Mark Scheme (Results)

Summer 2015

Pearson Edexcel International GCSE
Mathematics A (4MA0)
Paper 4H

Pearson Edexcel Level1/Level 2 Certificate
Mathematics A (KMA0)
Paper 4H

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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
  - eeoo – each error or omission
  - awrt –answer which rounds to

- **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 7c, 13, 19a, 20b, 21b and 23, 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	Working	Answer	Marks	Comments
1	$1-\frac{2}{5}$ or $\frac{3}{5}$ oe		3	M1 or for $\frac{2}{5}\times 20$ oe or 8 or $\frac{8}{20}$
	$\frac{3}{5}\times 20$ oe			M1 (dep) for 20 − '8'
		12		A1 **NB: $\frac{12}{20}$ gains M2, A0**
				Total 3 marks

2	$15 \div (6 - 4)$ (=7.5) "7.5" × 3 (=22.5)	22.5(0)	3	M1 or use of cancelled ratios (eg 3 : 6 : 4 = 0.75 : 1.5 : 1, M1dep 15÷0.5(=30)) or cancelled ratios, (eg 30×0.75) or M2 for $15 \div \frac{2}{3}$ oe A1 oe
	Alternative			
	$\frac{6n}{13} - \frac{4n}{13} = 15$ **or** $\frac{2n}{13} = 15$ oe **or** $15 \times \frac{13}{2}$ oe **or** n = 97.5		3	M1
	$\frac{3}{3+6+4}$ × 97.5 oe			M1dep
		22.5(0)		A1 oe
	Alternative			
	(3 : 6 : 4)…..21 : 42 : 28 and 24 : 48 : 32 22.5 : 45 : 30	22.5(0)	3	M1 For using ratios and seeing 21 : 42 : 28 and 24 : 48 : 32 M1dep Correct line **or** (21+24)÷2 A1 oe
				Total 3 marks

3	(a)(i)		90	1	B1
	(a)(ii)		25	1	B1
	(b)		line from (13 45, 45) to (15 15, 45) and line from (15 15, 45) to (16 30, 0)	2	B2 B1 for line from ((13 45, 45) to (15 15, 45) **or** for a line from (x, 45) to (16 30, 0) where x is a time before 1630
					Total 4 marks

4	(a)	(25 + 1) ÷ 2 or 13 or 12.5		2	M1 or listing scores and clear attempt to find middle value
			2		A1
	(b)	1×9 + 2×6 + 3×3 + 4×2+ 5×1 + 4×6 oe (=67)		3	M1 sight of at least 4 products and intention to add
		"67"÷25 or $\frac{9+12+9+8+5+24}{25}$ oe (allow one error in a product)			M1dep for division of sum of products by 25 (can be their 25 if evidence of adding frequencies)
			2.68 or $2\frac{17}{25}$		A1 accept 2.7 or 3 if preceded by $\frac{67}{25}$
					Total 5 marks

5 (a)	$y = -x$ drawn	(2,2)(2,5)(4,5)(4,3)	2	M1 or a congruent shape with the correct orientation in the 1st quadrant or a correct reflection in $y = x$ A1
(b)		Rotation about $(0, -1)$ 90° clockwise	3	B1 Rotation B1 (centre) $(0, -1)$ B1 90° clockwise or $-90°$ or $270°$ anti-clockwise or $+270°$ **NB. If more than one transformation given then no marks should be awarded**
				Total 5 marks

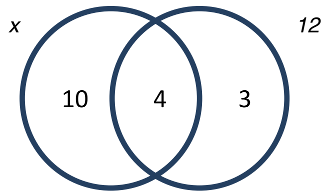
6	(a)	angle MRQ (or RMQ) = x **or** $\frac{180-y}{2}$		2	M1 could be marked on diagram **or** for a correct equation in x and y
			$180 - 2x$		A1 oe eg $2(90 - x)$, $2(180 - x) - 180$ etc
	(b)	$(6 - 2) \times 180$ oe (=720)		4	M1 or $(180 - 360 \div 6) \times 6$
		"720" − (90 + 115 + 144 + 87), [720 – 436] **or** 284			M1dep
		"284" ÷ 2			M1dep
			142		A1
		Alternative			
		180−90(=90), 180−115(=65), 180−144(=36), 180−87(=93)		4	M1 A correct method to find each of the exterior angles at A,C,D & E – angles could be seen on diagram.
		360 – ("90"+"65"+"36"+"93") , [360−284] (= 76)			M1dep A correct method to find the total of the remaining exterior angles
		180 – ("76" ÷ 2)			M1dep A correct method to find k
			142		A1
					Total 6 marks

7 (a)		$24 - 18y$	1	B1
(b)		$e(e + 4)$	1	B1 Allow $(e + 0)(e + 4)$ ignore missing bracket at end
(c)	Eg. $7x - 2x = -3 - 8$		3	M1 for correct rearrangement with x terms on one side and numbers on the other **or** the correct simplification of either x terms or numbers on one side in a correct equation eg. $5x + 8 = -3$; $7x = 2x - 11$
	$5x = -11$			M1 Award also for $-5x = 11$
		-2.2 oe		A1 -2.2 oe dependent on at least M1 awarded; if no correct algebraic working then award no marks
(d)	$y^2 + 10y - 2y - 20$		2	M1 for 3 correct terms out of 4 or for 4 correct terms ignoring signs or for $y^2 + 8y + c$ for any non-zero value of c or for ... $+ 8y - 20$
		$y^2 + 8y - 20$		A1 cao
(e)		$4e^2f(5e^3f - 4)$	2	B2 B1 for a correct but incomplete factorised answer with a minimum of 2 out of **4**, $\boldsymbol{e^2}$ or $\boldsymbol{f}$ outside the bracket, ie $4e^2(5e^3f^2 - 4f)$, $4f(5e^5f - 4e^2)$, $e^2f(20e^3f - 16)$, $4ef(5e^4f - 4e)$, $2e^2f(10e^3f - 8)$ **or** $4e^2f$(a two term algebraic expression)
				Total 9 marks

8	$\cos 39 = \frac{11.3}{x}$ oe		3	M1	or $\frac{x}{\sin 90} = \frac{11.3}{\sin(180-90-39)}$
	$(x=)\ \frac{11.3}{\cos 39}$			M1	or $x = \frac{11.3}{\sin(180-90-39)} \times \sin 90$
		14.54		A1	awrt 14.54
	Alternative				
	$\tan 39 = \frac{y}{11.3}$; $y = 9.15...$ $\text{“}9.15\text{”}^2 + 11.3^2 = x^2$ oe			M1	Must get to correct Pythagoras statement
	$(x=)\sqrt{\text{"}9,15\text{"}^2 + 11.3^2}$ oe			M1	
		14.54		A1	awrt 14.54 (**NB: 14.5 with no working gains M0A0)**
					Total 3 marks

9 (a)	$-5-4 < x \leq 3-4$	$-9 < x \leq -1$	2	M1 A1	subtraction of 4 from either side in an inequality **or** one side of inequality correct (eg $x \leq -1$) or for $-5-4(=-9)$ and $3-4(=-1)$ Accept $x > -9,\ x \leq -1$
(b)		$-3, -2, -1, 0, 1$	2	B2	B1 for one omission or addition
					Total 4 marks

10 (a)	131 − 111	20	2	M1 For 60 & 20 or 60.75 & 20.25 seen in working or in diagram. A1 Allow answers in the range 20-21 from correct readings.
(b)	80 - 50 (=30) $\frac{"30"}{80}\times 100$	37.5	3	M1 or for $\frac{50}{80}\times 100$ (=62.5) M1 or for 100 − "62.5" A1 Accept 38% from correct working
				Total 5 marks

11	(12 =) 2 × 2 × 3 or (120 =) 2 × 2 × 2 × 3 × 5 (condone 2,2,3 or 2,2,2,3,5) [factors could be seen at the end of a 'factor tree' or in a 'factor ladder'] **or** Venn diagram with the middle and one other region correct:  Where 10 may be 2,5 and 4 may be 2,2	40	2	M1 **or** for a <u>list</u> of at least 5 consecutive multiples of 4 **or** a <u>list</u> of at least 5 factors of 120 **or** for $12x = 120 \times 4$ oe (eg $\frac{120}{12}\times 4(=x)$) **or** 12 ÷ 4(= 3) and 120 ÷ "3" A1 accept 2 × 2 × 2 × 5 **or** $2^3 \times 5$
				Total 2 marks

12	eg $\frac{16}{100}\times 65000$ oe or 10400	65000×0.84^3		3	M1 For $\frac{16}{100}\times 65000$ oe or 10400	(M2 for 65000×0.84^3) **or** (M1 for 65000×0.84 or 54600 or 65000×0.84^2 or 45864 or 65000×0.84^4 or 32361.63..)
	$\frac{16}{100}\times (65000 - \text{“10400”})$ = 8736 $\frac{16}{100}\times (65000 - \text{“10400”} - \text{“8736”})$ = 7338.24 65000 – “10400” – “8736”– “7338.24”				M1 For completing Method	
					Accept (1 – 0.16) as equivalent to 0.84 throughout	
					SC: If no other marks gained, award M1 for 65000 x 0.48 oe (=31200) or 65000 × 0.52 oe (=33800)	
			38525.76		A1 for 38525 – 38526	
					Total 3 marks	

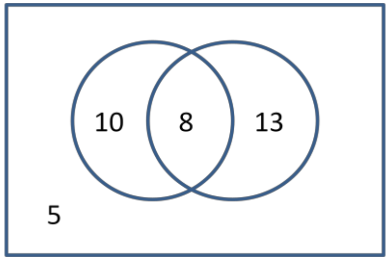
13	$\dfrac{-2\pm\sqrt{2^2-4\times3\times-7}}{2\times3}$ $\dfrac{-2\pm\sqrt{4+84}}{6} = \dfrac{-2\pm\sqrt{88}}{6}$	1.23, −1.90	3	M1 correct substitution into the quadratic formula, allow one sign error in numbers; some evaluation may be seen. M1 Indep for simplification of discriminant to $\sqrt{88}$ or $\sqrt{4+84}$ or $2\sqrt{22}$ A1 1.23 (or better), −1.90 (accept answers in range −1.90 to −1.89) provided at least M1 awarded
				Total 3 marks

14 (a)	$\dfrac{20}{8}\times 3$ **oe**	7.5	2	M1 A1 oe
(b)	$1875 \div \left(\dfrac{20}{8}\right)^3$ oe	120	2	M1 for $\left(\dfrac{20}{8}\right)^3$ or $\left(\dfrac{8}{20}\right)^3$ oe, accept ratios A1
	Alternative			
	$\dfrac{1875}{20}\times\left(\dfrac{8}{20}\right)^2$ $(=15)$ oe	120		M1 A1
				Total 4 marks

15	(a)	Probabilities on branches correct.	$\frac{6}{10},\frac{4}{10},\frac{5}{9},\frac{4}{9},\frac{6}{9},\frac{3}{9}$	3	B1 for $\frac{6}{10},\frac{4}{10}$ oe on LH branches B1 for $\frac{5}{9},\frac{4}{9}$ oe on top RH branches B1 for $\frac{6}{9},\frac{3}{9}$ oe on bottom RH branches Decimals given on the 2nd set of branches to be to at least 2dp (truncated or rounded).
	(b)	$\frac{6}{10}\times\frac{4}{9}$ or $\frac{4}{10}\times\frac{6}{9}$ **or** ft from their tree diagram $\frac{6}{10}\times\frac{4}{9}+\frac{4}{10}\times\frac{6}{9}$ **or** ft from their tree diagram	$\frac{48}{90}$ oe	3	M1 or $\frac{6}{10}\times\frac{5}{9}+\frac{4}{10}\times\frac{3}{9}\left(=\frac{42}{90}\right)$ M1dep or $1-\text{"}\frac{42}{90}\text{"}$ A1 Allow 0.53(33…) Note: If all 4 probability products are seen at the ends of the branches on the tree diagram or in lists in the working space for (b), marks can only be awarded in (b) if it is clear which product(s) they are intending to use.
					Total 6 marks

16	$\dfrac{x}{\sin 62} = \dfrac{14.6}{\sin 105}$		3	M1 or $\dfrac{\sin 62}{x} = \dfrac{\sin 105}{14.6}$
	$\dfrac{14.6}{\sin 105} \times \sin 62$			M1
		13.3		A1 Accept answers in the range 13.3 – 13.35
				Total 3 marks

17	$\begin{pmatrix} 5 \\ -1 \end{pmatrix} + \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ **or** $\begin{pmatrix} 5 \\ -1 \end{pmatrix} - \begin{pmatrix} -2 \\ 3 \end{pmatrix}$		2	M1 Or for $\begin{pmatrix} 7 \\ a \end{pmatrix}$ or $\begin{pmatrix} b \\ -4 \end{pmatrix}$
		$\begin{pmatrix} 7 \\ -4 \end{pmatrix}$		A1 Must be written as a vector.
				Total 2 marks

18 (a)	 	5, 10, 8, 13	3	B1 for 8 in intersection and 13 in correct position B1 for 5 in correct position B1 for 10 in correct position
(b)		31	1	B1 or ft from diagram
(c)		10	1	B1 or ft from diagram
				Total 5 marks

19	(a)	$5\times7+5\sqrt{2}-7\sqrt{8}-\sqrt{8}\sqrt{2}$ **Or** $35+5\sqrt{2}-7\sqrt{8}-\sqrt{8}\sqrt{2}$ **Or** $35+5\sqrt{2}-7\sqrt{8}-\sqrt{16}$ **Or** $35+5\sqrt{2}-7(2\sqrt{2})-\sqrt{16}$		3	M1 4 terms, allow one sign error Note 5×7 may be 35 $-7\sqrt{8}$ may be $-7\times2\sqrt{2}$ but not $-14\sqrt{2}$ $\sqrt{8}\sqrt{2}$ may be $\sqrt{16}$ or 4 **or** for $\sqrt{8}=2\sqrt{2}$
		$35+5\sqrt{2}-14\sqrt{2}-4$ or $31+5\sqrt{2}-14\sqrt{2}$			M1dep
			$31-9\sqrt{2}$		A1 show from correct working
	(b)	$\frac{3c-\sqrt{c}}{\sqrt{c}}\times\frac{\sqrt{c}}{\sqrt{c}}$ **or** $\frac{3c\sqrt{c}-c}{c}$ **or** $\frac{\sqrt{c}(3\sqrt{c}-1)}{\sqrt{c}}$		2	M1
			$3\sqrt{c}-1$		A1
					Total 5 marks

20	(a)	Eg. $2n$ is always even so $2n + 1$ is odd	explanation	1	B1
	(b)	$(2n + 1) + (2n + 3) + (2n + 5) + (2n + 7)$ oe $8n + 16$ $8(n + 2)$	show	3	M1 M1dep A1 or a complete explanation from correct algebraic working
		Alternative			
		let x be an even number $x + 1 + x + 3 + x + 5 + x + 7$ oe $4x + 16$ $4(x + 4)$		3	M1 For defining x (at beginning or end) and summing 4 consecutive odd numbers M1dep A1 For a complete explanation from correct algebraic working., eg $x + 4$ must be even and 4 times an even number = $4 \times 2n$ which is a multiple of 8
		Alternative			
		Let y be an odd number $y + y + 2 + y + 4 + y + 6$ oe $4y + 12$ $4(y + 3)$		3	M1 For defining y (at beginning or end) and summing 4 consecutive odd numbers M1dep A1 For a complete explanation from correct algebraic working. eg $(y + 3)$ is (odd + odd) which is even and therefore a multiple of 2, and $4 \times 2n$ is a multiple of 8
					Total 4 marks

21	(a)		$3x^2 + 12x$	2	B2	B1 for $3x^2$ or $12x$
	(b)	" $3x^2 + 12x$ " = 0 $3x(x + 4) = 0$ **or** $x(x + 4) = 0$ **or** $x(3x + 12) = 0$ or correct use of the formula (all values correctly substituted) or completing the square (as far as $(3)((x+2)^2-4)=0$) $x = 0$ and $x = -4$	 (0, 5) and (−4, 37)	4	M1 M1 A1 A1	ft ft as long as in the form of a quadratic equation. dep on M1 Could be x=0,y=5;x=−4,y=37
						Total 6 marks

22	$\frac{1}{2}ab\sin 150$ oe **or** $\frac{1}{2}(a+1)(b+2)$ oe (must be sin150, not sin C)		5	M1	Or $\frac{1}{2}(a+1)(b+2)\sin 90$
	$3 \times \frac{1}{2}ab\sin 150 = \frac{1}{2}(a+1)(b+2)$ oe			M1	correct equation, eg may see $\frac{3}{4}ab = \ldots$
	$3 \times \frac{1}{2}ab\sin 150 = \frac{1}{2}(ab+b+2a+2)$ oe			M1	expansion of brackets in a correct equation
	$3ab - 2ab - 4a = 2b + 4$ oe **or** $3ab\sin 150 - ab - 2a = b + 2$ oe			M1	isolation of terms in a in a correct equation (may be on either side of equation & can still have sin150)
		$\frac{2b+4}{b-4}$ oe		A1	eg $\frac{-2b-4}{4-b}$; $\frac{\frac{1}{2}b+1}{\frac{1}{4}b-1}$, $\frac{b+2}{3b\sin 150 - b - 2}$, etc
					Total 5 marks

23	$x^2 + (10 - 2x)^2 = 20$ oe			M1 or $\left(\frac{10-y}{2}\right)^2 + y^2 = 20$ oe
	$100 - 20x - 20x + 4x^2$ or $100 - 40x + 4x^2$			M1 (indep) for correct expansion of $(10 - 2x)^2$ or $\left(\frac{10-y}{2}\right)^2$ even if unsimplified
	$x^2 + 100 - 20x - 20x + 4x^2 = 20$ or $x^2 + 100 - 40x + 4x^2 = 20$			$\left(\frac{100-10y-10y+y^2}{4}\right) + y^2 = 20$ or $\left(\frac{100-20y+y^2}{4}\right) + y^2 = 20$
	$5x^2 - 40x + 80\ (= 0)$ **or** $x^2 - 8x + 16\ (= 0)$		5	A1 $5y^2 - 20y + 20\ (= 0)$ **or** $y^2 - 4y + 4\ (= 0)$
	$5(x - 4)(x - 4)\ (= 0)$ **or** $(x - 4)(x - 4)(= 0)$ **or** $(5x - 20)(x - 4)\ (= 0)$ **or** $\frac{--8 \pm \sqrt{(-8)^2 - 4(1)(16)}}{2(1)}$ oe (may be partially evaluated; condone lack of brackets around negative numbers)			M1 $5(y - 2)(y - 2)\ (= 0)$ **or** $(y - 2)(y - 2)\ (= 0)$ **or** $(5y - 10)(y - 2)\ (= 0)$ **or** $\frac{--4 \pm \sqrt{(-4)^2 - 4(1)(4)}}{2(1)}$ oe (may be partially evaluated; condone lack of brackets around negative numbers)
	$x = 4$ $y = 2$	$x = 4$; $y = 2$		A1 dep on all preceding method marks No marks for $x = 4$; $y = 2$ with no working. Accept (4, 2)
				Total 5 marks

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