

Mark Scheme (Results)

Summer 2013

International GCSE Mathematics
(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**
 - M marks: method marks
 - A marks: accuracy marks
 - B marks: unconditional accuracy marks (independent of M marks)
- **Abbreviations**
 - cao – correct answer only
 - ft – follow through
 - isw – ignore subsequent working
 - SC - special case

- oe – or equivalent (and appropriate)
- dep – dependent
- indep – independent
- eooo – each error or omission

- **No working**

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

If no working is shown then incorrect (even though nearly correct) answers score no marks.

- **With working**

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

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

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

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

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

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

- **Ignoring subsequent work**

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

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

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

- **Parts of questions**

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

Apart from Questions 3(c), 19(b) and 20(b) (where the mark scheme states otherwise), the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

| Question Number | Working | Answer | Mark | Notes |
|-----------------|--|--------|------|---|
| 1 | $(0 \times 13) + 1 \times 2 + 2 \times 3 + 3 \times 8 + 4 \times 14$ or $(0) + 2 + 6 + 24 + 56$ or 88 | | 3 | M1 for sum of at least 3 products (products may or may not be evaluated) |
| | "88" \div 40 | | | M1 (dep) for division by 40 (or by their 40) |
| | | 2.2 | | A1 accept 2.2 or $\frac{11}{5}$ or $2\frac{1}{5}$ Also accept '2' if both method marks are scored. |
| | | | | Total 3 marks |

| | | | | |
|-------|---------------------------|---------------|---|---|
| 2 (a) | $\frac{2.720294102}{7.7}$ | | 2 | M1 for 2.72029... if first 5 figures correct (rounded or truncated) or for 7.7 or for $\frac{2\sqrt{185}}{77}$ |
| | | 0.35328(4948) | | A1 Accept if first 5 figures correct |
| (b) | | 0.35 | 1 | B1 ft from (a) only if more than 2 sig figs given in (a) |
| | | | | Total 3 marks |

| | | | | | |
|---|-----|---------------------------|------------------|---|---|
| 3 | (a) | | $6n - 12$ | 1 | B1 |
| | (b) | | $p(p - 5)$ | 2 | B2 Also accept $(p+0)(p-5)$ for B2 B1 for factors which, when expanded and simplified, give two terms, one of which is correct. SC B1 for $p(p - 5p)$ |
| | (c) | $7x - 3 = 2x$ | | 3 | M1 for $7x - 3 = 2x$ or $7x - 3 = 2 \times x$ or $\frac{7x}{2} - \frac{3}{2} = x$ oe |
| | | $7x - 2x = 3$ or $5x = 3$ | | | M1 for $7x - 2x = 3$ or $5x = 3$ or $5x - 3 = 0$ or $\frac{7x}{2} - x = \frac{3}{2}$ or $\frac{5x}{2} = \frac{3}{2}$ NB. All these examples could be written with all terms 'on the other side' eg $-5x = -3$ etc |
| | | | $\frac{3}{5}$ oe | | A1 Award full marks if at least one method mark awarded and answer correct. |
| | | | | | Total 6 marks |

| | | | | | |
|---|-----|--|-----|----|---|
| 4 | (a) | corresponding (angle(s)) | 1 | B1 | oe eg x corresponds to angle A ; corresponding to angle A |
| | (b) | $(6 - 2) \times 180$ or 4×180 or $(2 \times 6 - 4) \times 90$ or 8×90 or 120×6 or $(180 - 60) \times 6$ or $360 + 360$ | 4 | M1 | $360 - (73 + 46 + 38 + 88 + 57)$ Condone one incorrect ext angle |
| | | 720 | | A1 | M1 A1 for 720 seen 58 M1 A1 for 58 seen |
| | | "720" - $(107 + 134 + 142 + 92 + 123)$ or "720" - 598 | | M1 | dep on first M1 180 - "58" |
| | | | 122 | A1 | |
| | | | | | Total 5 marks |

| | | | | | | |
|---|-----|--|---------------------|---|--|---|
| 5 | (a) | $43 = 12x + 2 \times 6.5$ or $43 = 12x + 13$ or $P - 2y = 12x$ (oe with $\pm 12x$ or $\pm x$ as the subject) | | 3 | M1 for correct rearrangement of original equation or substitution | M2 for $43 - 2 \times 6.5 (= 12x)$ or $30 (= 12x)$ |
| | | $12x = 43 - 13$ or $12x = 30$ or $-12x = 13 - 43$ or $-12x = -30$ | | | M1 for correct rearrangement and substitution | |
| | | | 2.5 oe | | A1 Correct answer scores full marks | |
| | (b) | $4xy + \frac{1}{2} \times 3x \times 4x$ or $\frac{3x + y + y}{2} \times 4x$ | | 2 | M1 for any one correct area eg $4xy$ oe or $\frac{1}{2} \times 3x \times 4x$ oe or $4x(3x + y)$ | |
| | | | $4xy + 6x^2$ etc | | A1 for $4xy + 6x^2$ or $4yx + 6x^2$ or $2x(3x + 2y)$ or $2(3x^2 + 2xy)$ or $x(6x + 4y)$ (No fractions or uncollected terms but could be multiplication signs and/or brackets present) | |
| | | | | | Total 5 marks | |

| | | | | | | |
|----------------------|-----|--|-----|---|----------|---|
| 6 | (a) | $\frac{8}{100} \times 475$ oe or 38 or 437 | | 3 | M1 | M2 for 475×1.08 oe |
| | | 475 + "38" | | | M1 (dep) | |
| | | | 513 | | A1 | cao |
| | (b) | 1% = $\frac{48}{8}$ or 6 8% (of amount) = 48 | | 3 | M1 | M2 for $\frac{48}{8} \times 100$ or 600 or $\frac{48}{0.08}$ |
| | | "6" $\times 100$ or 600 | | | M1 | or $\frac{48}{8} \times 108$ or $\frac{48}{0.08} \times 1.08$ |
| | | | 648 | | A1 | cao (NB: An answer of 600 scores M2A0) |
| Total 6 marks | | | | | | |

| | | | | | | |
|----------------------|------|--|------------------------|---|----|--|
| 7 | (i) | | u, a, e | 2 | B1 | Any order. Brackets and commas not necessary |
| | (ii) | | s, q, r, a, e, i, o, u | | B1 | |
| Total 2 marks | | | | | | |

| | | | | |
|---|---|-----|---|---|
| 8 | $2 \times \pi \times 5.1^2 + 2 \times \pi \times 5.1 \times 3.7$ oe or 163.42... + 118.56... (using π) or 163.3428 + 118.5036 (using 3.14) (rounded or truncated to at least 3 sig figs) or $2 \times \pi \times 5.1 \times (5.1 + 3.7)$ or $\frac{2601}{50} \pi + \frac{1887}{50} \pi$ or $\frac{2244}{25} \pi$ | | 3 | M2 M1 for one of $2 \times \pi \times 5.1^2$ or value in range 163-163.43 inc or $\frac{2601}{50} \pi$ $2 \times \pi \times 5.1 \times 3.7$ oe or value in range 118-119 inc or $\frac{1887}{50} \pi$ NB. Accept 3.14(...) or 22/7 in place of π |
| | | 282 | | A1 for answer in range 281.8-282 inc |
| | | | | Total 3 marks |

| | | | | | |
|---|---|-----|--|----|--|
| 9 | No approximation $\frac{37527}{365}$ or $\frac{37527}{366}$ or $\frac{37527}{365.25}$ or $\frac{37527}{364}$ | | | M2 | M1 for $\frac{37527}{x}$ where $356 \leq x \leq 370$ |
| | | 103 | | A2 | Accept 102 if M2 awarded A1 for $102.5 \leq \text{answer} \leq 103.1$ |

| | | | | | |
|---|---|---|---|----|---|
| 9 | Alternative - with approximation $\frac{x}{y}$ or $x \times \frac{1}{y}$ where x is $35\,000 \leq x \leq 40\,000$ AND $336 \leq y \leq 400$ | | 4 | M2 | M1 for $\frac{x}{y}$ or $x \times \frac{1}{y}$ where either the value of x or the value of y is acceptable |
| | | integer in the range 93 – 111 inclusive | | A2 | The award of any accuracy marks is dependent on the award of M2 A1 for non-integer in the range 93 – 111 |
| | | | | | Total 4 marks |

| | | | | | | |
|----|--|------|---|----|---|---|
| 10 | use of cos | | 3 | M1 | cos must be selected for use in trig ratio NOT Cosine Rule | or M2 for sin and $\frac{\sqrt{21.36}}{9.5}$ following correct Pythagoras or M2 for tan and $\frac{\sqrt{21.36}}{8.3}$ following correct Pythagoras or correct Pythag and then correct use of sine or cosine rule with "21.36" |
| | $\cos ("x") = \frac{8.3}{9.5} (=0.87\dots)$ or $("x" =) \cos^{-1} \left(\frac{8.3}{9.5} \right)$ | | | M1 | | |
| | | 29.1 | | A1 | for awrt 29.1 e.g. (29.1103...) | |
| | | | | | | Total 3 marks |

| | | | | | | |
|--------|---|-----|---|----|---|----------------------|
| 11 (a) | $54 = 2 \times 3^3$ and $90 = 2 \times 3^2 \times 5$ or 1,2,3,6,9,18,27,54 and 1,2,3,5,6,9,10,15,18,30,45,90 or 2×3^2 oe | | 2 | M1 | Need not be products of powers; accept products or lists eg 2,3,3,3 and 2,3,3,5 accept 9, 2, 3 and 9, 2, 5 (may be seen in a Venn diagram or may be shown as factor trees or repeated division) | |
| | | 18 | | A1 | cao | |
| (b) | $2 \times 3^3 \times 5$ oe eg $6 \times 9 \times 5$ or 54,108,162,216,270 and 90,180,270 | | 2 | M1 | Need not be products of powers; accept products or lists eg 2, 3, 3, 3, 5 | |
| | | 270 | | A1 | cao | |
| | | | | | | Total 4 marks |

| | | | | | | |
|----|-----|--|----------------|---|---|----------------------|
| 12 | (a) | | Points correct | 2 | B1 $\pm \frac{1}{2}$ sq | |
| | | Curve or line segments | | | B1 ft from points if 4 or 5 correct or if points are plotted consistently within 50-60, 60-70, 70-80 etc at the correct heights Ignore any attempt at curve to left of first plotted point | |
| | (b) | 30 (or 30.5) indicated on cumulative frequency graph or stated | | 2 | M1 for 30 (or 30.5) indicated on cumulative frequency axis or stated | |
| | | | approx 66 | | A1 If M1 scored, ft from <i>their</i> cumulative frequency graph If M1 not scored, ft only from correct curve & if answer is correct ($\pm \frac{1}{2}$ sq tolerance) award M1 A1 | |
| | | | | | | Total 4 marks |

| | | | | | | |
|----|--|--|----|---|--|---|
| 13 | | NB : M2 cannot be awarded if angles are marked incorrectly on the diagram 180 – 77 – 39 or $\angle BAD = 77^\circ$ and $\angle ABD = 39^\circ$ or $\angle BA''x'' = 64^\circ$ where x is on PA produced or a fully correct method to find angle ADB | | 3 | M2 also accept 103 – 39 M1 for $\angle BAD = 77^\circ$ or $\angle ABD = 39^\circ$ | Angles may be stated or marked on diagram |
| | | | 64 | | A1 cao | |
| | | | | | | Total 3 marks |

| | | | | | |
|----|-----|--------------------|---|----|--|
| 14 | (a) | $24p^5q^6$ | 2 | B2 | B1 for 2 of 24, p^5 , q^6 correct in a single product with no additional terms or $24p^{3+2}q^{5+1}$ |
| | (b) | $125x^6y^{12}$ | 2 | B2 | B1 for 2 of 125, x^6 , y^{12} correct in a single product with no additional terms or $125x^{2 \times 3}y^{4 \times 3}$ |
| | (c) | $(3a + b)(3a - b)$ | 2 | B2 | B1 for $(3a + b)(3a + b)$ or $(3a + b)^2$ or $(3a - b)(3a - b)$ or $(3a - b)^2$ |
| | | | | | Total 6 marks |

| | | | | | | |
|----|-----|---|----------------|---|----|---|
| 15 | (a) | | $x = 3, y = 2$ | 1 | B1 | cao |
| | (b) | Use of gradient and $y = mx + c$ or clear attempt to use $\frac{\text{vertical difference}}{\text{horizontal difference}}$ eg $\frac{2}{3}$ oe (ignore omission of - sign) or for $3y = 12 - 2x$ or $3y = -2x + 12$ or for $y = \frac{12 - 2x}{3}$ oe or gradient = $\frac{2}{3}$ stated or used | | 4 | M1 | Throughout question accept $\frac{2}{3}$ written as a decimal rounded or truncated to 2 or more decimal places |
| | | (grad =) $-\frac{2}{3}$ oe or $y = 4 - \frac{2}{3}x$ oe | | | A1 | |
| | | $y = -\frac{2}{3}x + c$ or for $y = "-\frac{2}{3}"x + c$ where $c \neq 10$ or $-\frac{2}{3}x + 10$, $"-\frac{2}{3}"x + 10$, $L = -\frac{2}{3}x + 10$ etc | | | M1 | ft from $"-\frac{2}{3}"$ |
| | | $y = -\frac{2}{3}x + 10$ oe or $2x + 3y = 30$ oe or $y = "-\frac{2}{3}"x + 10$ oe | | | A1 | ft from $"-\frac{2}{3}"$ |

| | | | | | |
|----------------------|--|---------------|--|----|--|
| (b) | Alternative scheme: Use of $2x+3y=k$ $2x+3y=k$ | | 4 | M1 | |
| | $2 \times 0 + 3 \times 10 (=k)$ | | | M1 | Substitution of (0, 10) into $2x+3y=k$ |
| | $k = 30$ | | | A1 | |
| | | $2x+3y=30$ oe | | A1 | |
| (c) | (1,1) (1,2) (1,3) (2,2) marked | 2 | B2 B1 for 3 correct points marked and none wrong or for all correct points and either one or more of points on y axis ie. (0,-1) (0,0) (0,1) (0,2) (0,3) (0,4) points on $y=x-1$ ie (0,-1) (1,0) (2,1) (3,2) | | |
| Total 7 marks | | | | | |

| | | | | | |
|----------------------|---|------|---|----|--|
| 16 (a) | $\frac{PR}{5} = \frac{14}{8}$ or $\frac{PR}{14} = \frac{5}{8}$ | | 2 | M1 | or for $5 \times \frac{14}{8}$ oe |
| | | 8.75 | | A1 | |
| (b) | $\frac{14}{8}$ or $\frac{7}{4}$ or 1.75 or $\frac{8}{14}$ or $\frac{4}{7}$ or 0.571... (May be implied by second M1) Allow ratio notation | | 3 | M1 | Alternative method M1 for $\frac{1}{2} \times 8 \times 5 \times \sin A$ and $\sin A = 0.8$ |
| | 1.75^2 oe eg 3.0625, $\frac{49}{16}$ or $\left(\frac{4}{7}\right)^2$ oe eg $\frac{16}{49}$, 0.326... allow ratio notation | | | M1 | M1 (dep) for $\frac{1}{2} \times 14 \times "8.75" \times 0.8$ |
| | | 49 | | A1 | cao SC : B1 for an answer of 28 |
| Total 5 marks | | | | | |

| | | | | | | |
|----------------------|-----|--|---------|---|----|---|
| 17 | (a) | 0.3×0.1 or $(1 - 0.7) \times 0.1$ and no other terms | | 2 | M1 | |
| | | | 0.03 oe | | A1 | |
| | (b) | 0.7×0.8 or $0.7 \times (1 - 0.2)$ or 0.3×0.9 or $(1 - 0.7) \times (1 - 0.1)$ | | 3 | M1 | M1 for "(a)" + 0.7×0.2 or $0.3 \times 0.1 + 0.7 \times 0.2 (=0.17)$ or $(1 - 0.7) \times 0.1 + 0.7 \times 0.2$ |
| | | $0.7 \times 0.8 + 0.3 \times 0.9$ or $0.7 \times (1 - 0.2) + (1 - 0.7) \times (1 - 0.1)$ | | | M1 | M1 for $1 - ("(a)" + 0.7 \times 0.2)$ or $1 - "0.17"$ (M2 for $1 - "(a)" - 0.7 \times 0.2$) |
| | | | 0.83 oe | | A1 | |
| Total 5 marks | | | | | | |

| | | | | | | | |
|----------------------|--|---|------|---|----|---|----------------------------------|
| 18 | | $\frac{2.9}{\sin 36^\circ} = \frac{QS}{\sin(180 - 62)^\circ}$ | | 3 | M1 | for correct substitution into the Sine Rule | Condone use of 62 instead of 118 |
| | | $(QS =) \frac{2.9 \sin "118"^\circ}{\sin 36^\circ}$ oe | | | M1 | for correct rearrangement (there may be partial evaluation) | |
| | | | 4.36 | | A1 | for awrt 4.36 | |
| Total 3 marks | | | | | | | |

| | | | | | | | |
|----------------------|-----|--|--|------|---|----|---|
| 19 | (a) | 3.65×6 | | | 2 | M1 | for 3.65 or $3.64\dot{9}$ or 3.6499... |
| | | | | 21.9 | | A1 | Also accept $21.8\dot{9}$ or 21.899... |
| | (b) | 75 or 12.5 or $12.4\dot{9}$ | | | 3 | M1 | |
| | | $\frac{75}{12.5}$ or $75 = w \times 12.5$ or $\frac{75}{12.4\dot{9}}$ or $75 = w \times 12.4\dot{9}$ | | | | M1 | for 75 and 12.5 (or $12.4\dot{9}$) used correctly |
| | | | | 6 | | A1 | cao dep on both method marks |
| Total 5 marks | | | | | | | |

| | | | | |
|--------|---|----------------|---|---|
| 20 (a) | $\frac{20-2x}{2}$ or $10-x$ seen as the width or $\sqrt{8^2-x^2}$ oe | | 4 | B1 |
| | $x^2+(10-x)^2=8^2$ or $x^2+(10-x)^2=64$ or $2x+2\sqrt{8^2-x^2}=20$ or $x+\sqrt{8^2-x^2}=10$ | | | M1 accept $\frac{20-2x}{2}$ in place of $10-x$ for all method marks |
| | $x^2+100-10x-10x+x^2=64$ or $(2\sqrt{8^2-x^2})^2=400-40x-40x+4x^2$ or $(\sqrt{8^2-x^2})^2=100-10x-10x+x^2$ | | | M1 (dep on previous M1) for correct expansion of $(10-x)^2$ or correct expansion of $(20-2x)^2$ |
| | | $x^2-10x+18=0$ | | A1 for correct manipulation resulting in given equation |
| (b) | $\frac{- -10 \pm \sqrt{(-10)^2 - 4 \times 1 \times 18}}{2 \times 1}$ or for this expression with one or more of $(- -10)$, $(-10)^2$, 10^2 , $-4 \times 1 \times$ 18 , 2×1 , $(-10)^2 - 4 \times 1 \times 18$ evaluated e.g. $\frac{10 \pm \sqrt{28}}{2}$ | | 3 | M1 correct substitution brackets not necessary (accept 10^2) or $(x-5)^2 - 25 + 18 = 0$ oe |
| | $\sqrt{28}$ or $2\sqrt{7}$ or $\sqrt{100-72}$ or 5.29... | | | M1 (independent) for correct simplification of discriminant (if evaluated at least 3sf rounded or truncated) or $x-5 = \pm\sqrt{7}$ oe |

| | | | | |
|--|--|-----------|--|---|
| | | 2.35 7.65 | | A1 for values rounding to 2.35 and 7.65 (2.35424... 7.64575...) Award full marks for correct solutions if at least 1 method mark scored. |
| | | | | Total 7 marks |

| | | | | | |
|----|---|-----|---|----|--|
| 21 | $\frac{1}{2} \times 7 \times 16 \times \sin 150^\circ$ | | 6 | M1 | for $\frac{1}{2} \times 7 \times 16 \times \sin 150^\circ$ |
| | | | | M1 | for $\pi \times 7^2$ or 49π or for value rounding to 153.9 |
| | $\frac{210}{360} \times \pi \times 7^2$ or $\pi \times 7^2 - \frac{150}{360} \times \pi \times 7^2$ | | | M2 | correct method for sector of circle M1 for $\frac{210}{360}$ oe inc 0.5833... rounded or truncated to at least 3 decimal places or for $\frac{360}{210}$ oe inc 1.714... rounded or truncated to at least 2 decimal places |
| | | | | A1 | for value rounding to 89.8 or $\frac{343\pi}{12}$ for area of sector or 28 for area of triangle |
| | | 118 | | A1 | for value rounding to 118 |
| | | | | | Total 6 marks |

| | | | | | |
|----|---|------------------------|---|----|---|
| 22 | $\frac{y(x+4)}{x(x+4)} + \frac{2xy}{x(x+4)} = 3$ or $\frac{y(x+4)}{x(x+4)} + \frac{2xy}{x(x+4)} = \frac{3x(x+4)}{x(x+4)}$ | | 5 | M1 | LHS may be two separate fractions or one single fraction (brackets may or may not be removed on RHS and denominator) |
| | $y(x+4) + 2xy = 3x(x+4)$ or $\frac{xy+4y}{x(x+4)} + \frac{2xy}{x(x+4)} = 3$ or $\frac{xy+4y}{x(x+4)} + \frac{2xy}{x(x+4)} = \frac{3x(x+4)}{x(x+4)}$ | | | M1 | LHS may be two separate fractions or one single fraction; if one fraction, numerator on LHS may or may not be simplified (implies previous M1) (brackets may or may not be removed on RHS and denominator) |
| | $xy+4y+2xy = 3x^2+12x$ or $xy+4y-2xy = 3x(x+4)$ or $3xy+4y = 3x^2+12x$ or $3xy+4y = 3x(x+4)$ | | | M1 | (brackets may or may not be removed on RHS) (implies previous two M1s) |
| | $y(3x+4) = 3x(x+4)$ or $y(3x+4) = 3x^2+12x$ | | | M1 | LHS factorised correctly - expression in bracket on LHS may or may not be simplified |
| | | $\frac{3x(x+4)}{3x+4}$ | | A1 | $\frac{3x(x+4)}{3x+4}$ or $\frac{3x^2+12x}{3x+4}$ a fully correct method must be seen in order to award full marks |
| | | | | | Total 5 marks |

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