



Pearson
Edexcel

Mark Scheme (Results)

Summer 2023

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. Send the response to review for your Team Leader to check.

- 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 (eg 3.5 – 4.2) then this is inclusive of the end points (eg 3.5, 4.2) and all numbers within the range

11 Number in brackets after a calculation

Where there is a number in brackets after a calculation eg $2 \times 6 (=12)$ then the mark can be awarded **either** for the correct method, implied by the calculation **or** for the correct answer to the calculation.

12 Use of inverted commas

Some numbers in the mark scheme will appear inside inverted commas eg "12" \times 50 ; the number in inverted commas cannot be any number – it must come from a correct method or process but the candidate may make an arithmetic error in their working.

13 Word in square brackets

Where a word is used in square brackets eg [area] \times 1.5 : the value used for [area] does **not** have to come from a correct method or process but is the value that the candidate believes is the area. If there are any constraints on the value that can be used, details will be given in the mark scheme.

14 Misread

If a candidate misreads a number from the question. eg uses 252 instead of 255; method or process marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review.

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 awarded for a fully correct statement(s) with no contradiction or ambiguity
- 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

Paper: 1MA1/3H

Question	Answer	Mark	Mark scheme	Additional guidance
1 (a)	m^6	B1	cao	
(b)	x^{13}	B1	cao	
(c)	$4p^3 + 12p^2$	B2	for $4p^3 + 12p^2$	
		(B1)	for expanding the bracket to get $p^3 + 3p^2$ or $4p^3$ or $12p^2$	
2 (a)	11533	P1	for working with 68%, eg 800×0.68 (= 544 people) oe or “16960” \times 0.68 oe	Percentage calculation could be done at any stage
		P1	for a correct process, other than that of finding a %, eg “544” \times 2 (= 1088) or 10.6×2 (= 21.2) or 800×2 (= 1600) or “544” \times 10.6 (= 5766.4) or 800×10.6 (= 8480)	
		P1	for full process to find amount of coffee required eg “1088” \times 10.6 or “544” \times “21.2” or “5766.4” \times 2 (= 11532.8) or for an answer of 11532	
		A1	for answer in the range 11532.5 to 11533	An answer within the range shown in working but incorrectly rounded gets full marks.
(b)	Statement	C1	for a correct statement Acceptable examples the amount will be more he will need more coffee it is an underestimate my answer in part (a) means there would not be enough for everyone he will need 12211(.2) needs 678(.4) more Not acceptable examples amount will decrease amount of coffee will change	If figures are given as part of the answer they must be correct, but can allow ft.

Paper: 1MA1/3H

Question	Answer	Mark	Mark scheme	Additional guidance
3	Shown with reasons	<p>M1</p> <p>M1</p> <p>A1</p> <p>C1</p> <p>C1</p>	<p>for method to find ACD using parallel lines eg $BCA = 125$ and $ACD = 180 - 125 (= 55)$ or $BCF = 180 - 125 (= 55) = ACD$ or $FCD = 125$ and $ACD = 180 - 125 (= 55)$ or $CFG = 180 - 125 (= 55) = ACD$</p> <p>for method to find ADC eg $180 - 110 (= 70)$ or for method to find CAD eg $180 - ("70" + "55") (= 55)$ or $110 - "55" (= 55)$</p> <p>for $ACD = 55$ and $CAD = 55$</p> <p>for one correct parallel lines reason linked to their method eg <u>Corresponding</u> angles are equal <u>Allied</u> angles / <u>Co-interior</u> angles add up to 180 <u>Alternate</u> angles are equal</p> <p>for one other reason stated linked to their method eg <u>Angles</u> on a <u>straight line</u> add up to 180 <u>Angles</u> in a <u>triangle</u> add up to 180 <u>Vertically opposite</u> angles are equal OR <u>Vertically opposite</u> angles are equal The <u>exterior angle</u> of a triangle is <u>equal</u> to the sum of the <u>interior opposite</u> angles. <u>Angles</u> in a <u>quadrilateral</u> add up to 360. Accept "4-sided shape"</p>	<p>Angles must be clearly labelled on the diagram or otherwise identified. Correct method can be implied from angles on the diagram if no ambiguity or contradiction.</p> <p>Underlined words need to be shown; reasons need to be linked to their method, which can be implied from correctly identified angles (stated or written on the diagram).</p>
4	17.5	<p>P1</p> <p>A1</p>	<p>for a first step, eg $5 \times 14 (= 70)$ or $14 \div 4 (= 3.5)$ or $5 \div 4 (= 1.25)$ or $4 \div 5 (= 0.8)$</p> <p>oe</p>	<p>Could be done algebraically. 11.2 as answer scores no marks.</p>

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
5 (a)	63	B1	for 63, accept $3 \times 3 \times 7$ or $3^2 \times 7$	(A =) $2^2 \times 3^4 \times 7$ scores 0 marks
(b)	15 876	M1	for at least two of $2^2, 3^4, 7^2$ or shows at least 3 multiples of 2268, eg 2268, 4536, 6804 and at least 3 multiples of 441, eg 441, 882, 1323	
		A1	for 15 876 or $2^2 \times 3^4 \times 7^2$ oe	
6	65	P1	for a correct process to find the number of seconds, eg $67\,205\,600 \div 11.9 (= 5\,647\,529.4\dots)$ or for a correct process to convert between seconds and days, eg $24 \times 60 \times 60 (= 86\,400)$ oe, may be seen in stages or $11.9 \times 60 \times 60 \times 24 (= 1\,028\,160)$	Note that this mark may be awarded at any stage in the working. If a correct answer within the range is shown in working but incorrectly rounded award full marks.
		P1	for a complete process, eg “ $5\,647\,529.4\dots$ ” \div “ $86\,400$ ” or $67\,205\,600 \div$ “ $1\,028\,160$ ”	
		A1	accept answers in the range 65 to 65.4 or 66	
7 (a)	(1, -3)	B1	cao	
(b)	-0.7 or 2.7	B1	for an answer in the range -0.8 to -0.6 or 2.6 to 2.8	
8	648	M1	for substitution into density formula eg 9×72 or $9 = \frac{m}{72}$	
		A1	cao	

Paper: 1MA1/3H																
Question	Answer	Mark	Mark scheme	Additional guidance												
9	56	P1 A1	for $70 \times 80 \div 100$ oe or for the use of $0.7 \times 0.8 (= 0.56)$ oe cao													
10	3.1	P1 P1 A1	for using sin to find length of AC, eg $6.8 \times \sin 41$ or a full process to find AC or (AC =) 4.46... or a full process to find AD or (AD =) 5.44... for a complete process to find a relationship involving DC eg $\tan 55 = \frac{4.46...}{DC}$ or (DC =) $\frac{4.46...}{\tan 55}$ or $\cos 55 = \frac{DC}{5.44...}$ answer in the range 3.1 to 3.2	Accept rounded or truncated figures. If a correct answer within the range is shown in working but is incorrectly rounded, award full marks.												
11 (a)	Box plot	B3 (B2 (B1	for fully correct box plot for box plot showing a box and whiskers and at least 3 correctly plotted values from 169, 174, 177, 180, 186) for at least 2 correctly plotted values including a box or whiskers)	Box can be of any height. Accept ends that are marked (eg line, cross, dot) or defined by the end of the whiskers if clear												
(b)	Comparisons	C1 C1	(ft) for a correct comparison of medians, eg the median for Adults is greater than the median for Teenagers or the Teenagers heights are lower in general as the median is lower (ft) for a correct comparison of a measure of spread, eg the interquartile (range) of the Adults is the same as (similar to) the IQR of the Teenagers, the range of the Teenagers is greater than the range of the Adults Comparisons for this mark can relate to the range or the IQR.	For 2 marks, at least one comparison must be in context (eg refers to heights or cm). Simply quoting values for median and range and IQR is insufficient, they must be compared <table style="margin-left: auto; margin-right: auto;"><tr><td></td><td>Median</td><td>Range</td><td>IQR</td></tr><tr><td>Adults</td><td>177</td><td>17</td><td>6</td></tr><tr><td>Teenagers</td><td>169</td><td>20.5</td><td>6</td></tr></table> Figures need not be seen but if given they must be correct.		Median	Range	IQR	Adults	177	17	6	Teenagers	169	20.5	6
	Median	Range	IQR													
Adults	177	17	6													
Teenagers	169	20.5	6													

Paper: 1MA1/3H

Question	Answer	Mark	Mark scheme	Additional guidance
12	Shown	M1 M1 A1	for a method to find the product of two linear expressions (3 out of 4 terms correct or 4 correct terms ignoring signs) eg $x^2 + 3x - x - 3$ or $x^2 + 3x - 5x - 15$ or $x^2 - 5x - x + 5$ for a complete method to obtain all terms, half of which are correct (ft their first product) eg $x^3 - 5x^2 - 10x + 2x^2 - 3x + 15$ for $x^3 - 3x^2 - 13x + 15$ shown, accept $x^3 + -3x^2 + -13x + 15$	Note that (eg) $2x - 3$ in expansion of $(x - 1)(x + 3)$ is to be regarded as 3 correct terms. First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
13	Proof	M1 M1 C1	for giving a general term for a consecutive triangular number eg $\frac{(n+1)(n+2)}{2}$ or $\frac{(n-1)n}{2}$ for $\frac{n(n+1)}{2} + \frac{(n+1)(n+2)}{2}$ or $\frac{(n-1)n}{2} + \frac{n(n+1)}{2}$ oe for completing the proof to show a square number, eg $(n + 1)^2$ or n^2	
14	19.9	P1 P1 P1 A1	for substituting into the cosine rule to find OB , eg $(OB^2) = 9^2 + 6^2 - 2 \times 9 \times 6 \times \cos 35$ for using correct order of operations eg $81 + 36 - 88.46... (= 28.5...)$ for process to find the area of the sector, eg $\frac{80}{360} \times \pi \times "5.34...^2"$ for answer in the range 19.8 to 20	May be implied by $OB = 5.34...$ Values may be rounded or truncated. If a correct answer within the range is shown in working but incorrectly rounded award full marks.

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15 (a)	$(a - b)(a + b)$	B1	for $(a - b)(a + b)$ oe	
(b)	Relationship shown	M1 C1	for factorising the expression, eg $(2^{20} - 1)(2^{20} + 1)$ or for $(2^{40} =) (2^{20})^2$ for explanation, eg 2^{20} is even so $2^{20} - 1$ and $2^{20} + 1$ are odd (leading to conclusion)	Note that 1048575 and 1048577 earns 2 marks as an alternative approach
16	Triangle at (6, -2) (4, 4) (8, 4)	M1 A1	for the correct shape in the correct orientation in the wrong position or for two correct points cao	
17 (a)	16.5 to 19.5	M1 M1 A1	for tangent drawn at $t = 2.5$ dep (M1) for a complete method to find the gradient from tangent eg $(48 - 0) \div (4 - 1.4) (= 18.4\dots)$ for answer in the range 16.5 to 19.5 or ft acceptable tangent	The tangent must be seen to award any marks Award 0 marks for a correct answer (in the range) with no (or incorrect) supportive working
(b)	Description	C1	eg speed or velocity	“speed” may be expressed in a different way, eg distance per unit time (at that point) Award if extra information is given provided not contradictory.

Paper: 1MA1/3H

Question	Answer	Mark	Mark scheme	Additional guidance
20	Proof	M1 M1 C1	for $(10x =) 1.2323\dots$ or $(100x =) 12.323\dots$ or $(1000x =) 123.23\dots$ (dep M1) for a method using two recurring decimals that leads to a terminating decimal difference, using correct multiples of x eg $(1000x - 10x =) 123.23 \dots - 1.23 \dots (= 122)$ or $\frac{122}{990}$ or $(100x - x =) 12.323 \dots - 0.123 \dots (= 12.2)$ or $\frac{12.2}{99}$ for completing algebra to $\frac{61}{495}$	Any recurring notation acceptable throughout. Proofs with terminating decimals (at least 5 figures) score M1M1C0
21	-2 and $-\frac{3}{2}$	M1 M1 M1 A1	for writing a correct equation without fractions eg $(2 - 2x) + 3(x + 4) = (2 - 2x)(x + 4)$ oe for simplifying to a correct equation in the form $ax^2 + bx + c (= 0)$, eg $2x^2 + 7x + 6 (= 0)$ for method to solve a correct quadratic equation, eg $(2x + 3)(x + 2) (= 0)$ or correct substitution into the formula or for correctly completing the square for -2 and $-\frac{3}{2}$ oe	

Paper: 1MA1/3H

Question	Answer	Mark	Mark scheme	Additional guidance
24	$\frac{5x^2-23x+50}{9x^2-3x}$	<p>P1</p> <p>P1</p> <p>P1</p> <p>P1</p> <p>A1</p>	<p>for using $y = 3x$ or $x = \frac{1}{3}y$ to obtain an expression for a probability in one variable</p> <p>for a correct second probability eg $\frac{x-1}{y-1}$ or $\frac{x-1}{3x-1}$ or $\frac{4}{y-1}$ or $\frac{4}{3x-1}$ or $\frac{y-x-6}{y-1}$ or $\frac{2x-6}{3x-1}$</p> <p>for forming a correct product eg $\frac{x}{y} \times \frac{x-1}{y-1}$ or $\frac{x}{3x} \times \frac{x-1}{3x-1}$ or $\frac{5}{y} \times \frac{4}{y-1}$ or $\frac{5}{3x} \times \frac{4}{3x-1}$ or $\frac{y-x-5}{y} \times \frac{y-x-6}{y-1}$ or $\frac{2x-5}{3x} \times \frac{2x-6}{3x-1}$</p> <p>for adding the 3 correct probabilities eg $\frac{x}{y} \times \frac{x-1}{y-1} + \frac{5}{y} \times \frac{4}{y-1} + \frac{y-x-5}{y} \times \frac{y-x-6}{y-1}$ or $\frac{x}{3x} \times \frac{x-1}{3x-1} + \frac{5}{3x} \times \frac{4}{3x-1} + \frac{2x-5}{3x} \times \frac{2x-6}{3x-1}$</p> <p>$\frac{5x^2-23x+50}{9x^2-3x}$</p>	<p>This may be awarded at any time</p> <p>Can be seen after processing of algebra</p>

Modifications to the mark scheme for Modified Large Print (MLP) papers: 1MA1 3H

Only mark scheme amendments are shown where the enlargement or modification of the paper requires a change in the mark scheme. Notes apply to both MLP papers and Braille papers unless otherwise stated.

The following tolerances should be accepted on marking MLP papers, unless otherwise stated below:

Angles: $\pm 5^\circ$

Measurements of length: ± 5 mm

PAPER: 1MA1_3H			
Question	Modification	Mark scheme notes	
1	(b)	Letter 'x' changed to 'y'.	Standard mark scheme but note change of letter.
2	(a)	Letter 'g' at end of answer line changed to 'grams'	Standard mark scheme
3		Wording added 'Look at the diagram for Question 3 in the Diagram Booklet. It shows triangle AGF and two straight lines ACF and ADG.' Wording removed 'ACF and ADG are straight lines.' Wording added 'Angle CDG = 110° ; Angle EFC = 125° ' Diagram enlarged. Angles moved outside of angle arcs. Angle arcs made smaller.	Standard mark scheme
5	(b)	Wording added 'Remember: $A = 2^2 \times 3^4 \times 7$ $B = 3^2 \times 7^2$ '	Standard mark scheme
7		Wording added 'Look at the diagram for Question 7 in the Diagram Booklet. It shows'. Wording 'Here is' removed. Diagram enlarged. Axes labels moved to above the vertical axes and right of the horizontal axes.	Standard mark scheme
8		Letter 'g' at end of answer line changed to 'grams'	Standard mark scheme

10		<p>Wording added ‘Look at the diagram for Question 10 in the Diagram Booklet. It shows a triangle ABD.’ Wording removed ‘ABD is a triangle.’</p> <p>Diagram enlarged. Angles moved out of angle arcs. Angle arcs made smaller.</p> <p>Right angles made more obvious.</p> <p>Wording added ‘AB = 6.8 cm; Angle ABC = 41°; Angle ADC = 55° ’</p> <p>Wording added: Angle ACB and angle ACD are right angles.</p>	Standard mark scheme												
11		<p>Wording added ‘below’. Table enlarged and left aligned.</p> <p>Values changed in the table, so values can be plotted on the modified grid.</p> <p>169 cm changed to 170 cm; 186 cm changed to 185 cm; 177 cm changed to 177.5 cm, 174 cm changed to 175 cm</p>													
11	(a)	<p>Wording added ‘Look at the diagram for Question 11(a) in the Diagram Booklet. It shows a grid.’</p> <p>Diagram enlarged, no small squares. Open headed arrow. Axis label moved to the left of the horizontal axis.</p>	Standard mark scheme but using the key values: 170, 175, 177.5, 180, 185												
11	(b)	<p>Wording added ‘Look at the diagram for Question 11(b) in the Diagram Booklet. It is a box plot showing the distribution of the heights of a group of teenagers.’</p> <p>Wording removed ‘below’. Diagram enlarged. Small squares removed. Open headed arrow.</p> <p>Axis label moved to the left of the horizontal axis. Box plot changed so values can be read on the modified grid:</p> <p>Key values now at 157.5, 165, 167.5, 172.5, 177.5</p>	Standard mark scheme but using the new key values: <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Median</th> <th>Range</th> <th>IQR</th> </tr> </thead> <tbody> <tr> <td>Adults</td> <td>177.5</td> <td>15</td> <td>5</td> </tr> <tr> <td>Teenagers</td> <td>167.5</td> <td>20</td> <td>7.5</td> </tr> </tbody> </table>		Median	Range	IQR	Adults	177.5	15	5	Teenagers	167.5	20	7.5
	Median	Range	IQR												
Adults	177.5	15	5												
Teenagers	167.5	20	7.5												
14		<p>Wording added ‘Look at the diagram for Question 14 in the Diagram Booklet.’</p> <p>Diagram enlarged. Angles moved out of angle arcs. Angle arcs made smaller.</p> <p>Wording added ‘BA = 9 cm; AO = 6 cm; Angle BAO = 35°; Angle BOC = 80</p>	Standard mark scheme												
15	(a)	Letter ‘a’ changed to ‘x’; Letter ‘b’ changed to ‘y’.	Standard mark scheme but note change of letter.												

16	<p>Wording added ‘Look at the diagram for Question 16 in the Diagram Booklet. It shows triangle T and triangle U on a grid.’ Diagram enlarged. Open headed arrows.</p> <p>Axes labels moved to above the vertical axes and right of the horizontal axes.</p> <p>Triangle U added on the grid. Shapes labelled as ‘triangle T’ and ‘triangle U’. Shading changed.</p> <p>Question changed.</p> <p>Wording removed ‘On the grid, enlarge triangle T by scale factor -2 with centre of enlargement (-2,-2)’</p> <p>Wording added ‘Describe fully the single transformation that maps triangle T onto triangle U.’</p>	<p>B2 for enlargement scale factor -2 centre $(-2, -2)$ (B1 for two of these three aspects) Award no marks if more than one transformation is given.</p>
17	<p>Wording removed ‘Here is’.</p> <p>Wording added ‘Look at the diagram for Question 17 in the Diagram Booklet. It shows’.</p> <p>Diagram enlarged. Open headed arrows. Right axis labelled. Small squares removed.</p>	<p>Standard mark scheme</p>
18	<p>Wording added ‘Look at Diagram 1, Diagram 2 and the formula for Question 18 in the Diagram Booklet. You may be provided with two models for this question and an additional formula model. They show a cone and a frustum.’ Wording removed ‘in the diagram.’</p> <p>Wording added ‘by Diagram 1 and the models. Diagram 2 is a simplified 2D diagram of the frustum.’</p> <p>Formula diagram enlarged and a formula model provided.</p> <p>Wording added to the formula ‘You may be provided with a model.’</p> <p>3D frustum diagram enlarged. Dashed lines made longer and thicker.</p> <p>Open headed arrows. 2D diagram added. Model of frustum provided.</p> <p>Braille additional wording: Ask for the model for Question 18. The model is a large cone made from a small cone and a frustum. The small cone is detachable from the frustum. On the model: the slant height of the small cone is 6 cm; the slant height of the large cone is 10 cm the slant height of the frustum is 4 cm; the radius of the base of the large cone is 3 cm.”</p>	<p>Standard mark scheme</p>

19	<p>Wording added 'Look at the diagram for Question 19 in the Diagram Booklet. It shows a graph.'</p> <p>'$0 \leq x \leq 4$' changed to '$0 \leq x \leq 2$'</p> <p>Wording added 'in the Diagram Booklet'</p> <p>Diagram enlarged but produced only in the range $0 \leq x \leq 2$. Small squares removed. Right axis labelled.</p> <p>y axis cut at 10; x axis cut at 2.</p> <p>Axes labels moved to above the vertical axes and right of the horizontal axes.</p>	Standard mark scheme
21	Letter 'x' changed to 'y'.	Standard mark scheme but note change of letter.

