



# Mark Scheme (Results)

## Summer 2014

Pearson Edexcel International GCSE  
Mathematics A (4MA0/4HR) 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**
  - o M marks: method marks
  - o A marks: accuracy marks
  - o B marks: unconditional accuracy marks (independent of M marks)
- **Abbreviations**
  - o awrt – answers which round to
  - o cao – correct answer only
  - o ft – follow through
  - o isw – ignore subsequent working
  - o SC - special case
  - o oe – or equivalent (and appropriate)
  - o dep – dependent
  - o indep – independent
  - o eeo – 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 specifically allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

**Apart from Questions 14 and 16 (where the mark scheme states otherwise), the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.**

**NB: All ranges for correct answers on the mark scheme are inclusive.**

| Question | Working                                                                           | Answer  | Mark | Notes                                                               |
|----------|-----------------------------------------------------------------------------------|---------|------|---------------------------------------------------------------------|
| 1        | eg. $-22 = 5 \times p - 4 \times -5$ <b>or</b> $5p = -22 + 4 \times -5$           |         |      | M1 for correct substitution (must be into a correct equation)       |
|          | eg. $-22 = 5p + 20$ <b>or</b><br>$5p = -22 - 20$ <b>or</b> $p = \frac{-22-20}{5}$ |         |      | M1 for correct simplification<br>(minimum of $-4 \times -5 = +20$ ) |
|          |                                                                                   | -8.4 oe | 2    | A1 (accept $-\frac{42}{5}$ or $-8\frac{2}{5}$ oe)                   |
|          |                                                                                   |         |      | <b>Total 3 marks</b>                                                |

| Question | Working                                                     | Answer | Mark | Notes                                                                                                                                                                                                                 |
|----------|-------------------------------------------------------------|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2        | 3.45 <b>or</b> $3\frac{27}{60}$                             |        |      | M1 for correctly converting '3h 27m' into a decimal (eg. 3.45)<br>For '3h 27m' there must be some indication that this is the elapsed time from 20:07 to 23:34                                                        |
|          | $"3\frac{27}{60}" \times 224$ <b>or</b> $"3.45" \times 224$ |        |      | M1 (independent)<br>allow<br>'3h 27m' $\times 224$ <b>or</b> $3.27 \times 224$<br>For '3h 27m' there must be some indication that this is the elapsed time from 20:07 to 23:34<br><br>NB. $224 \times 20\ 07$ gets M0 |
|          |                                                             | 772.8  | 3    | A1 accept 773                                                                                                                                                                                                         |
|          |                                                             |        |      | <b>Total 3 marks</b>                                                                                                                                                                                                  |

| Question | Working                                   | Answer      | Mark | Notes                                                                                                         |
|----------|-------------------------------------------|-------------|------|---------------------------------------------------------------------------------------------------------------|
| 3 (a)    |                                           |             |      | M1 for $3n + k$ ( $k$ may be zero) oe                                                                         |
|          |                                           | $3n + 1$ oe | 2    | A1 need not be simplified eg. $4 + 3(n - 1)$<br><br>NB: $n = 3n + 1$ gains M1 A0                              |
| (b)      | $3n + 1 = 88$ <b>or</b> $(88 - 1) \div 3$ |             |      | M1 ft $"3n + 1" = 88$<br>NB. Only ft if their expression is of the form $an + b$ where $a > 1$ and $b \neq 0$ |
|          |                                           | 29          | 2    | A1 ft NB. unrounded answer must be an integer                                                                 |
|          |                                           |             |      | <b>Total 4 marks</b>                                                                                          |

| Question | Working | Answer                                              | Mark | Notes                                                                                                                                                                                                                                                                                                                                          |
|----------|---------|-----------------------------------------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 (a)    |         | Rotation, $90^\circ$ ,<br>anticlockwise, centre $O$ | 3    | B1 Rotate <b>or</b> rotated<br>B1 $90^\circ$ (anticlockwise) <b>or</b> $-270^\circ$ <b>or</b> $270^\circ$ clockwise<br>B1 (centre) $O$ <b>or</b> $(0,0)$ <b>or</b> origin<br>(do <b>not</b> accept $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$ but do not count as an additional transformation)<br>NB if more than one transformation then 0 marks |
| (b)      |         | triangle at $(6,1)$ $(7,1)$<br>$(7,3)$              | 1    | B1 cao                                                                                                                                                                                                                                                                                                                                         |
|          |         |                                                     |      | <b>Total 4 marks</b>                                                                                                                                                                                                                                                                                                                           |

| Question | Working                                  | Answer | Mark | Notes                                         |
|----------|------------------------------------------|--------|------|-----------------------------------------------|
| 5        | $\pi \times 3^2 (= 9\pi) (= 28.27\dots)$ |        |      | M1 rounded or truncated to 3 or more sig figs |
|          | $20 \times 12 (= 240)$                   |        |      | M1                                            |
|          | "240" $- 2 \times$ "28.27..."            |        |      | M1 dep on M2                                  |
|          |                                          | 183    | 4    | A1 for answer in range 183 – 184              |
|          |                                          |        |      | <b>Total 4 marks</b>                          |

| Question | Working                                                                                                  | Answer | Mark | Notes                                                                                                          |
|----------|----------------------------------------------------------------------------------------------------------|--------|------|----------------------------------------------------------------------------------------------------------------|
| 6        | <b>Working with all 12 boxes</b><br>$12 \times 15 (=180)$ <b>or</b> $12 \times 12 (=144)$                |        |      | M1 for correct total cost or correct total number of drinks (either may appear as part of another calculation) |
|          | $12 \times 12 \times \frac{3}{4} \times 1.5$ oe (=162)                                                   |        |      | M1 for revenue from all full price drinks sold                                                                 |
|          | $12 \times 15 \times 1.15$ oe (=207) <b>or</b><br>$180 \times 0.15$ oe (=27)                             |        |      | M1 for total revenue or total profit                                                                           |
|          | $\frac{"207" - "162"}{36}$ <b>or</b> $\frac{45}{36}$ <b>or</b> $\frac{"27" + ("180" - "162")}{36}$       |        |      | M1 dep on M3                                                                                                   |
|          |                                                                                                          | 1.25   | 5    | A1 cao                                                                                                         |
|          |                                                                                                          |        |      | <b>Total 5 marks</b>                                                                                           |
|          | <b>Alternative – working with one box</b><br>$15 \div 12 (=1.25)$ <b>or</b> $12 \times \frac{3}{4} (=9)$ |        |      | M1 for price of 1 drink <b>or</b> number of full price drinks                                                  |
|          | $12 \times \frac{3}{4} \times 1.5$ oe (=13.5)                                                            |        |      | M1 for revenue from all full price drinks sold                                                                 |
|          | $15 \times 1.15 (=17.25)$                                                                                |        |      | M1 for total revenue from one box                                                                              |
|          | $\frac{"17.25" - "13.5"}{3}$ <b>or</b> $\frac{3.75}{3}$                                                  |        |      | M1 dep on M3                                                                                                   |
|          |                                                                                                          | 1.25   | 5    | A1 cao                                                                                                         |
|          |                                                                                                          |        |      | <b>Total 5 marks</b>                                                                                           |

| Question | Working            | Answer | Mark | Notes                              |
|----------|--------------------|--------|------|------------------------------------|
| 7 (a)    |                    | 0.9 oe | 1    | B1 accept 90% or $\frac{9}{10}$ oe |
| (b)      | $50 \times 0.1$ oe |        |      | M1 $50 \times 0.1$                 |
|          |                    | 5      | 2    | A1 cao                             |
|          |                    |        |      | <b>Total 3 marks</b>               |

| Question | Working                                                                     | Answer                                  | Mark | Notes                                                                                                                                                                                         |
|----------|-----------------------------------------------------------------------------|-----------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8 (a)    | $252 = 2 \times 126 = 2 \times 2 \times 63 = 2 \times 2 \times 3 \times 21$ |                                         |      | M1 for a process that isolates at least 2 correct prime factors e.g. $252 = 2 \times 126$ , $126 = 3 \times 42$ or a factor tree with 2 primes from 2, 3 or 7 identified or repeated division |
|          |                                                                             | $2 \times 2 \times 3 \times 3 \times 7$ | 2    | A1 for $2 \times 2 \times 3 \times 3 \times 7$ oe with correct prime factors                                                                                                                  |
| (b)      | $2^2 \times 3^2 \times 7 \times 2^4 \times 3 \times 5$                      |                                         |      | M1 " $2^2 \times 3^2 \times 7$ " $\times 2^4 \times 3 \times 5$ or a fully correct factor tree or fully correct repeated division                                                             |
|          |                                                                             | $2^6 \times 3^3 \times 5 \times 7$      | 2    | A1 cao accept in any order                                                                                                                                                                    |
|          |                                                                             |                                         |      | <b>Total 4 marks</b>                                                                                                                                                                          |

| Question | Working                                                                                                 | Answer   | Mark | Notes                                                                                                                                                                   |
|----------|---------------------------------------------------------------------------------------------------------|----------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9        | $x + 24 = 4x - 30$                                                                                      |          |      | M1 for forming a correct equation in $x$                                                                                                                                |
|          |                                                                                                         | $x = 18$ |      | A1 cao                                                                                                                                                                  |
|          | $x + 2y + x + 24 = 180$ or<br>$x + 2y + 4x - 30 = 180$ or<br>$x + 2y + 4x - 30 + x + 24 + x + 2y = 360$ |          |      | M1 for forming a correct equation in $x$ and $y$<br><b>or</b> a correct equation in $y$<br>(NB. Their found value of $x$ (which may not be correct) may be substituted) |
|          |                                                                                                         | $y = 60$ | 4    | A1 cao                                                                                                                                                                  |
|          |                                                                                                         |          |      | <b>Total 4 marks</b>                                                                                                                                                    |

| Question | Working                                                                                                                      | Answer | Mark | Notes                                                                |
|----------|------------------------------------------------------------------------------------------------------------------------------|--------|------|----------------------------------------------------------------------|
| 10 (a)   | $2.1 \div (1 + 2 + 3) (= 0.35)$ <b>or</b> $2.1 \div 6$<br>$2.1 \div (1 + 2 + 3) \times 2$ <b>or</b> $2.1 \div 6 \times 2$ oe |        |      | M1 allow $2.1 \div (1 + 2 + 3) \times 3 (=1.05)$ for the method mark |
|          |                                                                                                                              | 0.7    | 2    | A1 (accept 0.70)                                                     |
| (b)      | eg. $6 \div 3 = 2$ <b>and</b> $2 \times 0.75$ <b>or</b> $\frac{0.75}{3} \times 6$ oe                                         |        |      | M1 for a complete method                                             |
|          |                                                                                                                              | 1.5    | 2    | A1 cao                                                               |
|          |                                                                                                                              |        |      | <b>Total 4 marks</b>                                                 |

| Question | Working                                                                                                                                                                | Answer | Mark | Notes                                                                                                                             |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|-----------------------------------------------------------------------------------------------------------------------------------|
| 11(a)    | $7 + 7 + 8 + d = 4 \times 8$ <b>or</b><br>$7, 7, 8, (x)$ <b>or</b><br>$4 \times 8 (=32)$                                                                               |        |      | M1                                                                                                                                |
|          |                                                                                                                                                                        | 10     | 2    | A1 (accept 7, 7, 8, 10 on answer line)                                                                                            |
| (b)      | $\frac{(2 \times "7" - 3) + (2 \times "7" - 3) + (2 \times "8" - 3) + (2 \times "10" - 3)}{4}$ <b>or</b><br>$\frac{2 \times 32 - 12}{4}$ <b>or</b><br>$2 \times 8 - 3$ |        |      | M1 ft for a complete method using candidate's 4 numbers from (a)<br><b>or</b><br>$\frac{2a - 3 + 2b - 3 + 2c - 3 + 2d - 3}{4}$ oe |
|          |                                                                                                                                                                        | 13     | 2    | A1 cao                                                                                                                            |
|          |                                                                                                                                                                        |        |      | <b>Total 4 marks</b>                                                                                                              |

| Question | Working                                                                                       | Answer                           | Mark | Notes                                                                                                                      |
|----------|-----------------------------------------------------------------------------------------------|----------------------------------|------|----------------------------------------------------------------------------------------------------------------------------|
| 12 (a)   |                                                                                               |                                  |      | M1 $(2t \pm 1)(t \pm 3)$ <b>or</b> $(2t \pm 3)(t \pm 1)$<br>NB. Accept $1t$ in place of $t$                                |
|          |                                                                                               | $(2t - 1)(t - 3)$                | 2    | A1 cao                                                                                                                     |
| (b)      | $bx^2 = a - y$ <b>or</b> $-bx^2 = y - a$                                                      |                                  |      | M1 for isolating $bx^2$ (or $-bx^2$ )                                                                                      |
|          | $x^2 = \frac{a - y}{b}$ <b>or</b> $x^2 = \frac{y - a}{-b}$ <b>or</b> $x^2 = -\frac{y - a}{b}$ |                                  |      | M1 for isolating $x^2$                                                                                                     |
|          |                                                                                               | $x = \pm \sqrt{\frac{a - y}{b}}$ | 3    | A1 <b>or</b> $x = \pm \sqrt{\frac{y - a}{-b}}$ <b>or</b> $x = \pm \sqrt{-\frac{y - a}{b}}$<br>(condone omission of $\pm$ ) |
|          |                                                                                               |                                  |      | <b>Total 5 marks</b>                                                                                                       |

| Question | Working                                                                                                           | Answer                                 | Mark | Notes                                                                                 |
|----------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------|------|---------------------------------------------------------------------------------------|
| 13 (a)   | 14 16 17 18 20 21 22 23 23 24 24                                                                                  |                                        |      | M1 arrange in order <b>or</b><br>One of 21(median), 17(LQ), 23(UQ) identified         |
|          | ( 14 16 17 18 20 <u>21</u> 22 23 23 24 24 )<br>(14 16 <u>17</u> 18 20) and<br>(22 23 <u>23</u> 24 24 )<br>23 - 17 |                                        |      | M1 Identify any <b>two</b> of 21, 17 and 23                                           |
|          |                                                                                                                   | 6                                      | 3    | A1 cao                                                                                |
| (b)      |                                                                                                                   | Carmelo <b>and</b><br>reason using IQR | 2    | B1 ft from (a) Carmelo - he has a lower IQR oe<br>(IQR must be part of the statement) |
|          |                                                                                                                   |                                        |      | <b>Total 5 marks</b>                                                                  |

| Question | Working                                                                                                                                                                                                                                                                                                                                                                               | Answer                | Mark | Notes                                                                                                                                                                                                                                                                              |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14 (a)   | $7.8 \times 10^8 \times 1000$ <b>or</b><br>$7.8 \times 10^{11}$ <b>or</b><br>$8 \div 1000$ <b>or</b><br>0.008                                                                                                                                                                                                                                                                         |                       |      | M1 for correct conversion from m to km or from km to m                                                                                                                                                                                                                             |
|          | $7.8 \times 10^8 \times 1000 \div 8$ <b>or</b> $7.8 \times 10^8 \div 0.008$                                                                                                                                                                                                                                                                                                           |                       |      | M1 (indep) award for digits 975<br>(eg. an answer of $9.75 \times 10^7$ gets M0 M1 A0)                                                                                                                                                                                             |
|          |                                                                                                                                                                                                                                                                                                                                                                                       | $9.75 \times 10^{10}$ | 3    | A1 cao                                                                                                                                                                                                                                                                             |
| (b)      | $1.95 \times 10^{10}$ km                                                                                                                                                                                                                                                                                                                                                              |                       |      | B1 cao                                                                                                                                                                                                                                                                             |
|          | $\frac{1.95 \times 10^{10}}{9.75 \times 10^{10}} (=0.2(\text{km}))$ <b>or</b> $\frac{1.95 \times 10^{13}}{9.75 \times 10^{10}}$<br>$(=200(\text{m}))$ <b>or</b> $\frac{1.95 \times 10^{10}}{7.8 \times 10^8} \times 8 (=200(\text{m}))$ <b>or</b><br>$\frac{1.95 \times 10^{13}}{7.8 \times 10^{11}} \times 8 (=200(\text{m}))$<br><b>NB: 1.95 may be the candidate's upper bound</b> |                       |      | M1 ft from (a) also award for<br>$\frac{1.9 \times 10^{10}}{9.75 \times 10^{10}}$ <b>or</b> $\frac{1.9 \times 10^{13}}{9.75 \times 10^{10}}$<br><b>or</b> $\frac{1.9 \times 10^{10}}{7.8 \times 10^8} \times 8$ <b>or</b> $\frac{1.9 \times 10^{13}}{7.8 \times 10^{11}} \times 8$ |
|          |                                                                                                                                                                                                                                                                                                                                                                                       | 200                   | 3    | A1 cao <b>must be from correct figures used in a correct calculation</b>                                                                                                                                                                                                           |
|          |                                                                                                                                                                                                                                                                                                                                                                                       |                       |      | <b>Total 6 marks</b>                                                                                                                                                                                                                                                               |

| Question | Working                                                                  | Answer                                                                                                                                          | Mark | Notes                                                                                                                                                                                                                                                                           |
|----------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15 (a)   |                                                                          | $\frac{2}{7}$ then two pairs of branches with $\frac{3}{5}, \frac{2}{5}$ on the W and R branches respectively<br><br>fully correct tree diagram | 2    | M1 $\frac{2}{7}$ on lower LH branch <b>OR</b><br>two additional pairs branches labelled with white and red<br><br>A1 for fully correct tree diagram with all probabilities and labels<br><br>NB: Accept 0.28571... rounded or truncated to 3 or more sig figs for $\frac{2}{7}$ |
| (b)      | $\frac{5}{7} \times \frac{3}{5}$                                         |                                                                                                                                                 |      | M1 ft from their tree diagram                                                                                                                                                                                                                                                   |
|          |                                                                          | $\frac{15}{35}$                                                                                                                                 | 2    | A1 oe eg. $\frac{3}{7}$ <b>or</b> 0.428571... rounded or truncated to 3 or more sig figs<br>Accept 0.43 if working shown                                                                                                                                                        |
| (c)      | $\frac{5}{7} \times \frac{2}{5}$ " or $\frac{2}{7} \times \frac{3}{5}$ " |                                                                                                                                                 | 3    | M1 for a correct product only ft probabilities < 1                                                                                                                                                                                                                              |
|          | $\frac{5}{7} \times \frac{2}{5}$ " + $\frac{2}{7} \times \frac{3}{5}$ "  |                                                                                                                                                 |      | M1 for full method                                                                                                                                                                                                                                                              |
|          |                                                                          | $\frac{16}{35}$                                                                                                                                 |      | A1 oe accept decimal answer 0.457142... rounded or truncated to 3 or more sig figs<br>Accept 0.46 if working shown                                                                                                                                                              |
|          |                                                                          |                                                                                                                                                 |      | <b>Total 7 marks</b>                                                                                                                                                                                                                                                            |

| Question |     | Working                                                                                                                                                              | Answer       | Mark | Notes                                                                                                                                                                                         |
|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16       | (a) | Eg. Area = $(4x-3)(x+1) + [3x-(x+1)] \times 4$ <b>OR</b><br><br>Area = $4 \times 3x + (x+1)(4x-3-4)$ <b>OR</b><br><br>Area = $(4x-3) \times 3x - (4x-3-4)(3x-(x+1))$ |              |      | M1 for a complete correct expression for area of hexagon                                                                                                                                      |
|          |     |                                                                                                                                                                      |              |      | A1 for all brackets correctly expanded                                                                                                                                                        |
|          |     |                                                                                                                                                                      | Answer given | 3    | A1 for convincing progression to given equation                                                                                                                                               |
|          | (b) | $\frac{-9 \pm \sqrt{9^2 - 4 \times 4 \times (-47)}}{2 \times 4}$                                                                                                     |              |      | M1 for correct substitution; condone one sign error; brackets not necessary; condone + instead of $\pm$ in formula<br><b>There may be partial evaluation – if so, this must be correct</b>    |
|          |     | $\sqrt{833}$ <b>or</b> $\sqrt{81+752}$ <b>or</b> $7\sqrt{17}$ <b>or</b> 28.8.....                                                                                    |              |      | M1 (independent) for correct simplification of discriminant (if evaluated, at least 3sf rounded or truncated)                                                                                 |
|          |     |                                                                                                                                                                      | 2.48, - 4.73 | 3    | A1 awrt 2.48 and -4.73<br>NB. If negative solution is discarded (or omitted at any stage) then full marks can still be obtained<br><b>Award 3 marks if first M1 scored and answer correct</b> |
|          | (c) | $3 \times "2.48".... (=7.44...) \text{ or } 4 \times "2.48" - 3 (=6.93...)$                                                                                          |              |      | M1                                                                                                                                                                                            |
|          |     |                                                                                                                                                                      | 7.45         | 2    | A1 for 7.44 - 7.45                                                                                                                                                                            |

|     |                                                                                                                                   |              |    |                                                                                                                                                                                  |
|-----|-----------------------------------------------------------------------------------------------------------------------------------|--------------|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16b | <b>Alternative</b><br>$x^2 + \frac{9}{4}x - \frac{47}{4} = 0$ $\left(x + \frac{9}{8}\right)^2 - \frac{81}{64} - \frac{47}{4} = 0$ |              | M1 | for $\left(x + \frac{9}{8}\right)^2$ oe                                                                                                                                          |
|     | $\left(x + \frac{9}{8}\right) = \pm \sqrt{\frac{833}{64}}$                                                                        |              | M1 | for $\left(x + \frac{9}{8}\right) = \pm \sqrt{\frac{833}{64}}$ oe                                                                                                                |
|     |                                                                                                                                   | 2.48, − 4.73 | 3  | A1 awrt 2.48 and −4.73<br>NB. If negative solution is discarded (or omitted) then full marks can still be obtained<br><b>Award 3 marks if first M1 scored and answer correct</b> |
|     |                                                                                                                                   |              |    | <b>Total 8 marks</b>                                                                                                                                                             |

| Question | Working                                                                                                         | Answer           | Mark | Notes                                                                                                                                                                             |
|----------|-----------------------------------------------------------------------------------------------------------------|------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17 (a)   |                                                                                                                 | $4x^2y$          | 2    | B2<br>(B1 for $ax^ny^m$ with two of $a = 4$ ; $n = 2$ ; $m = 1$ )                                                                                                                 |
| (b)      | $2(x-2)(x+2)$ <b>or</b> $(2x-4)(x+2)$ <b>or</b><br>$(x-2)(2x+4)$                                                |                  |      | M1 for numerator factorised                                                                                                                                                       |
|          | $4x(x-2)$ <b>or</b> $2x(2x-4)$                                                                                  |                  |      | M1 for denominator factorised                                                                                                                                                     |
|          |                                                                                                                 | $\frac{x+2}{2x}$ | 3    | A1 accept $\frac{1}{2} + \frac{1}{x}$                                                                                                                                             |
|          | <b>Alternative to (b):</b><br><br>$\frac{2x^2-8}{4x^2-8x} = \frac{x^2-4}{2x^2-4x} = \frac{(x-2)(x+2)}{2x(x-2)}$ | $\frac{x+2}{2x}$ | 3    | <b>In order to use this mark scheme, correct simplification of the original fraction must be seen</b><br>M1 $(x-2)(x+2)$<br>M1 $2x(x-2)$<br>A1 accept $\frac{1}{2} + \frac{1}{x}$ |
|          |                                                                                                                 |                  |      | <b>Total 5 marks</b>                                                                                                                                                              |

| Question | Working                                                                                                                                                                                                                                | Answer                                                       | Mark | Notes                                                                                                     |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------|
| 18 (a)   | $\angle AOC = 90 - 36$                                                                                                                                                                                                                 | 54                                                           | 2    | B1 cao                                                                                                    |
|          |                                                                                                                                                                                                                                        | Angle between <u>tangent</u> and <u>radius</u> is <u>90°</u> |      | B1 for Angle between <u>tangent</u> and <u>radius</u> is <u>90°</u> (accept right-angle or perpendicular) |
| (b)      | <b><u>Using angle CGF = angle FGE + angle CGE</u></b>                                                                                                                                                                                  |                                                              |      |                                                                                                           |
|          | $\angle FGE = 90 - 34 (=56)$                                                                                                                                                                                                           |                                                              |      | M1 may be on diagram                                                                                      |
|          | $\angle CGE = "54" \div 2 (=27)$ or<br>$\frac{180 - (180 - "54")}{2} (=27)$                                                                                                                                                            |                                                              |      | M1 may be on diagram                                                                                      |
|          |                                                                                                                                                                                                                                        | 83                                                           | 3    | A1 cao                                                                                                    |
|          | <b><u>Alternative:</u></b><br><b>Using angles in a cyclic quadrilateral = 180°</b><br><b>Angle CGF = 180 – (angle CEO + angle FEG)</b><br><br>Angle CEO = $(180 - "54") \div 2 (=63)$ and<br>angle FEG = $180 - (180 - 70) - 36 (=34)$ |                                                              |      | M1 may be on diagram                                                                                      |
|          | Angle CGF = $180 - ("34" + "63")$                                                                                                                                                                                                      |                                                              |      | M1 dep on previous M1                                                                                     |
|          |                                                                                                                                                                                                                                        | 83                                                           | 3    | A1 cao                                                                                                    |
|          |                                                                                                                                                                                                                                        |                                                              |      | <b>Total 5 marks</b>                                                                                      |

| Question | Working                                                                                                                                                                            | Answer | Mark | Notes                                                                                                                                          |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 19       | $(BC^2 = ) 3.8^2 + 6.4^2 - 2 \times 3.8 \times 6.4 \cos 120^\circ$<br>( = 79.72)                                                                                                   |        |      | M1 correct use of Cosine rule to find $BC$                                                                                                     |
|          | $(BC^2 = ) 14.44 + 40.96 + 24.32 (=79.72)$                                                                                                                                         |        |      | M1 correct order of operations                                                                                                                 |
|          |                                                                                                                                                                                    |        |      | A1 for $BC = 8.9 - 8.93$ <b>or</b><br>$\sqrt{79.72}$ <b>or</b> $\sqrt{\frac{1993}{25}}$ oe                                                     |
|          | $\frac{\sin C}{6.4} = \frac{\sin 120}{"8.92.."} \text{ or }$<br>$6.4^2 = 3.8^2 + "8.92"{}^2 - 2 \times 3.8 \times "8.92" \times \cos C$                                            |        |      | M1 correct use of Sine rule or Cosine rule to find angle $C$                                                                                   |
|          | $\sin C = \frac{6.4 \times 0.866...}{"8.92.."} (= 0.62...) \text{ or }$<br>$\cos C = \frac{3.8^2 + "8.92"{}^2 - 6.4^2}{2 \times 3.8 \times "8.92"} (= 0.78...)$<br>$C = 38 - 38.5$ |        |      | M1 correct rearrangement                                                                                                                       |
|          |                                                                                                                                                                                    |        |      | Award M2 for $C = 38 - 38.5$<br><br>Award M2 for $B = 21.5 - 22$<br><b>and</b><br>$C = 180 - 120 - B$                                          |
|          |                                                                                                                                                                                    | 068    | 6    | A1 (0)68 – (0)68.4                                                                                                                             |
|          | <b>Alternative</b><br>$CD$ is the perpendicular from $C$ to $BA$ produced.<br>$\angle CAD = 60^\circ$ <b>or</b> $ACD = 30^\circ$                                                   |        |      | M1 uses triangle $CAD$ and $\angle CAD = 60^\circ$ <b>or</b> $ACD = 30^\circ$<br><b><math>CD</math> may not be drawn in but can be implied</b> |
|          | $AD = 3.8 \cos 60^\circ$ <b>or</b> $3.8 \sin 30 (= 1.9)$                                                                                                                           |        |      | M1 for correct method to find horizontal length                                                                                                |
|          | $BD = 6.4 + 1.9 (= 8.3)$                                                                                                                                                           |        |      | A1 for $BD = 8.3$                                                                                                                              |
|          | $CD = 3.8 \sin 60$ <b>or</b> $3.8 \cos 30 (= 3.29)$                                                                                                                                |        |      | M1                                                                                                                                             |
|          | $\tan BCD = \frac{8.3}{3.8 \sin 60}$ oe                                                                                                                                            |        |      | M1                                                                                                                                             |
|          |                                                                                                                                                                                    | 068    |      | A1 (0)68 – (0)68.4                                                                                                                             |
|          |                                                                                                                                                                                    |        |      | <b>Total 6 marks</b>                                                                                                                           |

| Question | Working                                                                                                                                                                                                                                | Answer | Mark | Notes                                                                                                                                                          |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20       | (Slant Height $= \sqrt{(5a)^2 + (12a)^2} (= 13a)$                                                                                                                                                                                      |        |      | M1 correct use of Pythagoras – condone missing brackets                                                                                                        |
|          | (total surface area $= \pi \times (5a)^2 + \pi \times 5a \times "13a"$<br>oe <b>or</b><br>$\pi \times (5a)^2 + \pi \times 5a \times \sqrt{(5a)^2 + (12a)^2} (=90 \pi a^2)$                                                             |        |      | M1 dep on first M1 – must have either $25a^2$ or $(5a)^2$                                                                                                      |
|          | eg. $90 \pi a^2 = 360\pi$ oe <b>or</b><br>$\pi \times (5a)^2 + \pi \times 5a \times "13a" = 360\pi$ oe                                                                                                                                 |        |      | M1 dep on first M1<br>for equation formed (need not be simplified) –<br>must have either $25a^2$ or $(5a)^2$                                                   |
|          |                                                                                                                                                                                                                                        |        |      | A1 $a = 2$                                                                                                                                                     |
|          | $V = \frac{1}{3} \times \pi \times (5 \times "2")^2 \times 12 \times "2" (=100\pi a^3)$ <b>or</b><br>$V = \frac{1}{3} \times \pi \times 10^2 \times 24$ oe <b>or</b><br>$k = \frac{1}{3} \times (5 \times "2")^2 \times 12 \times "2"$ |        |      | M1 dep on first M1<br><br>NB. For the award of this mark, brackets must be present or the value for $r^2$ evaluated correctly for the candidate's value of $a$ |
|          |                                                                                                                                                                                                                                        | 800    | 6    | A1 cao                                                                                                                                                         |
|          |                                                                                                                                                                                                                                        |        |      | <b>Total 6 marks</b>                                                                                                                                           |

| Question |     | Working                                                                                       | Answer         | Mark | Notes                                                                     |
|----------|-----|-----------------------------------------------------------------------------------------------|----------------|------|---------------------------------------------------------------------------|
| 21       | (a) | LHS $a^2c^2 + a^2 + c^2 + 1$                                                                  |                |      | M1 for correct expansion of LHS                                           |
|          |     | RHS $a^2c^2 - 2ac + 1 + a^2 + 2ac + c^2$                                                      |                |      | M1 for correct expansion of RHS                                           |
|          |     |                                                                                               | Shown          | 3    | A1 for convincing progression and conclusion                              |
|          |     | <b>Alternative (i):</b><br>LHS $a^2c^2 + a^2 + c^2 + 1$                                       |                |      | M1 for correct expansion of LHS                                           |
|          |     | $a^2c^2 - 2ac + 1 + a^2 + 2ac + c^2$                                                          |                |      | M1 for introduction of $+2ac$ and $-2ac$                                  |
|          |     |                                                                                               | Shown          | 3    | A1 for convincing progression and conclusion                              |
|          |     | <b>Alternative (ii)</b><br>RHS $a^2c^2 - 2ac + 1 + a^2 + 2ac + c^2$                           |                |      | M1 for correct expansion of RHS                                           |
|          |     | $a^2c^2 - 2ac + 1 + a^2 + 2ac + c^2 = a^2c^2 + a^2 + c^2 + 1$<br>$= a^2(c^2 + 1) + (c^2 + 1)$ |                |      | M1 for correct simplification and convincing factorisation                |
|          |     |                                                                                               | Shown          | 3    | A1 for convincing progression and conclusion                              |
|          | (b) | $65 \times 10001$<br>$a = 8, c = 100$<br>$ac - 1 = 8 \times 100 - 1$<br>$a + c = 8 + 100$     |                |      | M1 for $65 \times 10001$                                                  |
|          |     |                                                                                               |                |      | A1 $a = 8, c = 100$ <b>or</b> $a = 100$ and $c = 8$ <b>or</b> 108 and 799 |
|          |     |                                                                                               | $108^2, 799^2$ | 3    | A1 $108^2, 799^2$ or 11664 and 638401                                     |
|          |     |                                                                                               |                |      | <b>Total 6 marks</b>                                                      |

|                                   |
|-----------------------------------|
| <b>TOTAL FOR PAPER: 100 MARKS</b> |
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