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Mark Scheme (Results)

January 2016

International GCSE Mathematics A
4MA0/4HR

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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

- **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.

International GCSE Maths				
Apart from Questions 6e, 14d and 24 (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 (a)	(40 ÷ 16) **×** 240 oe			M1 for a fully correct method
		600	2	A1
(b)	(600 ÷ 120) **×** 16 oe			M1 for a fully correct method
		80	2	A1
(c)	240÷150 **or** 150 : 240 oe			M1
		1.6 oe	2	A1
				Total 6 marks

2 (a) (i)		57	1	B1
(ii)		Corresponding angles	1	B1 For correct reason
(b)	(5 – 2) × 180 **or** 3 × 180 or (2 × 5 −4) × 90 **or** 6 × 90 **or** 360 +180 **or** 540			M1 for correct method to find total of angles in a pentagon **or**
	'540' – (86+142+72+115) oe			M1 (dep) fully correct method to find *y*
		125	3	A1 cao
	Alternative method (exterior angles) 360 – ("94" + "38" + "108" + "65") (=55) **or** 360 – 305 (=55)			M1 if just values seen then condone one error in exterior angles
	180 – "55"			M1 (dep) fully correct method to find *y*
		125	3	A1 cao
				Total 5 marks

3	$\frac{3\times5}{20}+\frac{4\times4}{20}$ or $\frac{15}{20}+\frac{16}{20}$			M1	for any pair of correct fractions with denominator a multiple of 20
		$\frac{31}{20}$	2	A1	dependent on M1
	Alternative 0.75 + 0.8 = 1.55			M1	
		$1\frac{55}{100}$		A1	dependent on M1
					Total 2 marks

4		5, 10, 20, 25, 50, 100	2	B2	If not B2 then B1 for at least 3 correct values and no incorrect values **or** all correct values with only 1 incorrect value
					Total 2 marks

5	48 ÷ 8 (=6)			M1	width of rectangle
	(8 + "6") × 2 (=28)			M1	perimeter
	"28" ÷ 4 (=7)			M1	length of side
		49	4	A1	
					Total 4 marks

6	**(a)**		x^9	1	
	(b)		y^6	1	
	(c)	$8d + 12 - 6d + 10$ oe	$2d + 22$	2	M1 for 3 terms with correct signs or 4 terms without signs A1 for $2d + 22$ **or** $2(d + 11)$
	(d)	eg. $9y - 5y = 2 + 3$ **or** $4y = 5$			M1 for a correct equation with terms in y on one side and numbers on the other.
			1.25	2	A1 for 1.25 or $\frac{5}{4}$ or $1\frac{1}{4}$
	(e)	$7x - 1 = 5x$			M1 multiplying x by 5 (seen as part of an equation) or showing $\frac{7}{5}x - \frac{1}{5} = x$
		eg. $7x - 5x = 1$ **or** $2x = 1$ **or** $\frac{7}{5}x - x = \frac{1}{5}$			M1 for isolating terms in x
			$\frac{1}{2}$ oe	3	A1 for $\frac{1}{2}$ or 0.5 dep on M1 scored
					Total 9 marks

7	**(a)**		15 - 19	1	B1	
	(b)	$2 \times 1 + 7 \times 5 + 12 \times 6 + 17 \times 10 + 22 \times 8$ or $2 + 35 + 72 + 170 + 176$ or 455			M2	Freq × midpoint values stated or evaluated with intention to add (condone any two errors in midpoints or frequencies). If not M2 then award M1 for all products $t \times f$ (and t is consistently within the interval, including end values) and intention to add (condone two errors).
		$\frac{2\times1 + 7\times5 + 12\times6 + 17\times10 + 22\times8}{30}$ **or** "455" ÷ 30			M1	(dep on at least M1) for division by 30
			15.2	4	A1	accept 15.166… rounded or truncated to 4 or more sig figs Accept 15 with working (15 without working gains M0A0) NB: accept 2.25 as mid-point for mid-interval value of 1st class (gives mean 15.175)
						Total 5 marks

8	$0.16x = 192$ **or** $16\% = 192$ oe **or** $\frac{192}{16}$ (=12)		3	M1
	$\frac{192}{0.16}$ **or** $\frac{192}{16} \times 100$ oe			M1
		1200		A1 cao
				Total 3 marks

9	$1\frac{24}{60}$ oe **or** 1.4 **or** 84			B1	for changing time to a decimal or to minutes
	$\frac{725}{1.4}$ oe **or** $\frac{725}{84} \times 60$			M1	allow 725 ÷ 1.24
		518	3	A1	for 518 or 517.857…
					Total 3 marks

10	(a)		1 590 000	1	B1	cao
	(b)	$2.97 \times 10^6 - 4.22 \times 10^5$ oe **or** $4.22 \times 10^5 - 2.97 \times 10^6$ oe **or** $\pm$ 2548000			M1	
			$\pm 2.548 \times 10^6$	2	A1	allow $\pm 2.5 \times 10^6$ or $\pm 2.55 \times 10^6$ if working shown.
	(c)	$1.25 \times 10^6 \div 4.22 \times 10^5$ oe **or** 2.96… **or** $\frac{625}{211}$			M1	
			3	2	A1	cao
						Total 5 marks

11	$\pi \times (20 - 2\times4)$ oe **or** $\pi \times 12$ oe **or** $2\times\pi\times6$ **or** 37.6... **or** 37.7 **or** $\frac{1}{2} \times \pi \times (20 - 2\times4)$ oe **or** $\frac{1}{2} \times \pi \times 12$ oe **or** $\pi\times6$ **or** 18.8…		3	M1	for a correct method to find the circumference or half of the circumference
	$4 + 10 + 20 + 10 + 4 + \frac{1}{2} \times$ "37.6…" **or** $4 + 10 + 20 + 10 + 4 +$ "18.8…"			M1	(dep on previous M1) for complete method
		66.8		A1	66.8 – 66.9
					Total 3 marks

12	$(4x^2+6x+6x+9) - (4x^2-6x-6x+9)$			M1	any one correct expansion	M1 for $((2x + 3) + (2x - 3))\ ((2x + 3) - (2x - 3))$
	$4x^2+6x+6x+9 - 4x^2+6x+6x-9$			M1	for dealing correctly with the negative sign	M1 for $(2x + 3 + 2x - 3)(2x + 3 - 2x + 3)$
		$24x$	3	A1		
						Total 3 marks

13	(a)	eg. $22 \times \frac{24}{20}$ **or** 22 × 1.2			M1	for complete method **or** correct scale factor (may be seen within an equation) eg. 20/24 or 24/20 or 1.2 or 0.83…oe
			26.4	2	A1	
	(b)	eg. 28.2 − 28.2 ÷ "1.2" **or** 28.2 ÷ 6 oe			M1ft	for a complete method ft from "1.2" used in (a) which must come from a correct method
			4.7	2	A1	
						Total 4 marks

14	(a)		−10, (4), 6, 2,(−2), 0,(14)	2	B2	Award B1 for any 2 correct.
	(b)	(−3, −10), (−2, 4), (−1, 6), (0, 2), (1,−2), (2, 0), ((3,14),	Correct curve	2	B2	For the correct smooth curve. B1 for at least 5 points plotted correctly; ft from table for plotting only provided at least B1 scored in (a).
	(c)	$1^3 - 6 \times 1 + m = 0$ **or** $1 - 6 + m = 0$	5	1	B1	
	(d)				M1	$y = x - 3$ drawn
			−2.7 to −2.9	2	A1	ft from graph (dep on M1)
						Total 7 marks

15	eg. $x = 0.2666\ldots$ and $10x = 2.666\ldots$ **or** $10x = 2.666\ldots$ and $100x = 26.66\ldots$			M1	Two correct decimals that, when subtracted, will leave a non-recurring value with intention to subtract. Must see a recurring symbol or 3+ sixes.
		show	2	A1	Must see a fraction prior to seeing $\frac{4}{15}$
	Alternative method				
	eg. $x = 0.0666\ldots$ and $100x = 6.666$ with subtraction			M1	for conversion of $0.0666\ldots$ to a fraction
			2	A1	for conclusion with all steps seen
					Total 2 marks

16	$Q = \frac{"k"}{t^2}$		3	M1	k must be a letter not a number
	$320 = \frac{"k"}{0.5^2}$ or "k" = 80			M1	for substitution (implies first M1)
		$Q = \frac{80}{t^2}$		A1	Award 3 marks for $Q = \frac{"k"}{t^2}$ and "k" = 80 stated anywhere
					Total 3 marks

17	**(a)**		0.4, 0.9, 0.3,0.7 in appropriate places	2	B2	All correct (B1 for any one correct)
	(b)	0.6 × 0.1			M1	
			0.06	2	A1	or 6% or $\frac{3}{50}$ oe
	(c)	(0.6 × '0.9') + ('0.4' × '0.7')			M2ft	Award M1 for one correct product
			0.82	3	A1	or 82% or $\frac{41}{50}$ oe
						Total 7 marks

18	**(a)**	1cm × 1cm square = 2.5 people or 1 large square = 10 people or 4.8 on axis corresponding to top of 20-25 bar or Correct scale marked on vertical axis or 10 small squares = 1 person oe		2	M1	
			31		A1	
	(b)	Freq densities: 38/10 (=3.8), 63/15 (=4.2), 24/30 (=0.8)		2	M1	2 correct frequency densities **or** 1 of the 3 bars correctly drawn
					A1	All 3 bars correctly drawn
						Total 4 marks

19	$4g - 9eg = 7 - 3e$ **or** $3e - 7 = 9eg - 4g$			M1	Correctly collecting terms in g on one side and everything else on the other.
	$g(4 - 9e) = 7 - 3e$ **or** $3e - 7 = g(9e - 4)$			M1	Factorising $g(4-9e)$ or $g(9e-4)$
		$g = \frac{7-3e}{4-9e}$ or $g = \frac{3e-7}{9e-4}$	3	A1	
					Total 3 marks

20	$\frac{3(2x+5) - 6(x+2)}{(x+2)(2x+5)}$			M1	For expressing both fractions correctly with a common denominator. Allow as two separate fractions. Condone one error in numerator expansion.
	$\frac{6x + 15 - 6x - 12}{(x+2)(2x+5)}$			M1	For removing brackets correctly in a correct single fraction. Allow denominator to be expanded or 2 brackets.
		$\frac{3}{(x+2)(2x+5)}$	3	A1	$\frac{3}{2x^2+9x+10}$ or
					Total 3 marks

21	(BD² or AC² =) $15^2 + 15^2$ **or** $\sqrt{450}$ **or** $15\sqrt{2}$ **or** 21.2 ...			M1	A correct statement to find diagonal of base
	eg. "$\sqrt{450}$ "$^2 = 12^2 + 12^2 - 2\times12\times12\times\cos BED$ **or** $\sin BEX = \frac{0.5"\sqrt{450}"}{12}$ **or** $\cos EBD = \frac{0.5"\sqrt{450}"}{12}$			M1	dep for use of cosine rule – correct statement in any form or correct trig statement to find angle *BED* or angle *BEX* or angle *EBD* or angle *EDB* **NB:** Any multi-step method must be fully correct
	eg $DEB = \cos^{-1}\left(\frac{12^2+12^2-"450"}{2\times12\times12}\right)$ **or** $DEB = 2\times\sin^{-1}\left(\frac{0.5\times"\sqrt{450}"}{12}\right)$ **or** $DEB = 180 - 2\times\cos^{-1}\left(\frac{0.5\times"\sqrt{450}"}{12}\right)$ **or** *DEB* = 55.7… **or** 56° (from ambiguous case of Sine Rule)			M1	Complete correct method to find angle *DEB*
		124	4	A1	answer in range 124 – 124.3
					Total 4 marks

22	$a^2 + a\sqrt{b} + a\sqrt{b} + b$ **or** $a^2 + a\sqrt{b} + a\sqrt{b} + \left(\sqrt{b}\right)^2$			M1	Correct expansion
		6		A1	For a
		13	3	A1	For b
					Total 3 marks

23	$0.5 \times 12 \times 14 \times \sin x = 72$			M1	For a correct equation for the area including 12, 14, sin x and 72
	$\sin x = \frac{72}{84}$			M1	For $\sin x = \frac{72}{84}$ oe
		59°		A1	
		121°	4	A1	
					Total 4 marks

24	$x^2 + (3x + 2)^2 = 20$		6	M1	for elimination of one variable $\left(\frac{y-2}{3}\right)^2 + y^2 = 20$
	$x^2 + 9x^2 + 6x + 6x + 4 = 20$			M1	indep for correct expansion ie. $9x^2 + 6x + 6x + 4$ **or** $\frac{y^2 - 2y - 2y + 4}{9}$
	$10x^2 + 12x - 16 = 0$ $(5x^2 + 6x - 8 = 0)$			A1	Correct simplified 3 part quadratic equation (may not be equated to zero) $10y^2 - 4y - 176 = 0$ **or** $5y^2 - 2y - 88 = 0$
	eg. $(10x - 8)(x + 2)$ **or** $(5x - 4)(2x + 4)$ **or** $(5x - 4)(x + 2)$ **or** $\frac{-12 \pm \sqrt{12^2 - 4 \times 10 \times -16}}{2 \times 10}$ oe			M1	for correct factorisation or substitution into quadratic formula ft (dep on at least 1 previous M1 scored) a 3 term quadratic for this mark only eg. $(5y - 22)(y + 4) = 0$
				A1	for **both** x values (or **both** y values)
		$x = \frac{4}{5}, y = \frac{22}{5}$ or $x = -2, y = -4$		A1	for both solutions with x and y values correctly paired
					Total 6 marks

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