



Mark Scheme (Results)

November 2019

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 (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.

11 Number in brackets after a calculation

Where there is a number in brackets after a calculation E.g. $2 \times 6 (=12)$ 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 E.g. "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 E.g. [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)			3 terms correct can be implied, eg $x^2 - 4x + c$
		M1	for 3 of 4 terms correct or 4 terms correct ignoring signs	
	(b)	A1	cao	
		B2	for $3x(3x + 2)$	
		(B1	for $3(3x^2 + 2x)$ or $x(9x + 6)$ or $3x(ax + b)$ where a and b are integers or $(3x + 2)$ as a factor)	
2	(a)			Answer must be given to at least 3 decimal places rounded or truncated Accept a clear indication of the decimal point. Check first 3 decimal places only
		M1	for 836.4 or 5.304(809139) or 28.141 or a truncated or rounded version of 157.668255 to no less than 3 sf	
	(b)	A1	for 157.668(255)	
		B1	ft from part (a) provided answer to (a) has at least 5 sf	
3	35 to 42	M1	for drawing a suitable line of best fit or for a line from $x = 34$ or for a point marked on the grid at $(34, y)$, y in the range 33 to 44	Line at $x = 34$ does not have to be full length of grid but should be in or reach the data set. Acceptable values for the data set are $y = 33$ to $y = 44$
		A1	answer in the range 35 to 42	

Paper: 1MA1/3H															
Question	Answer	Mark	Mark scheme	Additional guidance											
4	18.6	M1	for finding 4 products within intervals (including end points)		<table><tr><td>Min fx</td><td>Max fx</td></tr><tr><td>5</td><td>10</td></tr><tr><td>20</td><td>30</td></tr><tr><td>105</td><td>140</td></tr><tr><td>160</td><td>200</td></tr></table>	Min fx	Max fx	5	10	20	30	105	140	160	200
		Min fx	Max fx												
		5	10												
20	30														
105	140														
160	200														
M1	for $\Sigma“fx” \div (1 + 2 + 7 + 8)$ or $(7.5 \times 1 + 12.5 \times 2 + 17.5 \times 7 + 22.5 \times 8) \div (1 + 2 + 7 + 8)$ or $(“7.5” + “25” + “122.5” + “180”) \div “18”$ or $“335” \div “18”$		$\Sigma“fx”$ must come from 4 products fx within intervals (including end points)												
A1	for 18.6(111...)														
5	37 000	B1	cao												
6	50	B1	for finding the time difference, eg, 1hr 18 mins or 78 mins oe	Allow 1.18 for this mark 118 scores B0											
		P1	for correct process to convert minutes to hours, eg $18 \div 60 (=0.3)$ or $78 \div 60 (=1.3)$ or for a correct process to convert speed in miles per minute to mph eg $“0.833..” \times 60$	For a conversion of time or speed											
		P1	for using speed = distance $\div$ time eg, $65 \div [\text{time}]$ or $65 \div 78 (=0.833..)$	[time] is what the candidate clearly indicates as time difference											
		A1	cao SCB2 for 83(.333...) seen as the answer												

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
8	45	P1	for $180 - 117 (=63)$ or states, or uses, exterior angle $+ x = 117$	Angles may be shown on the diagram.
		P1	for process to find the exterior or the interior angle of the pentagon, eg $360 \div 5 (=72)$ or $180 - (360 \div 5) (=108)$ or $((5-2) \times 180) \div 5 (=108)$	Any angle labelled correctly as 63 and not contradicted scores this mark
		P1	for a complete process to find x , eg $180 - "72" - "63"$ or $"108" - "63"$ or $117 - "72"$	Exterior = 108 or interior = 72 does not score the mark
		A1	cao	An answer of 45 with no supporting working scores 0
9	Enlargement	B2	vertices at (2.5, 1) (2.5, 6) (5, 6)	
		(B1	for triangle of the correct size and orientation in the wrong position or a correct enlargement of a different scale factor centre (0, 1) or correct orientation with 2 of 3 vertices correct)	
10 (a)	8.5	M1	for multiplying both sides by 7 as a first step eg $9 + x = 7(11 - x)$ or dividing each term on the left hand side by 7 eg $\frac{9}{7} + \frac{x}{7} = 11 - x$	$\times 7$ written near the equation is not enough for this mark
		M1	(dep M1) for method to isolate the x terms on one side	
		A1	oe	
(b)	$4(y + 3)$	B1	$4(y + 3)$ or $4y + 12$	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
11	0.1709	M1	for one product, $0.07 \times 0.98 (=0.0686)$ or $0.93 \times 0.11 (=0.1023)$ or $0.07 \times 0.02 (=0.0014)$ or $0.93 \times 0.89 (= 0.8277)$	If all products shown, award this mark
		M1	for a fully correct method, eg $0.07 \times 0.98 + 0.93 \times 0.11$ or $1 - (0.07 \times 0.02) - (0.93 \times 0.89)$	
		A1	oe	
12	Box plot	M1	for correctly identifying one of the LQ (188), median (197) or UQ (209) from the stem leaf	May be implied by one of these values being correctly plotted.
		M1	for showing a box and at least 3 correctly plotted values from 173, 188, 197, 209, 219	
		A1	for a fully correct box plot	
13	739	P1	process to find the volume of C, eg $\pi \times 3^2 \times 25 (= 706.8583471$ or $225\pi)$	For use of 3.14 Volume of C is 706.5
		P1	process to find the volume of A or the volume of B, eg $"706.8..." \times \frac{2}{2+13} (= 94.24777961$ or $30\pi)$ or $"706.8..." \times \frac{13}{2+13} (= 612.6105675$ or $195\pi)$ or process to work with density and ratio, eg $(2 \times 1.21 + 13 \times 1.02) (= 15.68)$	Volume of A is 94.2 Volume of B is 612.3
		P1	process to find the mass of C, eg $"30\pi" \times 1.21 (= 114.0398133) +$ $"195\pi" \times 1.02 (= 624.8627788)$ or $"225\pi" \times "15.68" \div (2+13)$	Mass of A is 113.982 Mass of B is 624.546
		A1	for an answer in the range 738.5 to 739	Do not award accuracy mark if the figure is from obvious incorrect working

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
14	$\frac{13}{20}$	P1	for finding the fraction who chose either soup ($\frac{2}{5}$ oe) or chose prawns ($\frac{3}{5}$ oe) or for process to share any number in the ratio 2 : 3 eg $100 \div (2 + 3) \times 2$ (=40)	Starting number 100 Soup : Prawn 40:60
		P1	for a process that could lead to the proportion who chose lasagne or curry for either starter, eg sharing 40% (soup) in the ratio 5 : 3 or sharing 60% (prawns) in the ratio 1 : 5 or $\frac{2}{5} \times \frac{5}{8}$ or $\frac{2}{5} \times \frac{3}{8}$ or $\frac{3}{5} \times \frac{1}{6}$ or $\frac{3}{5} \times \frac{5}{6}$ or for continuing the process with their starting number to find the number who chose lasagne or curry for either starter	L:C L:C 25:15 10:50
		P1	for a complete process to find the proportion who chose curry for both starters, eg $(\frac{2}{5} \times \frac{3}{8}) + (\frac{3}{5} \times \frac{5}{6})$ or to find the number who chose curry for both starter for their starting number	15 + 50 =65 and $\frac{15+50}{100}$
		A1	$\frac{13}{20}$ or equivalent fraction	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	Proof	M1	for correct expressions for two consecutive even numbers eg $2n$ and $2n+2$	$(2n)^2 + (2n + 2)^2$ $= 4n^2 + 4n^2 + 8n + 4$ $= 8n^2 + 8n + 4 = 4(2n^2 + 2n + 1)$
		M1	(dep M1) for expanding both expressions with at least one expansion fully correct eg $4n^2$ and $4n^2 + 4n + 4n + 4$ or for factorising both terms and intention to square correctly eg $(2n)^2$ and $2^2(n+1)^2$	Or $(2n)^2 + (2n - 2)^2$ $= 4n^2 + 4n^2 - 8n + 4$ $= 8n^2 - 8n + 4 = 4(2n^2 - 2n + 1)$
		A1	complete proof	Or $(2n)^2 + (2n + 2)^2$ $= 4(n)^2 + 4(n + 1)^2$ $= 4(n^2 + (n + 1)^2)$
16	-7.5	M1	for stating a correct relationship, eg $y = \frac{k}{x^2}$ or $8 = \frac{k}{2.5^2}$	Accept $y \propto \frac{k}{x^2}$ where k may be 1
		A1	for $k = 50$, could be seen in an equation	
		A1	-7.5 oe	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
17	2.7 and -0.7	M1	for $x^2-3 = 2x-1$ oe or $x^2-3 -2x + 1 (=0)$ or completing the square eg $(y=)(x-1)^2-1-2$	Line segments required For 1.7 allow from 1.6 to 1.8 For -1.7 allow from -1.8 to -1.6 Points indicated or attempt to read off x -axis at the appropriate points – maybe indicated by dashes No marks will be awarded for correct answers only
		M1	(dep M1) draws graph of $y = 2x-1$ or drawing the translated graph or describing the translation in words or $-1.7 + 1 (= -0.7)$ or $1.7 + 1 (=2.7)$	
		M1	shows the points of intersection clearly for the given quadratic graph and linear graph or for one correct solution from appropriate supportive working	
		A1	for x in the range 2.6 to 2.8 and -0.6 to -0.8 SCB2 for plotting $y = 2x + 1$ and values for x in the range -1.1 to -1.3 and 3.1 to 3.3	
18	1.95	P1	for correct substitution into the cosine rule, eg $3.4^2 = 6.1^2 + 6.2^2 - 2 \times 6.1 \times 6.2 \times \cos BCA$	Can be any angle within triangle ABC P2 can be awarded for $BCA = 32(.08046913...)$ Must not come from incorrect processing
		P1	for a full process to find BCA eg $(\cos BCA =) \frac{6.1^2 + 6.2^2 - 3.4^2}{2 \times 6.1 \times 6.2}$ or $(BCA =) 32(.08046913...)$	
		P1	correct substitution into the sine rule, eg $\frac{DC}{\sin("32.08..." \times \frac{2}{5})} = \frac{6.2}{\sin(180 - "32.08..." - ("32.08..." \times \frac{2}{5}))}$	
		P1	for complete process to find DC eg $(DC =) \frac{6.2 \times \sin "12.832"}{\sin "135.088"}$	
		A1	Answer in the range 1.94 to 1.951	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	3.4	M1	for drawing a suitable tangent at $t = 6$	Use of change in y over change in x Answers of $\frac{10}{6}$ oe scores no marks
		M1	for a full method to find the gradient of the tangent at $t=6$, eg $20 \div 5.8$	
		A1	answer in the range 3.05 to 3.7	
20	$n^2 - 2n$	M1	for correct deduction from differences, eg 2nd difference of 2 implies $1n^2$ or gives a quadratic expression which includes the term $1n^2$ or states 1,4,9,16,25 and deduces 2,4,6,8,10	
		A1	oe	
21	$\frac{1}{81}$	M1	for finding the probability of heads eg $\sqrt[4]{\frac{16}{81}}$ ($= \frac{2}{3}$) or for finding the probability of tails $1 - \sqrt[4]{\frac{16}{81}}$ ($= \frac{1}{3}$)	Seeing a probability of $\frac{2}{3}$ or $\frac{1}{3}$ is enough for this mark
		A1	oe	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
22	7x	M1	multiplication by reciprocal, eg $\frac{7(x-2)}{(x-2)(x+6)} \times \frac{x(x+6)(x-6)}{x-6}$	Independent mark, may be awarded at any point
		M1	for factorising the numerator or denominator of the 1 st fraction, eg $\frac{7(x-2)}{(x-2)(x+6)}$ or $\frac{7(x-2)}{x^2+4x-12}$ or $\frac{7x-14}{(x-2)(x+6)}$	
		M1	for factorising the denominator of the second fraction, eg $\frac{x-6}{x(x+6)(x-6)}$ ($= \frac{1}{x(x+6)}$)	
		A1	completing the algebra to reach 7x	
23	264	P1	correct substitution into the volume formula, eg $56.8 = \frac{1}{3} \times \pi \times r^2 \times 3.6$	AOB does not need to be the subject of the equation
		P1	completes process to find base radius or the value of r ² , eg $r = \sqrt{\frac{56.8 \times 3}{\pi \times 3.6}}$ (=3.88158...) or $r^2 = \frac{56.8}{1.2\pi}$ (=15.066)	
		P1	Uses Pythagoras to find the sloping length, eg $\sqrt{3.88^2 + 3.6^2}$ (=5.29.....)	
		P1	process to find an equation in AOB, eg $\pi \times "3.88" \times "5.29" = \frac{AOB}{360} \times \pi \times "5.29" ^2$ or $\frac{AOB}{360} \times \pi \times 2 \times "5.29" = 2 \times \pi \times "3.88"$ or $\frac{AOB}{360} \times "5.29" = "3.88"$	
		A1	answer in the range 263.9 to 264.1	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
24	4 : 3	P1	Process to find a missing vector using the given ratios as fractions, eg. $\frac{1}{3}$ of $\overrightarrow{OX}$ ($=\frac{1}{3}\mathbf{a}$) or. $\frac{1}{4}$ of $\overrightarrow{OY}$ ($=\frac{1}{4}\mathbf{b}$)	Might be embedded in their answer for ZP The award of this mark implies the first two process marks.
		P1	for a process to use $\overrightarrow{ZO} = \overrightarrow{YX} = \mathbf{a} - \mathbf{b}$ oe	
		P1	for a process to find either $\overrightarrow{ZP}$ or $\overrightarrow{ZR}$ in terms of $\mathbf{a}$ and $\mathbf{b}$, eg. either $\overrightarrow{ZP} = \mathbf{a} - \mathbf{b} + \frac{1}{3}\mathbf{a}$ or $\overrightarrow{ZR} = \mathbf{a} - \mathbf{b} + \frac{1}{4}\mathbf{b}$	
		P1	for a process to write $\overrightarrow{ZP}$ and $\overrightarrow{ZR}$ as multiples of the same vector, eg. multiplying both by 12 to get the ratio, $\frac{4}{3}(\mathbf{a} - 0.75\mathbf{b})$ and $\mathbf{a} - 0.75\mathbf{b}$ respectively	
		A1	oe	

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.

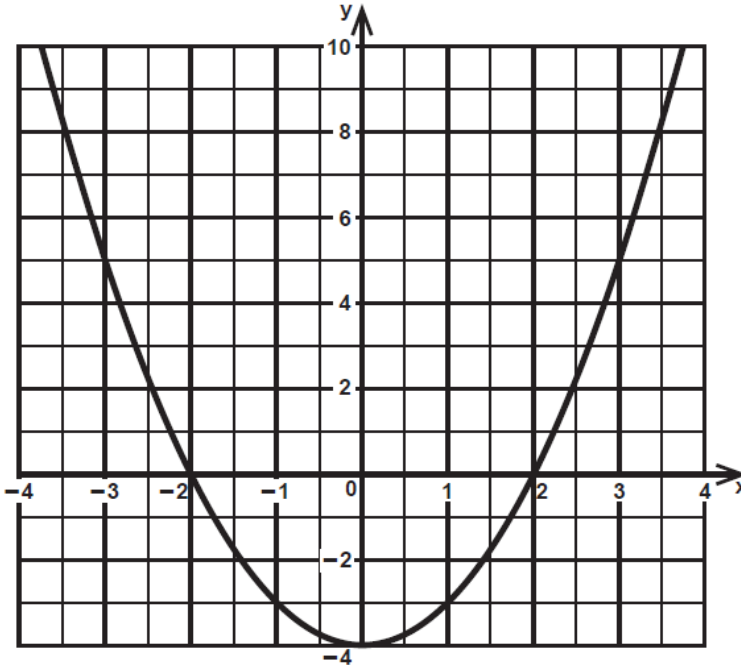
The following tolerances should be accepted on marking MLP papers, unless otherwise stated below:

Angles: $\pm 5^\circ$

Measurements of length: ± 5 mm

PAPER: 1MA1/3H			
Question		Modification	Mark scheme notes
1		MLP only: x changed to y .	Standard mark scheme but note the letter change.
3		Diagram enlarged. Crosses changed to solid circles. Right axis labelled. Axes labels moved to the left of the horizontal axis and above the vertical axis. Question wording changed to 'Jamie got a mark of 35 in the Science test.'	M1 for drawing a suitable line of best fit or for a line from $x = 35$ to a point at $(35, y)$, y in the range 30 – 45 or for a point marked on the grid at $(35, y)$, y in the range 30 – 45 A1 for an answer in the range 30 to 45
4		Frequency column widened.	Standard mark scheme
6		Wording changed to 'The table shows the information on his Sat Nav at 13 30.'	Standard mark scheme
8		Diagram enlarged. Angles moved outside angle arcs and angle arcs made smaller. Wording added 'Two angles are marked 117° and x°	Standard mark scheme

PAPER: 1MA1/3H													
Question		Modification	Mark scheme notes										
9		Wording added ‘It shows triangle A and triangle B on a coordinate grid.’ Diagram enlarged. Label removed from inside triangle. Shading removed. Enlargement drawn at (2.5,1), (2.5,6) (5,6) Triangles labelled as ‘triangle A’ and ‘triangle B’. Cross removed from (0,1) on the diagram. Grid cut at 7 on the x axis and 6 on the y axis. Grid cut before the <i>x</i> and <i>y</i> axes labels. Question wording now ‘Describe fully the transformation that maps triangle A onto triangle B.’ Three answer lines provided. Braille only: Two labelled shapes, triangle A and triangle B.	Amended mark scheme as follows: B1 for “enlargement scale factor 2.5” B1 for “centre (0,1)” Award B0 for any mention of a different transformation.										
10	(a)	MLP only: <i>x</i> changed to <i>y</i> .	Standard mark scheme but note letter change.										
11		Diagram enlarged.	Standard mark scheme										
12		Diagrams enlarged. Key moved above and to the left of the stem and leaf diagram. Horizontal line added to the base of the stem and leaf diagram. Wording changed to ‘Look at Diagram 1 and Diagram 2 for Question 12... Diagram 1 shows a stem and leaf diagram. Diagram 2 shows a grid.’ Wording added ‘below Diagram 1’. Numbers in the stem and leaf changed (see table below) <table><tr><td>17</td><td>5 7 9</td></tr><tr><td>18</td><td>4 5 5</td></tr><tr><td>19</td><td>0 0 1 3 4 5 8</td></tr><tr><td>20</td><td>1 3 4 4 5 7</td></tr><tr><td>21</td><td>2 3 3 5</td></tr></table>	17	5 7 9	18	4 5 5	19	0 0 1 3 4 5 8	20	1 3 4 4 5 7	21	2 3 3 5	Amended mark scheme: P1 for correctly identifying one of the LQ (185), median (195) or UQ (205) from the stem leaf M1 for showing a box and at least 3 correctly plotted values from 175, 185, 195, 205, 215 A1 for a fully correct box plot
17	5 7 9												
18	4 5 5												
19	0 0 1 3 4 5 8												
20	1 3 4 4 5 7												
21	2 3 3 5												

PAPER: 1MA1/3H		
Question	Modification	Mark scheme notes
14	Wording added 'shown in the table.'	
17	Question wording 1st line changed to 'It shows the graph of $y = x^2 - 4$' Question demand changed to 'Use the graph to find estimates to the equation $x^2 - 2x - 3 = 0$.' Diagram enlarged and changed (see below). The graph line will go through (-3, 5) and (3,5). 	Mark scheme first P1 now process to rearrange the equation to $x^2 - 4 = 2x - 1$ Otherwise standard mark scheme.
18	Diagram enlarged.	Standard mark scheme
19	Diagram enlarged. Right axis labelled. Axes labels moved to the left of the horizontal axis and above the vertical axis.	Standard mark scheme

PAPER: 1MA1/3H		
Question		Modification
23		Diagrams enlarged and model and shape may be provided. Sector $OACB$ labelled as Diagram 1 and the cone labelled as Diagram 2. Add wording 'Diagram 1 shows a sector $OACB$... Diagram 2 shows a hollow cone...' There may be a model of the hollow cone and a cut out shape of the sector $OACB$. Wording added 'The formulae are shown above Diagram 1 and Diagram 2 in the Diagram Book.' Dashed lines made longer and thicker.
24		Diagram enlarged.
		Mark scheme notes
		Standard mark scheme
		Standard mark scheme

