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# Mark Scheme (Provisional)

## Summer 2021

Pearson Edexcel International GCSE
In Mathematics A (4MA1)
Paper 1H

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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

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- **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.
  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 mark the one that leads to the answer on the answer line. If there is no answer given then mark the method that gives the lowest mark and award this mark.
  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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**NOTES**

Please note: [height =] 8 + 0.5 × 6 (=11)[metres] means we do not need to see 'height =' or 'metres' and if we see 8 + 0.5 × 6 we can award the method mark – and we can award the method mark if we see 11 without the working.

In the mark scheme, if we see a number written "82.5" in speech marks it means the number can be a followed through value, gained from correct working but with an inaccurate result from this working. It does not mean that the student can use any value. If a student can use any previous value that has been stated, it will be made clear in the mark scheme.

When a certain degree of accuracy is requested in the question, students will normally be given the mark if they give this accuracy or better eg
Q22 asks for 3 significant figures which is 34.6
The mark scheme says award this mark for 34.6 or better, so if you see 34.6028, for instance, you would award full marks, even if this value is rounded too far later, eg to 35. If you only saw 35 and never saw a value that rounds to 34.6 it is likely that the student would gain the method marks if they showed a fully correct method. However, 35 with no working would gain zero marks.

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**International GCSE Maths**

Apart from questions 7b, 11a, 11b, 13, 14, 16, 20, 23, 26 (where the mark scheme states otherwise) the correct answer, unless clearly obtained from an incorrect method, should be taken to imply a correct method.

| Question | | Working | Answer | Mark | Notes | |
|---|---|---|---|---|---|---|
| **1** | | For [8 hours 12 minutes =] 8.2 [hours] **or** $8\frac{12}{60}$ oe **or** $\frac{41}{5}$ oe **or** $8 \times 60 + 12$ (= 492) [minutes] | | 3 | B1 | For correctly writing the time as a time in hours **or** minutes **or** for a correct calculation to do this |
| | | [Average speed =] $\frac{5658}{8.2}$ oe<br>eg $\frac{5658}{"492"} \times 60$ oe | | | M1 | For use of speed = distance ÷ time<br>(use of their time in hours – if used minutes, then must multiply by 60)<br>(allow 5658 ÷ 8.12 (= 696.79…) for this mark if B0 awarded (allow 696 – 697)) |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 690 | | A1 | |
| | | | | | | **Total 3 marks** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **2** | | | $91 - 6n$ | 2 | B2 | For a correct answer in any form<br>eg $91 - 6 \times n$ **or** $-6n + 91$ **or** $85 + (n - 1)(-6)$ oe<br><br>(B1 for $-6n + k$ oe ($k$ may be zero or absent))<br><br>NB: award full marks for eg $x = 91 - 6n$<br>**or** $n$th term = $91 - 6n$ but only B1 for $n = 91 - 6n$ |
| | | | | | | **Total 2 marks** |

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|---|---|---|---|---|---|
| **3** | $8 \times x$ (= $8x$) **or** $14 \times x$ (= $14x$) **or** $(14 - 8) \times x$ (= $6x$)<br>**or** ½ × (14 – 8) × (13 – $x$) (= 39 – 3$x$)<br>**or** $\frac{13+x}{2} \times (14-8)(=39+3x)$<br>**or** ½ × 13 × (14– 8) (=39) **or** $\frac{8+14}{2} \times x$ (= 11$x$)<br>**or** 14 × 13 (=182) **or** 8 × (13 – $x$) (= 104 – 8$x$)<br>**or** $\left(\frac{8+14}{2} \times (13-x)\right)$ (= 143 – 11$x$) oe | | 4 | M1 | one correct area linked to the shape |
| | $14x + 6 \times ½ \times (13 - x)$ oe eg $8x + \frac{x+13}{2} \times 6$<br>**or** $\frac{8+14}{2} \times x + \frac{13 \times (14-8)}{2}$<br>**or** "182" – $\left(\frac{8+14}{2} \times (13-x)\right)$ **or** 11$x$ + 39 oe | | | M1 | ft from correct working expression for total area of shape – with no parts omitted or duplicated<br><br>Adding up parts of given shape<br><br>**or** large rectangle subtracting trapezium (or subtracting (rectangle + triangle)) |
| | eg 11$x$ + 39 = 91.8 **or** 14$x$ + 39 – 3$x$ = 91.8<br>**or** 182 – 143 + 11$x$ = 91.8<br>**or** 16$x$ + 6$x$ + 78 = 183.6 oe | | | M1 | fully correct equation with no fractions (allow 91.8 or multiples of 91.8 but no other decimals) **and** no brackets |
| | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 4.8 | | A1 | **or** $4\frac{4}{5}$ oe **or** $\frac{24}{5}$ oe |
| | | | | | **Total 4 marks** |

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| **4** | | eg (36 ÷ 9) × 5 **or** 20 [ducks] **or** 20 : 36<br>**or** for writing the 3 parts of the ratio correctly eg 35 : 10 : 18 oe | | 3 | M1 | For a fully correct calculation for the number of ducks or stating 20 ducks – may be shown in a ratio – does not need to be labelled if it is clear that the number or calculation refers to the number of ducks |
| | | "20" ÷ 2 = 10 **and** 10 × 7 oe<br>**or** $\frac{36}{18} \times 35$ oe | | | M1 | For a correct calculation to find the number of chickens.<br><br>(award the M2 for 70 : 20 : 36 or a different order if intention is clear eg by labels) |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 70 | | A1 | |
| | | | | | | **Total 3 marks** |

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| **5** | (a) | $6x^2 + 9x - 3x^2 - 5x$ | | 2 | M1 | expansion with at least 3 correct terms (must see for example, $6x^2$ and not just $3x \times 2x$)(can assume that no sign in front of a number is a + if terms written in a list or table) |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | $3x^2 + 4x$ | | A1 | **or** $4x + 3x^2$ **or** $x(3x + 4)$ **or** $x(4 + 3x)$ |
| | (b) | eg $p + d = at$ **or** $-at = -d - p$ **or** $\frac{p}{a} = \frac{at}{a} - \frac{d}{a}$ oe | | 2 | M1 | Correct first stage in rearrangement |
| | | *Working not required, so correct answer scores full marks* | $t = \frac{p+d}{a}$ | | A1 | oe eg $t = \frac{p}{a} + \frac{d}{a}$ **or** $t = \frac{-d-p}{-a}$<br>Must have "$t =$" either in working or on answer line |
| | (c) | $w^2 \times w^n = w^{10}$ **or** $w^5 \times w^n = w^{13}$ **or** $w^5 \times w^{n-3} = w^{10}$<br>**or** $\frac{w^{5+n}}{w^3} = w^{10}$ oe<br>**or** $5 + n - 3 = 10$ **or** $2 + n = 10$ **or** $5 + n = 13$ | | 2 | M1 | A correct first stage simplifying at least one index in a correct equation<br>**or**<br>a clearly correct subsequent stage showing correct use of a rule of indices<br>eg $w^5 \times w^n = w^{30}$ **and** $w^n = w^{30-5}$<br>**or**<br>a correct equation using indices only |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 8 | | A1 | accept $w^8$<br><br>(trial and error gains full marks if correct and no marks if incorrect unless a rule of indices is clearly shown) |
| | | | | | | **Total 6 marks** |

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| **6** | (a) | eg 1 – (0.2 + 0.12 + 0.08) (= 0.6)<br><br>$1-\left(\frac{20}{100}+\frac{12}{100}+\frac{8}{100}\right)\left(=\frac{60}{100}\right)$oe<br>**or**<br>100(%) – (20(%) + 12(%) + 8(%)) (= 60(%))<br>**or**<br>0.2 + 0.12 + 0.08 + 3$x$ + $x$ = 1 oe | | 3 | M1 | For a correct calculation for the remaining probability<br>**or**<br>a correct equation for the remaining probability |
| | | "0.6" ÷ 4 (= 0.15) oe **or** "0.6" ÷ 4 × 3<br>**or** "0.6" × 0.75 oe<br>(Sight of 0.15 in the table for Orange or Pink or 0.45 for Pink gains M2) | | | M1 | For dividing the remaining probability by 4 or finding ¾ of the remaining probability<br>NB "0.6" means 0.6 must come from correct working |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 0.45 | | A1 | **or** $\frac{9}{20}$ oe **or** 45% (if working in % final answer must have % sign). Allow $\frac{0.45}{1}$<br>If no answer on answer line, check in the correct space in table above. Value on the answer line takes precedence over the table. |
| | (b) | 0.12 × 150 oe eg 12 + 6 | | 2 | M1 | For a correct calculation to find the number of times the spinner lands on blue |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 18 | | A1 | (an answer of $\frac{18}{150}$ scores M1A0 as this is a probability not a number of times) |
| | | | | | | **Total 5 marks** |

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|---|---|---|---|---|---|---|
| **7** | (a) | | $-2, -1, 0, 1, 2$ | 2 | B2 | (B1 for 4 correct values and no incorrect values (eg –1, 0, 1, 2) **or** for 6 values with no more than one incorrect value (eg –2, –1, 0, 1, 2, 3)) |
| | (b) | $7t - 2t \leq 31 + 3$<br>**or** $5t \leq 34$<br>**or** $-3 - 31 \leq 2t - 7t$<br>**or** $-34 \leq -5t$ oe | | 2 | M1 | $t$ terms on one side and numbers on the other. Condone = rather than ≤ or any other sign for this mark. |
| | | *Working required* | $t \leq 6.8$ | | A1 | oe (dep on M1) eg $t \leq \frac{34}{5}$ **or** $t \leq 6\frac{4}{5}$<br>**or** $6.8 \geq t$<br>Must have correct sign on answer line (sight of correct answer in working space and just 6.8 oe on answer line gains M1 only) |
| | | | | | | **Total 4 marks** |

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|---|---|---|---|---|---|---|
| **8** | (a) | $1.4 \times 10^9 - 8.2 \times 10^7$<br><br>**or** $1.4 \times 10^9 - 0.082 \times 10^9$<br><br>**or** $140 \times 10^7 - 8.2 \times 10^7$ $(= 131.8 \times 10^7)$ | | 2 | M1 | **or** for 1 318 000 000 oe but not in standard form eg $1318 \times 10^6$<br>**or**<br>$1.318 \times 10^n$ where $n \neq 9$ |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | $1.318 \times 10^9$ | | A1 | Allow $1.32 \times 10^9$ or $1.3 \times 10^9$ |
| | (b) | $\frac{9.9 \times 10^6}{9.1 \times 10^5}$ oe | | 2 | M1 | |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 11 | | A1 | allow 10.8 – 11 (inclusive)<br><br>SC: if M1 not scored, award B1 for an answer of $\frac{1}{11}$<br>allow 10.8 – 11 for the denominator |
| | | | | | | **Total 4 marks** |

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| **9** | (a) | | $5a^4c^3(5c^4d + 9a^5h)$ | 2 | B2 | If not B2 then award B1 for any **correct** factorisation with at least 2 of: the 5, a term in *a*, a term in *c*, outside the bracket<br>eg $5ac(5a^3c^6d + 9a^8c^2h)$<br>**or** $a^2c(25a^2c^6d + 45a^7c^2h)$ (NB: not just $a^4$ etc as we want to know students have considered more than just one letter or the number)<br>**or**<br>the correct common factor **and** a 2 term expression inside the bracket eg $5a^4c^3(5c^4 + 9a^5)$ (this is missing *d* in first term and *h* in the second but the common factor is correct) |
| | (b) | $4x^2 + 10x + 10x + 25 = 4x^2 - 2x + 6x - 3$<br>$4x^2 + 20x + 25 = 4x^2 + 4x - 3$ | | 3 | M1 | Correct expansion of $(2x + 5)^2$ **or** $(2x + 3)(2x - 1)$ **or** expansion of **both** sets of brackets with at least 3 of 4 terms correct in both (NB: if written as a 3 term quadratic (and not seen as 4 terms) then the middle term must be correct as it is equivalent to 2 correct terms) (eg (RHS) $4x^2 + 4x + 3$ has 1 error, $2x^2 + 4x - 3$ has 1 error, $4x^2 + 10x - 3$ has 2 errors) |
| | | $10x + 10x - 6x + 2x = -3 - 25$<br>**or** $3 + 25 = -16x$<br>**or** $16x = -28$ oe | | | M1 | ft if previous mark awarded. For terms in *x* on one side and number terms on the other side in a correct ft equation dependent on a linear equation |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working eg -1.75 oe from $2x^2 + 20x + 25 = 2x^2 + 4x - 3$ scores M2A0)* | $-1.75$ | | A1 | **or** $-1\frac{3}{4}$ **or** $-\frac{7}{4}$ **or** $-\frac{28}{16}$ **or** $-1\frac{12}{16}$ oe |
| | | | | | | **Total 5 marks** |

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| **10** | | 5 × 74 (= 370) **or** 6 × 77 (= 462)<br>**or**<br>5 × 0.74 (= 3.7) **or** 6 × 0.77 (= 4.62) | | 3 | M1 | one correct product | M2 for<br>74 + (3 × 6) oe<br>**or** 77 + (3 × 5) oe<br><br>(where 3 = 77 – 74) |
| | | 6 × 77 – 5 × 74 **or** "462" – "370"<br>**or**<br>(6 × 0.77 – 5 × 0.74) × 100<br>**or** ("4.62" – "3.7") × 100 | | | M1 | from correct working | |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 92 | | A1 | allow 92/100 **or** 92% **or** 92 out of 100<br><br>(trial and error scores no marks unless correct – and then it gains full marks) | |
| | | | | | | | **Total 3 marks** |

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|---|---|---|---|---|---|---|
| **11** | (a) | $2^{\frac{1}{2}} \times 2^4$<br>**or** eg $2 \times (2^4)^2 = (2^x)^2$ or $2^9 = 2^{2x}$ | | 2 | M1 | for a correct expression in powers of 2 that is equivalent to $2^x$ eg $2^{\frac{1}{2}} \times 2^4$<br>**or** for showing $\sqrt{2} = 2^{\frac{1}{2}}$ **and** $16 = 2^4$<br>**or** for writing the equation in powers of 2 eg $2 \times (2^4)^2 = (2^x)^2$ or $2^9 = 2^{2x}$ |
| | | *Working required* | $\frac{9}{2}$ | | A1 | **or** 4.5 **or** 4½ dependent on M1 |
| | (b) | $\frac{11^{-30}}{11^4}$<br>**or**<br>$-30 - 4 = n$ **or** $-30 = n + 4$ oe | | 2 | M1 | For $(11^{-6})^5$ written as $11^{-30}$ in the equation or $(11^{-6})^5 = 11^{-30}$ shown in working<br>**or** a correct equation with indices only<br>(no marks for $3.914....\times 10^{-36}$) |
| | | *Working required* | −34 | | A1 | dep on M1 (as we have asked for working) |
| | | | | | | **Total 4 marks** |

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| **12** | | $\frac{50}{360} \times \pi \times 7 \times 2$ oe eg $\frac{14\pi}{36} \times 5$<br>**or** "43.98…"÷ 360 × 50 oe | | 2 | M1 | Students may use $\pi$ or 3.14, 3.142 or $\frac{22}{7}$ |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 6.1 | | A1 | Accept answers in the range 6.05 – 6.2 |
| | | | | | | **Total 2 marks** |

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| **13** | | $4x(3x + 1) = 12x^2 + 4x$<br>**or** $4x(2x - 3) = 8x^2 - 12x$<br>**or** $(3x + 1)(2x - 3) = 6x^2 - 9x + 2x - 3$ $(= 6x^2 - 7x - 3)$ | | 3 | M1 | for expanding two of the three factors, allow one error |
| | | $(12x^2 + 4x)(2x - 3) = 24x^3 - 36x^2 + 8x^2 - 12x$ oe<br>$(8x^2 - 12x)(3x + 1) = 24x^3 + 8x^2 - 36x^2 - 12x$ oe<br>$4x(6x^2 - 7x - 3) =$ eg $24x^3 - 28x^2$.... oe | | | M1 | (dep)ft for expanding by the third factor, allow one error<br>(some may do the expansion in one stage and will get to $24x^3 - 36x^2 + 8x^2 - 12x$ without firstly expanding two factors) |
| | | *Working required* | $24x^3 - 28x^2 - 12x$ | | A1 | dep on M1<br><br>isw correct factorisation eg<br>$4(6x^3 - 7x^2 - 3x)$<br>$x(24x^2 - 28x - 12)$<br>$4x(6x^2 - 7x - 3)$<br><br>do not isw incorrect simplification eg $24x^3 - 28x^2 - 12x = 6x^3 - 7x^2 - 3x$ gets M2A0 |
| | | | | | | **Total 3 marks** |

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| **14** | | 16 — 9 | | 2 | M1 | 9 and 16 clearly identified either in list or stated. Some may have also identified the second 13 which we will allow as working so long as not intended as the LQ or UQ |
| | | *Working required* | 7 | | A1 | Dep on M1 |
| | | | | | | **Total 2 marks** |

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| **15** | *ORQ* = 90 – 60 (=30) **or** *OQR* = 30<br>**or**<br>*PQR* = 0.5 × (360 – 238) (= 61)<br>**or**<br>*QPR* = 60<br>**or**<br>*OPR* = $\frac{180-(360-238)}{2}$ (= 29) | | 4 | M1 | The correct working or the correct angle for *ORQ* **or** *OQR* **or** *PQR* **or** *QPR* **or** *OPR*. Must be clearly stated as the correct angle or shown on the diagram in correct position. (eg just seeing 30 in working without a label is not sufficient for the award of this mark) |
| | *Working not required, so correct answer scores M1A1 (unless from obvious incorrect working)* | 31 | | A1 | if not on answer line, may be seen on diagram or clearly labelled |
| | *NB: degrees symbol not essential for reasons*<br><br>*We will allow the symbol*<br>Δ *for 'triangle'*<br>∠ *for angle*<br>Σ *for sum* | full reasons for method used | | B2 | (dep on a fully correct method that should lead to the answer) for fully correct reasons for method used (underlined words **must** be seen) eg<br>Angle between <u>tangent</u> and <u>radius</u> is 90°<br><u>Angles</u> around a <u>point</u> total 360°<br><u>Angle</u> at <u>centre</u> is <u>twice</u> angle at <u>circumference/edge</u><br>Total of <u>angles</u> in <u>triangle</u> is 180° / <u>triangle 180</u>°<br>Base angles in an <u>isosceles</u> triangle (or <u>2 sides equal</u>, so <u>2 angles equal</u>)<br><u>Angles</u> in a <u>quadrilateral</u> total 360° or <u>quadrilateral 360º</u> / Accept "4-sided shape" or "quad"<br><u>Alternate segment</u> theorem<br><br>(B1 dep on M1 for at least one reason for method used) |
| | | | | | **Total 4 marks** |

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| **16** | | eg 10 000$x$ = 2813.13…_<br>100$x$ = 28.13…<br><br>**or** 1000$x$ = 281.313…_<br>10$x$ = 2.813…<br><br>**or** 100$x$ = 28.1313…_<br>$x$ = 0.2813…<br><br>oe | | 2 | M1 | For 2 recurring decimals that when subtracted give a whole number or terminating decimal (27.85 or 278.5 or 2785 etc)<br>eg 10 000$x$ = 2813.13... and 100$x$ = 28.1313....<br>**or** 1000$x$ = 281.313… and 10$x$ = 2.81313…<br>**or** 100$x$ = 28.1313… and $x$ = 0.281313…<br>with intention to subtract.<br>(if recurring dots not shown then showing at least **one** of the numbers to at least 6sf)<br>**or** $0.28+0.00\dot{1}\dot{3}$ **and** eg $100x = 0.1313...$, $10\,000x = 13.1313...$ with intention to subtract. |
| | | eg 10 000$x$ – 100$x$ = 2813.13... – 28.1313...= 2785<br>**and** $\frac{2785}{9900}=\frac{557}{1980}$<br>**or**<br>1000$x$ – 10$x$ = 281.313... – 2.81313...= 278.5<br>**and** $\frac{278.5}{990}=\frac{557}{1980}$<br>**or**<br>100$x$ – $x$ = 28.1313... – 0.281313...= 27.85<br>**and** $\frac{27.85}{99}=\frac{557}{1980}$<br>**or**<br>eg 10 000$x$ – 100$x$ = 13.1313... – 0.1313...= 13<br>**and** $0.28+\frac{13}{9900}=\frac{28\times99+13}{9900}=\frac{2785}{9900}=\frac{557}{1980}$ oe | shown | | A1 | for completion to $\frac{557}{1980}$ dep on M1<br>*(NB: this is a "use algebra to show that…" question, so we need to see algebra as well as seeing all the stages of working to award full marks)* |
| | | | | | | **Total 2 marks** |

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|---|---|---|---|---|---|---|
| **17** | | eg $2n$, $2n + 2$, $2n + 4$<br>**or** $2n - 2$, $2n$, $2n + 2$ etc | | 3 | M1 | 3 consecutive even numbers in algebraic form (any letter can be used) |
| | | eg $(2n + 4)^2 - (2n)^2$<br>$(= 4n^2 + 8n + 8n + 16 - 4n^2 (= 16n + 16))$<br>**or**<br>$(2n + 2)^2 - (2n - 2)^2$<br>$(= 4n^2 + 4n + 4n + 4 - (4n^2 - 4n - 4n + 4) (= 16n))$ | | | M1 | for squaring the largest and smallest even numbers and subtracting<br>(no need to expand or simplify for this mark) |
| | | eg $8(2n + 2) = 16n + 16$<br>**or**<br>eg $16n + 16 = 8(2n + 2)$<br>**or**<br>eg $16n = 8(2n)$<br>**or**<br>eg $8n + 8n = 8(n + n)$<br>**or**<br>eg $\frac{16n+16}{2n+2} = 8$ | Correctly shown | | A1 | dep on M2 for use of algebra to show correct conclusion<br><br>(SCB1 for eg $(p + 4)^2 - p^2$)<br><br>(SCB2 for use of<br>eg $(p + 4)^2 - p^2 = 8p + 16 = 8(p + 2)$<br>If the student shows this and also says "it is true for all numbers, so it must be true for even numbers" oe then this would gain M2A1 |
| | | ***Alternative*** | | | | **Total 3 marks** |
| | | eg $a$, $b$, $c$ are consecutive even numbers where $a < b < c$<br>**and** one of $b = \frac{a + c}{2}$ **or** $a + c = 2b$ **or** $c - a = 4$ oe | | 3 | M1 | 3 numbers defined as consecutive even numbers with one correct equation, writing one term in terms of one or more of the others<br>or $c - a = 4$ |
| | | eg $a$, $b$, $c$ are consecutive even numbers where $a < b < c$<br>**and** all of $b = \frac{a + c}{2}$ **and** $a + c = 2b$ **and** $c - a = 4$ oe | | | M1 | 3 numbers defined as consecutive even numbers with three correct equations that involve all letters in some place |
| | | Now $c^2 - a^2 = (c - a)(c + a) = 4 \times 2b = 8b$ | Correctly shown | | A1 | dep on M2 for use of algebra to show correct conclusion |
| | | | | | | **Total 3 marks** |

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|---|---|---|---|---|---|---|
| **18** | (a) | eg height of first bar labelled as FD 4<br>**or**<br>one 1 cm by 1 cm square = 5 people<br>**or**<br>1 line of 5 small squares = 1 person<br>**or**<br>one 2cm by 2 cm square = 20 people etc | | 2 | M1 | for the use of frequency density – ie that area is proportional to frequency – with either a correct frequency density unambiguously labelled on axis **or** for an area representing a correct number of people **or** 2 correct frequencies completed |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 35, 39, 56 | | A1 | All 3 correct |
| | (b) | | Correct bar | 1 | B1 | Width from 30 – 60 and height 1 cm |
| | (c) | 0.5 × "56" + 30 (= 58)<br>**or**<br>40 + "35" + "39" + "56" + 30 (= 200) | | 2 | M1ft | follow through **their** stated value for $20 \leq d < 30$ for total greater than 25 or ft **their** 3 values in the table for total |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | $\frac{58}{200}$ | | A1ft | ft dep on a completed table<br>oe eg $\frac{29}{100}$ **or** 0.29 **or** 29% |
| | | | | | | **Total 5 marks** |

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| **19** | (i) | | 45 | 3 | B1 |
| | (ii) | | 12 | | B1 |
| | (iii) | | 28 | | B1 |
| | | | | | **Total 3 marks** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **20** | | 9.65, 9.75, 5.85, 5.95, 2.5, 3.5 | | 3 | B1 | for any one of these stated or used,<br>accept $9.74\dot{9}$, $5.94\dot{9}$, $3.4\dot{9}$ |
| | | $\frac{9.75-5.85}{2.5}$ | | | M1 | for $\frac{\mathrm{UB}_t-\mathrm{LB}_w}{\mathrm{LB}_y}$ where<br>$9.7 < \mathrm{UB}_t \leq 9.75$,<br>$5.85 \leq \mathrm{LB}_w < 5.9$,<br>$2.5 \leq \mathrm{LB}_y < 3$<br>This allows for the student who uses some sort of lower/upper value, but are slightly inaccurate eg using 9.74 for *t* |
| | | *Working required* | 1.56 | | A1 | dep on previous marks (as working is requested) |
| | | | | | | **Total 3 marks** |

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| **21** | | $[x =]\ \dfrac{5}{9\left(\dfrac{5}{5a-2}\right)+5}$ oe **or** $y = \dfrac{5}{9x} - \dfrac{5}{9}$ oe | | 4 | M1 | A correct substitution for $y$<br>**or**<br>writing $y$ in terms of $x$ |
| | | $[x =]\ \dfrac{5(5a-2)}{45+5(5a-2)}$ oe **or** $(5-5x)(5a-2) = 45x$ oe<br>**or** $9x = \dfrac{5(45a-18)}{35+25a}$ oe | | | M1 | Multiplying each term in the numerator and denominator by $(5a - 2)$ to eliminate the fraction in the denominator<br>**or**<br>equating $y$'s and getting rid of fractions as far as shown on left<br>**or** single fraction in terms of $a$ |
| | | $[x =]\ \dfrac{25a-10}{35+25a}$ oe **or** $[x =]\ \dfrac{5(5a-2)}{5(7+5a)}$ | | | M1 | A correct fraction not in simplest form with all brackets expanded<br>**or** numerator and denominator factorised with the same common factor taken out |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | $x = \dfrac{5a-2}{7+5a}$ | | A1 | Correctly simplified<br>$x =$ needed for the answer, or $x =$ previously seen in working with correct simplified expression<br><br>Do not isw if students have tried to do some incorrect cancelling<br>eg $x = \dfrac{5a-2}{7+5a} = \dfrac{-2}{7}$ gets M3A0 |
| | | | | | | **Total 4 marks** |

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| **22** | | $[AM =]\sqrt{5^2+15^2}\,(=\sqrt{250}=15.8...)$<br>where $M$ is midpoint of $EF$, oe other correct method to find $AM$<br><br>$[AD =]\sqrt{12^2+15^2}\,(=\sqrt{369}=19.2...)$<br><br>$[DM =])\sqrt{12^2-5^2}\,(=\sqrt{119}=10.9...)$ | | 4 | M2 | for a complete method to find **two** of *AM*, *AD*, *DM* (where *M* is the midpoint of *EF*)<br><br>Other longer ways to find *AM*, *AD*, *DM* may be used but must be a complete method eg<br>$\angle DEM = \cos^{-1}(\frac{5}{12})(=65.37...)$ **and** $DM = 12\sin 65.37...$<br>$\angle DEM = \cos^{-1}(\frac{5}{12})(=65.37...)$ **and** $DM = 5\tan 65.37...$<br><br>Use 10 ÷ 2 as 5 throughout |
| | | | | | (M1 | For a complete method to find **one** of *AM*, *AD*, *DM* (where *M* is the midpoint of *EF*)) |
| | | eg tan $DAM = \frac{"\sqrt{119}"}{"\sqrt{250}"}\left(=\frac{"10.9..."}{"15.8..."}\right)$ oe<br>**or** sin $DAM = \frac{"\sqrt{119}"}{"\sqrt{369}"}\left(=\frac{"10.9..."}{"19.2..."}\right)$ oe<br>**or** cos $DAM = \frac{"\sqrt{250}"}{"\sqrt{369}"}\left(=\frac{"15.8..."}{"19.2..."}\right)$ oe | | | M1 | a correct method to find the required angle –other longer methods may be used but they must get to the stage of an equation for the required angle<br>eg $\sin DAM = \frac{"10.9..."}{\sqrt{"15.8..."^2+"10.9..."^2}}$<br>NB: "10.9…" and "15.8…" must come from correct working |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 34.6 | | A1 | any answer which rounds to 34.6 |
| | | | | | | **Total 4 marks** |

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| **23** | | $a + d = 8.5$, $a + 4d = 13$ oe | | 5 | M1 | for at least 1 correct equation **or** for $d = 1.5$ |
| | | $a = 7$, $d = 1.5$ | | | A1 | both values correct |
| | | $\frac{N}{2}(2\times 7+(N-1)1.5)=292$<br>(eg $3N^2 + 25N - 1168$ [= 0]<br>**or** $1.5N^2 + 12.5N - 584$ [= 0]) | | | M1 | A correct equation for the total of the first $N$ terms of the series with $a$ and $d$ substituted in.<br>The mark can be gained by using **their** values of $a$ and $d$ even if no previous marks awarded. |
| | | eg $(3N + 73)(N - 16)$ [=0]<br>$[N =] \frac{-25\pm\sqrt{25^2-4\times 3\times -1168}}{2\times 3}$ | | | M1 | A correct method dep on the previous M1 for solving **their** 3 term quadratic equation using any correct method (allow one sign error and some simplification – allow as far as $\frac{-25\pm\sqrt{625+14016}}{6}$) oe (may be ± or just +) or if factorising, allow brackets which expanded give 2 out of 3 terms correct, or if completing the square allow as far as the stage<br>$3((N+\frac{25}{6})^2-\frac{25^2}{6^2})-1168$ (= 0) |
| | | *Working required* | 16 | | A1 | dep on M2 |
| | | | | | | **Total 5 marks** |

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| **24** | (a) | g(2) = 7 × 2 – 6 (= 8)<br>**or** $5(7\times 2-6)^2-10(7\times 2-6)+7$ | | | 2 | M1 |
| | | *Working not required, so correct answer scores full marks* | | 247 | | A1 |
| | (b) | eg $y = 5(x^2-2x)+7$<br>**or** $y=5(x^2-2x+\frac{7}{5})$ oe | eg $x = 5(y^2-2y)+7$<br>**or** $x=5(y^2-2y+\frac{7}{5})$ | | 4 | M1 **or** eg $\frac{y-7}{5}=x^2-2x$ |
| | | eg $y = 5[(x-1)^2-1^2]+7$<br>**or** $y=5\left((x-1)^2-1^2+\frac{7}{5}\right)$<br>oe | eg $x=5\left((y-1)^2-1^2\right)+7$ **or**<br>$x=5\left((y-1)^2-1^2+\frac{7}{5}\right)$ oe | | | M1 **or** eg $\frac{y-7}{5}=(x-1)^2-1^2$ |
| | | $(x-1)^2=\frac{y-2}{5}$ oe | $(y-1)^2=\frac{x-2}{5}$ oe | | | M1 **or** eg $(x-1)^2=\frac{y-7}{5}+1$ |
| | | *Working not required, so correct answer scores full marks(unless from obvious incorrect working)* | | $1+\sqrt{\frac{x-2}{5}}$ | | A1 Must be in terms of $x$, oe eg $1+\sqrt{\frac{x-7}{5}+1}$<br>(NB: $f^{-1}(x)=1\pm\sqrt{\frac{x-2}{5}}$ is 3 marks) |
| | | ***Alternative for (b)*** | | | | **Total 6 marks** |
| | | Let $x = 5y^2-10y+7$ [⇔] $5y^2-10y+(7-x)=0$ oe | | | 4 | M1 |
| | | $[y=]\frac{10\pm\sqrt{100-20(7-x)}}{10}$ | | | | M1 |
| | | $1\pm\sqrt{\frac{x-2}{5}}$ | | | | M1 |
| | | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | | $1+\sqrt{\frac{x-2}{5}}$ | | A1 Must be in terms of $x$ |
| | | | | | | **Total 6 marks** |

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|---|---|---|---|---|
| **25** | [chord $AB$ =] $\sqrt{5^2+5^2-2\times5\times5\times\cos 50}$ **or** $2 \times 5 \times \sin 25$ (= 10sin25 or 4.226...) | | 6 | M1 oe |
| | [$\angle APB$ =] $\cos^{-1}(\frac{4^2+4^2-"4.226..."^2}{2\times4\times4})$ (=63.77...) **or** [$\angle OPA$ =] $\sin^{-1}(\frac{0.5\times"4.226..."}{4})$ (= 31.88...) | | | M1 oe may use other methods but must be a complete method for $\angle APB$ **or** $\angle OPA$ (see below for sine rule) |
| | [Area sector $AOB$ =] $\frac{50}{360}\times\pi\times5^2$ (= $\frac{125}{36}\pi$ or 10.9...) | | | M1 oe independent |
| | [Area sector $APB$ =] $\frac{"63.77..."}{360}\times\pi\times4^2$ (= 8.90...) | | | M1 oe NB: 2 × "31.88…" = "63.77…" |
| | $\left(\frac{50}{360}\pi\times5^2-\frac{1}{2}\times5^2\times\sin 50\right)+\left(\frac{"63.77..."}{360}\times\pi\times4^2-\frac{1}{2}\times4^2\times\sin"63.77..."\right)$ | | | M1 oe (10.9…– 9.57…) + (8.90… – 7.17…) |
| | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 3.06 | | A1 allow 3 – 3.1 |
| | ***Alternative version*** (using line of symmetry *OP* in quadrilateral *OAPB*) | | | **Total 6 marks** |
| | [$\angle OPA$] $= \sin^{-1}\left(\frac{5\sin 25}{4}\right)$ (= 31.88..) | | 6 | M1 oe (see above for cosine rule & trig) |
| | [Area sector $APB$ =] $\frac{2\times"31.88..."}{360}\times\pi\times4^2$ (= 8.90...) | | | M1 oe |
| | [Area $OAPB$ =] 2 × ½ × 5 × 4 × sin(180 – "31.88.." – 25) (=16.75...) | | | M1 oe |
| | [Area sector $AOB$ =] $\frac{50}{360}\times\pi\times5^2$ (= $\frac{125}{36}\pi$ = 10.9...) | | | M1 oe independent |
| | [Area **R** =] "10.9..." + "8.90..." – "16.75..." | | | M1 oe |
| | *Working not required, so correct answer scores full marks (unless from obvious incorrect working)* | 3.06 | | A1 allow 3 – 3.1 |
| | | | | **Total 6 marks** |

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|---|---|---|---|---|---|---|
| **26** | | eg $\overrightarrow{OP}$ = $n(2\mathbf{a} + 3\mathbf{b})$<br>**or** $\overrightarrow{OP} = 2\mathbf{a} + m(5\mathbf{b} - 2\mathbf{a})$<br>**or** $\overrightarrow{OP} = 5\mathbf{b} + x(2\mathbf{a} - 5\mathbf{b})$ | | 5 | M1 | for a vector equation for $\overrightarrow{OP}$ |
| | | eg $\overrightarrow{OP} = n(2\mathbf{a} + 3\mathbf{b})$ **and** $\overrightarrow{OP} = 2\mathbf{a} + m(5\mathbf{b} - 2\mathbf{a})$<br>**or**<br>eg $\overrightarrow{OP} = n(2\mathbf{a} + 3\mathbf{b})$ **and** $\overrightarrow{OP} = 5\mathbf{b} + x(2\mathbf{a} - 5\mathbf{b})$ oe | | | M1 | 2 vector equations for $\overrightarrow{OP}$ that can be used to find $\overrightarrow{OP}$ - must be in terms of **a** and **b** and a scalar |
| | | eg $5m = 3n$ or $m = \frac{3}{5}n$ or $2n = 2 - 2m$ or $n = 1 - m$ oe<br>**and** $2 - 2 \times \frac{3}{5}n = 2n$ or $2 \times \frac{5}{3}m = 2 - 2m$ oe<br>**or**<br>eg $2n = 2x$ or $n = x$ or $3n = 5 - 5x$ oe<br>**and** $3x = 5 - 5x$ or $3n = 5 - 5n$ oe | | | M1 | Writing one equation in terms of only one scalar eg one of $n$ or $m$ or $x$ etc |
| | | eg $m = \frac{3}{8}$ or $n = \frac{5}{8}$ or $x = \frac{5}{8}$ oe | | | M1 | for a correct value for one scalar |
| | | *Working is required* | $\frac{5}{4}\mathbf{a} + \frac{15}{8}\mathbf{b}$ | | A1 | oe (dep on M1) but terms in **a** and terms in **b** should be simplified.<br>eg $\frac{1}{8}(10\mathbf{a} + 15\mathbf{b})$ or $\frac{5}{8}(2\mathbf{a} + 3\mathbf{b})$ etc |
| | | | | | | **Total 5 marks** |
| | | **Alternative method as a vector method not requested** | | | | |
| | | eg $\overrightarrow{OP} = n(2\mathbf{a} + 3\mathbf{b})$ | | 5 | M1 | for a vector equation for $\overrightarrow{OP}$ |

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| | | eg $CP : OP = 3 : 5$ or $CP : CO = 3 : 8$ or $\frac{CP}{OP} = \frac{3}{5}$ or $\frac{CP}{CO} = \frac{3}{8}$ oe | | | M2 | for a correct ratio for two sides in triangle *ACP* and triangle *BOP* that help to find $\overrightarrow{OP}$ as *a* fraction of $\overrightarrow{OC}$ (could be seen on the diagram) |
| | | $\overrightarrow{OP} = \frac{5}{8}\overrightarrow{OC}$ or $n = \frac{5}{8}$ | | | M1 | |
| | | *Working is required* | $\frac{5}{4}\mathbf{a} + \frac{15}{8}\mathbf{b}$ | | A1 | oe (dep on M1) but terms in **a** and terms in **b** should be simplified. eg $\frac{1}{8}(10\mathbf{a} + 15\mathbf{b})$ or $\frac{5}{8}(2\mathbf{a} + 3\mathbf{b})$ etc |
| | | | | | | **Total 5 marks** |

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