least two numbers are 8  
The range is 7  
The total is 44  
or  
**B1** for 4 numbers with one condition met  
or 44 seen  
Accept any order  
Examples:  
**B2** for 8, 8, 10.5, 17.5  
**B2** for 8, 8, 8, 20  
**B2** for 8, 8, 28  
**B2** for 1, 8, 8  
**B1** for 8, 8, 8, 8  
**B0** for 8, 8 |
| 2        | 18 nfww | 4     | **B1** for [green] 36  
or  
ratio(s) equivalent to 5 : 9 : 36  
For **B1** accept 5 : 36 or 9 : 36  
or  
ratio(s) involving a common term for blue  
eg 10 : 18 and 18 : 72  
eg 1 : 1.8 : 7.2  
eg 5 / 9 : 1 : 4  
(decimals should be accurate rot to 3 figs)  
Their (5 + 9 + 36) must come from a ratio (or ratios) with a common term.  
1 + 4 + 5 + 9 = 19 followed by 5 / 19 \[ \text{scores 0.} \]
|           |        |       | AND  
**M2** for \( \frac{9}{(5 + 9 + 36)} \times 100 \)  
or  
**M1** for their \( 5 + 9 + 36 \) soi  
<p>|</p>
<table>
<thead>
<tr>
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<th>Marks</th>
<th>Part marks and guidance</th>
</tr>
</thead>
</table>
| 3        | \[
\frac{300 \times (7 - 3)}{60} = 20
\]  
AND  
it is close to 19.5 oe  
or  
19.5 rounds to 20 oe  
or  
[Asha’s estimate] is reasonable  

3 | B2 for 300, 7, 3 and 60 seen  
or  
B1 for two of 300, 7, 3 and 60 seen  
or  
300, 4 and 60 seen  
or  
300.0, 7.0, 3.0, 60.0  
AND  
B1dep for result 20 and correct conclusion following B1 or B2  

| 4        | (a) \[
\begin{align*}
\quad a^5 \times a^3 &= a^{5+3} = a^{11} \\
\text{or} \\
\quad a^5 \times a^3 \times a^3 &= a^{5+3+3} = a^{11}
\end{align*}
\]  

2 | B1 for \([(a^3)^2 = a^6] \text{ or } a^3 \times a^3 \]  
Alternative:  
B2 for \([a^2 \times (a^3)^2 =] \)  
\a \times a \times \ldots \times a \text{ [ = a}^{11}] \]  
or  
B1 for \([(a^3)^2 =] a \times a \times a \times a \times a \times a \]

| (b)      | \(5^{15}\) | 3 | B1 for \(\frac{1}{125} = 5^{-3}\) or \([125 = 5^3]\)  
B1 for \(5^{18}\)  

Actual answer 19.475959...(may be rounded) scores 0  
Accept “Yes” or “She’s right” or “It is” or equivalent comment  

written in full with eleven a’s.  
written in full with six a’s  
May be implied by \((a \times a \times a \times a \times a \times a)\) seen within an incorrect lengthier product.
<table>
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<tr>
<th>Question</th>
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</tr>
</thead>
<tbody>
<tr>
<td>5 (a)</td>
<td>$y = 0.75x + 2$ oe</td>
<td>3</td>
<td><strong>B2</strong> for $y = 0.75x\pm c$ or answer $0.75x + 2$ \ OR \ <strong>M1</strong> for attempt at change in $y$ soi by $\pm (5 \pm 2) \pm (4 \pm 0)$ or $\pm 0.75$ and <strong>B1</strong> for $y = kx + 2$ with $k \neq 0$ \ ISW after a correct equation if attempting rearrangement \ Accept oe throughout eg <strong>B2</strong> for $4y = 3x$ \ Examples: <strong>M1B1</strong> for $y = -0.75x + 2$ <strong>M1B0</strong> for $0.75, 0.75x, -0.75, -0.75x$ If gradient inverted: <strong>M0B1</strong> for $y = 1.3x + 2$ <strong>M0B0</strong> for $1.3x + 2, y = 1.3x$ Condone poorly written $\frac{3}{4}x$ unless clearly $\frac{3}{4}x$.</td>
</tr>
<tr>
<td>(b)</td>
<td>3 nfww</td>
<td>3</td>
<td><strong>M2</strong> for $12 = 16 - 4k + 8$ or better \ OR \ <strong>M1</strong> for $12 = -4^2 - 4 \times k + 8$ or sign errors in $12 = 16 - 4k + 8$ or better \ or $k = \frac{y - x^2 - 8}{x}$ \ Condone $\cdot 4$ not in brackets but $12 = \cdot 4^2 + k - 4 + 8$ with no times sign or dot between $k$ and $\cdot 4$ scores 0 unless subsequently clarified.</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
<td>Marks</td>
<td>Part marks and guidance</td>
</tr>
<tr>
<td>----------</td>
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<td>-------------------------</td>
</tr>
<tr>
<td><strong>(c)</strong></td>
<td><strong>Using symmetry:</strong>&lt;br&gt;Q is (0, 8)&lt;br&gt;Midpoint, M, of AQ is at (0, 5)&lt;br&gt;MB is perpendicular to QA&lt;br&gt;So isosceles/Diann is correct</td>
<td>1 dep</td>
<td>dep mark is always dependent on 3 marks being achieved. For first mark in all methods, condone [Q =] 8 or [QA =] 8-2 or 6, seen in working or on diagram. eg 8 – 5 = 3 and 5 – 2 = 3 so B is in the middle of A and Q. May see “midpoint” or any other letter for M.</td>
</tr>
<tr>
<td></td>
<td>OR <strong>Using Pythagoras:</strong>&lt;br&gt;Q is (0, 8)&lt;br&gt;AB² = 4² + 3² oe or AB = 5 nfww&lt;br&gt;or QB² = 4² + (their 8 – 5)² or QB = 5 nfww&lt;br&gt;AB = 5 and QB = 5&lt;br&gt;or&lt;br&gt;AB² = 25 and QB² = 25&lt;br&gt;AB = QB or “two sides are equal” oe so isosceles/Diann is correct</td>
<td>1</td>
<td>Accept implied symmetry</td>
</tr>
<tr>
<td></td>
<td>OR <strong>Using gradients, vectors or descriptions of translations</strong>&lt;br&gt;Q is (0, 8)&lt;br&gt;1 for Q is (0, 8)&lt;br&gt;1</td>
<td>1</td>
<td>1 for gradients/vectors/descriptions of translations for both AB and QB (must be seen together in part (c): eg&lt;br&gt;gradients: AB = 3/4 and QB = −3/4 (may be implied from the equations of the two lines) descriptions: AB is 4 along (treat as in positive sense) and 3 up and QB is 4 along and 3 down oe&lt;br&gt;To score more than 2 marks, the approach needs to be developed to justify isosceles, such as by switching to the 3rd and 4th marks of the Pythagoras or trig methods.</td>
</tr>
<tr>
<td></td>
<td>OR <strong>Using trig:</strong>&lt;br&gt;Q is (0, 8)&lt;br&gt;tan BAQ = 4/3 [=53.1]&lt;br&gt;tan BQA = 4/3 [= 53.1]&lt;br&gt;BAQ = BQA or “two angles are equal” oe so isosceles/Diann is correct</td>
<td>1 dep</td>
<td>dep mark is always dependent on 3 marks being achieved. For first mark in all methods, condone [Q =] 8 or [QA =] 8-2 or 6, seen in working or on diagram. eg 8 – 5 = 3 and 5 – 2 = 3 so B is in the middle of A and Q. May see “midpoint” or any other letter for M.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>1 for gradients/vectors/descriptions of translations for both AB and QB (must be seen together in part (c): eg&lt;br&gt;gradients: AB = 3/4 and QB = −3/4, so triangle is isosceles also scores a max of 1 1 0 0&lt;ref&gt;W&lt;ref&gt;arnings:&lt;ref&gt;dimensions of triangle shown as (8 – 2), 4, 4 and isosceles stated is B1 only; blank answer space but BQ drawn on diagram is 0 not NR.</td>
</tr>
</tbody>
</table>

9
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Marks</th>
<th>Part marks and guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.1 oe nfww</td>
<td>3</td>
<td>M2 for $80 \times 0.04 = y \times 32$ or $3.2 = 32y$ or $y = \frac{3.2}{32}$ oe OR M1 for $80 \times 0.04$ soi by $3.2$ or $16 \over 5$ or $y = \frac{k}{x}$ soi</td>
</tr>
</tbody>
</table>
| 7        | $r = 5$
$t = 2$ | 4     | M2 for $u = 14$, may be seen in table A1 for $r = 5$ or $t = 2$ OR M1 for $\pm(u - 3) = 11$ oe soi by $u = -8$ or $\pm(u - 8) = 6$ oe soi by $u = 2$ A1FT for $r = 17$ and $t = 20$ following $u = -8$ or $r = 7$ and $t = 10$ following $u = 2$ If no credit-worthy working B2 for $r = 5$ B2 for $t = 2$ FT only from a partially correct value for $u$ (ie. -8 or 2) |
<table>
<thead>
<tr>
<th>Question</th>
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<th>Marks</th>
<th>Part marks and guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 (a)</td>
<td>0.3 oe</td>
<td>2</td>
<td>M1 for $\frac{[\pm]6}{85-65}$ oe or answer -0.3 oe or answer -0.3 if 0 scored, allow SC1 for 0.092[3…] or $\frac{6}{65}$ as final answer. Allow unsimplified equivalents for full marks eg. $\frac{6}{20}$.</td>
</tr>
<tr>
<td>(b)</td>
<td>255</td>
<td>3</td>
<td>M2 for valid method to find complete area under the graph using one or more parts OR M1 for attempt to find partial area below the graph M2 examples: $\frac{85 \times 6}{2}$ oe or two triangles soi by 195 and 60 or [rectangle] $6 \times 85$ – two triangles oe M1 examples a triangle between $t = 0$ and 65 or a triangle between $t = 65$ and 85 or [rectangle] $6 \times 85$ – one triangle M0 for [rectangle] $6 \times 85$ Allow full marks for equivalent with units stated eg. 0.255 km</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
<td>Marks</td>
<td>Part marks and guidance</td>
</tr>
<tr>
<td>----------</td>
<td>--------</td>
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<td>-------------------------</td>
</tr>
<tr>
<td>(c)</td>
<td>21.6 or $\frac{108}{5}$ or $21\frac{3}{5}$ nfww</td>
<td>4</td>
<td><strong>B1</strong> for 6 soi AND <strong>M2</strong> for ( \frac{6 \times 60 \times 60}{1000} ) oe ( \frac{60 \times 60}{1000} ) oe soi 3.6. <strong>M1</strong> for their ( 6 \times 60 \times 60 ) oe soi 2160 or ( \frac{6}{1000} ) oe soi 0.006 imply B1M1. Condone missing or incorrect units in working eg 6 m for 6 m/s. <em>their</em> 6 could be the average speed 255/85. 21600 or 0.006 imply B1M1.</td>
</tr>
<tr>
<td>9 (a)</td>
<td>-6</td>
<td>1</td>
<td><strong>B1</strong> for 24 seen After ( x = 4, y = 24 ) scored: Examples just sufficient for second mark include: change of sign (-6 &lt; 0 &lt; 24) ( x = 3 ) gives an answer &lt; 0 and ( x = 4 ) gives an &gt; 0. Examples insufficient for second mark: so ( p ) lies between 3 and 4.</td>
</tr>
<tr>
<td>9 (b)</td>
<td>([x = 4, y = 24] ) Change of sign, so ( p ) lies between 3 and 4 oe</td>
<td>2</td>
<td><strong>B1</strong> for 24 seen If using ( 3.27 &lt; x &lt; 4 ) rather than 4: <strong>SC2</strong> evaluate ( y ) correctly (see table in (c)), state change of sign oe and that because ( 3 &lt; p &lt; ) their ( x )-value, then so ( 3 &lt; p &lt; 4 ). 0 for just evaluating ( y ).</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
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<td>Part marks and guidance</td>
</tr>
<tr>
<td>----------</td>
<td>------------------------------------------------------------------------</td>
<td>-------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>(c)</td>
<td>Examples: when $x = 3.5, y = 6.4$, so $3 &lt; p &lt; 3.5$ when $x = 3.1, y = -3.9$, so $3.1 &lt; p &lt; 4$ when $x = 3.1, y = -3.9$ and when $x = 3.5, y = 6.4$, so $3.1 &lt; p &lt; 3.5$</td>
<td>3</td>
<td><strong>M2</strong> for one further value of $y$ evaluated correctly, possibly not to 2 or more sf, for a value of $x$ such that $3 &lt; x &lt; 4$ <strong>OR</strong> <strong>M1</strong> for working shown to calculate one further value of $y$ for a value of $x$ such that $3 &lt; x &lt; 4$ Note after SC considered in (b): if SC2 was awarded then they must use a value of $x$ that produces a smaller interval than $3 &lt; x &lt;$ their $x$-value in (b); if SC2 was not awarded then $3 &lt; x &lt; 4$ applies If 0 scored, award <strong>SC1</strong> or <strong>SC2</strong> if evidence for M1 or M2 has not yet been credited in (b)</td>
</tr>
</tbody>
</table>

Solution is approx. 3.2670

<table>
<thead>
<tr>
<th>Common values:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$x$</td>
<td>$y$</td>
<td>$x$</td>
</tr>
<tr>
<td>3.1</td>
<td>-3.909</td>
<td>3.5</td>
</tr>
<tr>
<td>3.2</td>
<td>-1.632</td>
<td>3.6</td>
</tr>
<tr>
<td>3.25</td>
<td>-0.422</td>
<td>3.7</td>
</tr>
<tr>
<td>3.26</td>
<td>-0.174</td>
<td>3.75</td>
</tr>
<tr>
<td>3.27</td>
<td>0.0758</td>
<td>3.8</td>
</tr>
<tr>
<td>3.3</td>
<td>0.837</td>
<td>3.9</td>
</tr>
<tr>
<td>3.4</td>
<td>3.504</td>
<td></td>
</tr>
</tbody>
</table>

A correct narrower range scores 0 unless accompanied by the relevant correct calculation(s). eg **M2** only for when $x = 3.1, y = -3.9$ so $3.1 < p < 3.5$ (as 3.5 has not been correctly justified) Calculations in support of $x = 3$ or $x = 4$ need not be repeated from parts (a) or (b).
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</table>
| 10       | Correct triangle drawn with **a + 2b** labelled and with correct arrows or **a** and **2b** labelled and with correct arrows AND length 7cm indicated on diagram | 3     | **M1** for vector **2b** drawn on grid  
**M1** **a + k**b drawn on grid  
The two vectors must be joined end to end but arrows may be contradictory.  
**k**b should be in the direction of b  
If both methods shown/started, mark the better one  
For **M** marks condone missing or incorrect arrows and labels on vectors  
Mark intent: end of vectors within 2mm of vertices of relevant square  
Examples (ignore arrows):  
**M1M1** for **a + 2b** drawn (3 marks if labelled and 7 cm indicated)  
**M1M1** for **a − 2b**  
**M1M0** for **2b** or **−2b**  
**M0M1** for **a + b**, **a − 1.5b** etc  
OR |  |  | |
|         | OR    |  |  
\[
\begin{pmatrix} 4 \\ 1 \\ 2 \\ 3 \\ 0 \\ 7 \\
\end{pmatrix} \text{ with brackets}
\]  | **B1** for \( \begin{pmatrix} 4 \\ 1 \end{pmatrix} \)  
**B1** for \( \begin{pmatrix} -2 \\ 3 \end{pmatrix} \) or \( \begin{pmatrix} -4 \\ 6 \end{pmatrix} \)  
For **B1** marks, condone missing brackets and fraction lines |
<table>
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<tr>
<td>11</td>
<td>Angle $\angle BCA = 44^\circ$ and angles [in a] triangle [$= 180^\circ$] or angle $\angle DCA = 56^\circ$ and angles [in a] triangle [$= 180^\circ$]</td>
<td>1</td>
<td>$C = 44$ (or 56) is not sufficient. Accept angles shown on diagram.</td>
</tr>
<tr>
<td></td>
<td>Best two statements from: (i) [side] $AC$ is common (ii) [angle] $\angle ACB = \angle CAD$ (iii) [angle] $\angle BAC = \angle ACD$ (iv) angle $B = \angle D$ or [angle] $\angle ABC = \angle CDA$</td>
<td>2 B1 for each to a max of 2</td>
<td>0 if alternate angles is given as the reason unless the parallelogram has been justified</td>
</tr>
<tr>
<td></td>
<td>Conclusion and third statement [congruent because] ASA after stating (i), (ii), (iii) AAS after stating (i), (ii), (iv) or (i), (iii), (iv)</td>
<td>1</td>
<td>Notation needed for these marks.</td>
</tr>
<tr>
<td></td>
<td>If 0 (or 1 for statements) scored then, to a maximum total of 2 marks, allow: SC1 for angle $\angle BCA = 44^\circ$ and angle $\angle DCA = 56^\circ$ stated or on diagram and SC1 for a correct statement lacking precision eg “both triangles have a common side”, “both triangles have an angle of 80”, “all the angles are the same”</td>
<td></td>
<td>Final mark needs a third statement (ignore superfluous ones) and the appropriate congruence conclusion.</td>
</tr>
<tr>
<td></td>
<td>Possible marks (without SC): $1 + 2 + 1, \quad 1 + 2 + 0, \quad 1 + 1 + 0, \quad 0 + 2 + 1, \quad 0 + 2 + 0, \quad 0 + 1 + 0, \quad 0 + 0 + 0$.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
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| 12       | $[QS = \sqrt{80}, 4\sqrt{5} \text{ oe or } 8.9]_4$ | 2     | M2 for $[QS = \sqrt{4^2 + 8^2} \text{ oe}$
|          |        |       | or
|          |        |       | M1 for $4^2 + 8^2$
|          |        |       | B1 for each to a max of 2
|          |        |       | For these marks, answers to
|          |        |       | calculations are sufficient, but
|          |        |       | corresponding pairs must be either
|          |        |       | exact or the same when rot to 3sf.
|          |        |       | In (ii) accept QRS and PQS are both
|          |        |       | right angles oe
|          |        |       | (iii) and (iv) can be shown using
|          |        |       | scale factors eg $QS = 1.118 \times RS$
|          |        |       | and $PS = 1.118 \times QS$
|          |        |       | Note: there is no mark for just finding
|          |        |       | $QP = \sqrt{20}$
|          |        |       | In all cases, it must be clear which
|          |        |       | angles and ratios are being used to
|          |        |       | support the conclusion made,
|          |        |       | usually by using labels or from
|          |        |       | values on a diagram.
|          |        |       | If it is not clear, withhold the final
|          |        |       | mark.
|          |        |       | Where more than two facts are
|          |        |       | shown, allow the final mark if the
|          |        |       | conclusion is fully supported.
|          |        |       | Conclusion:
|          |        |       | two (or three) equal angles oe after
|          |        |       | showing (i) and (ii)
|          |        |       | or
|          |        |       | three pairs of corresponding sides in
|          |        |       | the same ratio after showing (iii) and
|          |        |       | (iv)
|          |        |       | or
|          |        |       | two pairs of corresponding sides in the
|          |        |       | same ratio and an equal angle between
|          |        |       | them oe after showing relevant
|          |        |       | combination of (i)/(ii) and (iii)
|          |        |       | Ratios of corresponding sides need to
|          |        |       | be seen in equivalent form.
|          |        |       | Accept QS on diagram
|          |        |       | First M2 may be implied by
|          |        |       | $QP = 2\sqrt{5}$ oe or 4.47[…] 
|          |        |       | Example values:
|          |        |       | angle RSQ = $\tan^{-1}\left(\frac{4}{8}\right) = \cos^{-1}\left(\frac{8}{\sqrt{80}}\right)$
|          |        |       | $= \sin^{-1}\left(\frac{4}{\sqrt{80}}\right) = 26.5(\ldots) \text{ or } 26.6$
|          |        |       | angle QSP = $\tan^{-1}\left(\frac{\sqrt{20}}{\sqrt{80}}\right) = \cos^{-1}\left(\frac{\sqrt{80}}{10}\right)$
|          |        |       | $= \sin^{-1}\left(\frac{\sqrt{20}}{10}\right) = 26.5(\ldots) \text{ or } 26.6$
|          |        |       | Accept as fractions or ratios.
|          |        |       | $\frac{PS}{QS} = \frac{10}{\sqrt{80}} = \frac{5}{2} = 1.118[\ldots]$ 
|          |        |       | $PS : QS = 10 : \sqrt{80}$ oe
|          |        |       | $\frac{QS}{RS} = \frac{\sqrt{80}}{8}$ with any of the above $\frac{PS}{QS}$ is
|          |        |       | insufficient for (iii) and (iv) as it is not clear
|          |        |       | that the ratios are the same.
| 13       | $288\pi$ or 904.3 to 905 | 2     | M1 for $\frac{4}{3} \times \pi \times (\times) 6^3$
|          |        |       | Accept 904 if M1 scored
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<td>(b)</td>
<td>20.0[9...] to 20.1[...] or $\frac{32}{5}\pi$ oe nfw</td>
<td>5</td>
<td>Accept answer 20 after full working. No requirement at any stage for a formal equation. Values below provided as a guide to method being used, but mark method not accuracy: ie hemisphere ($144\pi$ or 452[...]) or pyramid ($75[h]$) and pyramid ($75[h]$) OR 30% of pyramid ($22.5[h]$) or “reverse %” using hemisphere ($480\pi$ or 1507[...]) and 30% of pyramid ($22.5[h]$) OR “reverse %” using hemisphere ($480\pi$ or 1507[...]) and pyramid ($75[h]$). To receive M1M1M1 they should have both parts of the “ands” correct If correct, at this stage, it should be ($480\pi$ or 1507[...]) ÷ 75 oe $1507[..] ÷ 225$ is likely to score M1M1M0M1</td>
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| **14 (a)** | 21.45 × 4663 ÷ 100 000 = 1.0002[1..] (km)  
  or  
  21.45 × 4663 = 100 020 to 100 021.4 > 100 000 (cm)  
  or  
  100 000 ÷ 21.45 = 4662[.0..] < 4663  
  or  
  100 000 ÷ 4663 = 21.44[5..] < 21.45  
  Note the first method does not require a comparison against 1 (km) | **4** |  
  **B1** for (minimum length =) 21.45 seen  
  **B1** for 1 km = 100 000 cm soie such as × 100 then ÷ 1000 or use of 1m = 100cm and 1km = 1000m if working in metres.  
  **M1** for their 21.45 × 4663 (÷ 100 000) or  
  100 000 ÷ their 21.45 or  
  100 000 ÷ 4663  
  If M0 scored, allow **SC1** for k × 4663 (÷ 100 000) or  
  100 000 ÷ k with k in the range 10.25 to 10.35 or 6.45 to 6.55  
  **B0,B1,SC1** whereas use of volume may score **B0/1,B1,SC0**  
  Accept equivalent if working in m or km | Allow access to all marks if brick and 1 km are in consistent units.  
  Allow these conversions even with their volume or surface area.  
  eg 21.5 × 10.3 × 6.5 = 1439.425 cm/cm²/cm³ = 0.01439425 km  
  their 21.45 must be in the range 21.45 to 21.55 but accept equivalent if attempting the unit conversion first  
  eg **B0B0M1** for 21.5 cm = 0.0215 km followed by 0.0215 × 4663  
  Thus, use of width or height of the brick may score **B0,B1,SC1** whereas use of volume may score **B0/1,B1,SC0**  
  Accept equivalent if working in m or km |
| **14 (b) (i)** | 7017 to 7020 | **3** |  
  **B1** for 20 000 or 2.849[…] or 2.85 or 0.0028[…] seen  
  **M1** for their 20 000 ÷ their 2.85 or 20 ÷ their 0.00285 | Ignore other bound  
  ie a division after an attempt to reach consistent units  
  their 2.85 must be in the range 2.75 to 2.85 inc.; their 0.00285 must be in the range 0.00275 to 0.00285.  
  **B0M0** for 20 ÷ 2.8 as no attempt to reach consistent units |
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<td>(ii)</td>
<td>The truck may not have enough room oe Safety regulations may not allow it</td>
<td>1</td>
<td>Mark their best reason. 0 for we do not know the exact weight of the bricks oe 0 for because the truck may need to carry other loads 0 there may not be enough bricks available</td>
</tr>
<tr>
<td>15</td>
<td>7.2[0] or 7.19[9…] nfww</td>
<td>4</td>
<td><strong>M3</strong> for ( \frac{1379.02}{\sqrt{1200}} ) oe soi by 1.067[…] to 1.072[…] OR ( \frac{1379.02}{1200} ) oe soi by 1.14 to 1.15 OR <strong>M1</strong> for ( 1200x^2 = 1379.02 ) Trials or no working: <strong>SC4</strong> for correct answer 7.2[0] or 7.19[9…] on answer line OR <strong>SC3</strong> for ( 1200 \times 1.072[0]^2 = 1379.02 ) or ( 1200 \times 1.0719[9…]^2 = 1379.02 ) OR <strong>SC1</strong> for use of ( 1200x^2 ) oe</td>
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Condone % symbol with correct answer.

Warning: \( 1200 \div 179.02 = 6.7 \)

Allow \( (1 + \frac{r}{100}) \) or any letter, including \( r \), in place of \( x \).
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<tr>
<td>16 (a)</td>
<td>37000</td>
<td>1</td>
<td>Allow 37k</td>
</tr>
<tr>
<td>(b)</td>
<td>22000</td>
<td>2</td>
<td><strong>M1</strong> for figs 43 – figs 21 soi by figs 22 Allow 22k</td>
</tr>
<tr>
<td>(c)</td>
<td></td>
<td>3</td>
<td><strong>B2</strong> for 4 or 5 correct markers OR <strong>B1</strong> for 3 correct markers or 17000 seen Tolerance ½ square Award the markers even if not correctly representing the information eg if 17000 is plotted at 68000 still credit the markers at 28000, 37000 etc.</td>
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<td>(d)</td>
<td>Interquartile range is the same for both oe or Range for CC is higher oe Average/median salaries are the same or The middle 50% of salaries for CC are higher</td>
<td>1</td>
<td>IQR = 22000 for both BB range = 59000 CC range = 68000 Medians = 37000 for both When given, figures should be correct. Ignore additional incorrect comparisons provided they do not contradict a correct answer given Do not accept comments just about a max (or min) salary <strong>B0</strong> for CC has the highest salary <strong>B0</strong> for highest paid worker at CC earns more than highest paid worker at BB <strong>B0</strong> (some) people earn more at CC <strong>B0</strong> for wider distribution at CC</td>
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| 17 (a)   | \( \frac{x}{5} - 14 \) oe | 2     | M1 for \( \frac{x}{5} \)  
If 0 scored then SC1 for \( \frac{x - 14}{5} \) oe  
Condone use of another letter for M1 max  
Must use \( x \) in SC1  
0 for \( x - 14 \div 5 \) |
| (b)      | -17.5 or \( \frac{-35}{2} \) oe nfww | 3     | M1 for 5\( (k' + 14) \) = 'k' or 'k' = \( \frac{k}{5} - 14 \)  
M1FT for 4\( k' \) = -70 or better  
or re-arrangement of their comparable \( f(k) = g(k) \) equation into the form \( ak = b \).  
M1FT solving their \( ak = b \)  
Alternative (FT as above):  
M1 for \( k' = \frac{k}{5} - 14 \)  
M1FT for \( 4k \) = -14 or better  
M1FT solving their \( ak = b \)  
Trials or no working:  
SC3 for -17.5  
eg 5\( k + 14 = k \) becomes 4\( k = -14 \) and then \( k = -3.5 \) scores M0 M1FT M1FT  
k + 70 = k is not comparable  
Answers may be in decimal or fractional form but fractions equating to integers should be simplified |
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<tr>
<td>18 (a)</td>
<td>Bars are of different width oe</td>
<td>1</td>
<td>0 for large tin looks larger than it is</td>
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<td></td>
<td></td>
<td></td>
<td>0 for the bars are different sizes</td>
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<td>0 for incorrect/no x-axis</td>
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<td>18 (b)</td>
<td>11.4[…] nfww</td>
<td>4</td>
<td><strong>B1</strong> for $1.5 \pm \frac{3}{2}$ or $3:2$ soi</td>
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<td>AND</td>
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<td></td>
<td><strong>M2</strong> for $10 \times \sqrt{1.5}$</td>
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<td>or</td>
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<td></td>
<td><strong>M1</strong> for $\sqrt{1.5}$ soi by 1.14(47…)</td>
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<td>If 0 scored allow <strong>SC1</strong> for 15 as final answer or seen radius of large tin</td>
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<td><strong>Alternative:</strong></td>
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<td><strong>B1</strong> for 0.666 to 0.667 or $\frac{2}{3}$ or $2:3$ soi</td>
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<td></td>
<td><strong>M2</strong> for $10 \div \sqrt[3]{0.666}$ to $0.667$ oe</td>
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<td>or</td>
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<td></td>
<td><strong>M1</strong> for $\sqrt[3]{0.666}$ to $0.667$ soi $0.873(…)$</td>
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| 19       | \[
\frac{(2x+5)(x+4)}{(2x+5)(x-2)} = \frac{x+4}{x-2}
\] | 4     | M3 for \((2x+5)(x+4)\) and \((2x+5)(x-2)\) seen  
OR  
M2 for \((2x+5)(x+4)\) or \((2x+5)(x-2)\) seen  
OR  
M1 for any two linear factors giving two correct terms in numerator or denominator  
Alternative:  
M1 for \((2x^2 + 13x + 20)(x - b)\) and \((2x^2 + x - 10)(x + a)\) seen  
M1 two correct from  
\(-10a = -20b\) oe  
\(a - 10 = 20 - 13b\) oe  
\(2a + 1 = 13 - 2b\) oe  
M1dep (on M1M1) valid attempt to solve their simultaneous equations (condone one error)  
If 0 scored, allow SC2 for \(\frac{x+4}{x-2}\) as final answer from incomplete working, or SC1 for \(\frac{x+4}{x-2}\) seen.  
Warning:  
\(2(x+5)(x+4) = \frac{x+4}{x-2}\) scores SC1  
eg. \((2x+10)(x+2)\) which gives \(2x^2\) and 20 |
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