Mark Scheme (Results)

November 2018

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 × 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" × 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] × 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)	7360	B1	cao	
(b)	0.1077981356	B2	for 0.1077(981…)	Answer must be given to at least 4 decimal places rounded or truncated
		(B1	for 5.74(45626…) **or** 53.29 **or** 0.11 **or** 0.107 **or** 0.108)	Accept a clear indication of the decimal point. Check first four decimal places only
2	260 to 260.5	M1	for 883 − 245 (=638) **or** 883 ÷ 245 (=3.60..) **or** 883 ÷ 245 × 100 (=360(.408...)) oe	
		M1	for a complete method to find the percentage increase eg "638" ÷ 245 × 100 (=260(.408..)) **or** 883 ÷ 245 × 100 − 100 (=260(.408..)) oe	
		A1	Accept answers in the range 260 to 260.5	

Paper: 1MA1/3H					
Question		**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
3 (a)		2, −4, 2, 8	B2	all 4 values correct	
			(B1	for 2 or 3 correct values)	
(b)		Graph	M1	(dep B1) for at least 5 points plotted correctly ft from part a	
			A1	for a fully correct curve drawn	Accept freehand curves drawn that are not line segments; there must be some attempt to draw the minimum point below $y = -4$
(c)		−2.6 or 1.6	B1	for 1 correct value, ft a non linear graph	Award for −2.6 or 1.6 or both values but do not award the mark if a correct value is given with an incorrect value. Accept 1.56 or −2.56 Note for ft to be applied if the graph may be joined by line segments

Question		Answer	Mark	Mark scheme	Additional guidance
4	(a)	5	M1	"2" ÷ 40 × 100	"2" comes from their reading of the height of the 20 to 24 column
			A1	cao	
	(b)	9.5 shown	M1	for frequencies of 11, 8, 13, 6 and 2 (allow one error) **or** for midpoints 2, 7, 12, 17 and 22	May be seen on chart
			M1	for finding at least 4 products fx consistently within interval (including end points)	
			M1	for Σ"fx" ÷ ("11" + "8" + "13" + "6" + "2") **or** (11×2 + 8×7 + 13×12 + 6×17 + 2×22) ÷ 40 **or** Σ"fx" (=380) **and** 9.5 × ("11" + "8" + "13" + "6" + "2") (=380)	Evidence of two different calculations that should lead to 380 are required for this mark
			C1	for correct figures showing the answer or accurate figures to compare from correct working eg 380 from two calculations	

Question		Answer	Mark	Mark scheme	Additional guidance
5	(a)	2 mins 48 secs	P1	for an appropriate first step eg 700 ÷ 475 (=1.47..) **or** 475 ÷ [time] (= 4.16.. m/s) **or** [time] ÷ 475 (= 0.24 s/m)	[time] what candidate indicates as time of first race Units are not needed and can be ignored if given
			P1	for a complete method to find the required time eg 700 ÷ 475 × [time] (=168) **or** 700 ÷ (475 ÷ [time]) (=168) **or** [time] ÷ 475 ×700 (=168)	Allow calculation in stages and appropriate rounding.
			A1	cao	
	(b)	Statement	C1	eg takes less time **Acceptable examples** Quicker time Faster time Reduces my answer to part (a) **Not acceptable examples** It is an underestimate The amount of time could/may increase Laura goes faster	

Question	Answer	Mark	Mark scheme	Additional guidance
6	17.3	P1	for full process to find either angle eg $(180 - 90) \div (2+3) \times 2 \ (=36)$ **or** for 36 or 54 seen as an angle	May be seen on diagram Condone correct values if incorrectly placed.
		P1	for a correct equation using trigonometry eg cos $[A] = 14 \div AB$	This must be shown as an equation with all four elements (eg cos, $[A]$, 14, AB) present. $[A]$ could be 36 or any angle clearly and unambiguously identified as A. This also applies to $[B]$ with Sine.
		P1	(dep previous P mark) for rearranging their trigonometry equation to make AB the subject eg $(AB =)$ "$14 \div \cos 36$"	
		A1	for an answer in the range 17.3 to 17.4	If an answer is shown in the range in working and then incorrectly rounded award full marks.

Paper: 1MA1/3H				
Question	**Answer**	**Mark**	**Mark scheme**	**Additional guidance**
7	Diagram drawn	B2	for correct frequency polygon	Plotting at (5,14), (15,18), (25,26), (35,12) Must use line segments for B2
		(B1	for points plotted at correct midpoints of intervals	
			or joining points at correct heights consistently within intervals including plotting at end values	Joining must be with line segments
			or correct frequency polygon with one point incorrect	NB ignore any histogram drawn and any part of frequency polygon outside range of first and last points plotted
			or correct frequency polygon with first and last points joined directly)	
8	8	P1	process to start the problem eg $xy = 45$ **and** $xz = 15$ **and** $yz = 27$ **or** 5×9 (=45) **and** 3×9 (=27) **and** 3×5 (=15) **or** 3, 5 and 9 stated	Maybe seen on diagram
		P1	for $3 \times 5 \times 9$ (=135) **or** 2 of "9" ÷ 2.5 (=3.6) **or** "5" ÷ 2.5 (=2) **or** "3" ÷ 2.5 (=1.2)	
		P1	for 2.5^3 (=15.625) **or** all of "9" ÷ 2.5 (=3.6) **and** "5" ÷ 2.5 (=2) **and** "3" ÷ 2.5 (=1.2)	
		P1	for a complete process to find the number of cubes possible eg [volume] ÷ "15.625" (=8.64) **or** "3.6" × "2" × "1.2" (=8.64)	[Volume] must come from multiplying together what they clearly indicate as the 3 dimensions of the cuboid. The three dimensions cannot be 45, 27 and 15
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
9 (a)	$2x^3 + x^2 - 7x - 6$	M1	for a method to find the product of two linear expressions eg 3 correct terms out of 4 terms or 4 terms ignoring signs	Note that (eg) $- x - 6$ in expansion of $(x - 2)(2x + 3)$ is to be regarded as 3 correct terms.
		M1	for a complete method to obtain all terms, half of which are correct (ft their first product) eg $2x^3 - x^2 - 6x + 2x^2 - x - 6$	First product must be quadratic but need not be simplified or may be simplified incorrectly
		A1	cao	
(b)	-5	M1	for beginning to combine indices eg $4+n$ or y^{-3+2}	
		A1	cao	
(c)	1.27 and -0.472	M1	for substitution into the formula	Condone one sign error in the substitution Accept -4^2 or $(-4)^2$
		M1	for simplifying to the form $\frac{-b \pm \sqrt{N}}{k}$ eg $\frac{4 \pm \sqrt{76}}{10}$ **or** 1.27 to 1.28 **or** -0.48 to -0.47	
		A1	for 1.27 to 1.28 **and** -0.48 to -0.47	

Question		Answer	Mark	Mark scheme	Additional guidance
10	(a)	1.56	B1	1.56 to 1.563	
	(b)	3.63	M1	for a complete method to find fg(34) eg 4 sin 65(=3.625..) **or** fg(x) eg 4 sin (2x−3)	
			A1	for answer in the range 3.6 to 3.63	If an answer in the range is seen in working and then incorrectly rounded award full marks.
	(c)	Statement	C1	for statement eg positive and negative square root required. **Acceptable examples** The other answer is −9 The quadratic should have 2 solutions. **Not acceptable examples** He has not expanded the brackets. He needed to (x+4) twice as there is a squared sign. (x+4)² is 16 not 25. Didn't expand the bracket.	
11		Graph drawn	C2	for fully correct sketch between 0° and 360°	
			(C1	for a graph with clear asymptotes at 90° and 270° only **or** the correct graph translated along the x-axis must have a period of 180)	

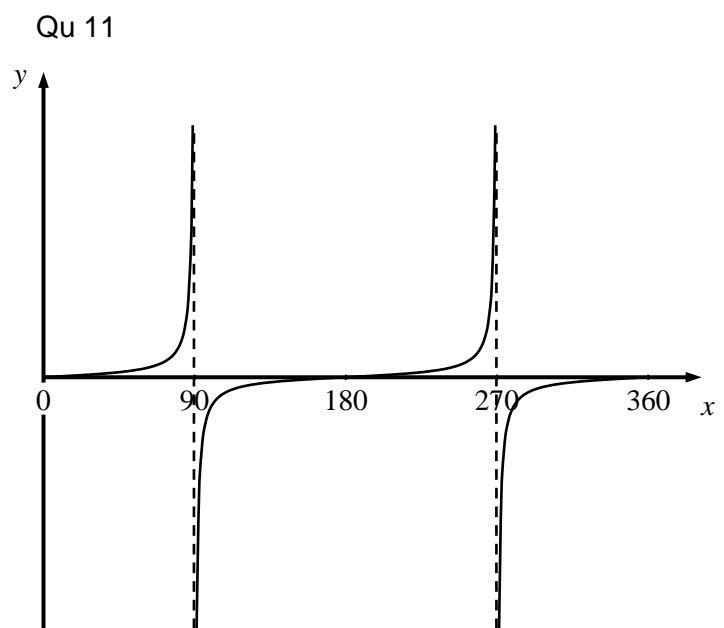| Question	Answer	Mark	Mark scheme	Additional guidance
12	73.6	P1	for correct initial use of Pythagoras eg $5^2 + 5^2$ (=50) **or** a trigonometric ratio in the form $\frac{5 \div 2}{0.5AC} = \sin 45$ oe	
		P1	for finding the length of half of the diagonal eg $\sqrt{"50"} \div 2$ (= 3.5...) **or** $0.5AC = \frac{5 \div 2}{\sin 45}$ (=3.5...) oe	do not accept $\sqrt{20} \div 2$
		P1	for process to use tan eg tan $TAC =$ (12 ÷ "3.5..") (=3.3..) **or** complete alternative method arriving at an equation with the subject as sin TAC or cos TAC	
		A1	for an answer in the range 73.58 to 74.1	
13	408	M1	for 1.01×400 (= 404) or 408.04 or 412.08	412(.08) on the answer line M1A0 1.01×400 may be seen as part of a calculation
		A1	cao	
14	Evidence of solution	M1	for constructing an equation eg $y \, \alpha \, \frac{1}{x^3}$ or eg $y = \frac{k}{x^3}$ oe	
		M1	for substituting in the values a and 44 into $y = \frac{k}{x^3}$	
		C1	for a complete method to use the equation, the value of k and $x = 2a$ to show $y = 5.5$ eg $(2a)^3 y = 44a^3$ and $y = 44a^3 \div 8a^3 = 5.5$	Must show all steps clearly

Question	Answer	Mark	Mark scheme	Additional guidance
15	proof	C1	for writing an expression for an odd number, eg $2n + 1$ or $2n – 1$ (assuming n is any integer) **or** states n is even and eg $(n + 1)$ or $(n + 3)$ as odd numbers	
		C1	for a correct expression of the form $(2n + 1)^2 − (2n – 1)^2$ expanded eg $4n^2 + 12n + 9 – (4n^2 + 4n + 1)$ or $4n^2 + 4n + 1 – (4n^2 – 4n + 1)$ **or** $(2n + 1 + 2n – 1)(2n + 1 – (2n – 1))$ **or** when n is even and eg $(n^2 + 6n + 9) – (n^2 + 2n + 1)$ $(=4n + 8)$	Expansion of $(2n – 1)^2 − (2n + 1)^2$ oe is acceptable
		C1	for a correct simplified expression as a multiple of 8 eg $8n + 8$ or $8n$ **or** when n is even **and** eg $4n + 8$ **and** full explanation as to why $4(n+2)$ is always a multiple of 8	
16	39.9	P1	for finding the length of the minor or major arc eg $\frac{220}{360}\pi\times12$ $(= 23(.03834..))$	Allow appropriate rounding if calculation seen in parts
		P1	for substituting into the sine or cosine rule to find OD eg $14 \div \sin140 = OD \div \sin 24$ **or** $(OD^2=)\ 6^2 +14^2 − 2 \times 6 \times 14 \times \cos 24$ $(=78.5....)$	Must involve OD in the relationship but may be implied
		P1	for a complete process to find the length OD eg $14 \div \sin140 \times \sin24$ $(=8.8(58778..))$	
		P1	for a complete process to find the perimeter eg "$23(.03834..)$" $+ 14+$ "$8.8(58778..)$" $– 6$	May be seen in multiple calculations
		A1	for an answer in the range 39.8 to 40	If an answer in the range is seen in working and then incorrectly rounded award full marks.

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
17 (a)	Histogram drawn	B3	for fully correct histogram eg relative heights 6, 3, 4, 2, 2	
		(B2	for 4 correct blocks **or** all 5 frequency ÷ class interval **and** 1 correct block)	
		(B1	for at least 2 correct blocks of different widths **or** for frequency ÷ class interval for at least 3 frequencies)	
(b)	66 to 71	M1	indication of the median in the third interval **or** proportional method shown	Just stating the interval is sufficient for this mark May be implied by the number on the answer line
		A1	ft answer between 66 and 71	Median is at (approx.) 68.75 by a proportional method
18	2.7 with statement	B1	for 179.5 or 180.5 or 180.4999...	
		B1	for 486.5 or 487.5 or 487.4999...	
		P1	for a correct process to find a bound for average speed, eg [upper bound of distance] ÷ [lower bound of time] where $487 <$ [UB of distance] ≤ 487.5 and $179.5 \le$ [LB of time] < 180 **or** for [lower bound of distance] ÷ [upper bound of time] where $486.5 \le$ [LB of distance] < 487 and $180 <$ [UB of time] ≤ 180.5	
		A1	(dep on all previous marks) for 2.695(2…) **and** 2.715(8 …) with both values clearly coming from working with correct values	Accept bounds truncated or rounded to at least 4 sig fig
		C1	for 2.7 from 2.695… and 2.715… **and** statement that both LB and UB round to 2.7	

Question	Answer	Mark	Mark scheme	Additional guidance
19	$x = -\dfrac{23}{7}$, $y = \dfrac{15}{7}$	M1	for substitution of a rearrangement eg for $2(1-2y)^2 - y^2 = 17$ **or** $2x^2 - \left(\dfrac{1-x}{2}\right)^2 = 17$ **or** expansion of $(1-2y)^2 = 1 - 4y + 4y^2$ **or** $\left(\frac{1-x}{2}\right)^2 = \frac{1-2x+x^2}{4}$	
	$x = 3$, $y = -1$	M1	for expansion of bracket **and** substitution eg $2(1 - 4y + 4y^2) - y^2 \,(= 17)$ **or** $8x^2 - (1 - 2x + x^2)\,(= 68)$	
		A1	for forming quadratic ready for solving eg $7y^2 - 8y - 15\,(= 0)$ **or** $7x^2 + 2x - 69\,(= 0)$	
		M1	ft a 3 term quadratic, factorising eg $(7y - 15)(y + 1)\,(= 0)$ **or** $(7x + 23)(x - 3)\,(= 0)$ **or** correct use of formula eg $\dfrac{8 \pm \sqrt{64 + 420}}{14}$ or $\dfrac{-2 \pm \sqrt{4 + 1932}}{14}$ **or** completing the square	Can be implied by both x values correct or both y values correct.
		A1	$x = -\dfrac{23}{7}$ oe, $y = \dfrac{15}{7}$ oe **and** $x = 3$, $y = -1$	Answers must be correctly paired. (Maybe in the body of the working) Accept for x between -3.29 and -3.28 and for y between 2.14 and 2.15 Answers only award 0 marks
20	$(-3.5, 1)$	M1	for a complete method to show the transformations	Image at $(-4,1)$, $(-3,1)$ and $(-3.5, -2)$
		A1	cao	

Qu 11

Modifications to the mark scheme for Modified Large Print (MLP) papers. Paper 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:
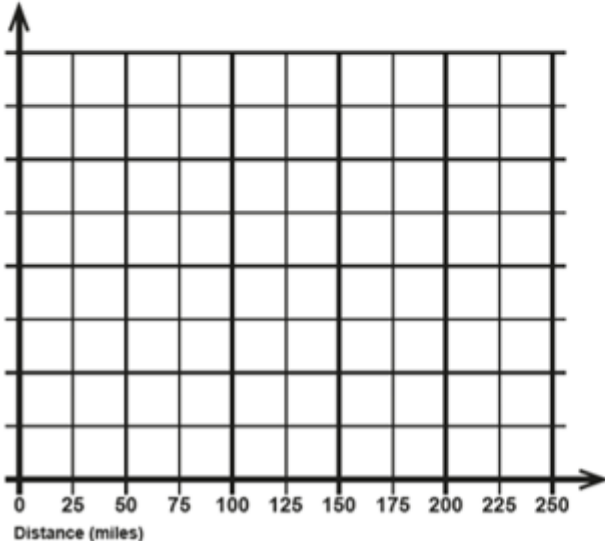Angles: ±5º
Measurements of length: ±5 mm

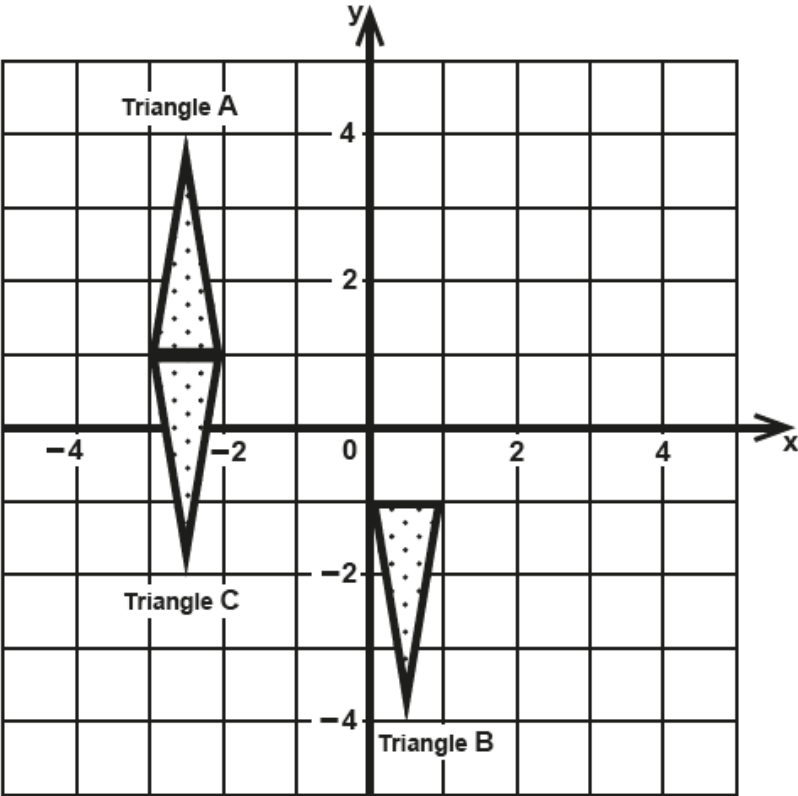| PAPER: 1MA1_3H		
Question	Modification	Mark scheme notes
3	Wording added 'There are four spaces to fill.' Table turned to vertical format. Grid enlarged. Y axis changed to go up in units of 2 from -10 to10.	Standard mark scheme
4	Diagram enlarged. Right axis labelled. Shading changed to dotty shading. Axes labels moved to the left of the horizontal axis and above the vertical axis.	Standard mark scheme
6	Diagram enlarged.	Standard mark scheme
7	Diagram enlarged. Right axis labelled. Axes labels moved to the left of the horizontal axis and above the vertical axis. Frequency table changed to: 5, 20, 25, 10 and Frequency column widened. Question wording changed from 70 cars to 60 cars.	Standard mark scheme but plotting at (5,5), (15,20), (25,25), (35,10)
8	Diagram enlarged and model provided for all candidates. Wording added 'and on the model: 15 cm^2, 27cm^2, 45 cm^2'	Standard mark scheme

PAPER: 1MA1_3H				
Question		**Modification**		**Mark scheme notes**
9	(a)	MLP only – *x* changed to *y*.		Standard mark scheme with *x* changed to *y*.
9	(b)	Wording added, 'when'.		Standard mark scheme
11		Diagram enlarged.		Standard mark scheme
12		Diagram enlarged and model provided for all candidates. A dot added at the centre of square *ABCD*, labelled *M*. A line added joining *A* to *M* and another line added joining *M* to *T*. An angle arc added at *A*. Question wording changed to 'The vertex *T* is 12 metres vertically above the midpoint *M* of *AC*.'		Standard mark scheme
16		Diagram enlarged. Shading changed to dotty shading. *AD* labelled 14 cm. Question wording changed to 'The shape is made from the triangle *AOD* and a sector of a circle, centre *O* and radius 6 cm.'		Standard mark scheme
17		Diagram enlarged. *x* axis marked in units of 25 (as shown). Table changed as shown below. Number of students changed from 570 to 575		Standard mark scheme but histogram drawn at 7.5, 3.75, 5, 2.5, 2.5 Allow some tolerance on heights within gaps if intention is clear. Median at (approx.) 65.75 so allow within range 60 to 70.

Question	Modification	Mark scheme notes
17		

Distance (*d* miles)	Frequency
$0 < d \leqslant 25$	150
$25 < d \leqslant 50$	75
$50 < d \leqslant 75$	100
$75 < d \leqslant 150$	150
$150 < d \leqslant 200$	100

Widen the frequency column to allow for working.

0   25   50   75   100   125   150   175   200   225   250
Distance (miles)

PAPER: 1MA1_3H		
Question	**Modification**	**Mark scheme notes**
20	Diagram enlarged and grid changed as shown below. Wording added, 'It shows triangle A, triangle B and triangle C on a grid. A cut out triangle is available if you wish to use it.' A cut out shape provided for all versions. Question wording changed as follows: (a) Describe the TWO transformations that map triangle A onto triangle B, then triangle B onto Triangle C. (1 mark). Three answer lines added for part (a). One point on triangle A is invariant under the combined transformation from triangle A to triangle C. (b) Find the coordinates of this point. (1 mark)	Part (a): award 1 mark for a full description of both transformations: A to B: a rotation of 180° about (−1,0) B to C: a translation of $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ Do **not** award the mark if there is any ambiguity or any reference to other forms of transformation. Part (b): award 1 mark for (−2.5, 1)

PAPER: 1MA1_3H		
Question	**Modification**	**Mark scheme notes**
20		