Mark Scheme (Results)

November 2017

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Higher (Calculator) Paper 3H

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General marking guidance

These notes offer general guidance, but the specific notes for examiners appertaining to individual questions take precedence.

1 All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.

Where some judgement is required, mark schemes will provide the principles by which marks will be awarded; exemplification/indicative content will not be exhaustive. When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the response should be sent to review.

2 All the marks on the mark scheme are designed to be awarded; mark schemes should be applied positively. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme. If there is a wrong answer (or no 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.

Questions where working is not required: In general, the correct answer should be given full marks.
Questions that specifically require working: In general, candidates who do not show working on this type of question will get no marks – full details will be given in the mark scheme for each individual question.

3 **Crossed out work**
This should be marked **unless** the candidate has replaced it with an alternative response.

4 **Choice of method**
If there is a choice of methods shown, mark the method that leads to the answer given on the answer line.

If no answer appears on the answer line, mark both methods **then award the lower number of marks.**

5 **Incorrect method**
If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.

6 **Follow through marks**
Follow through marks which involve a single stage calculation can be awarded without working as you can check the answer, but if ambiguous do not award.
Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

7   **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 or its context. (eg. an incorrectly cancelled fraction when the unsimplified fraction would gain full marks).
It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect (eg. incorrect algebraic simplification).

8   **Probability**
Probability answers must be given as a fraction, percentage or decimal. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).
Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.
If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

9   **Linear equations**
Unless indicated otherwise in the mark scheme, full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously identified in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded (embedded answers).

10   **Range of answers**
Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and all numbers within the range.

Guidance on the use of abbreviations within this mark scheme

M   method mark awarded for a correct method or partial method

P   process mark awarded for a correct process as part of a problem solving question

A   accuracy mark (awarded after a correct method or process; if no method or process is seen then full marks for the question are implied but see individual mark schemes for more details)

C   communication mark

B   unconditional accuracy mark (no method needed)

oe   or equivalent

cao   correct answer only

ft   follow through (when appropriate as per mark scheme)

sc   special case

dep   dependent (on a previous mark)

indep   independent

awrt   answer which rounds to

isw   ignore subsequent working

Question	Working	Answer	Mark	Notes
1 (a)		$160 < h \le 170$	B1	correct class interval
(b)		Line segments joining the points (135, 4), (145, 11), (155, 24), (165, 22) and (175, 19)	C2 [C1	for fully correct frequency polygon for points plotted correctly at midpoints of intervals OR joining points with line segments at the correct heights and consistent within the intervals (including end values) OR correct frequency polygon with one point incorrect OR correct frequency polygon with first and last point joined] NB: ignore any histogram drawn and any part of frequency polygon outside range of first and last points plotted
2		New York (supported)	P1	for changing between £ and $, eg 1.089×1.46 (= 1.58(9.)) or 2.83÷1.46 (= 1.93(8.)) or between litres and gallons, eg 1.089×3.785 (= 4.12(1.)) or 2.83÷3.785 (= 0.74(7.))
			P1	for a complete process to give values that can be used for comparison, eg "1.938..." ÷ 3.785 (= 0.51(2.)) **or** "1.589..."...× 3.785 (= 6.01(7.)) **or** 1.089 × 3.785 = (4.12(1.)) and 2.83 ÷ 1.46 (= 1.93(8.))
			C1	for New York and correct comparative values
3		648	M2	a complete method, eg 12.5 × 1000 ÷ 19.3
			[M1	for using volume = mass/density, eg 12500 ÷ 19.3 (condone inconsistent units or incorrect conversions) may be implied by digits 647... or 648...]
			A1	for answer in range 647 to 648

Question	Working	Answer	Mark	Notes
4		15	P1	strategy to start the problem, eg $8:20$ and $20:5$
			P1	process to solve the problem, eg $\dfrac{5}{33} \times 100$ or $24:60:15$
			A1	cao
5 (a)		0.625	B1	cao
(b)		$9.75 \leq x < 9.85$	B2	for $9.75 \leq x < 9.85$
			[B1	for 9.75 or 9.85 (or $9.84\dot{9}$)]
6		147	P1	starts process, eg uses x and $x + 7$
			P1	starts to work with at least 6 correct sides, may be on the diagram or in an expression
			P1	(dep on previous P1) gives a correct expression for the perimeter, eg $x + x + 7 + x + 7 + x + 7 + x + x + 7 + x + 7 + x + 7$ or adds at least 6 correct sides and equates to 70
			A1	for width = 3.5 oe **and** length = 10.5 oe
			B1	ft (dep P2) for correct area for their x
7		0.000 745 2	M1	digits 7452 seen
			A1	cao

Question		Working	Answer	Mark	Notes
8	(a)		Mel (supported)	B1	Mel with reference to greatest number of throws
	(b)		$\dfrac{2}{9}$	M1	selects overall total and multiplies P(point up)×P(point down) eg $\dfrac{50}{150} \times \dfrac{100}{150}$ oe (accept $\dfrac{14}{45} \times \dfrac{31}{45}$ or $\dfrac{27}{80} \times \dfrac{53}{80}$ or $\dfrac{9}{25} \times \dfrac{16}{25}$)
				A1	for $\dfrac{2}{9}$ oe
9	(a)		5	M1	evaluates $(0.85)^n$ or $12\,500 \times (0.85)^n$ for at least one value of n
				A1	cao
	(b)		2.4	P1	for a process to find the amount of interest before tax, eg $79.20 \div 0.6$ (= 132)
				P1	for a process to find value of R, eg "132"÷5500×100
				A1	cao
10	(a)		0.05	B1	for 0.05 oe
	(b)		20	C1	for stating that at least 20 required
			Reason	C1	for reason eg explains that number of each colour must be a whole number or that there must be (at least) 1 red counter or shows that $0.05 = \dfrac{1}{20}$

Question	Working	Answer	Mark	Notes
11 (a)		57	B1	cao
(b)		Decision and reason	C1	Jamil might not be correct and reason, eg the maximum weight could be less than 80 or the minimum weight could be less than 40
(c)		Shown	C1	for evidence of reading from the graph at weight 65 (= 48 to 49) or at cf 45 (= 63)
			C1	eg 25% of 60 is 15 but only 11 potatoes have a weight greater than 65g or 25% of potatoes have a weight greater than 63g
12		48	M1	for 0.25×0.6 (= 0.15) or 0.75×0.4 (= 0.3)
			M1	for 0.25×0.6 (= 0.15) and 0.75×0.4 (= 0.3) or for $24 \div$ "0.15" (= 160)
			A1	cao
13		$(x + 3)^2 - 16$	M1	for $(x + 3)^2$ or $(x^2 + 6x - 7 =) x^2 + 2ax + a^2 + b$
			A1	cao
14		Shown	M1	for $\sqrt[3]{\dfrac{8}{27}}$ $(= \dfrac{2}{3})$ or $\sqrt[3]{\dfrac{27}{8}}$ $(= \dfrac{3}{2})$ or 2 : 3 or 3 : 2
			M1	for $\left(\sqrt[3]{\dfrac{8}{27}}\right)^2$ $(= \dfrac{4}{9})$ or $\left(\sqrt[3]{\dfrac{27}{8}}\right)^2$ $(= \dfrac{9}{4})$ or 4 : 9 or 9 : 4
			A1	132 from correct arithmetic

Question	Working	Answer	Mark	Notes
15 (a)		Shown	M1	for method to establish at least one root between $x = 0$ and $x = 1$, eg f(0) = – 5 and f(1) = 3
			C1	for correct values and a deduction about the roots eg as there is a sign change there must be at least one root between $x = 0$ and $x = 1$ (as f is continuous)
(b)		Shown	C1	for a correct first step in rearrangement, eg $x(x^2 + 7) – 5 = 0$ or $x^3 + 7x = 5$
			C1	for clear and correct steps showing complete rearrangement
(c)	$x_1 = 0.625$ $x_2 = 0.6765327696$ $x_3 = 0.6704483001$	0.6704(483001)	M1 M1 A1	for substitution of 1 into the formula (to get 0.625) for substitution of "$x_1 = 0.625$" and "$x_2 = 0.6765327696$" to give x_2 and x_3 0.6704(483001)
(d)		Comment	M1 C1	substitutes answer to (c) into expression (to get –0.00549...) appropriate comment, eg accurate as answer is close to 0
16		Yes and correct working	B1 P1 A1	for 147.5 or 148.5 or 148.4999... or 11.75 or 11.85 or 11.84999... substitutes $11.8 < UB \le 11.85$ and $147.5 \le LB < 148$ in the formula to work out petrol consumption for 'Yes' and 8.03(3898305...) from correct working
17		14.4	P1	for start of process, eg $0.5 \times 11 \times CD \times \sin105 = 56$
			P1	for complete process to find CD, eg $(CD =) \dfrac{56}{0.5\times11\times\sin105}$ oe (= 10.54)
			P1	for process to find AC, eg $(AC^2 =) 11^2 + [CD]^2 – 2\times11\times[CD] \times\cos105$ ($AC = 17.09$)
			P1	for process to find AB, eg $\dfrac{AB}{\sin48} = \dfrac{[AC]}{\sin118}$
			A1	answer in range 14.3 to 14.4

Question	Working	Answer	Mark	Notes
18 (a)	values 0, 2, 5, 10, 18	130	M1	for starting to find area under the curve, eg $0.5 \times 5 \times 2$ (= 5)
			M1	for a complete method to find the area under the curve using 4 strips of equal width, eg "5" + $0.5 \times 5 \times (2+5)$ (= 17.5) + $0.5 \times 5 \times (5+10)$ (= 37.5) + $0.5 \times 5 \times (10+18)$ (= 70)
			A1	for 130 or answer in range 130.1 to 132 supported by accurate working
(b)		overestimate with reason	C1	for "overestimate" and appropriate reason linked to method eg area between trapeziums and curve also included
19		Proof	M1	starts process to find point of intersection by substituting, eg $(10 + 2y)^2 + y^2$ (= 20)
		(supported)	M1	for expanding, eg $4y^2 + 20y + 20y + 100$ (3 out of 4 terms correct)
			M1	(dep M2) for 3-term quadratic equation ready for solving, eg $5y^2 + 40y + 80 = 0$
			M1	(dep on previous M1) for method to solve an equation of the form $ay^2 + by + c = 0$, eg by factorising or correct substitution into quadratic formula
			C1	fully correct method leading to $y = -4$ or $x = 2$ or $(y + 4)^2 = 0$ or $(x - 2)^2 = 0$ and statement, eg only one point of intersection so the line is a tangent to the circle
20		Proof	C1	draws OC and considers angles in an isosceles triangle (algebraic notation may be used, eg two angles labelled x)
			C1	finds sum of angles in triangle ABC, eg $x + x + y + y = 180$, or sum of angles at O, eg $180 - 2x + 180 - 2y$
			C1	complete method leading to $ACB = 90$
			C1	complete proof with all reasons given, eg base angles of an <u>isosceles</u> <u>triangle</u> are equal, <u>angles</u> in a <u>triangle</u> add up to 180°, <u>angles</u> on a straight <u>line</u> add up to 180°

Paper: 1MA1/3H				
Question	Working	Answer	Mark	Notes
21		$\dfrac{2}{5}$	P1	for process to find $\overrightarrow{AB}$ $(= \mathbf{b} - \mathbf{a})$ or $\overrightarrow{BA}$ $(= \mathbf{a} - \mathbf{b})$
			P1	for process to find $\overrightarrow{MN}$ $(= -\dfrac{1}{2}\mathbf{b} + \mathbf{a} + 2\mathbf{a})$ or $\overrightarrow{PN}$ $(= -k(\mathbf{b} - \mathbf{a}) + 2\mathbf{a})$ or $\overrightarrow{MP}$ $(= -\dfrac{1}{2}\mathbf{b} + \mathbf{a} + k(\mathbf{b} - \mathbf{a})$ or $\dfrac{1}{2}\mathbf{b} + (1 - k)(\mathbf{a} - \mathbf{b}))$
			P1	for process to find two of $\overrightarrow{MN}$, $\overrightarrow{PN}$ and $\overrightarrow{MP}$
			P1	for process to find k, using $\overrightarrow{MN}$ as a multiple of $\overrightarrow{PN}$ or using $\overrightarrow{MN}$ as a multiple of $\overrightarrow{MP}$ or using $\overrightarrow{PN}$ as a multiple of $\overrightarrow{MP}$
			A1	for $\dfrac{2}{5}$ oe

Question 2

London	$1.089 \times 1.46 = \$1.58(9..)$ per litre	$\rightarrow$	$1.589... \times 3.785 = \$6.01(7..)$ per gallon
	$1.089 \times 3.785 = £4.12(1..)$ per gallon	$\rightarrow$	$4.121... \times 1.46 = \$6.01(7..)$ per gallon
New York	$2.83 \div 1.46 = £1.93(8..)$ per gallon	$\rightarrow$	$1.938... \div 3.785 = £0.51(2..)$ per litre
	$2.83 \div 3.785 = \$0.74(7..)$ per litre	$\rightarrow$	$0.747... \div 1.46 = £0.51(2..)$ per litre

The table shows the most commonly used approaches. There are of course other approaches that can be used.

Question 9(a)

n	$(0.85)^n$	$12\,500 \times (0.85)^n$
1		10 625
2	0.7225	9031.25
3	0.614125	7676.5625
4	0.52200625	6525.078125
5	0.4437053125	5546.316406

Modifications to the mark scheme for Modified Large Print (MLP) papers.

Only mark scheme amendments are shown where the enlargement or modification of the paper requires a change in the mark scheme.

The following tolerances should be accepted on marking MLP papers, unless otherwise stated below:
Angles: ±5°
Measurements of length: ±5 mm

PAPER: 1MA1_3H			
Question		**Modification**	**Mark scheme notes**
1		Numbers in the table have changed to: 130-140: **5**; 140-150: **10**; 150-160: **20**; 160-170: **30**; 170-180: **15** In part (b) Diagram enlarged. Right axis has been labelled. Axes labels moved to the left of the horizontal axis and above the vertical axis. Vertical axis extended so it goes up to 35.	Standard mark scheme with the amendment: Line segments joining the points (135, 5), (145, 10), (155, 20), (165, 30) and (175, 15)
6		Diagram enlarged. Wording added 'Diagram (i) shows'. Shape labelled as 'Diagram (i)'. Wording added 'Diagram (ii)' after '8-sided shape,' Shape labelled as 'Diagram (ii)'.	Standard mark scheme
10		Table turned to vertical format.	Standard mark scheme

PAPER: 1MA1_3H		
Question	**Modification**	**Mark scheme notes**

11	Diagram enlarged and right axis labelled.
	    Axes labels moved to the left of the horizontal axis and above the vertical axis.
	    Graph line moved so it goes through (40, 5) (55, 30) and (65, 50).
		Standard mark scheme

		(a) B1 55 cao (b) standard mark scheme (c) standard mark scheme with some adjustments: C1 reads from graph at weight 65 (= 50) or at cf 45 (in range 8 to 9.5) C1 eg 25% of 60 is 15 but only 10 potatoes have a weight greater than 65g or 25% of potatoes have a weight greater than 63g (approx.)

PAPER: 1MA1_3H		
Question	**Modification**	**Mark scheme notes**
12	Diagram enlarged.	Standard mark scheme
17	Diagram enlarged. Angles moved outside of the angle arcs and the angle arcs made smaller. Wording added 'Angle ABC = 118°, Angle BCA = 48°, Angle ADC = 105° and AD = 11cm.'	Standard mark scheme
18	Diagram enlarged and right axis labelled. Axes labels moved to the left of the horizontal axis and above the vertical axis. Graph line moved to go through points (0, 0) (5, 2.5) (10, 5) (20, 17.5) (23.75, 25).	M1 for splitting the area into 4 strips and a method of finding the area of one shape under the graph, eg $0.5 \times 5 \times 2.5$ (= 6.25) M1 for complete method to find the area under the curve, eg "6.25" + $0.5 \times 5 \times (2.5+5)$ (= 18.5) + $0.5 \times 5 \times (5+12)$ (= *42.5*) + $0.5 \times 5 \times (12+17.5)$ (= *73.75*) [figures in italic will be approximate] A1 for value near to 140-141 (b) standard mark scheme
20	Diagram enlarged. Dot at O made bigger.	Standard mark scheme
21	Diagram enlarged.	Standard mark scheme