



# Mark Scheme (Results)

January 2013

International GCSE Mathematics A  
(4MA0) Paper 3H

Level 1 / Level 2 Certificate in Mathematics  
(KMA0) Paper 3H

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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 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 eeoo – each error or omission

- **No working**

If no working is shown then correct answers normally score full marks

If no working is shown then incorrect (even though nearly correct)

answers score no marks.

- **With working**

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If it is clear from the working that the “correct” answer has been obtained from incorrect working, award 0 marks.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

If there is no answer on the answer line then check the working for an obvious answer.

- **Follow through marks**

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

- **Ignoring subsequent work**

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **Parts of questions**

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

| Q       | Working                                                    | Answer                                                                                                         | Mark | Notes                                                                                                                                                                                                                                                                                                                                               |
|---------|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. (a)  | $1 - (0.18 + 0.2 + 0.23 + 0.22)$                           | 0.17                                                                                                           | 2    | M1<br>A1<br>$1 - 0.83$                                                                                                                                                                                                                                                                                                                              |
| 1. (b)  | $40 \times 0.2$                                            | 8                                                                                                              | 2    | M1<br>A1<br>8 out of 40 = M1A1<br>$8/40 = M1A0$                                                                                                                                                                                                                                                                                                     |
|         |                                                            |                                                                                                                |      | <b>Total 4 marks</b>                                                                                                                                                                                                                                                                                                                                |
| 2. (i)  |                                                            | $2x + 2(x+2) = 2 \times 2x + 2 \times 4x$<br>or $4x + 4 = 12x$<br>or $x + (x+2) = 2x + 4x$<br>or $2x + 2 = 6x$ | 2    | B2 Must be an equation based on perimeter or semi-perimeter with x's on both sides of equation<br><br>If not B2 then B1 for $\{2x + 2(x+2)\}$ or $\{2 \times 2x + 2 \times 4x\}$<br>or $\{4x + 4\}$ or $12x$ i.e correct perimeter of A or B<br>or $\{x + (x+2)\}$ or $\{2x + 4x\}$<br>or $\{2x + 2\}$ or $6x$ i.e correct semi-perimeter of A or B |
| 2. (ii) | $4x + 4 = 12x$<br>or $2x + 2 = 6x$<br>$4 = 8x$ or $2 = 4x$ | 0.5                                                                                                            | 2    | M1 One step from co<br>A1 Allow numerical methods. Correct answer only = M1A1                                                                                                                                                                                                                                                                       |
|         |                                                            |                                                                                                                |      | <b>Total 4 marks</b>                                                                                                                                                                                                                                                                                                                                |



|            |                                                                                                                                                     |                   |   |                                                                                                                                                                                                                                                                                                                                   |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6. (a)     |                                                                                                                                                     | $25 < d \leq 30$  | 1 | B1 identifies $25 \rightarrow 30$ class                                                                                                                                                                                                                                                                                           |
| 6. (b)     | $(12 \times 2.5) + (6 \times 7.5) + (4 \times 12.5) + (6 \times 17.5) + (14 \times 22.5) + (18 \times 27.5)$<br>(totals: 30, 45, 50, 105, 315, 495) | 1040              | 3 | M2 do not have to see intention to add<br><br>If not M2 then M1 for freq x consistent interval value<br>(890 = freq x lower limit, 1190 = freq x upper limit)<br>or 3 or more correct products stated or evaluated<br>A1 isw if 1040 calculated correctly and correct mean calculation follows ( $1040 \div 60 = 17.3$ or better) |
|            |                                                                                                                                                     |                   |   | <b>Total 4 marks</b>                                                                                                                                                                                                                                                                                                              |
| 7. (i)     | $-2 - 2 < x$ and $x \leq 5 - 2$                                                                                                                     | $-4 < x \leq 3$   | 2 | M1 condone omission/addition of “equals” in inequalities<br>A1cao accept $x > -4$ and $x \leq 3$ (both present)                                                                                                                                                                                                                   |
| 7. (ii)    | $-4$<br>                                                           |                   | 2 | B2 ft ft for an inequality where range lies between $-5$ and $+5$<br>If not B2ft then B1ft for correct values but wrong shading of end circles                                                                                                                                                                                    |
|            |                                                                                                                                                     |                   |   | <b>Total 4 marks</b>                                                                                                                                                                                                                                                                                                              |
| 8. (a)     | $7.9 \times \cos 38^\circ$ or $7.9 \times \sin 52^\circ$                                                                                            | 6.23              | 3 | M2 M1 for $\cos 38^\circ$ or $\sin 52^\circ$ selected<br>A1 6.2252.. awrt 6.23                                                                                                                                                                                                                                                    |
| 8. (b)     |                                                                                                                                                     | 37.5              | 1 | B1                                                                                                                                                                                                                                                                                                                                |
| 8. (i)     |                                                                                                                                                     |                   |   |                                                                                                                                                                                                                                                                                                                                   |
| 8. (b)(ii) |                                                                                                                                                     | 38.5 or 38.49 rec | 1 | B1                                                                                                                                                                                                                                                                                                                                |
|            |                                                                                                                                                     |                   |   | <b>Total 5 marks</b>                                                                                                                                                                                                                                                                                                              |

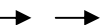
|         |                                                                           |                       |   |                              |                                                                                                                                                                  |
|---------|---------------------------------------------------------------------------|-----------------------|---|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9. (a)  |                                                                           | Mars                  | 1 | B1                           | Accept $6.8 \times 10^3$ oe                                                                                                                                      |
| 9. (b)  | $1.2 \times 10^5 - 5.0 \times 10^4$ or 70000                              | $7 \times 10^4$       | 2 | M1<br>A1                     | Correct values with intention to subtract<br>M1 A0 for 70000 with no working                                                                                     |
| 9. (c)  | $(1.4 \times 10^6) \div (3.5 \times 10^3)$                                | 1:400 oe              | 2 | M1<br>A1                     | Correct values with intention to divide<br>M1 A0 for 400 or 400:1 with no working                                                                                |
|         |                                                                           |                       |   |                              | <b>Total 5 marks</b>                                                                                                                                             |
| 10. (a) | Correct $v \div h$                                                        | 1.5 oe                | 2 | M1<br>A1                     | e.g. $6 \div 4$<br>accept improper fractions (e.g. $3/2$ )<br>N.B. $1.5x = \text{M1A0}$                                                                          |
| 10. (b) |                                                                           | $y = "1.5"x - 1$ oe   | 1 | B1                           | ft from (a)                                                                                                                                                      |
| 10. (c) | $y = "1.5"x + c$ oe or $"1.5"x + 3$<br>or $0 = -2x$ gradient from (a) + c | $y = "1.5"x + "c"$ oe | 2 | M1ft from (a)<br>A1ft        | $c \neq -1$ (c must be a numeric value)<br>(substituting $y = 0$ and $x = -2$ into $y = mx + c$ )<br>"c" = follow through using numeric value of gradient in (a) |
|         |                                                                           |                       |   |                              | <b>Total 5 marks</b>                                                                                                                                             |
| 11.     | $2.1 - 1.7 (= 0.4)$<br>$6^2 + "0.4"^2 (= 36.16)$<br>$\sqrt{"36.16"}$      | 6.01                  | 4 | M1<br>M1 dep<br>M1 dep<br>A1 | awrt 6.01<br>N.B. Accept working in cms throughout for method marks                                                                                              |
|         |                                                                           |                       |   |                              | <b>Total 4 marks</b>                                                                                                                                             |

|          |                                                                                                                                                   |     |                               |   |                                                                                                                              |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------------------|---|------------------------------------------------------------------------------------------------------------------------------|
| 12.      | $\frac{A}{2\pi r} = r + h$ or $A = 2\pi r^2 + 2\pi rh$                                                                                            |     | $\frac{A}{2\pi r} - r = h$ oe | 2 | M1 Correct first step<br>A1 e.g. $\frac{A-2\pi r^2}{2\pi r}$ Give full credit to equivalent correct expressions              |
|          |                                                                                                                                                   |     |                               |   | <b>Total 2 marks</b>                                                                                                         |
| 13. (i)  | 5 x 8                                                                                                                                             |     | 40                            | 2 | M1 Or any correct fd marked on vertical axis (2, 4 etc) with no errors<br>or 1 square = 4 students<br>A1                     |
| 13. (ii) | Missing blocks = 5cm, 6cm, 1.5cm                                                                                                                  |     |                               | 2 | B2 3 correct blocks<br>If not B2 then B1 for 1 or 2 correct blocks                                                           |
|          |                                                                                                                                                   |     |                               |   | <b>Total 4 marks</b>                                                                                                         |
| 14. (a)  | Black circle = 0.3 White region = 0.6<br>All values “correct” for second stage                                                                    | 0.6 |                               | 3 | B1 B1<br>B1ft Allow ft if each group of 3 branches on second arrow all sum to 1 and are consistent with first arrow branches |
| 14. (b)  | Any one correct product in numerical form<br>e.g. (“0.3” x 0.1) or (0.1 x “0.3”) or (“0.6” x “0.6”) (“0.3”x 0.1) + (0.1x “0.3”) + (“0.6” x “0.6”) |     | 0.42oe                        | 3 | M1ft e.g. (Black, Miss) or (Miss, Black) or (White, White)<br>M1ft 3 “correct” products with intention to add<br>A1 cao      |
|          |                                                                                                                                                   |     |                               |   | <b>Total 6 marks</b>                                                                                                         |

|              |                                                                           |                             |   |                                                                 |
|--------------|---------------------------------------------------------------------------|-----------------------------|---|-----------------------------------------------------------------|
| 15. (i)      |                                                                           | 18                          | 1 | B1                                                              |
| 15. (ii)     |                                                                           | 15                          | 1 | B1                                                              |
| 15. (iii)    |                                                                           | 9                           | 1 | B1                                                              |
| 15. (iv)     |                                                                           | 22                          | 1 | B1                                                              |
|              |                                                                           |                             |   | <b>Total 4 marks</b>                                            |
| 16.          | $7^2 = 9^2 + 13^2 - 2 \times 9 \times 13 \cos x$ oe<br>$234 \cos x = 201$ | 30.8                        | 3 | M1<br>M1 or $\cos x = 0.86$ or better<br>A1 30.798... awrt 30.8 |
|              |                                                                           |                             |   | <b>Total 3 marks</b>                                            |
| 17.          | $\frac{(2x - 5)(2x + 5)}{(2x + 5)(3x - 1)}$                               | $\frac{(2x - 5)}{(3x - 1)}$ | 3 | M2 If not M2 then M1 for numerator or denominator correct<br>A1 |
|              |                                                                           |                             |   | <b>Total 3 marks</b>                                            |
| 18. (a) (i)  |                                                                           | $16x$                       | 1 | B1                                                              |
| 18. (a) (ii) | $2x^{-1}$                                                                 | $-2x^{-2}$ oe               | 2 | M1<br>A1                                                        |
| 18. (b)      | “16x” + “ $-2/x^2$ ” = 0<br>$16x = 2/x^2$<br>$x^3 = 1/8$<br>$x = 1/2$     | $(1/2, 6)$                  | 4 | M1<br>M1 $x^3$ isolated<br>A1, A1                               |
|              |                                                                           |                             |   | <b>Total 7 marks</b>                                            |

|            |                                                                                                                      |                      |   |                                                                                                                                                                                                                                                                                                            |
|------------|----------------------------------------------------------------------------------------------------------------------|----------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 19.<br>(a) | $2 \times 3 \times x \times x = (x + 10)(3x + 20)$<br>or $6x^2 = (x + 10)(3x + 20)$<br><br>$6x^2 = 3x^2 + 50x + 200$ |                      | 3 | M2 If not M2 then M1 for $2 \times 3 \times x \times x$ or $2 \times 3x^2$ or $6x^2$ or $(x + 10)(3x + 20)$<br><br>A1 Dependent on at least M1                                                                                                                                                             |
| 19.<br>(b) | $(3x + 10)(x - 20) (=0)$<br><br>Marks can be awarded in b) if seen in a)<br><br><br>$20 \times 3 \times 20$          | $x = 20$<br><br>1200 | 5 | M2 or $x = \frac{50 \pm \sqrt{2500 + 2400}}{6}$<br>If not M2 then M1 for $(3x \pm 10)(x \pm 20)$<br>or $x = \frac{-50 \pm \sqrt{-50^2 - 4 \times 3 \times -200}}{2 \times 3}$ condone 1 sign error<br><br>A1 dep on M1 in b). Ignore negative root (– 3.3 rec)<br>M1<br>A1 dep on 1 <sup>st</sup> M1 in b) |
|            |                                                                                                                      |                      |   | <b>Total 8 marks</b>                                                                                                                                                                                                                                                                                       |

|                     |                                                                                                                                                                                                  |                                                |   |                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20.<br>(a) (i)      |                                                                                                                                                                                                  | $2\mathbf{a}$ oe                               | 1 | B1                                                                                                                                                                                                                                                                                                                                                                          |
| 20.<br>(a)<br>(ii)  |                                                                                                                                                                                                  | $2\mathbf{a} + \mathbf{b}$ oe                  | 1 | B1                                                                                                                                                                                                                                                                                                                                                                          |
| 20.<br>(a)<br>(iii) |                                                                                                                                                                                                  | $-\mathbf{a} + \mathbf{b}$ oe                  | 1 | B1                                                                                                                                                                                                                                                                                                                                                                          |
| 20.<br>(b)          | $\overrightarrow{PN} = \mathbf{a} + \frac{1}{3}(-\mathbf{a} + \mathbf{b})$<br>$\overrightarrow{PN} = \frac{2\mathbf{a}}{3} + \frac{\mathbf{b}}{3} \{= \frac{1}{3}(2\mathbf{a} + \mathbf{b})\}$   | $\rightarrow \rightarrow$ stating $PN = PR/3$  | 2 | <p>M1ft from (a)(iii) i.e. a valid path from P to N, or N to P, using lower case letters.</p> <p>A1 Arrows not necessary. Dependent on M1</p>                                                                                                                                                                                                                               |
|                     | $\overrightarrow{NR} = \frac{2}{3}(-\mathbf{a} + \mathbf{b}) + 2\mathbf{a}$<br>$\overrightarrow{NR} = \frac{4\mathbf{a}}{3} + \frac{2\mathbf{b}}{3} \{= \frac{2}{3}(2\mathbf{a} + \mathbf{b})\}$ | $\rightarrow \rightarrow$ stating $NR = 2PR/3$ |   | <p>Alt</p> <p>M1ft from (a)(iii) i.e. a valid path from N to R, or R to N, using lower case letters.</p> <p>A1 Arrows not necessary. Dependent on M1</p> <p>NB: If both <math>\overrightarrow{PN}</math> and <math>\overrightarrow{NR}</math> worked out correctly, award M1A1</p> <p>for stating <math>2PN = NR</math> or stating or showing <math>PN + NR = PR</math></p> |
|                     |                                                                                                                                                                                                  |                                                |   | <b>Total 5 marks</b>                                                                                                                                                                                                                                                                                                                                                        |



|     |                                                                                                    |      |   |                                                                                                                          |
|-----|----------------------------------------------------------------------------------------------------|------|---|--------------------------------------------------------------------------------------------------------------------------|
| 21. | $\sqrt{(16^2 + 10^2)}$ (=18.9 or better)<br>“18.867” $\div$ 2 (=9.433)<br>$\tan "x" = 15/ "9.433"$ | 57.8 | 4 | M1 or M2 for $\sqrt{(8^2 + 5^2)}$ (=9.43 or better)<br>M1 dep on previous M1<br>M1 dep on M2<br>A1 57.832..... awrt 57.8 |
|     |                                                                                                    |      |   | <b>Total 4 marks</b>                                                                                                     |
|     |                                                                                                    |      |   | <b>TOTAL = 100 marks</b>                                                                                                 |

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