Mark Scheme (Results)

Summer 2017

Pearson Edexcel International GCSE
In Mathematics (4MA0) 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

- **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  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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 2b, 7, 15a, 15b, 20 (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) (i)		t, a, l	1	B1
	(a)(ii)		p, o, r, t, u, g, a, l, i, y	1	B1 No repeats
	(b)		No with reason	1	B1 eg. 'a is in both sets' or 'they share a member' oe (but not member**s**/letter**s**)
					Total 3 marks

2	(a)	$2 \times (-3)^2 - 7\times(-3)$ oe e.g. $2(9) - (-21)$ **or** $2\times9 + 21$ **or** $18 + 21$			M1	Brackets must be round $(-3)^2$
			39	2	A1	
	(b)	$4x + 12 = 9x - 10$ **or** $x + 3 = \frac{9x}{4} - \frac{10}{4}$ oe			M1	for $4x + 12$ (may not be in an equation) or for dividing RHS by 4
		$12 + 10 = 9x - 4x$ or $-9x + 4x = -12 - 10$ or $22 = 5x$ or $-5x = -22$ or $3 + 2.5 = 2.25x - x$ or $1.25x = 5.5$			M1	(ft from $4x + b = 9x - 10$, $b \neq 0$) for all terms in x isolated on one side and numbers on other side
			4.4	3	A1	for 4.4 oe eg. $\frac{22}{5}$, $4\frac{2}{5}$ dep on at least M1
	(c)		$-1, 0, 1, 2, 3$	2	B2	B1 for $-2, -1, 0, 1, 2$ or list with one error or omission: e.g. $-2, -1, 0, 1, 2, 3$ **;** $-1, 0, 1, 2$; $-1, 1, 2, 3$
						Total 7 marks

3	(a)	250 × 97			M1	Completely correct method or figures 2425(0) e.g. 242.5
			24 250	2	A1	
	(b)	4 × 500 (=2000) **or** 500 ÷ 93.5 (=5.34759…)			M1	
		(4 × 500) ÷ 93.5 **or** "5.34.." × 4			M1	
			21	3	A1	21 – 21.4
						Total 5 marks

4	$\frac{-4+1}{2}$ **or** $\frac{9+5}{2}$			M1	or for $(-1.5\ ,\ y)$ or $(x,\ 7)$ or $(7, -1.5)$
		$(-1.5\ ,\ 7)$	2	A1	oe
					Total 2 marks

5	(a)	20×0.3			M1	Or for an answer of $\frac{6}{20}$	
			6	2	A1	condone '6 out of 20'	
	(b)	$0.3 + x + 3x = 1$			M1	oe, e.g. $4x = 0.7$	M1 for (20 – "6") ÷ 4 (=3.5)
		$(1 – 0.3) \div 4$ **or** 0.175 **or** $(1 – 0.3) \times 0.75$			M1	complete method to find x or $3x$	M1 for $\frac{3\times"3.5"}{20}$
			0.525	3	A1	oe, e.g. $\frac{21}{40}$, 52.5% (accept 0.53 from correct working)	A1 for 0.525 oe
							Total 5 marks

6		$T = 6m + 9g$	3	B3	Or $T = 3(2m + 3g)$ [award B2 if $T = 6m + 9g$ is incorrectly simplified](condone $T = 6\times m + 9\times g$)
					if not B3 then
					B2 for $T = 6m + kg$ **or** $T = km + 9g$ (k may be zero) **or** $6m + 9g$
					if not B2 then
					B1 for $6m$ **or** $9g$ **or** $T = am + bg$ (where $a \neq 0$ or 6 and $b \neq 0$ or 9)

					Total 3 marks

7	(a)	eg. $\frac{14}{24}+\frac{9}{24}$ **or** $\frac{56}{96}+\frac{36}{96}$ oe			M1	correct fractions with common denominators and intention to add
		$\frac{14}{24}+\frac{9}{24}=\frac{23}{24}$ **or** $\frac{56}{96}+\frac{36}{96}=\frac{92}{96}=\frac{23}{24}$ oe	shown	2	A1	dep on M1
	(b)	$\frac{5}{3}\times\frac{31}{15}$ oe			M1	fractions written as correct improper fractions and intention to multiply
		$\frac{1}{3}\times\frac{31}{3}$ **or** $\frac{155}{45}$ oe			M1	correct cancelling or multiplication of numerators and denominators without cancelling
		$\frac{1}{3}\times\frac{31}{3}=\frac{31}{9}$ **or** $\frac{155}{45}=\frac{31}{9}$ **or** $3\frac{20}{45}$ oe	shown	3	A1	$\frac{31}{9}$ or $3\frac{20}{45}$ dep on M2
						Total 5 marks

8	180 – 156 (=24) **or** 180(n – 2) = 156n oe **or** 90(2n – 4) = 156n oe			M1
	360 ÷ "24" **or** (180 × 2) ÷ (180 – 156) **or** $\frac{90\times4}{2\times90-156}$			M1 complete method
		15	3	A1
				Total 3 marks

9	420 ÷ (4 + 5 + 3) (=35) [or Manu = 140 or Liam = 175]			M1	M2 for $\frac{3}{12}\times 420$ oe
	"35" × 3 (=105)			M1 or Ned = 105	
	$\frac{"105"+75}{420}\times 100$ oe			M1	
		43	4	A1 42.85 – 43	
					Total 4 marks

10	(a)		e^{15}	1	B1	
	(b)				M1	for ng^8 or $4g^m$ or $\frac{4g^9}{g}$
			$4g^8$	2	A1	(condone $\frac{4}{1}g^8$)
	(c)		1	1	B1	
	(d)	$(3x^2)^2$ **or** $9(x^2)^2$ **or** $(729x^{12})^{\frac{1}{3}}$ **or** $9(x^{12})^{\frac{1}{3}}$ **or** $\sqrt[3]{729x^{12}}$ **or** $9\sqrt[3]{x^{12}}$			M1	**or** kx^4 **or** $9x^n$ (not just 9 or x^n)
			$9x^4$	2	A1	
						Total 6 marks

11	eg (d^2 =) $7^2 + 7^2$ **or** $r^2 + r^2 = 7^2$ **or** $\cos 45 = \frac{7}{d}$ **or** $\sin 45 = \frac{7}{d}$ **or** $\cos 45 = \frac{r}{7}$ **or** $\sin 45 = \frac{r}{7}$			M1	Start of method to find radius or diameter of circle
	eg (d=) $\sqrt{98}$ (9.899..) **or** (r=) $\sqrt{\frac{49}{2}}$ (=4.9...) **or** $d = \frac{7}{\cos 45}$ **or** $d = \frac{7}{\sin 45}$ **or** $r^2 = 24.5$ **or** $r = 7\cos 45$ **or** $r = 7\sin 45$			M1	complete method to find radius or diameter or r^2 (if method to find radius or diameter shown then allow use of radius = 5 for method marks only)
	eg. π × "4.9.."^{2} (=76.969...)			M1	For method to find area of circle or semi-circle or quarter circle – use of radius from correct working
	eg. π × "4.9.."^{2} – 7^2			M1	for complete method
		28	5	A1	27.9 – 28
					Total 5 marks

12	10 12 15 16 17 19 19 23 24 27 27 **or**			M1	Ordered list – allow one error or omission
	15 **and** 24 identified			M1	
		9	3	A1	
					Total 3 marks

13	(a)	$y = 3 - 1.5x$ **or** $2x - 1.5 = y$ **or** $m = 2$ (A) **or** $m = -1.5$ (B) **or** $m = 2$ (C) **or** $m = -2$ (D)			M1	If using gradients, must state $m =$ or gradient =
			A and **C**	2	A1	(allow correct equations listed)
	(b)	$y = -\frac{5}{2}x + c$ **or** $y - y_1 = -\frac{5}{2}(x - x_1)$			M1	c can be any value, e.g. $y = -\frac{5}{2}x + 3$
		$3 = -\frac{5}{2} \times 1 + c$ **or** $c = \frac{11}{2}$ oe **or** $y = -\frac{5}{2}x + \frac{11}{2}$ or $y - 3 = -\frac{5}{2}(x - 1)$ or $2(y - 3) = -5(x - 1)$			M1	
			$5x + 2y = 11$	3	A1	oe eg. $10x + 4y = 22$ or in a different but correct form but must have integer values, e.g. $2y = -5x + 11$
						Total 5 marks

14	(a) (i)		52		B1	
	(a) (ii)		<u>angles</u> in <u>same segment</u> or <u>angles subtended</u> by the same <u>arc</u>	2	B1	Dep on B1 in (ai)
	(b) (i)		104		B1	accept 256
	(b) (ii)		<u>angle</u> at <u>centre</u> is <u>twice angle at circumference</u>	2	B1oe	Dep on B1 in (bi) or correct working
						Total 4 marks

15	(a)	$\frac{1}{2}\times(x+5+2x-4)\times(x+3)$ or $(3x + 1)(x + 3) = 120$ or $(2x – 4)(x + 3) + ½(9 – x)(x + 3)$ or $(x + 5)(x + 3) − ½(9 – x)(x + 3)$			M1	correct expression for area (trapezium) (rectangle + triangle) (rectangle – triangle)
		$\frac{1}{2}\times(3x^2+9x+x+3)=60$ oe			M1	correct expansion of (all pairs) brackets in a correct equation
		$3x^2 + 10x + 3 = 120$ or $1.5x^2 + 5x + 1.5 = 60$	shown	3	A1	dep on fully correct working to get to $3x^2 + 10x – 117 = 0$
	(b)	$\frac{-10\pm\sqrt{1504}}{6}$ **or** $\frac{-10\pm\sqrt{10^2--1404}}{2\times3}$ oe **or** $\frac{-10\pm4\sqrt{94}}{6}$ NB: denominator must be 2 × 3 or 6 **and** there must be evidence for correct order of operations in the numerator			M2	If not M2 then M1 for $\frac{-10\pm\sqrt{10^2-4\times3\times-117}}{2\times3}$ (may have just + rather than ±) Condone one sign error in substitution; allow partial evaluation
			4.80	3	A1	Award M2A1 for answers in range 4.796 – 4.8 (and no other answer) with sufficient correct working that would gain at least M1 [Award M2A0 for working sufficient for M1 with both the –ve and +ve answers (−8.13 *&* 4.80)]
						Total 6 marks

16	(a)		0.2, 0.65, 0.35, 0.4, 0.6	2	B2oe	B1 for any 2 correct probabilities (in correct position)	
	(b)	0.8 × "0.35"(=0.28) **or** "0.2" × "0.4"(=0.08)			M1	ft from (a)	M2 ft from (a) for 1−(0.8×'0.6'+'0.2'×'0.6') M1 for 1 – (0.8×'0.65') or 1− ('0.2'×'0.6')
		0.8 × "0.35" + "0.2" × "0.4"			M1	ft from (a)	
			0.36 oe	3	A1	eg $\frac{9}{25}$, 36%	
							Total 5 marks

17	(a)		$24x^2 - 6x - 25$	2	M1 A1	for 2 correct from $3 \times 8x^2$, $-3\times 2x$,-25 fully correct
	(b)	$24x^2 - 6x - 25 = 5$			M1	ft from (a)
		$24x^2 - 6x - 30$ (= 0) **or** $4x^2 - x - 5$ (= 0) **or** $12x^2 - 3x - 15$ (= 0)			M1	ft from (a) for a 3 term quadratic with no coefficients of zero
		$(4x - 5)(6x + 6)$ (=0) or $(4x - 5)(x + 1)$ (= 0) $(4x - 5)(3x + 3)$ (= 0) **or** $\frac{--1 \pm \sqrt{(-1)^2 - 4\times 4\times -5}}{2\times 4}$			M1	ft from (a) for a 3 term quadratic with no coefficients of zero. If using quadratic formula some simplification may be seen.
			1.25 oe, −1	4	A1	cao dep on M1 [ignore attempts to work out y values]
						Total 6 marks

18	60 ÷ 30 (=2) **or** 270 ÷ 60 (=4.5) **or** 150 ÷ 30 (=5) **or** 156 ÷ 120 (=1.3) **or** 24 ÷ 60 (=0.4)			M1	for use of area eg. any one correct fd or any 2 correct bars of different widths
	fd : 2, 4.5, 5, 1.3, 0.4			M1	for any 4 correct fd or bars
		histogram	3	A1	for a correct histogram, including frequency density (FD) label and scale/correct key
					Total 3 marks

19	$0.5 \times 6.4 \times 9.7 \times \sin 110$ (= 29.16…)			M1	M2 for $6.4 \times 9.7 \times \sin 110$
	2 × "29.16…"			M1	
		58.3	3	A1	for 58.3 – 58.4
	alternative				
	$AC = \sqrt{6.4^2 + 9.7^2 - 2\times 9.7\times 6.4\times\cos 110}$ (=13.323...) $DAC = \sin^{-1}(\frac{\sin 110}{'13.323'}\times 9.7)(=43.167...)$ or $ACD = \sin^{-1}(\frac{\sin 110}{'13.323'}\times 6.4)(=26.83...)$			M1	For method to find *AC* and angle *DAC* or angle *ACD*
	Area = (sin '43.167..' × 6.4 × 2 × '13.323..') ÷ 2 Or area = (sin '26.83..' × 9.7 × 2 × '13.323...') ÷ 2			M1	find *DB* and then area using half product of diagonals
		58.3		A1	for 58.3 – 58.4
					Total 3 marks

20	45.75 **or** 45.85 **or** 63.25 **or** 63.75			B1	Accept $45.84\dot{9}$ **or** 45.8499... **or** $63.74\dot{9}$ **or** 63.7499...
	$\frac{63.25}{45.85}$ (= 1.379)... **or** $\frac{45.85}{60}$ (=0.764)...			M1	Or for $\frac{LB_1}{UB_2}$ **or** $\frac{UB_2}{60}$ where $63.25 \le LB_1 < 63.5$, $45.8 < UB_2 \le 45.85$
	$\frac{63.25}{45.85}\times 60$ oe e.g. $\frac{63.25}{0.764...}$			M1	$\frac{LB_1}{UB_2}\times 60$ oe, e.g. $\frac{LB_1}{'0.764...'}$
		82.8	4	A1	Or better (82.76990185)
					Total 4 marks

21	$15.6^2 + 4.3^2 - 2\times15.6\times4.3\times\cos72^o$ (=220.39…)			M1	substitution into Cosine rule
	LN = 14.8(4561…)			A1	14.8(4561…)
	$\frac{\sin 58}{"14.8.."} = \frac{\sin MLN}{13.7}$ **or** $\frac{\sin NLP}{4.3} = \frac{\sin 72}{"14.8"}$ **or** $\frac{\sin LNP}{15.6} = \frac{\sin 72}{"14.8.."}$			M1	ft LN dep on 1st M1 or correct start to alternative method to find angle MLN **or** angle NLP **or** angle LNP [$4.3^2=14.8..^2+15.6^2-2\times14.8\times15.6\cos NLP$]
	$MLN = \sin^{-1}\left(\frac{\sin 58}{"14.8.."}\times13.7\right)$ (=51.49..) **or** $NLP = \sin^{-1}\left(\frac{\sin 72}{"14.8"}\times4.3\right)$ (=15.99..) **or** $LNP = \sin^{-1}\left(\frac{\sin 72}{"14.8"}\times15.6\right)$ (=87.99 or 92.00..)			M1	ft LN dep on 1st M1 or complete alternative method to find angle MLN **or** angle NLP **or** angle LNP NB: LNP = 180 −87.99 = 92.009... $NLP = \cos^{-1}\left(\frac{14.8..^2+15.6^2-4.3^2}{2\times14.8..\times15.6}\right)$
	$MLN = \sin^{-1}\left(\frac{\sin 58}{"14.8.."}\times13.7\right)$ (=51.49..) **and** $NLP = \sin^{-1}\left(\frac{\sin 72}{"14.8"}\times4.3\right)$ (=15.99..) **or** $LNP = \sin^{-1}\left(\frac{\sin 72}{"14.8"}\times15.6\right)$ (=87.99 or 92.00..)			M1	ft LN dep on 1st M1 or complete method to find angle MLN **and** angle NLP (or LNP acute or obtuse)
		67.5	6	A1	for 67.46 – 67.8
					Total 6 marks

22	e.g. $\left(\frac{1}{8\times10^{9n}}\right)^{\frac{1}{3}}$ **or** $\left(2\times10^{3n}\right)^{-1}$ **or** $\frac{1}{\sqrt[3]{8\times10^{9n}}}$ **or** $\left(\sqrt[3]{8\times10^{9n}}\right)^{-1}$ **or** $(8^{\frac{-1}{3}}\times10^{\frac{-9n}{3}})$ **or** $\left[\frac{1}{8^{\frac{1}{3}}} \textit{ and } \frac{1}{\left(10^{9n}\right)^{\frac{1}{3}}}\right]$ **or** $\left[2^{-1} \textit{ and } (10^{3n})^{-1}\right]$ oe			M1 Correct first stage.
	e.g. $\frac{1}{2\times10^{3n}}$ **or** 0.5×10^{-3n} oe **or** $\left[8^{\frac{-1}{3}}=0.5 \textit{ and } (10^{9n})^{\frac{-1}{3}}=10^{-3n}\right]$ oe			M1 For dealing with $8^{-⅓}$ (shown as ½ or 0.5) and $(10^{9n})^{-⅓}$ shown as 10^{-3n}
		$5\times10^{-3n-1}$	3	A1 $5\times10^{-(3n+1)}$
				Total 3 marks

23	$\frac{4\pi r^2}{2}+\pi r^2=\frac{16}{3}\pi$ **or** $3\pi r^2=\frac{16}{3}\pi$			M1	allow $\frac{4\pi r^2}{2}+\pi r^2=16.755...$
	$r=\frac{4}{3}$ oe			A1	(allow 1.33... or better)
	$\frac{1}{2}\times\frac{4}{3}\pi\left("\frac{4}{3}"\right)^3$			M1	dep on 1st M1 (need not include π) or answer of $\frac{128}{81}\pi$ (=4.96(44…))
		$\frac{128}{81}$	4	A1	$1\frac{47}{81}$ (accept 1.58(024…)
					Total 4 marks