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Pearson Edexcel

# Mark Scheme (Provisional)

## Summer 2021

Pearson Edexcel International GCSE
In Mathematics B (4MB1)
Paper 01

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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
  - awrt – answer which rounds to
  - 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**

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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.

If a candidate misreads a number from the question: eg. Uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review.

If there is a choice of methods shown, mark the method that leads to the answer on the answer line; where no answer is given on the answer line, award the lowest mark from the methods shown.

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.

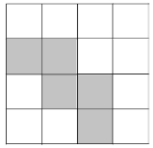
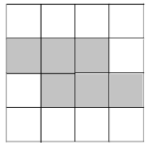
- **Parts of questions**

  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded to another.

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 1 | $2x(4y^2-9y)$ or $2y(4xy-9x)$ or $xy(8y-18)$ | | | M1 Correct partial factorisation by taking out a common factor consisting of at least 2 different terms. Implied by correct answer. Do Not ISW |
| | | $2xy(4y-9)$ | 2 | A1 Completely correct |
| | | | | ***Total 2 marks*** |

| | | | | |
|---|---|---|---|---|
| 2(a) | |  | 1 | B1 No other squares shaded |
| (b) | |  | 1 | B1 No other squares shaded |
| | | | | ***Total 2 marks*** |

| | | | | |
|---|---|---|---|---|
| 3 | $y-4y^2=tx$ or $\frac{y}{t}=x+\frac{4y^2}{t}$ | | | M1 |
| | | $x=\frac{y-4y^2}{t}$ | 2 | A1 oe eg $x=\frac{y}{t}-\frac{4y^2}{t}$ or $x=\frac{-y+4y^2}{-t}$ Allow the other way round eg $\frac{y-4y^2}{t}=x$ Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| | | | | ***Total 2 marks*** |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 4 | $(1-0.64)\times 75$ or $0.64\times 75$ or $75-0.64\times 75$ oe | | | M1 |
| | | 27 | 2 | A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| | | | | ***Total 2 marks*** |

| | | | | | |
|---|---|---|---|---|---|
| 5 | Method 1 | Method 2 | | | |
| | $2y=17$ oe | $4x=-16$ oe | | | M1 Eliminating either $x$ or $y$ to get a correct equation in one unknown |
| | $4x+4\times"8.5"=18$ or $4x=-16$ | $4\times("-4")+6y=18$ or $2y=17$ | | | M1 Subst their $x$ or $y$ value into either equation or start again. If M1 has already been awarded this can be implied by a correct value for $x$ **and** $y$.<br>**NB** The Speech marks around the $-4$ ("$-4$") means this follows through from their value |
| | | | $x=-4$<br>$y=8.5$ | 3 | A1 dep on 1st M1 being awarded |
| | | | | | ***Total 3 marks*** |

| | | | | |
|---|---|---|---|---|
| **6** | $[AD=]\sqrt{25^2-(50-35)^2}$ $[=20]$ | | | M1 Correct calculation to find $AD$ or[ $AD$ =] 20<br>Allow using their $h=(50-35)$ if marked on their diagram provided $h$ is between 5 and 25. Must see the Pythagoras calculation eg $\sqrt{25^2-18^2}$<br>**NB** Anything appearing in square brackets is not required |
| | [Perimeter =] $50+25+35+"20"$ | | | M1 dep on previous method mark being awarded. Follow through their "20". |
| | | 130 | 3 | A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| | | | | ***Total 3 marks*** |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 7 | Sight of $3n$ or $3n - 8$ or $n + 20$ | | | M1 One correct expression seen. May be seen as part of an equation |
| | $n + 20 = 3n - 8$ oe | | | A1 Correct equation |
| | | 14 | 3 | A1 dep on previous A mark awarded |
| | | | | ***Total 3 marks*** |

| | | | | |
|---|---|---|---|---|
| 8 | Arc, centred *B*, radius 4 cm, drawn within *ABCD* | | | M1 Ignore any parts outside of *ABCD*. Arc drawn should lie between an arc radius 3.8 cm and arc radius 4.2 cm. It should intersect *AB* and *BC* and be complete within *ABCD* |
| | 2 pairs of intersecting arcs of equal radius centred at *A* and *D* with line drawn through intersection points oe | | | M1 Ignore any parts outside of *ABCD*. Construction lines **must** be shown. Line should lie between 4.3 cm and 4.7cm from *AB*. |
| | | *R* identified by shading and labelled | 3 | A1 dep on both previous method marks awarded. Allow just shading or just *R* if it is clear which the area is. |
| | | | | ***Total 3 marks*** |

| | | | | | |
|---|---|---|---|---|---|
| 9 | $\frac{27}{1.08}$ or $\frac{27}{108} \times 100$ [=25] | | | M1 For a correct method to find the original price. | M2 for $\frac{135}{108} \times 27$ oe |
| | $"\frac{27}{1.08}" \times 1.35$ or $"\frac{27}{108} \times 100" + \frac{35}{100} \times "25"$ oe | | | M1 dep on previous method mark being awarded. For a correct method to increase their original price by 35% | |
| | | 33.75 | 3 | A1 oe Working not required, so correct answer scores full marks (unless from obvious incorrect working) | |
| | | | | ***Total 3 marks*** | |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 10 | 28 = 2 × 2 × 7 or 4 × 7<br>120 = 2 × 2 × 2 × 3 × 5 or 4 × 30 oe<br>Or factor trees<br>28 → 2, 14 → 2, 7<br>120 → 2, 60 → 2, 30 | | | M1 For prime factorisation of 28 and 120 (may be at ends of a factor tree), must have 2 × 2… or 4 ×…<br>or for multiples of 120 up to at least 840<br>or for multiples of 28 up to at least 840 |
| | LCM (28, 120) = 840 | | | A1 Allow 2 × 2 × 2 × 3 × 5 × 7 |
| | | 843 | 3 | A1ft For adding 3 to their LCM.<br>The M1 must be awarded. An answer with no working gains no marks |
| | | | | ***Total 3 marks*** |

| | | | | |
|---|---|---|---|---|
| 11 | $(68-32)\times 34$ or $(32+x)\times 42$ oe | | | M1 Calculating the cost for either *R* or *C*. May be seen as part of a calculation |
| | $(68-32)\times 34+(32+x)\times 42=3702$<br>or $\frac{3702-36\times 34-32\times 42}{42}$ oe | | | M1 Setting up a correct equation or expression. |
| | | 27 | 3 | A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| | | | | ***Total 3 marks*** |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 12 | $\frac{4(x-6)-3(8x+2)}{12}$ oe | | | M1 Correct method to reduce to a single fraction. Condone invisible brackets if multiplied out correctly with one sign error only. Implied by next M1 |
| | $\frac{4x-24-24x-6}{12}$ oe | | | M1 Multiplying out correctly (allow one sign error if 4 terms given - if incorrect answer this line must be seen) If M1 has already been awarded this can be implied by a correct answer |
| | | $\frac{-10x-15}{6}$ | 3 | A1 oe with denominator of 6 or – 6 Dependent on both M marks being awarded. |
| | | | | ***Total 3 marks*** |

| | | | | |
|---|---|---|---|---|
| 13 | $\angle BAE = \angle CDE$<br>**angles** in the **same segment** OR **angles** at the circumference **subtend** from the same **arc** of the circle | | | Allow *BAC* and *CDB* Do not accept other notations such as $\hat{A}$ and $\hat{D}$ |
| | $\angle ABE = \angle DCE$<br>**angles** in the **same segment** OR **angles** at the circumference **subtend** from the same **arc** of the circle | | | Allow *ABD* and *DCA* Do not accept other notations such as $\hat{B}$ and $\hat{C}$ |
| | $\angle BEA = \angle CED$<br>**vertically opposite** angle OR vertically **opposite angle** | | | M2 For two correct corresponding pairs of angles with at least one correct reason. Words in bold needed. Allow $\angle$ for angles (Allow M1 for 2 correct corresponding pair of angles) |
| | | Two/Three angles are equal therefore *ABE* is similar to *DCE* | 3 | A1 A correct conclusion and 2 corresponding angles stated equal with correct reason for both angles. Ignore a third angle given even if incorrect.<br>Allow Two/Three angles are equal therefore similar |
| | | | | ***Total 3 marks*** |

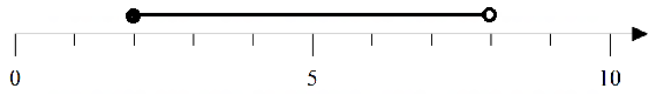
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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 14 | $[AX =]\sqrt{4^2+4^2}\ [=\sqrt{32}$ or 5.656.... $]$ oe | | | M1 Allow $[AX =]\frac{1}{2}\sqrt{8^2+8^2}$ |
| | $\tan(\angle EAX)=\frac{15}{\sqrt{4^2+4^2}}$ | | | M1 dep on previous M mark being awarded. A correct method to find $\angle EAX$ eg using $\tan(\angle AEX)=\frac{\sqrt{4^2+4^2}}{15}$ **and** $\angle EAX = 90-\angle AEX$ |
| | | 69.3 | 3 | A1 awrt 69.3 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| **Alternatives for the 2nd M1** | | | | |
| $[AE =]\sqrt{\sqrt{\left(4^2+4^2\right)^2+15^2}\ [=\sqrt{257}]}$ **and** $\sin EAX=\frac{15}{\sqrt{"257"}}$ or $\sin EAX=\frac{15\sin 90}{\sqrt{"257"}}$ or $\cos EAX=\frac{"\sqrt{32}"}{"\sqrt{257}"}$ | | | | |
| $[AE =]\sqrt{\sqrt{\left(4^2+4^2\right)^2+15^2}\ [=\sqrt{257}]}$ **and** $\angle EAX = 90-\angle AEX$ **and** $\sin AEX=\frac{"\sqrt{32}"}{"\sqrt{257}"}$ or $\sin AEX=\frac{"\sqrt{32}"\sin 90}{"\sqrt{257}"}$ or $\cos AEX=\frac{15}{"\sqrt{257}"}$ | | | | |
| $[AE =]\sqrt{\sqrt{\left(4^2+4^2\right)^2+15^2}\ [=\sqrt{257}]}$ **and** $\cos(\angle EAX)=\left(\frac{"257"+"32"-15^2}{2\times"\sqrt{257}"\times"\sqrt{32}"}\right)$ | | | | |
| $[AE =]\sqrt{\sqrt{\left(4^2+4^2\right)^2+15^2}\ [=\sqrt{257}]}$ **and** $\cos(\angle AEX)=\frac{"257"+15^2-"32"}{2\times"\sqrt{257}"\times 15}$ **and** $\angle EAX = 90-\angle AEX$ | | | | |
| **Alternative for M1M1 -Finding *EA* from triangle *EAD*** | | | | |
| M1 $[AE =]\sqrt{\sqrt{\left(4^2+15^2\right)^2+4^2}\ [=\sqrt{257}]}$<br>M1dep $\sin EAX=\frac{15}{\sqrt{"257"}}$ or $\sin EAX=\frac{15\sin 90}{\sqrt{"257"}}$ or another correct method to find *EAX* | | | | |
| | | | | ***Total 3 marks*** |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 15 | $\frac{4-\sqrt{12}}{4+\sqrt{12}}\times\frac{4-\sqrt{12}}{4-\sqrt{12}}$ oe | | | M1 multiplying by $\frac{4-\sqrt{12}}{4-\sqrt{12}}$ or $\frac{2-\sqrt{3}}{2+\sqrt{3}}\times\frac{2-\sqrt{3}}{2-\sqrt{3}}$ or $\frac{4-\sqrt{12}}{4-\sqrt{12}}\times\frac{2-\sqrt{3}}{2-\sqrt{3}}$ oe |
| | $\frac{16+12-8\sqrt{12}}{16-12}$ or $\frac{28-8\sqrt{12}}{4}$ oe | | | M1 multiplies out correctly but need not be simplified. Allow $\frac{4+3-4\sqrt{3}}{4-3}$ or $\frac{7-4\sqrt{3}}{1}$ or $7-4\sqrt{3}$ or $\frac{14-2\sqrt{12}-4\sqrt{3}}{2+2\sqrt{12}-4\sqrt{3}}$ oe |
| | | $7-\sqrt{48}$ | 3 | A1 dep on both the previous method marks being awarded. Correct answer with no working is no marks. Allow $a = 7$ and $b = 48$ ISW once $7-\sqrt{48}$ seen<br>**NB** Do not allow for $7-4\sqrt{3}$ unless $7-\sqrt{48}$ seen in working |
| | | | | ***Total 3 marks*** |

| | | | | |
|---|---|---|---|---|
| 16(a) | $25a^4b^6$ | | | M1 Any 2 terms correct $25a^4...$ or $...a^4b^6$ or $25...b^6$ |
| | | $25a^4b^6$ | 2 | A1 |
| (b) | $\frac{3x^2y^1}{3x^2y^{-4}}$ or $\frac{y^1}{y^{-4}}$ | | | M1 Allow $y$ for $y^1$ |
| | | $y^5$ | 2 | A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| | | | | ***Total 4 marks*** |

| | | | | |
|---|---|---|---|---|
| 17(a) | $10 \leqslant 5x$ or $x < 8$ oe | | | M1 Condone $10 < 5x$ and $x \leqslant 8$ |
| | $10 \leqslant 5x$ and $x < 8$ oe | | | M1 Correct inequality signs must be used. |
| | | $2 \leqslant x < 8$ | 3 | A1 oe ISW Working not required, so correct answer scores full marks (unless from obvious incorrect working) Allow [2,8) or other notation eg $\{x : 2 \leqslant x < 8\}$ |
| (b) |  | | 1 | B1 ft their inequality if answer to (a) is in the form $a \leqslant x < b$ or $a < x \leqslant b$ (one closed dot one open dot – do not accept alternative notation) |
| | | | | ***Total 4 marks*** |

| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|

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| | | | | | |
|---|---|---|---|---|---|
| 18 | $[AD =]\dfrac{25}{\tan 33} - 20[= 18.496...]$ | | | M1 A correct method to find *AD* eg 25tan57 – 20<br>Must use correct angle | |
| | $\tan(\angle DBA) = \dfrac{"18.496..."}{25}[\angle DBA = 36.496]$ | | | M1 dep on previous M mark awarded<br>Allow use of their *AD* (maybe marked on the diagram) | M2 for $\tan(\angle BDA) = \left(\dfrac{25}{"18.496"}\right)$ |
| | Angle of depression = 90 – "36.49…" | | | M1 dep on previous M mark awarded. | |
| | | 53.5 | 4 | A1 awrt 53.5 Working not required, so correct answer scores full marks (unless from obvious incorrect working) Allow marked on diagram if clearly the angle of depression. | |
| Alt 1 | $[AD =]\dfrac{25}{\tan 33} - 20[= 18.496...]$ | | | M1 A correct method to find *AD* eg 25tan57 – 20<br>Must use correct angle | |
| | $[BD =]\sqrt{25^2 + "18.496..."^2}[= 31.098...]$ **and** $\cos\angle DBA = \dfrac{25}{"31.098..."}$ **or** $\sin\angle DBA = \dfrac{"18.496..."}{"31.098..."}$ | | | M1 dep on previous M mark awarded Allow use of their *AD* if clearly labelled or marked on the diagram for *AD*. Also allow use of their "31.098…" | M2 for $BD = \sqrt{25^2 + "18.496..."^2}[= 31.098...]$ **and** $\cos\angle BDA = \dfrac{"18.496..."}{"31.098..."}$ or $\sin\angle BDA = \dfrac{25}{"31.098..."}$ oe |
| | Angle of depression = 90 – 36.49… | | | M1 dep on previous M mark awarded | |
| | | 53.5 | 4 | A1 awrt 53.5 Allow marked on diagram if clearly the angle of depression. | |
| Alt 2 | $[AD =]\dfrac{25}{\tan 33} - 20[= 18.496...]$ | | | M1 A correct method to find *AD* eg 25tan57 – 20<br>Must use correct angle | |
| | $\cos\angle CBD = \dfrac{\left(25^2 + \left(20 + "18.496..."\right)^2\right) + \left(25^2 + 18.496...^2\right) - 20^2}{2 \times \sqrt{25^2 + \left(20 + "18.496..."\right)^2} \times \sqrt{\left(25^2 + 18.496...^2\right)}}$ | | | M1 dep on previous M mark awarded. Allow use of their *AD* if their value of *AD* is labelled or marked on the diagram for *AD* | |
| | Angle of depression = $33 + "20.51…"$ | | | M1 dep on previous M mark awarded | |
| | | 53.5 | 4 | A1 awrt 53.5 Allow marked on diagram if clearly the angle of depression. | |
| | | | | | ***Total 4 marks*** |
| **NB:** Allow use of sine or cosine rule for calculations on triangle *ABD* or *ACB* but need to rearrange to get $\cos\angle BDA$ etc | | | | | |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 19 | $\frac{1}{2}y\sqrt{y^2-\left(\frac{1}{2}y\right)^2}\left[=\frac{\sqrt{3}}{4}y^2\right]$ | | | M1 Correct method for finding the area of the triangle eg $\frac{1}{2}y^2\sin 60$ or $\frac{1}{2}y^2\cos 30$ or $\frac{y^2}{4}\tan 60$ or $\frac{y^2}{4\tan 30}$ oe or Heron's formula |
| | $\sqrt{3}x^2=\frac{1}{2}y\sqrt{y^2-\left(\frac{1}{2}y\right)^2}$ $[\Rightarrow 2x=y]$ oe | | | M1 dep on previous M being awarded. Equating the area of the rectangle to the area of the triangle eg $\sqrt{3}x^2=\frac{1}{2}y^2\sin 60$ |
| | $2x+2\sqrt{3}x:3\times"2x"$ **or** $"y"+"y"\sqrt{3}:3y$ | | | M1 A correct ratio un-simplified. Allow multiples. Allow $2x+2\sqrt{3}x:3\times y$ where $y$ is a function of $x$ based on their equation or $2x(1+\sqrt{3}):3y$ where $x$ is a function of $y$ based on their equation. |
| | | $\left(1+\sqrt{3}\right):3$ | 4 | A1 cao Working not required, so correct answer scores full marks (unless from obvious incorrect working) Allow $a = 1$ and $b = 3$ |
| | | | | ***Total 4 marks*** |

| | | | | |
|---|---|---|---|---|
| 20 | $[m_{LB}=]5075,\ [m_{UB}=]5085\ [d_{LB}=]8.725,\ [d_{UB}=]8.735$ $[r_{LB}=]8.45,\ [r_{UB}=]8.55$ | | | B1 For one correct LB or UB stated or used. |
| | Volume $=\frac{1}{3}\times 3.142\times(r)^2 h$ where $8.45\le r\le 8.55$ **or** Volume $=\frac{m}{d}$ where $5075\le m\le 5085$ and $8.725\le d\le 8.735$ | | | M1 Correct method to find Volume. Allow $\pi$ instead of 3.142 |
| | $[h=]\frac{5085}{\frac{1}{3}\times 3.142\times 8.45^2\times 8.725}$ | | | M1 dep on previous M being awarded. Correct formula used for the height of cone, using $m_{UB}$ where $5080<m_{UB}\le 5085$, $r_{LB}$ where $8.45\le r_{LB}<8.5$, and $d_{LB}$ where $8.725\le d_{LB}<8.73$ Allow if use $\pi$ instead of 3.142 |
| | | 7.8 | 4 | A1 awrt 7.8 from correct working. Must be seen to use 5085, (Allow 5084.99…), 8.45, 8.725 |
| | | | | ***Total 4 marks*** |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 21 | $\left(\sqrt{\frac{10478}{1550}}\right)^3 \left[=\frac{2197}{125}\right]$ oe | | | M2 The correct scale factor (17.576)<br>Allow (M1) for $\left(\frac{10478}{1550}\right)^3$ or $\sqrt{\frac{10478}{1550}}\left[=\frac{13}{5}\right]$ or<br>$5\sqrt{62}$ **and** $13\sqrt{62}$ identified as the linear SF (Accept 5 and 13) |
| | $V_A \times "\frac{2197}{125}" - V_A = 62160$ oe | | | M1 dep on at least one of the previous M being awarded. For equation with their SF. May be implied. |
| | $[V_A =] \frac{62160}{"\frac{2197}{125}" - 1}$ | | | M1 dep on previous M mark being awarded. For making $V_A$ the subject. Allow equivalent methods |
| | | 3750 | | A1 cao Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| | | | 5 | |
| **Alternative** | | | | |
| | $\left(\sqrt{\frac{1550}{10478}}\right)^3 \left[=\frac{125}{2197}\right]$ oe | | | M2 The correct scale factor (0.0568957…)<br>Allow (M1) for $\left(\frac{1550}{10478}\right)^3$ or $\sqrt{\frac{1550}{10478}}$ or<br>$5\sqrt{62}$ **and** $13\sqrt{62}$ identified as the linear SF (Accept 5 and 13) |
| | $V_B - V_B \times "\frac{125}{1297}" = 62160$ oe | | | M1 dep on at least one of the previous M being awarded. For equation with their SF. May be implied |
| | $[V_B =] \frac{62160}{1 - "\frac{125}{2197}"} - 62160$ | | | M1 dep for making $V_B$ the subject and subtracting 62160. Allow equivalent methods |
| | | 3750 | | A1 cao Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| | | | | ***Total 5 marks*** |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 22 | $x+7x=180\left[\Rightarrow x=22.5\right]$ | | | M1 Correct method to find the value of $x$ or $7x$ Allow if 22.5 or 157.5 seen |
| | [Sum of angles of *BCDEFGP* =] $180(7-2)\left[=900\right]$ | | | M1 Calculating the sum of interior angles of a relevant polygon eg For *GFEDCBA* $180(6-2)\left[=720\right]$ For *GFEDCBAH* $180(8-2)\left[=1080\right]$ |
| | Internal angle eg *BCD* 180 + "22.5" [=202.5] oe | | | M1 Correct method to calculate a second relevant angle(sum of angles) eg $360-"157.5"$[=202.5] or for *GFEDCBA* $720-4\times"157.5"$ [=90] or for *GFEDCBAH* $1080-6\times"157.5"$[=135] |
| | $\left[\angle GPB=\right]"900"-2\times"22.5"-4\times"202.5"$ | | | M1 Dep on all 3 previous method marks being awarded. Complete correct method to find $\angle BPG$ eg for *PGB* $180-90-22.5\times2$ or for *PAH* $180-135$ |
| | | 45 | 5 | A1 Previous method mark must be awarded |
| | | | | ***Total 5 marks*** |
| **Alternative** – using kite *BPGO* or *OAPH* (where *O* is the centre of the *n*-sided polygon) | | | | |
| | $x+7x=180\left[\Rightarrow x=22.5\right]$ | | | M1 Correct method to find the value of $x$ or $7x$ Allow if 22.5 or 157.5 seen |
| | $\left[n=\right]\frac{360}{"22.5"}\left[=16\right]$ | | | M1 finding the number of sides of the *n*-sided polygon |
| | $OGP=4.5x$ and $OBP=4.5x$ $BOG=5x$ or $OHP=3.5x$ and $OAP=3.5x$ $AOH=7x$ | | | M1 Correct method to find the 3 angles of a kite |
| | $360-14\times"22.5"$ | | | M1 dep on all 3 previous method marks being awarded. Complete correct method to find $\angle BPG$ |
| | | 45 | | A1 |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 23 | $2x+16$ and $5x-107$ | | | M1 or $X+16$ and $Y-107$ and $5X=2Y$ |
| | $\frac{2x+16}{4}=\frac{5x-107}{3}$ oe | | | M1 dep Allow one sign error or $\frac{X+16}{Y-107}=\frac{4}{3}$ or<br>Allow $2x+16=4y$ and $5x-107=3y$ |
| | $[x=]34$ | | | M1 dep on both previous Method marks. Using a correct method to solve equation(s) leading to $x$ = … or $y$ = … or $5x$ = …or $X$ = … or $Y$ = … |
| | $5\times"34"-107$ | | | M1 dep on previous mark. or $3\times"21"$ |
| | | 63 | 5 | A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| | | | | ***Total 5 marks*** |
| **Alternative** | | | | |
| | $T$ is the total number of eagles in 2003<br>$t$ is the total number of eagles in 2015 | | | |
| | $\frac{2}{7}T+16$ and $\frac{5}{7}T-107$ **or**<br>$\frac{4}{7}t-16$ and $\frac{3}{7}t+107$ | | | M1 May be seen as part of a correct equation. |
| | $\frac{2}{7}T+16=\frac{4}{7}t$ and $\frac{5}{7}T-107=\frac{3}{7}t$ oe | | | M1 dep for 2 correct equations |
| | $t=147$ **or** $T=238$ | | | M1 dep on both previous Method marks. Using a correct method to solve equation(s) leading to $T$ = … or $t$ = or $5T$ = … or $3t$ = |
| | $\frac{3}{7}\times"147"$ **or** $\frac{5}{7}\times"238"-107$ | | | M1 dep on previous mark. Allow their 147 or their 238 |
| | | 63 | | A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |

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| Question | Working | | Answer | Mark | Notes |
|---|---|---|---|---|---|
| 24 | Method 1 | Method 2 | | | |
| | $(2x+1)$ | $\left(x+\frac{1}{2}\right)$ | | | B1 Using the factor theorem to find a factor. Implied by the 1st M1 |
| | $3x^2 \pm nx - 6$ | $6x^2 \pm mx - 12$ | | | M1 Finding the quadratic factor. Accept synthetic division |
| | $\left(3x^2+7x-6\right)$ | $\left(6x^2+14x-12\right)$ | | | A1 A correct quadratic for their method |
| | $(3x-2)(x+3)$ | $2(3x-2)(x+3)$ | | | M1 dep on previous M mark being awarded. Correct method for solving their 3 term quadratic = 0 by formula, completing the square or factorising. Method must be seen if the quadratic is incorrect. By factorisation brackets must expand to give 2 out of 3 terms correct or correct substitution into fully correct formula (Allow 1 sign error). Allow $(6x-4)(x+3)$ or $(3x-2)(2x+6)$ Allow $(3x-2)(x+3)[=0]$ If the 1st M1A1 is awarded this may be implied by both solutions being correct. |
| | | | $\frac{2}{3}, -3$ | 5 | A1 dep on 1st M1A1 Correct answers with no working scores no marks. |
| | | | | | ***Total 5 marks*** |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 25 | $\left[\frac{dx}{dt} =\right] 6-4kt$ | | | M1 Differentiating – at least one term correct |
| | $"6-4kt" = 0 \therefore t = \frac{3}{2k}$ oe | | | M1 dep on first M being awarded. For putting $\frac{dx}{dt}$ equal to 0 and rearranging leading to a value for $t$ |
| | $k + 0.9 = k + 6t - 2kt^2$ or<br>$+0.9 = 6t - 2kt^2$ oe | | | M1 Allow $k \pm 0.9$ as distance to form equation<br>Implied by 4th M1 |
| | $+0.9 = 6\times\left("\frac{3}{2k}"\right) - 2k\left("\frac{3}{2k}"\right)^2 \left[= \frac{9}{2k}\right]$ | | | M1 Allow $\pm 0.9$ substituting in their value of $t$ |
| | | 5 | 5 | A1 dep on all previous method marks being awarded. No incorrect working seen. Do not accept –5 since $t \geqslant 0 \therefore k > 0$<br>5 must be clearly identified as the final answer. |
| | | | | ***Total 5 marks*** |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 26(a) | 21,24, 32,35,42,49,56,67,69, *x*,83,98 | | | M1 Ordering the numbers. *x* to be greater than 69 ie it could also come after the 83 or the 98 |
| | | 52.5 | 2 | A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| (b) | $\frac{576+x}{12}=54.5$ | | | M1 Forming an equation – need not be simplified<br>Allow $\frac{n+x}{12}=54.5$ where 476 < *n* < 676 |
| | | 78 | 2 | A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| (c) | $(30-12)\times 56[=1008]$ | | | M1 |
| | $\frac{"1008"+12\times 54.5}{30}$<br>or $\frac{"1008"+("576+x")}{30}\left[=\frac{1662}{30}\right]$ | | | M1 ft their 576 + *x* from (b) if required |
| | | 55.4 | 3 | A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| | | | | ***Total 7 marks*** |

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| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 27(a) | $\frac{1}{a}\begin{pmatrix}3 & -1\\ 2 & -2\end{pmatrix}\begin{pmatrix}2 & -1\\ 2 & -3\end{pmatrix}=\frac{1}{a}\begin{pmatrix}4 & 0\\ 0 & 4\end{pmatrix}$ | | | M1 Allow for [det **A** =] $(3\times -2)-(2\times -1)$ or $-4$ |
| | | 4 | 2 | A1 Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| (b) | $\mathbf{AB}=(\mathbf{ABA}^{-1})\mathbf{A}$ or $\mathbf{BA}^{-1}=\mathbf{A}^{-1}(\mathbf{ABA}^{-1})$ | | | M1 May be implied by attempting to multiply matrices in the correct order |
| | $[\mathbf{AB}=]\begin{pmatrix}9 & -11\\ 8 & -11\end{pmatrix}\begin{pmatrix}3 & -1\\ 2 & -2\end{pmatrix}$<br>or $[\mathbf{BA}^{-1}=]\begin{pmatrix}"0.5" & "-0.25"\\ "0.5" & "-0.75"\end{pmatrix}\begin{pmatrix}9 & -11\\ 8 & -11\end{pmatrix}$ | | | M1 Allow use of their value of $a$ for $\mathbf{BA}^{-1}$<br>$[\mathbf{BA}^{-1}=]\begin{pmatrix}\frac{2}{"4"} & -\frac{1}{"4"}\\ \frac{2}{"4"} & \frac{-3}{"4"}\end{pmatrix}\begin{pmatrix}9 & -11\\ 8 & -11\end{pmatrix}$ |
| | $[\mathbf{AB}=]\begin{pmatrix}5 & 13\\ 2 & 14\end{pmatrix}$<br>or $[\mathbf{BA}^{-1}=]\begin{pmatrix}"2.5" & "-2.75"\\ "-1.5" & "2.75"\end{pmatrix}$ | | | M1 Allow use of their value of $a$ for $[\mathbf{BA}^{-1}=]\begin{pmatrix}\frac{10}{"4"} & -\frac{11}{"4"}\\ -\frac{6}{"4"} & \frac{11}{"4"}\end{pmatrix}$ |
| | $[\mathbf{B}=]\begin{pmatrix}"0.5" & "-0.25"\\ "0.5" & "-0.75"\end{pmatrix}\begin{pmatrix}5 & 13\\ 2 & 14\end{pmatrix}$<br>or $[\mathbf{B}=]\begin{pmatrix}"2.5" & "-2.75"\\ "-1.5" & "2.75"\end{pmatrix}\begin{pmatrix}3 & -1\\ 2 & -2\end{pmatrix}$ | | | M1 Allow use of their value of $a$ |
| | | $\begin{pmatrix}2 & 3\\ 1 & -4\end{pmatrix}$ | 5 | A1 cao Working not required, so correct answer scores full marks (unless from obvious incorrect working) |
| NB if answer is incorrect in part (a) ie if $a = -4$ then the answer is $\begin{pmatrix}-2 & -3\\ -1 & 4\end{pmatrix}$ and will get M1M1M1M1A0 in part(b) | | | | |
| | | | | ***Total 7 marks*** |

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