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Mark Scheme (Results)

Summer 2013

International GCSE Mathematics A
4MA0/3HR

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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**
  - awrt – answers which round to....
  - 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

- **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: e.g. 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 e.g. 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 4c, 5, 21, 23b and 25 (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	Mark	Notes
1 (a)	1 − (0.3 + 0.35 + 0.15)	0.2 oe	2	M1 for a complete method A1 for 0.2 oe as a fraction or percentage eg.20%, $\frac{1}{5}$ etc.
(b)	0.15 x 40 oe	6	2	M1 A1 cao NB. An answer of $\frac{6}{40}$ scores M1 A0
				Total 4 marks

2	495 ÷ 2.25	220	3	M2 M1 for 495÷2.15 **or** 230.2... rounded or truncated to 3 or more sig figs A1 cao
				Alterative M1 for 495÷135 **or** $3.\dot{6}$ **or** 3.666.. rounded or truncated to 3 or more sig figs M1dep for "3.66.." x 60 A1 220 cao
				Total 3 marks

3 (a)	$\frac{6}{32}\times 100$	18.75	2	M1 Allow "32" from evidence of adding frequencies A1 Accept 19 if the correct method or 18.75 seen
(b)	(7x10)+(16x30)+(3x50)+(6x70) =70 + 480 + 150 + 420	1120	3	M1 f x x for 3 products with x used consistently within interval (incl. end points) & intention to add M1(dep) use of correct half way values ($\frac{1120}{32}$ implies M2) A1 cao
				Total 5 marks

4 (a)		18a − 12b + 6c (oe)	1	B1
(b)		t(t − 10)	2	B2 also accept (t ± 0)(t − 10) for B2 B1 for factors which, when expanded and simplified, give only two terms, one of which is correct. **SC** B1 for $t(t - 10t)$
(c)	$3x = 7 - 2x$ $5x = 7$ **or** $5x - 7$ **= 0**	1.4oe	3	M1 **or** $x = \frac{7}{3} - \frac{2x}{3}$ M1 **or** $\frac{5x}{3} = \frac{7}{3}$ **or** $x + \frac{2x}{3} = \frac{7}{3}$ A1 Answer dependent on at least M1
				Total 6 marks

5	$\frac{8}{18}-\frac{3}{18}$ **or** $\frac{8n}{18n}-\frac{3n}{18n}$ $\frac{8}{18}-\frac{3}{18}=\frac{5}{18}$ **or** $\frac{8n}{18n}-\frac{3n}{18n}=\frac{5n}{18n}\left(=\frac{5}{18}\right)$		2	M1 for 2 correct fractions with a common denominator a multiple of 9 & 6 A1 $\frac{5}{18}$ coming from $\frac{8}{18}-\frac{3}{18}$ **or** for final fraction equivalent to $\frac{5}{18}$
				Total 2 marks

6 (a)		Enlargement (Scale factor) 2 (Centre) (0,4)	3	B1 B1 B1 NB. Award no marks for more than one transformation (i.e. if NOT a **single** transformation)
(b)		Shape in correct position	2	B2 vertices at(2, 0) (6, 0) (10, − 4) (10, − 8) B1 for **any** 2 vertices correct **or** correct orientation but wrong position **or** rotating shape P correctly - vertices at 7, 0), (9, 0) (11,−2), (11, −4)
				Total 5 marks

7 (a)	$3 \times (-2)^2 - (5 \times -2)$ **or** $3(-2)^2 - 5(-2)$ **or** $3 \times (-2)^2 - 5 \times -2$ **or** $3 \times 4 - 5 \times -2$	22	2	M1 **or** 12 − − 10 **or** 12 + 10 **or** 12 and −10 A1 cao
(b)	$12 = 3 \times 4^2 - 4n$ $4n = 48 - 12$ oe	9	3	M1 **or** M2 for 48 − 12 **or** 36 M1 A1 cao A1 cao
				Total 5 marks

8 (a) (i)	u, p, e, r	1	B1	Allow in any order Brackets and commas not necessary
(ii)	s, c, o, m, p, u, t, e, r	1	B0 if 'p' or 'u' or 'e' or 'r' are repeated	
(b)	no 2 (or 3) are prime 2 (or 3) belongs to *X* & *Y* etc	1	B1 - identifies the element 2 or 3 **or** 2 and 3 - dependent on "No" box ticked **or** "No" stated in answer with neither box ticked allow eg $X \cap Y = \{2,3\}$	
				Total 3 marks

9 (a) (i)		6^8	1	B1
(ii)		9^{14}	1	B1 (oe e.g. 3^{28} ; 81^7)
(b)	$5^n \times 5^3 = 5^{10}$ **or** $\frac{5^n}{5^6} = 5$ **or** $\frac{5^n}{5^3} = 5^4$ **or** $5^{n+3} = 5^{4+6}$	7	2	M1 or a correct equation in *n* eg. *n* + 3 = 10 **or** *n* + 3 − 6 = 4 A1 **SC** B1 for an answer of 5^7
				Total 4 marks

10	$\pi \times 36.6^2$ (= 4208.35..) 85 x 2 x 36.6 (=6222) "4208.35.." + "6222" (=10430.35..)	10400	4	M1 or x 36.6^2 ÷ 2 (=2104.17..) M1 M1 dep on both previous method marks A1 awrt 10400 (accept correct answers given in an alternative form eg. 1.04×10^4 ; 104×10^2) **SC**: B2 for an awrt 7320
				Total 4 marks

11	identify sin 52 or cos 38 sin 52 = $\frac{6.8}{x}$ **or** $(x=)\frac{6.8}{\sin 52}$ **or** $\frac{x}{\sin 90}=\frac{6.8}{\sin 52}$	8.63	3	M1 for use of sin 52 **or** use of cos 38 M1 or cos 38 = $\frac{6.8}{x}$ **or** $(x=)\frac{6.8}{\cos 38}$ A1 (8.62932..) awrt 8.63
				Total 3 marks

12 (a) (i)		4200000	1	B1
(a) (ii)		(0).000382	1	B1
(b)	8.6 x 10^{-9} 5.64 x 10^{-8} 5.6 x 10^{-7}		2	B2 B1 for smallest or largest in correct position
				Total 4 marks

13 (a)	Correct v ÷ h eg 2 ÷ 8 **or** $\frac{5-3}{8-0}$ oe	0.25 oe	2	M1 **or** $y=mx+3$ with any (x, y) on **L** substituted eg. 5 = 8*m* + 3 A1	
(b)		$y="0.25"x+3$ oe	1	B1 ft Accept equivalents (e.g. 4*y* = *x* + 12)	Gradient used must be 0.25 **or** the gradient found in (a)
(c)		$y="0.25"x-1$ oe e.g. $4y=x-4$	2	M1ft for $y="0.25"x+c$ $(c\neq -1)$ **or** *c* = −1 as a statement **or** $"0.25"x-1$ **or** $L="0.25"x-1$ **or** $-2="0.25"\times 4+c$ A1ft from "0.25" with *c* = −1 or *c* evaluated	
				Total 5 marks	

14 (a)	8 x $\frac{8}{5}$ oe	12.8 oe	2	M1 A1
(b)	12 x 1.6^2	30.72	2	M1 M1 for 1.6^2 (=2.56) **or** 0.625^2 (=0.39..) **or** $\left(\frac{8}{5}\right)^2 \left(=\frac{64}{25}\right)$ **or** $\left(\frac{5}{8}\right)^2 \left(=\frac{25}{64}\right)$ or 0.5 x 8 x "12.8" x sin 36.9 A1 cao
				Total 4 marks

15		Blocks at heights 2.4, 6.8, 3 squares	3	B3 for all 3 blocks correct (B2 for any 2 blocks correct) (B1 for any one block correct **or** for correct frequency density calculated or marked ((0.8), 1.2, 3.4 and 1.5) **or** 1 square = 2.5 people stated **or** 1 person = 10 squares)
				Total 3 marks

16	168.5 – 121.5	47	2	M1 for 168.5 **or** $168.4\dot{9}$ **or** 168.499... **or** 121.5 A1 for 47 with no incorrect working
				Total 2 marks

17	$t^2 =$ —— $nt^2 = n + 3$ $nt^2 - n = 3$ $n(t^2 - 1) = 3$	$n =$ ——	4	M1 squaring both sides M1 isolating terms in n M1 factorising A1 or $n = \frac{3}{(t+1)(t-1)}$ **or** $n = \frac{-3}{1-t^2}$ **or** $n = \frac{-3}{(1-t)(1+t)}$
				Total 4 marks

18 (a)	$1-\frac{1}{2}-\frac{1}{3}\left(=\frac{1}{6}\right)$	correct fractions on branches	3	M1 A1 for $\frac{1}{6}$ oe A1 correct values in correct places on full tree *Note:* (simplest form of fractions is **not** necessary) (accept $\frac{1}{6}$ and/or $\frac{1}{3}$ rounded or truncated to 2 or more decimal places eg 0.16 , 0.17 , 0.33 etc) **SC** : If M1 cannot be awarded then award B1 if top two branches in 2nd and 3rd games are **correct**
(b)	$\frac{1}{3} + \frac{1}{2}\times"\frac{1}{3}" + \frac{1}{2}\times"\frac{1}{2}"\times"\frac{1}{3}"$	$\frac{7}{12}$	3	M2 M1 for $\frac{1}{2}\times"\frac{1}{3}"$ **or** $\frac{1}{2}\times"\frac{1}{2}"\times"\frac{1}{3}"$ A1 accept 0.583... rounded or truncated to 2 or more sf
	Alternative method for (b) $1-\left("\frac{1}{6}"+\frac{1}{2}\times"\frac{1}{6}"+\frac{1}{2}\times"\frac{1}{6}"\times"\frac{1}{6}"+\frac{1}{2}\times"\frac{1}{2}"\times"\frac{1}{2}"\right)$	$\frac{7}{12}$		M1 for $\frac{1}{2}\times"\frac{1}{6}"$ or $\frac{1}{2}\times"\frac{1}{6}"\times"\frac{1}{6}"$ or $\frac{1}{2}\times"\frac{1}{2}"\times"\frac{1}{2}"$ A1 accept 0.583... rounded or truncated to 2 or more sf
				Total 6 marks

19 (a)		(v =) 18t − 3*t*	2	B2 for $18t - 3t^2$ oe seen as final answer B1 for $18t$ or $3t^2$ or $-3t^2$
(b)		(*a*=) "18 − 6*t*" (=0) (*t* =) 3	2	M1ft ft if differentiating correctly a quadratic with 2 or 3 terms A1ft
				Total 4 marks

20	$10\times x=3\times15$ **or** $(x=)\ 3\times15\div10$ oe	4.5 oe	2	M1 A1
				Total 2 marks

21 (a)	$\frac{7}{x} \times \frac{6}{x+1} = 0.2$ $42 = 0.2x(x-1)$ $210 = x^2 - x$	$x^2 - x - 210\ (=0)$	2	M1 for $\frac{7}{x} \times \frac{6}{x-1} = 0.2$ **or** $\frac{7}{x} \times \frac{6}{x-1} = \frac{1}{5}$ A1* * answer given; sufficient steps must be seen to get to correct quadratic	
(b)	$(x - 15)(x + 14)\ (=0)$	-14 , 15	3	M2 M1 for $(x \pm 15)(x \pm 14)$ A1 (dep on M2) for -14, 15 **or** 15	M1 $\frac{-(-1) \pm \sqrt{(-1)^2 - 4 \times 1 \times (-210)}}{2}$ (may be partially evaluated, condone no brackets around negative numbers, accept 1^2) M1 (indep) for $\sqrt{841}$ or 29 A1 (dep on M1) for -14, 15 **or** 15
					Total 5 marks

22	$(\sqrt{a})^2 + (\sqrt{8a})^2 + 2\sqrt{a}\sqrt{8a}$ $a + 8a + 2a\sqrt{8}$ $9a + 4a\sqrt{2}$	$a = 6$ $b = 24$	3	M1 for correct expansion of brackets A1 for $9a + 4a\sqrt{2}$ A1
				Total 3 marks

23 (a) (i)		½ **y** − **x**	1	B1 **or** − **x** + ½ **y** oe eg **y** − **x** − ½ **y**	
(ii)		**y** − 2**x**	1	B1 **or** −2**x** + **y** oe eg **x** + **y** − 3**x**	
(b)		*OD* is parallel to *AM* OD is twice length of AM oe	2	B1 B1	both marks dependent on a(i) **and** a(ii) correct and simplified
					Total 4 marks

24	(FH^2 =) $5^2 + 5^2$ (=50) $\sqrt{50}$ **or** $5\sqrt{2}$ (= 7.07..) $\tan x = \frac{5}{"\sqrt{50}"}$	35.3	4	M1 or correct Pythagoras statement to find any diagonal A1 for $\sqrt{50}$ **or** $5\sqrt{2}$ **or** awrt 7.1 M1 dep on previous M1 **or** $\sin x = \frac{5}{\sqrt{75}}$ **or** $\cos x = \frac{"\sqrt{50}"}{\sqrt{75}}$ **or** correct statement using Sine or Cosine rule with angle *AHF* as the only unknown (NB. $\sqrt{75}$ may be $5\sqrt{3}$ **or** awrt 8.7 may be used for *AH* if any other value used then it must clearly come from correct method to find *AH*) A1 35.264... awrt 35.3
	Alternative scheme (AH^2 =) $5^2 + 5^2 + 5^2$ (=75) $\sqrt{75}$ **or** $5\sqrt{3}$ (= 8.66..) $\sin x = \frac{5}{"\sqrt{75}"}$	35.3	4	M1 A1 for $\sqrt{75}$ **or** $5\sqrt{3}$ **or** awrt 8.7 M1 dep on previous M1 A1 35.264... awrt 35.3
				Total 4 marks

25	$x^2 + (3 - 2x)^2 = 26$			M1 or $y^2 + \left(\frac{3-y}{2}\right)^2 = 26$	
	$x^2 + 9 - 6x - 6x + 4x^2 = 26$ or $5x^2 - 12x + 9 = 26$			$y^2 + \left(\frac{9-6y+y^2}{4}\right) = 26$ or $y^2 + \left(\frac{9-3y-3y+y^2}{4}\right) = 26$	
				M1 (indep) for correct expansion of $(3-2x)^2$ **or** $\left(\frac{3-y}{2}\right)^2$ even if unsimplified	
	$5x^2 - 12x - 17 (= 0)$			A1 $5y^2 - 6y - 95 (= 0)$	
	$(5x - 17)(x + 1) (= 0)$ **or** $\frac{--12 \pm \sqrt{(-12)^2 - 4\times5\times(-17)}}{2\times5}$ (may be partially evaluated; condone lack of brackets around negative numbers) eg. $\frac{12 \pm \sqrt{144+340}}{10}$ **or** $\frac{12 \pm 22}{10}$			M1 $(5y + 19)(y - 5) (=0)$ oe **or** $\frac{--6 \pm \sqrt{(-6)^2 - 4\times5\times(-95)}}{2\times5}$ (may be partially evaluated; condone lack of brackets around negative numbers) eg. $\frac{6 \pm \sqrt{1936}}{10}$ **or** $\frac{6 \pm 44}{10}$	
	$x = 3.4$ oe , $x = -1$			A1 $y = 5$, $y = -3.8$ oe	dep on all preceding marks
		$x = 3.4$oe $x = -1$ $y = 5$ $y = -3.8$ oe		A1 **NB.** No marks for $x = -1$, $y = 5$ with no working	
					Total 6 marks

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