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Mark Scheme (Results)

Summer 2015

Pearson Edexcel International GCSE
Mathematics A (4MA0)
Paper 3H

Pearson Edexcel Level1/Level 2 Certificate
Mathematics A (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
  - eeoo – each error or omission
  - awrt –answer which rounds to

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- **No working**
  If no working is shown then correct answers normally score full marks
  If no working is shown then incorrect (even though nearly correct) answers score no marks.
- **With working**
  If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.
  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 13a, 17 and 18 (where the mark scheme states otherwise) the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method				
Q	**Working**	**Answer**	**Mark**	**Notes**
1	345 ÷ 200 (=1.725) **or** 345 × 100(=34500)			M1 for a correct units conversion (×100) **or** ÷200
	"1.725" × 100 **or** "34500" ÷ 200		3	M1 for a correct units conversion (×100) **and** ÷200
		172.5		A1 accept 173 if at least M1 awarded
				Total 3 marks

2	(360−76 − 82−30) ÷2 = 86 **or** 225.5 ÷ 82 (=2.75) **or** 225.5 ÷ 82 × *a* where $a \neq 86$ **or** 225.5÷82 × (360 – 76 – 82 − 30) oe (=473)		3	M1 Accept digits 2255(000…) in place of 225.5 in both method marks
	225.5 ÷ 82 × "86" **or** 225.5 ÷ 22.7.. × 23.8… **or** digits 236… **or** "473" ÷ 2			M1(dep) for complete method **NB: 82 and 86 may be converted to percentage of 360 – and then these percentages used** $\frac{82}{360} = 22.7..\%$ or 23% ; $\frac{86}{360} = 23.8..\%$ or 24%
		236.5		A1 oe accept 236.5 million or 236 500 000
				Total 3 marks

3 (a)			2	M1 $4n + k$ (k may be zero)
		$4n + 1$		A1 oe eg. $5 + (n – 1)\times 4$ **NB: $n = 4n + 1$ oe scores M1 A0**
(b)		$4n + 5$	1	B1 ft from (a) if (a) is of the form $4n + k$ oe **NB: Accept $4(n +1) + 1$ oe**
				Total 3 marks

4	(a)	4×13 (=52) **or** $\frac{w+x+y+z}{4}=13$ **or** $4\times13-33$		2	M1
			19		A1
	(b)	$z-w = 10$ **or** $w = 9$ **or** $w =$ "19" – 10 **or** $x + y = 33 - 9 = 24$		2	M1 ft from (a) (can be implied by 9, x, y, 19 **OR** w, x, y, z with $x + y = 24$)
			12		A1 cao
					Total 4 marks

5	(a)	$15960 \div 5.7 \times 4.6$ **or** $15960 \div 5.7$ (=2800)		2	M1		
			12880		A1		
	(b)	$15960 \times \frac{7.5}{100}$ oe (= 1197)		3	M1	M2 for 0.925×5.7 (=5.27(25)) **AND** $\frac{5.27}{5.7}\times15960$	M2 for $15960\times\frac{92.5}{100}$ oe
		15960 − "1197"			M1 (dep)		
			14763		A1		
		NB: Accept 12880 or ans to (a) in place of 15960 for both method marks					
							Total 5 marks

6	(a)	$1.5 \times \pi$ **or** $2 \times \pi \times (1.5\div2)$		2	M1
			4.71		A1 4.71 - 4.72
	(b)	$1000 \div$ "4.71 "		2	M1 ft from (a) (accept use of rounded answer from (a) for method mark only)
			212		A1 ft from (a) provided working is shown (must round down to integer value)
					Total 4 marks

7	(a)	450 × 1.16 oe		2	M1	
			522		A1	
	(b)	850÷1.16 oe (= 732.76) **or** 732 – 733		3	M1	M1 for 3.50 × 1.16 (= 4.06)
		"732.76" + 3.50			M1 (dep)	M1 (dep) for (850 + "4.06") ÷1.16 oe
			736.26		A1 Accept 736 – 736.3	
						Total 5 marks

8	$(AB^2 =)\ 6.5^2 - 6.3^2$ (=2.56)		3	M1	**Alternative method :** M1 for finding a correct angle ($A = 75.7\ldots$; $C = 14.2\ldots$) **AND** a correct trig statement with a correct angle eg.
	$(AB =)\sqrt{6.5^2 - 6.3^2}$ **or** $\sqrt{"2.56"}$			M1 dep	$\sin 14.2 = \frac{AB}{6.5}$ M1 for making AB the subject eg. $AB = 6.5\sin 14.2$
		1.6		A1	**NB: 1.6 as a rounded answer eg. from1.594… gains A0**
					Total 3 marks

9	(a)		$20y^3$	2	B2 (B1 for $ny^3, n \neq 20$ **or** $20y^m$ $m \neq 3$)
	(b)		$\frac{3e}{5f^2}$	2	B2 $\frac{3e}{5f^2}$ **or** $\frac{3}{5}ef^{-2}$ **or** $0.6\frac{e}{f^2}$ **or** $0.6ef^{-2}$ (B1 for $k\frac{e}{f^2}$ with $k \neq 0.6$ oe **or** $\frac{3ef}{5f^3}$ **or** $\frac{3e^2}{5ef^2}$)
	(c)			2	M1 for $(ap + bq)(cp + dq)$ with $ac = 6$ and $bd = -6$ (ie. the coefficients of p multiply to give 6 and the coefficients of q multiply to give −6)
			$(3p + 2q)(2p - 3q)$		A1 oe
	(d)		x^{yz}	1	B1
					Total 7 marks

10	(a)	$2.57 \times 10^{10} + 6.01 \times 10^{10} + 5.80 \times 10^{10} + 1.91 \times 10^{10} + 8.21 \times 10^{10}$ **or** 2.57 + 6.01 + 5.8 + 1.91 + 8.21 **or** 245 000 000 000 oe **or** digits 245		2	M1 for clear intention to add all surface areas
			2.45×10^{11}		A1 cao
	(b)	$(1.22 \times 10^{13}) \div (7.45 \times 10^{9})$ **or** 1637(.58…) **or** digits 1637(58…)		2	M1 condone missing brackets
			1640		A1 accept 1637 – 1640 (may be in standard form)
					Total 4 marks

11	**NB: If it is clear that the surface area is being calculated then no marks can be awarded**			
	$\frac{1}{2}\times(12+22)\times(20-12)$ oe (=136)		5	M1
	12 × 12 (= 144)			M1
	"136" + "144" = 280			M1 dep on at least one previous M1 scored
	80 × "280"			M1 dep on previous M1
		22400		A1
	Alternative $\frac{1}{2}\times(12+22)\times(20-12)$ oe (=136)			M1 (may be seen within a volume calculation)
	12 × 12 (= 144)			M1(may be seen within a volume calculation)
	"136" × 80 = 10880 **or** "144" × 80 = 11520			M1 dep on at least one previous M1 scored
	"10880" + "11520"			M1 dep on previous M1
		22400		A1
	Special Case : Use of 10cm for height of trapezium AND 10cm for *AF*			B3 for answer of 23200
				If not B3 then B2 for 290 × 80 **or** 80 × (10 × 12 + $\frac{1}{2}\times(22+12)\times10$)
				If not B2 then B1 for 10 × 12 + $\frac{1}{2}\times(22+12)\times10$ (= 290) **or** 10 × 12 × 80 **and** $\frac{1}{2}\times(22+12)\times10\times80$
				Total 5 marks

12	20 × 151 (= 3020) **or** 12 × 148 = (1776) **or** 4796			M1
	("3020" + "1776") ÷ (12 + 20) **or** ("3020" + "1776") ÷ 32		3	M1 dep
		149.875		A1 for 149.875 rounded or truncated to 1 or more decimal places Accept 150 if M2 awarded
				Total 3 marks

13 (a)	$6x + 6y = 18$ $12x + 6y = 39$ $(6x = 21)$	$12x + 12y = 36$ $12x + 6y = 39$ $(6y = -3)$	$x = 3.5$ oe, $y = -0.5$oe	4	M1 for appropriate multiplication to get coefficients of x or y the same (condone one arithmetic error) with the correct operation to eliminate one variable **or** for correct rearrangement of one equation followed by substitution in the other (condone one arithmetic error). **NB: Could work with $x + y = 3$ throughout rather than $3x + 3y = 9$**
	$x = 3.5$	$y = -0.5$			A1 (dep on M1)
	$4 \times 3.5 + 2y = 13$				M1 (dep) for substituting into an equation to find the second variable **or** for a fully correct method to find second variable
					A1 Award 4 marks for correct values if at least first M1 scored

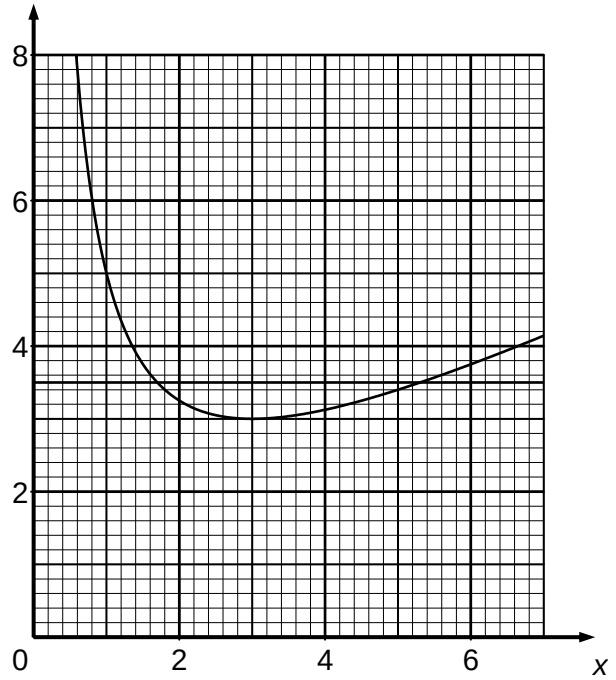
(b)	$y = \frac{-4x+13}{2}$ **or** $y = -2x + 6.5$ **or** line L has gradient −2 eg. L has equation $2y = -4x + k$ $k \neq 13$		3	M1	M1 $4x + 2y = p$
	$-1 = -2 \times 3 + k$ **or** $y - -1 = -2(x - 3)$			M1	M1 $4\times3 + 2 \times -1 = p$ **NB: $4\times3 + 2 \times -1 = 10$ gets no marks unless clearly part of a complete method**
		$y = -2x + 5$		A1 oe eg. $4x + 2y = 10$	**NB: $L = -2x + 5$ gets M2 A0**
					Total 7 marks

14	(a)		$(a - b)(a + b)$	1	B1 oe
	(b)	$(2^{11} - 1)(2^{11} + 1)$ **or** $(2048 - 1)(2048 + 1)$ **or** $\sqrt{4194304} = 2048$ **or** $\sqrt{2^{22}} = 2048$ **or** $\sqrt{2^{22}} = 2^{11}$ **or** $\sqrt{4194304} = 2^{11}$ **or** 3 , 23 , 89 , 683 (may be seen in a factor tree)		2	M1
			2047, 2049		A1 cao
					Total 3 marks

15	$\tan x = \frac{25-10}{24}$		4	M1
	$(x =)\ \tan^{-1}\left(\frac{25-10}{24}\right)$ **or** $\tan^{-1}0.625$ **or** $32(.005\ldots)$			M1(dep)
	$90 + "x"$ oe			M1 (indep)
		122		A1 awrt 122
	Alternative		4	
	$\tan A = \frac{24}{25-10}$			M1
	$(A=)\ \tan^{-1}\left(\frac{24}{25-10}\right)$ **or** $\tan^{-1}1.6$ **or** 58 **or** $57.9(94\ldots)$			M1(dep)
	$360 - 90 - 90 - "A"$ oe			M1 (indep)
		122		A1 awrt 122
	Alternative $(BDC =)\ \tan^{-1}\left(\frac{24}{10}\right)$ or $(BDC =)\ 67.4$ **or** $67.3\ldots$		4	M1 for a fully correct method to find angle BDC
	Fully correct method for *BDA* **or** $(ADB =)\ 54.6$			M1 for a fully correct method to find angle *BDA*
	"54.6" + "67.4"			M1 (indep)
		122		A1 awrt 122
				Total 4 marks

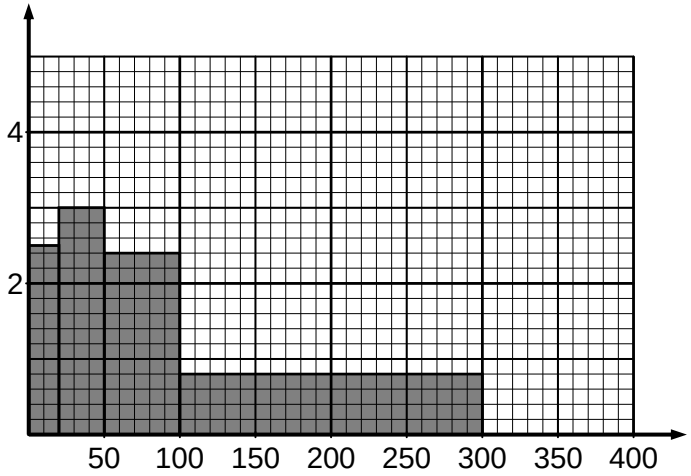
16	(a)			2	B2 all 3 correct If not B2 then B1 for 2 correct
	(b)		Graph	2	M1(ft if at least B1 scored in (a)) for at least 5 points plotted correctly ± ½ square A1 for correct curve between $x = 1$ and $x = 6$
	(c)	$y = 3.5$ drawn		2	M1
			1.7, 5.3		A1 ft graph which gives at least 2 roots **NB: Sight of just one correct solution with no method shown gets M0 A0**
					Total 6 marks

x	1.5	3	6
y	3.75	3	3.75



17	(a)		-1 or 2	1	B1 for -1 or for 2 or both
	(b)		$\frac{5}{2}$ oe	1	B1
	(c)	$\frac{3(x-2)}{(x+1)(x-2)}+\frac{x+1}{(x+1)(x-2)}$ **or** $\frac{3(x-2)(x+1)}{(x+1)}+\frac{(x-2)(x+1)}{(x-2)}$ **or** $3(x-2)+x+1$		3	M1 for correct method to clear fractions
		$3(x-2)+x+1=0$ oe **or** $4x-5=0$			M1 for clearing fractions **and** obtaining a correct equation
			$\frac{5}{4}$ oe		A1 (depending on at least M1)
					Total 5 marks

18	41.5 **or** 42.5 **or** 24.5 **or** 23.5 **or** 14.5 **or** 13.5		3	B1
	$(y=)\frac{2\times 41.5}{24.5-13.5}$			M1
		7.5		A1 accept $\frac{83}{11}$ or 7.55 or $7.\dot{5}\dot{4}$ (depending on M1) **NB: Answer <u>must</u> come from correct working**
				Total 3 marks

19	Any 2 of $50 \div 20 (=2.5)$, $90 \div 30 (=3)$, $120 \div 50 (=2.4)$, $160 \div 200 (=0.8)$		3	M1 for any two correct fd calculations can be implied by any **two** correct frequency densities or any two correct bars
	Any 3 of 2.5, 3, 2.4, 0.8			A1 for any 3 FDs correct (can be implied by at least 3 correct bars)
		Correct histogram		A1 for a fully correct histogram SC : B2 All four bars of correct width with heights in the correct ratio (B1 for 3 bars of correct width with heights in the correct ratio)
				
				Total 3 marks

20	(a)	$\frac{1}{6}\times\frac{1}{6}$		2	M1
			$\frac{1}{36}$ oe		A1 or 0.0277… rounded or truncated to 2 or more sig figs
	(b)	$\frac{5}{6}\times\frac{5}{6}\times\frac{1}{6}$ oe $\left(=\frac{25}{216}\right)$		3	M1
		$3\times\frac{5}{6}\times\frac{5}{6}\times\frac{1}{6}$ oe			M1
			$\frac{25}{72}$ oe		A1 or 0.34722… rounded or truncated to 2 or more sig figs
					Total 5 marks

21	Angle *CBD* = 32° **or** angle *ABC* = 90° **or** angle *DBO* = 90° **or** angle *OBA* = 32° **or** angle *BOD* = 2 × 32 (=64) (where *O* is the centre of the circle)		3	M1 angle must be clearly identifed either on diagram or in working
	eg (Angle *BDC* =) 180° −32° −32° − 90°			M1 for a complete method
		26		A1
				Total 3 marks

22	$A = KT^2$ and $A = kr^3$ **or** $T^2 = \frac{k}{K}r^3$ **or** $T^2 = pr^3$ $r^3 = \frac{K}{k}T^2$ **or** $r^3 = qT^2$		4	M1 condone the same constant used in both equations **NB: Values may be substituted in place of the variables**
	$47^2 = \frac{k}{K}0.25^3$ **or** $47^2 = m0.25^3$ **or** $\frac{47^2}{0.25^3}(=141376)$ **or** $\frac{0.25^3}{47^2}(=\frac{1}{141376}=7.07(3...)\times10^{-6})$			M1 **NB: 2209 may be seen in place of 47^2** $\frac{1}{64}$ or 0.015625 may be seen in place of 0.25^3
	$\left(r^3=\right)\frac{0.25^3}{47^2}\times365^2$ **or** $365^2 \div 141376$ **or** $365^2 \times 7.07(3\ldots) \times 10^{-6}$ **or** 0.942…			M1
		0.980		A1 awrt 0.980 accept 0.98
				Total 4 marks

23	Let O be the centre of the square. $(AC^2) = 10^2 + 10^2$ (= 200) **or** $(AC =)\ \sqrt{200}$ oe **or** $(AC =)$ 14.1(4…)		4	M1 or $2AO^2 = 10^2$
	$(AO =)\ \frac{1}{2}\sqrt{200}$ oe **or** $(AO) = 7.07(1\ldots)$ **or** $(AO) = 7.05$			M1
	$\left(VO^2 =\right) 12^2 - \left(\frac{1}{2}\sqrt{200}\right)^2$ oe $(=94)$ **OR** Angle VAC is $\cos^{-1}\left(\frac{7.07}{12}\right) = 53.896^{o}$ **AND** 12 sin 53.896 (= 9.695...)			M1 (dep on both previous method marks) for a fully correct method (condone missing brackets)
		9.70		A1 awrt 9.70 accept 9.7
	Alternative method Let M be the midpoint of a side of the square $VM^2 = 12^2 - 5^2\ (=119)$ **or** $VM = \sqrt{119}$ (=10.9(…)			M2 **but it must be explicitly clear that it is *VM* being calculated**
	$VO^2 = 119 - 5^2\ (=94)$ **or** $VO^2 = 10.9^2 - 5^2$ oe			M1
		9.70		A1 awrt 9.70 accept 9.7
				Total 4 marks

24 (a)	$\vec{PQ} = 6\mathbf{b} - 6\mathbf{a}$ **or** $\vec{QP} = 6\mathbf{a} - 6\mathbf{b}$ **or** $\left(\overrightarrow{OX}\right) = \overrightarrow{OP} + \overrightarrow{PX}$ oe **or** $\left(\overrightarrow{OX}\right) = \overrightarrow{OQ} + \overrightarrow{QX}$ oe **or** $6\mathbf{a} + \frac{1}{2}(6\mathbf{b} - 6\mathbf{a})$ **or** $6\mathbf{b} + \frac{1}{2}(6\mathbf{a} - 6\mathbf{b})$		2	M1 NB: $\overrightarrow{OX}$ may be partially in terms of **a** and/or **b**
		$3\mathbf{a} + 3\mathbf{b}$		A1 or $3(\mathbf{a} + \mathbf{b})$
(b)	eg. $\left(\vec{QY} =\right)\vec{QO} + \frac{2}{3}\overrightarrow{OX}$ **or** $\left(\overrightarrow{QY} =\right) -6\mathbf{b} + \frac{2}{3}(3\mathbf{a} + 3\mathbf{b})$		2	M1 for a complete method ft from (a)
		$2\mathbf{a} - 4\mathbf{b}$ or $2(\mathbf{a} - 2\mathbf{b})$		A1ft from (a)
				Total 4 marks

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