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# Mark Scheme (Results)

Summer 2017

Pearson Edexcel International GCSE
In 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
    - eeoo – each error or omission

- **No working**
  If no working is shown then correct answers normally score full marks
  If no working is shown then incorrect (even though nearly correct) answers score no marks.
- **With working**
  If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.
  Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.
  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
  If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.
  If there is no answer on the answer line then check the working for an obvious answer.
- **Ignoring subsequent work**
  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.
  It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.
  Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.
- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

| **International GCSE Maths** | | | | |
|---|---|---|---|---|
| Apart from questions 9, 14, 17, 21b and 23 (where the mark scheme states otherwise) the correct answer, unless clearly obtained from an incorrect method, should be taken to imply a correct method. | | | | |
| **Q** | **Working** | **Answer** | **Mark** | **Notes** |
| **1** (a) | Eg $\frac{30}{12}\times 110$ or $2.5\times 110$ or $\frac{30}{12}$ or 2.5 or<br>$\frac{110}{12}\times 30$ or 9.16(666...) × 30 or $\frac{110}{12}$ or 9.16(666...) oe | 275 | 2 | M1 Accept 9.16(666...) rounded or truncated to at least 3 SF<br>A1 |
| (b) | Eg $\frac{375}{100}\times 12$ or $3.75\times 12$ or<br>$375 \div \frac{100}{12}$ or 375 ÷ 8.33(333...) or<br>$\frac{12}{100}\times 375$ or $0.12\times 375$ | 45 | 2 | M1 For a complete method<br>Accept 8.33(333...) rounded to at least 3 SF<br>A1 |
| | | | | **Total 4 marks** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **2** | (a) (i) | | 5, 15 | 1 | B1 | |
| | (ii) | | 5, 7, 9, 10, 11, 13, 15 | 1 | B1 | |
| | (b) | | 4, 6, 8, 10, 12, 14 | 2 | B2 | B2 for all correct and none incorrect.<br>If not B2 then B1 for 4 or more correct and no more than 1 incorrect. |
| | | | | | | **Total 4 marks** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **3** | (a) | | 14.37028405 | 2 | M1<br>A1 | 102.66 or 1.843(9...) or 7.143(9..)<br>Accept 14.37(028.....) rounded or truncated to at least 4SF |
| | (b) | | 14.4 | 1 | B1 ft | As long as from at least 4sf |
| | | | | | | **Total 3 marks** |

| | | | | | |
|---|---|---|---|---|---|
| **4** | $10 \times 4.2 \times 7.5$ or 315 ($cm^3$) oe | | 4 | M1 | For volume of cuboid |
| | Eg $0.5 \times 7 \times x \times 5$ or $17.5x$ oe | | | M1 | indep<br>For volume of triangular prism |
| | $10 \times 4.2 \times 7.5 = 0.5 \times 7 \times x \times 5$ or $17.5x = 315$ oe or<br>$\frac{10 \times 4.2 \times 7.5}{0.5 \times 7 \times 5}$ or $\frac{"315"}{"17.5"}$ oe | | | M1 | Dep on M2<br>For a correct equation involving volume of cuboid and volume of prism or<br>For a correct expression for $x$ |
| | | 18 | | A1 | 18<br>SCB2 for For volume of cuboid = 315 and final answer = 9 |
| | | | | | **Total 4 marks** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **5** | (a) | | $12 - 28c$ | 1 | B1 | |
| | (b) | | $y(y + 8)$ | 1 | B1 | |
| | (c) | $x^2 - 3x + 7x - 21$ | $x^2 + 4x - 21$ | 2 | M1<br><br><br><br>A1 | For 3 correct terms<br>or for 4 correct terms ignoring signs<br>or for $x^2 + 4x + c$ for any non-zero value of $c$ or for ... + $4x - 21$<br>cao |
| | (d) | $5p - 3p = 9$ or $2p = 9$ or $-9 = 3p - 5p$ or $-9 = -2p$ | 4.5 | 2 | M1<br><br>A1 | <br><br>oe<br>eg $\frac{9}{2}$ or $4\frac{1}{2}$ |
| | (e) | | $y^{11}$ | 1 | B1 | |
| | (f) | | $h^8$ | 1 | B1 | |
| | (g) | | $e^{15}$ | 1 | B1 | |
| | | | | | | **Total 9 marks** |

| | | | | | | |
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| **6** | (a) | | $30 < d \leq 40$ | 1 | B1 | Accept $30-40$ |
| | (b) | $5\times5 + 15\times12 + 25\times17 + 35\times20 + 45\times6$ **or**<br>$25 + 180 + 425 + 700 + 270$ **or**<br>1600 | | 4 | M2 | $f \times d$ for at least 4 products with correct mid- interval values **and** intention to add.<br><br>If not M2 then award M1 for<br>$d$ used consistently for at least 4 products within interval (including end points) **and** intention to add<br>**or**<br>for at least 4 correct products with correct mid-interval values with no intention to add |
| | | $\frac{25+180+425+700+270}{5+12+17+20+6}$ or $\left(=\frac{1600}{60}\right)$ | | | M1 | dep on M1 (ft their products)<br>NB: accept their 60 if addition of frequencies is shown |
| | | | 26.7 | | A1 | Accept 26.6 – 26.7 inclusive<br>Accept 27 if M3 awarded<br>Do not accept fractions or mixed numbers, eg $\frac{80}{3}$ or $26\frac{2}{3}$ |
| | | | | | | **Total 5 marks** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **7** | (a) | $4x \geq 27 - 13$ or $4x \geq 14$<br>or $-4x \leq 13 - 27$ or $-4x \leq -14$ | $x \geq 3.5$ | 2 | M1<br><br><br><br>A1 | Accept an equation in place of an inequality or<br>accept wrong inequality sign or<br>accept 3.5 oe given as answer<br><br>oe<br>Must be the final answer |
| | (b) | | Correct line drawn | 1 | B1 | For a closed circle at −1with line that goes at least as far as 3 or<br>for a closed circle at −1with an arrow on a line pointing to the right |
| | (c) | | −2, −1, 0, 1, 2 | 2 | B2 | B1 for list with one error or omission:<br>e.g.<br>−2, −1, 0, 1, 2, 3;<br>−1, 0, 1, 2;<br>−2, −1, 1, 2;<br>−3, −2, −1, 0, 1, 2<br>SCB1 for −3, −2, −1, 0, 1 |
| | | | | | | **Total 5 marks** |

| | | | | | |
|---|---|---|---|---|---|
| **8** | $(x^2 =)\ 18^2 - 13^2$ or $324 - 169$ or $155$ | | 3 | M1 | Squaring and subtracting |
| | $(x =)\ \sqrt{18^2 - 13^2}$ or $\sqrt{"155"}$ | | | M1dep | for square rooting |
| | | 12.4 | | A1 | Accept 12.4 – 12.46 inclusive |
| | **Alternative Methods - Using Trigonometry**<br><br>Eg $\sin^{-1}(\frac{13}{18})$ **and** 18cos"46.2(382...)" oe or<br><br>$\cos^{-1}(\frac{13}{18})$ **and** 18sin"43.7(617...)"oe | | | M2<br><br><br><br>A1 | For a complete method<br><br><br><br>Accept 12.4 – 12.46 inclusive |
| | | | | | **Total 3 marks** |

| | | | | | |
|---|---|---|---|---|---|
| **9** | Eg $9x = 22.5$ or $18y = 27$ or $-18y = -27$ or<br>$5x - (13 - 4x) = 9.5$ or $4x + 5x - 9.5 = 13$ or<br>$5\left(\frac{13-2y}{4}\right) - 2y = 9.5$ or<br>$4\left(\frac{9.5+2y}{5}\right) + 2y = 13$ | | 3 | M1 | For a complete method to eliminate one variable (condone one arithmetic error) |
| | Eg $5 \times$ "2.5" $- 2y = 9.5$ or $5x - 2 \times$ "1.5" $= 9.5$ | | | M1 | Dep on M1<br>For substituting the other variable or starting again to eliminate the other variable |
| | | $x = 2.5$, $y = 1.5$ | | A1 | dep on M1<br>NB: candidates showing no correct working score 0 marks. |
| | | | | | **Total 3 marks** |

| | | | | | |
|---|---|---|---|---|---|
| **10** | (a) | | 22 000 000 | 1 | B1 |
| | (b) | | $9.5 \times 10^5$ | 1 | B1 |
| | | | | | **Total 2 marks** |

| | | | | | | |
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| **11** | $7500 \times 0.04$ or 300 or $7500 \times 1.04$ or 7800 or $7500 \times 1.04^n$ ($n > 1$ )<br><br>Eg $7500 + \frac{4}{100} \times 7500 + \frac{4}{100} \times (7500 +$ "300")<br>$+ \frac{4}{100} \times (7500 +$ "300" + "312") or<br><br>7500 + "300" + "312" + "324.48" | 8436.48 | 3 | M1 | For interest for first year or for $7500 \times 0.04 \times 3$ oe or 900 or for $7500 + 7500 \times 0.04 \times 3$ oe or an answer of 8400<br><br>M1 For a complete method | M2 for $7500 \times 1.04^3$ oe |
| | | | | A1 | Accept answers in the range 8436 – 8437<br>NB: Answer in the range 936 -937 gets M2A0 | |
| | | | | | | **Total 3 marks** |

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|---|---|---|---|---|---|
| **12** (a) | | $y = \frac{1}{2}x - 1$ oe | 2 | M1 | For ($y$=) $\frac{3}{6}x + c$ (c may be any number or letter) or<br>For $(y =)\, mx - 1$ where $m$ is non-zero or for<br>Gradient = $\frac{3}{6}$ oe or $m = \frac{3}{6}$ oe clearly stated |
| | | | | A1 | For a fully a correct equation for **L**<br>Eg<br>$y = \frac{3}{6}x - 1$ or $2y = x - 2$ or<br>$y - 1 = \frac{1}{2}(x - 4)$ or<br>$y - -2 = \frac{1}{2}(x - -2)$<br>M1A0 for $L = \frac{1}{2}x - 1$ or $\frac{1}{2}x - 1$ |
| (b) | $4 = "\frac{1}{2}" \times 5 + c$ or $y - 4 = "\frac{1}{2}"(x - 5)$ | $y = \frac{1}{2}x + 1\frac{1}{2}$ | 2 | M1ft | For correct substitution of given coordinate into their equation<br>Follow through their gradient in (a) |
| | | | | A1 | oe<br>Eg $y = \frac{1}{2}(x + 3)$<br>SCB1 for $(l =) \frac{1}{2}x + 1\frac{1}{2}$ |
| | | | | | **Total 4 marks** |

| | | | | | |
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| **13** | (Angle $ABD$ =) $\tan^{-1}(\frac{5}{9})$ or (Angle $ADB$ =) $\tan^{-1}(\frac{9}{5})$ or<br>(Angle $ABC$ =) $\cos^{-1}(\frac{9}{15})$ or (Angle $ACB$ =) $\sin^{-1}(\frac{9}{15})$<br>($BD$ =) $\sqrt{9^2+5^2}$ or ($AC$ =) $\sqrt{15^2-9^2}$ ($DC$ =) $\sqrt{15^2-9^2}$ -5 | | 4 | M1 | For correct method to find angle *ABD* or *ADB* or *ABC* or *ACB* or for correct method to find side *BD*, *AC* or *DC*. |
| | | | | A1 | For angle *ABD* = 29.(0546...) or<br>for angle *ADB* = 60.(9453...) or<br>for angle *ABC* = 53.(1301...) or<br>for angle *ACB* = 36.(8698...) or<br>For $BD = \sqrt{106}$ or10.(2956...) or<br>for *AC* = 12 or<br>for *DC* = 7<br>Accept rounded or truncated to at least 2SF |
| | Eg ($x$ =) $\cos^{-1}(\frac{9}{15}) - \tan^{-1}(\frac{5}{9})$ or<br>($x$ =) $180-90-"29.(0546...)"-"36.(8698...)"$ or<br>$\cos x = \frac{15^2+"10.(2956...)"^2-7^2}{2\times15\times"10.(2956...)"}$ or $\cos x = 0.913(009)$ or<br>$\sin x = \frac{7\sin"36.(8698...)"}{\sqrt{106}}$ or $\sin x = \frac{7\sin"119.(054...)"}{15}$ or<br>$\sin x = 0.407(940...)$ | | | M1 | For a complete method to find $x$ or $\sin x$ or $\cos x$<br><br>Accept $0.912 \leq \cos x \leq 0.9152$<br><br>Accept $0.407 \leq \sin x \leq 0.413$ |
| | | 24 | | A1 | Awrt 24 |
| | | | | | **Total 4 marks** |

| | | | | | |
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| **14** | $\frac{6(5-x)}{2}-\frac{6(x-1)}{3}=6\times 1$ or<br>$3(5-x)-2(x-1)=6$ or<br>$\frac{3(5-x)-2(x-1)}{6}(=1)$ or<br>$\frac{3(5-x)}{6}-\frac{2(x-1)}{6}(=1)$ | | 4 | M1 | For a clear intention to multiply both sides by 6 or a multiple of 6 or to express LHS as a single fraction with denominator of 6 or a multiple of 6 or to express LHS as the sum of 2 fractions with denominator of 6 or a multiple of 6 |
| | $15-3x-2x+2=6$ or<br>$\frac{15-3x-2x+2}{6}=1$<br>$\frac{15-3x}{6}-\frac{2x-2}{6}=1$ | | | M1 | Expanding brackets in a correct equation. |
| | Eg $-3x-2x=6-2-15$ or $-5x=-11$ or<br>$3x+2x=15+2-6$ or $5x=11$ | | | M1 | dep on both preceding marks for a correct rearrangement of a correct equation with terms in $x$ on one side and numbers on the other. |
| | | 2.2 | | A1 | oe<br>Dependent on M2 |
| | | | | | **Total 4 marks** |

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| **15** | (a)(i) | | 61° | 1 | B1 | |
| | (ii) | | Alternate segment theorem | 1 | B1 | Dep on B1 for (a)(i)<br>Accept alternate segment(s)<br>Accept angles in **alternate segments** are equal or<br>Accept Angle between a chord and a tangent is equal to the angle on the circumference subtended/made by the same chord |
| | (b) | 180 – (180−(61+53)) | 114° | 2 | M1 | For 61 + 53 or 180 – 66 |
| | | | | | A1 | cao |
| | | | | | | **Total 4 marks** |

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| **16** (a) | $\frac{2}{6} \times \frac{1}{5}$ oe | | 2 | M1 | For a complete method |
| | | $\frac{1}{15}$ | | A1 | oe<br>Eg $\frac{2}{30}$<br>Accept 0.066(666...) rounded or truncated to at least 3 decimal places |
| (b) | $\frac{4}{6} \times \frac{3}{5}$ or 0.4 or $\frac{2}{6} \times \frac{1}{5}$ or 0.066(666...) or<br>$\frac{1}{6} \times \frac{3}{5}$ or $\frac{3}{6} \times \frac{1}{5}$ or 0.1 or $\frac{3}{6} \times \frac{2}{5}$ or 0.2 or $\frac{2}{6} \times \frac{1}{5}$ or 0.066(666...) | | 3 | M1 | One correct product that gives an even number |
| | $\frac{4}{6} \times \frac{3}{5} + \frac{2}{6} \times \frac{1}{5}$ or<br>$\frac{1}{6} \times \frac{3}{5} + \frac{3}{6} \times \frac{1}{5} + \frac{3}{6} \times \frac{2}{5} + \frac{2}{6} \times \frac{1}{5}$ | | | M1 | Sum of correct products |
| | | $\frac{7}{15}$ | | A1 | oe<br>Accept 0.466(666...) rounded or truncated to at least 3 decimal places |

| | | | | |
|---|---|---|---|---|
| | **With Replacement**<br>$\frac{4}{6}\times\frac{4}{6}$ or 0.444(444) or $\frac{2}{6}\times\frac{2}{6}$ or 0.111(111...) or<br>$\frac{1}{6}\times\frac{3}{6}$ or $\frac{3}{6}\times\frac{1}{6}$ or 0.083(333...) or $\frac{2}{6}\times\frac{2}{6}$ or 0.111(111...) or<br>$\frac{3}{6}\times\frac{3}{6}$ or 0.25 or $\frac{1}{6}\times\frac{1}{6}$ or 0.027(777...)<br><br>$\frac{4}{6}\times\frac{4}{6}+\frac{2}{6}\times\frac{2}{6}$ oe or<br>$\frac{1}{6}\times\frac{3}{6}+\frac{3}{6}\times\frac{1}{6}+\frac{2}{6}\times\frac{2}{6}+\frac{3}{6}\times\frac{3}{6}+\frac{1}{6}\times\frac{1}{6}$ oe or<br>or $\frac{5}{9}$ or 0.555(555...) | | | M1<br><br>M1 |
| | **Alternative method**<br>$1-(\frac{2}{6}\times\frac{4}{5}+\frac{4}{6}\times\frac{2}{5})$ oe | $\frac{7}{15}$ | 3 | M2<br>A1 oe<br>Accept 0.466(666...) rounded or truncated to at least 3 decimal places |
| | | | | **Total 5 marks** |

| | | | | | |
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| **17** | $\frac{3\pm\sqrt{9+220}}{22}$ or $\frac{3\pm\sqrt{9+220}}{2\times11}$ or $\frac{3\pm\sqrt{(-3)^2--220}}{2\times11}$ or $\frac{3\pm\sqrt{(-3)^2--220}}{22}$<br>NB: denominator must be 2×11 or 22 **and** there must be evidence for correct order of operations in the numerator<br>Do not accept sign error or omission of brackets | | 3 | M2 | Or for $\frac{--3\pm\sqrt{(-3)^2-4\times11\times-5}}{2\times11}$ (allow partial correct evaluation)<br>**and** $\frac{3\pm\sqrt{229}}{22}$<br><br>If not M2 then<br><br>M1 for<br><br>$\frac{--3\pm\sqrt{(-3)^2-4(11)(-5)}}{2\times11}$<br><br>Condone one sign error in substitution;<br>Condone omission of brackets<br>Allow partial correct evaluation |
| | | 0.82 and −0.55 | | A1 | for awrt 0.82 **and** awrt −0.55<br><br>Award M2 A1 for awrt 0.82, −0.55 with sufficient correct working that would gain at least M1 |
| | **Alternative scheme** | | | | |
| | $11[(x-\frac{3}{22})^2-\frac{229}{484}]$ oe | | | M1 | |

| | | | | | |
|---|---|---|---|---|---|
| | $\frac{3}{22} \pm \sqrt{\frac{229}{484}}$ oe | | | M1 | |
| | | 0.82 and −0.55 | | A1 | for awrt 0.82 **and** awrt −0.55<br>Award M2 A1 for awrt 0.82, −0.55 with sufficient correct working that would gain at least M1 |
| | | | | | **Total 3 marks** |

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| **18** | $480 = k \times 5^2$ or $480 \propto k \times 5^2$ oe or<br>or $(k =) \frac{480}{5^2}$ or $(k =)$ 19.2 oe<br>$k \propto \frac{480}{5^2}$ or $k \propto 19.2$ oe | | 3 | M1 | |
| | "19.2" × $1.5^2$ | | | M1 | Dep on M1<br>or for $A = 19.2x^2$ oe |
| | | 43.2 | | A1 | oe |
| | | | | | **Total 3 marks** |

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| **19** | (a) | Frequency densities: 1.2, 2.8, 1.6, 0.4, 0.2 | | 3 | M1 | For 3 or more correctly calculated freq densities or<br>For a correct scale indicated or<br>1 small square = 1 (person)<br>1 big square = 25 (people) |
| | | | | | M1 | For at least 2 additional correct bars (with or without scale)<br>Implies first M1 |
| | | | A fully correct histogram | | A1 | All 4 additional bars correct |
| | (b) | $\frac{100}{150} \times 240 + 100$ or $1.6 \times 100 + 100$ or "160" + 100 oe<br>or $600-(120+140+\frac{1}{3}\times 240)$ or<br>$600-(120+140+50\times 1.6))$ or $600-340$ oe | | 2 | M1 | A fully complete method to find the number of people who took from 200 to 300 minutes + 100 |
| | | | 260 | | A1 | |
| | | | | | | **Total 5 marks** |

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| **20** | (a) | | $-5$ | 1 | B1 |
| | (b) | | 23 | 1 | B1 |
| | (c) | $(f(-7)) = \frac{1}{-7+5}$ or $(f(-7)) = -\frac{1}{2}$ or $2\left(\frac{1}{-7+5}\right)+3$ or $2\times-\frac{1}{2}+3$ | | 2 | M1 |
| | | | 2 | | A1 |
| | (d) | $x-3=2y$ or $\frac{x}{2}=y+\frac{3}{2}$ or $y-3=2x$ or $\frac{y}{2}=x+\frac{3}{2}$ or $\frac{y-3}{2}$ or $\frac{y}{2}-\frac{3}{2}$ | | 2 | M1 |
| | | | $\frac{x-3}{2}$ | | A1 oe<br>Eg $\frac{x}{2}-\frac{3}{2}$ |
| | | | | | **Total 6 marks** |

| | | | | | |
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| **21** (a) (i) | | $3\mathbf{b} - 6\mathbf{a}$ | 1 | B1 | Oe<br>Need not be simplified<br>Mark the final answer |
| (ii) | | $2\mathbf{b} - 4\mathbf{a}$ | 1 | B1ft | oe eg $\frac{2}{3}$('3b −6a')<br>Need not be simplified<br>Mark the final answer |
| (iii) | | $6\mathbf{b} - 3\mathbf{a}$ | 1 | B1 | oe<br>Need not be simplified<br>Mark the final answer |
| (b) | Eg $\overrightarrow{XY} = 2\mathbf{b} - \mathbf{a}$ oe or $\overrightarrow{YB} = 4\mathbf{b} - 2\mathbf{a}$ | shown | 2 | M1 | Work out $\overrightarrow{XY}$ or $\overrightarrow{YX}$ or $\overrightarrow{YB}$ or $\overrightarrow{BY}$ |
| | | | | A1 | Dep on M1<br>Correct conclusion from correct simplified vectors<br>Eg $\overrightarrow{XB} = 3\overrightarrow{XY}$ or $\overrightarrow{YB} = 2\overrightarrow{XY}$ or $\overrightarrow{XB} = 1.5\overrightarrow{YB}$<br>or $XB$ and $XY$ are parallel<br>or $YB$ and $XY$ are parallel<br>or $XB$ and $YB$ are parallel |
| | | | | | **Total 5 marks** |

| | | | | | |
|---|---|---|---|---|---|
| **22** | | | 4 | B1 | Identifying correct triangle |
| | $\sqrt{8^2 + 15^2}$ or $\sqrt{289}$ or 17 | | | M1 | Complete method to find *MG* |
| | Eg $\tan 24 = \frac{BG}{\sqrt{8^2+15^2}}$ or $\tan 24 = \frac{BG}{17}$<br>or $\frac{BG}{\sin 24} = \frac{\sqrt{8^2+15^2}}{\sin(90-24)}$ or $\frac{BG}{\sin 24} = \frac{17}{\sin 66}$<br>(*BG* =) $17\tan 24$ or (*BG*=) $\frac{17}{\sin 66} \times \sin 24$ | | | M1 | Dep<br>For a correct equation involving *BG* or a correct expression for *BG*<br>Implies B1 |
| | | 7.57 | | A1 | Accept 7.56 – 7.57 |
| | | | | | **Total 4 marks** |

| | | | | | |
|---|---|---|---|---|---|
| **23** | 27.25 **or** 27.35 **or** 17.5 **or** 18.5 **or** 9.805 **or** 9.815 | | 3 | B1 | Accept 27.34$\dot{9}$ **or** 27.3499… **or** 18.4$\dot{9}$ or 18.499... **or** 9.814$\dot{9}$ **or** 9.81499... |
| | $(t =)\dfrac{27.25-18.5}{9.815}$ | | | M1 | For $\dfrac{LB-UB_1}{UB_2}$ oe where<br><br>$27.25 \leq$ LB $<$ 27.3<br>**and** 18 $<$ $UB_1 \leq$ 18.5<br>**and** 9.81 $<$ $UB_2 \leq$ 9.815 |
| | | 0.891 | | A1 | dep on seeing $\dfrac{27.25-18.5}{9.815}$<br>Correct working must be seen<br>Accept 0.891 - 0.8915 |
| | | | | | **Total 3 marks** |

| | | | | | |
|---|---|---|---|---|---|
| **24** | Eg $12.6^2 = 10.4^2+18^2-2\times10.4\times18\times\cos L$ or<br>$158.76 = 108.16 + 324 - 374.4\cos L$<br><br>Note: $\cos K = \frac{-57.08}{262.08}$ (= −0.217(796…)) and $K$ = 102.(579...)<br>$\cos M = \frac{374.6}{453.6}$ (= 0.825(837…)) and $M$ = 34.3(264...) | | 5 | M1 | Correct substitution into cosine rule to find $L$ or<br><br>For $\cos K = \frac{10.4^2+12.6^2-18^2}{2\times10.4\times12.6}$ oe<br>**AND**<br>$\sin L = \frac{12.6\sin"102.(579...)"}{18}$ or<br><br>For $\cos M = \frac{18^2+12.6^2-10.4^2}{2\times18\times12.6}$ oe<br>**AND**<br>$\sin L = \frac{12.6\sin"34.3(264...)"}{10.4}$ |
| | Eg $\cos L = \frac{10.4^2+18^2-12.6^2}{2\times10.4\times18}$ or $\cos L = \frac{273.4}{374.4}$ or<br>$\cos L$ = 0.73(0235...) oe or $L$ = 43.0(938...) | | | A1 | Rearranging cosine rule correctly.<br>Accept $L = 43°$<br>Accept 43.0(938...) rounded or truncated to at least 3 SF |
| | (Area of sector =) $\frac{"43.0(938...)"}{360}\times\pi\times10.4^2$ or 40.6(752...) | | | M1 | Dep on at least M1<br>Accept 40.5 – 40.7 |
| | | | | B1 | For (area of triangle=) 63.9(471…)<br>Accept 63.8 – 64.0 |
| | | 23.3 | | A1 | Accept 23.2 – 23.3 |
| | | | | | **Total 5 marks** |

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