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## 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.  $2 \times 6 (=12)$  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) 7360	B1	cao	Answer must be given to at least 4 decimal places rounded or truncated Accept a clear indication of the decimal point. Check first four decimal places only
	(b) 0.1077981356	B2  (B1	for 0.1077(981...)  for 5.74(45626...) <b>or</b> 53.29 <b>or</b> 0.11 <b>or</b> 0.107 <b>or</b> 0.108 )	
2	260 to 260.5	M1  M1  A1	for $883 - 245 (=638)$ <b>or</b> $883 \div 245 (=3.60..)$ <b>or</b> $883 \div 245 \times 100 (=360(.408...))$ oe  for a complete method to find the percentage increase eg " $638 \div 245 \times 100 (=260(.408..))$ " <b>or</b> $883 \div 245 \times 100 - 100 (=260(.408..))$ oe  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 (B1	all 4 values correct for 2 or 3 correct values)	<p>Accept freehand curves drawn that are not line segments; there must be some attempt to draw the minimum point below <math>y = -4</math></p> <p>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</p>
(b)	Graph	M1 A1	(dep B1) for at least 5 points plotted correctly ft from part a for a fully correct curve drawn	
(c)	-2.6 or 1.6	B1	for 1 correct value, ft a non linear graph	

Paper: 1MA1/3H					
Question	Answer	Mark	Mark scheme	Additional guidance	
4	(a)	5	M1	“2” $\div$ 40 $\times$ 100	“2” comes from their reading of the height of the 20 to 24 column  May be seen on chart  Evidence of two different calculations that should lead to 380 are required for this mark
		A1	cao		
	(b)	9.5 shown	M1	for frequencies of 11, 8, 13, 6 and 2 (allow one error) <b>or</b> for midpoints 2, 7, 12, 17 and 22	
			M1	for finding at least 4 products $fx$ consistently within interval (including end points)	
			M1	for $\Sigma“fx” \div (“11” + “8” + “13” + “6” + “2”)$ <b>or</b> $(11 \times 2 + 8 \times 7 + 13 \times 12 + 6 \times 17 + 2 \times 22) \div 40$ <b>or</b> $\Sigma“fx” (=380)$ <b>and</b> $9.5 \times (“11” + “8” + “13” + “6” + “2”)$ (=380)	
C1	for correct figures showing the answer or accurate figures to compare from correct working eg 380 from two calculations				



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
5 (a)	2 mins 48 secs	P1	for an appropriate first step eg $700 \div 475 (=1.47..)$ <b>or</b> $475 \div [\text{time}] (= 4.16.. \text{ m/s})$ <b>or</b> $[\text{time}] \div 475 (= 0.24 \text{ s/m})$	[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 $700 \div 475 \times [\text{time}] (=168)$ <b>or</b> $700 \div (475 \div [\text{time}]) (=168)$ <b>or</b> $[\text{time}] \div 475 \times 700 (=168)$	Allow calculation in stages and appropriate rounding.
		A1	cao	
(b)	Statement	C1	eg takes less time <b>Acceptable examples</b> Quicker time Faster time Reduces my answer to part (a)  <b>Not acceptable examples</b> It is an underestimate The amount of time could/may increase Laura goes faster	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
6	17.3	P1	for full process to find either angle eg $(180 - 90) \div (2+3) \times 2 (=36)$ <b>or</b> 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  (B1	for correct frequency polygon  for points plotted at correct midpoints of intervals  <b>or</b> joining points at correct heights consistently within intervals including plotting at end values  <b>or</b> correct frequency polygon with one point incorrect  <b>or</b> correct frequency polygon with first and last points joined directly)	Plotting at (5,14), (15,18), (25,26), (35,12) Must use line segments for B2  Joining must be with line segments  NB ignore any histogram drawn and any part of frequency polygon outside range of first and last points plotted
8	8	P1  P1  P1  P1  A1	process to start the problem eg $xy = 45$ <b>and</b> $xz = 15$ <b>and</b> $yz = 27$ <b>or</b> $5 \times 9 (=45)$ <b>and</b> $3 \times 9 (=27)$ <b>and</b> $3 \times 5 (=15)$ <b>or</b> 3, 5 and 9 stated  for $3 \times 5 \times 9 (=135)$ <b>or</b> 2 of “9” $\div 2.5 (=3.6)$ <b>or</b> “5” $\div 2.5 (=2)$ <b>or</b> “3” $\div 2.5 (=1.2)$  for $2.5^3 (=15.625)$ <b>or</b> all of “9” $\div 2.5 (=3.6)$ <b>and</b> “5” $\div 2.5 (=2)$ <b>and</b> “3” $\div 2.5 (=1.2)$  for a complete process to find the number of cubes possible eg [volume] $\div$ “15.625” (=8.64) <b>or</b> “3.6” $\times$ “2” $\times$ “1.2” (=8.64)  cao	Maybe seen on diagram       [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

Paper: 1MA1/3H					
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. First product must be quadratic but need not be simplified or may be simplified incorrectly  Condone one sign error in the substitution Accept $-4^2$ or $(-4)^2$
			M1	for a complete method to obtain all terms, half of which are correct (ft their first product) eg $2x^3 - x^2 - 6x + 2x^2 - x - 6$	
			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 simplifying to the form $\frac{-b \pm \sqrt{N}}{k}$ eg $\frac{4 \pm \sqrt{76}}{10}$ <b>or</b> 1.27 to 1.28 <b>or</b> -0.48 to -0.47				
A1	for 1.27 to 1.28 <b>and</b> -0.48 to -0.47				

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
10	(a) 1.56	B1	1.56 to 1.563	If an answer in the range is seen in working and then incorrectly rounded award full marks.
	(b) 3.63	M1	for a complete method to find $\text{fg}(34)$ eg $4 \sin 65(=3.625..)$ <b>or</b> $\text{fg}(x)$ eg $4 \sin (2x-3)$	
	(c) Statement	A1 C1	for answer in the range 3.6 to 3.63  for statement eg positive and negative square root required. <b>Acceptable examples</b> The other answer is $-9$ The quadratic should have 2 solutions.  <b>Not acceptable examples</b> 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 (C1	for fully correct sketch between $0^\circ$ and $360^\circ$  for a graph with clear asymptotes at $90^\circ$ and $270^\circ$ only <b>or</b> the correct graph translated along the $x$ -axis must have a period of 180)	

Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
12	73.6	P1  P1  P1  A1	for correct initial use of Pythagoras eg $5^2 + 5^2 (=50)$ <b>or</b> a trigonometric ratio in the form $\frac{5 \div 2}{0.5AC} = \sin 45$ oe  for finding the length of half of the diagonal eg $\sqrt{50} \div 2 (= 3.5\dots)$ <b>or</b> $0.5AC = \frac{5 \div 2}{\sin 45} (=3.5\dots)$ oe  for process to use tan eg $\tan TAC = (12 \div "3.5..") (=3.3..)$ <b>or</b> complete alternative method arriving at an equation with the subject as $\sin TAC$ or $\cos TAC$  for an answer in the range 73.58 to 74.1	do not accept $\sqrt{20} \div 2$
13	408	M1  A1	for $1.01 \times 400 (= 404)$ or 408.04 or 412.08  cao	412(.08) on the answer line M1A0 $1.01 \times 400$ may be seen as part of a calculation
14	Evidence of solution	M1  M1  C1	for constructing an equation eg $y \propto \frac{1}{x^3}$ or eg $y = \frac{k}{x^3}$ oe  for substituting in the values $a$ and 44 into $y = \frac{k}{x^3}$  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

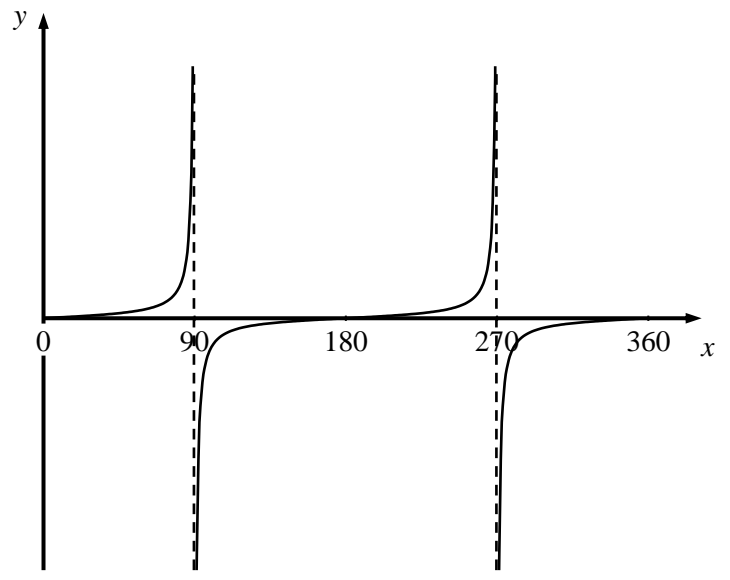
Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
15	proof	C1	for writing an expression for an odd number, eg $2n + 1$ or $2n - 1$ ( assuming $n$ is any integer) <b>or</b> states $n$ is even and eg $(n + 1)$ or $(n + 3)$ as odd numbers	Expansion of $(2n - 1)^2 - (2n + 1)^2$ oe is acceptable
		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 $4n^2 + 4n + 1 - (4n^2 - 4n + 1)$ <b>or</b> $(2n + 1 + 2n - 1)(2n + 1 - (2n - 1))$ <b>or</b> when $n$ is even and eg $(n^2 + 6n + 9) - (n^2 + 2n + 1) (=4n + 8)$	
		C1	for a correct simplified expression as a multiple of 8 eg $8n + 8$ or $8n$ <b>or</b> when $n$ is even <b>and</b> eg $4n + 8$ <b>and</b> 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 $\frac{220}{360}\pi \times 12 (= 23(.03834..))$	Allow appropriate rounding if calculation seen in parts
		P1	for substituting into the sine or cosine rule to find $OD$ eg $14 \div \sin 140 = OD \div \sin 24$ <b>or</b> $(OD^2 =) 6^2 + 14^2 - 2 \times 6 \times 14 \times \cos 24 (=78.5....)$	Must involve $OD$ in the relationship but may be implied
		P1	for a complete process to find the length $OD$ eg $14 \div \sin 140 \times \sin 24 (=8.8(58778..))$	
		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 <b>or</b> all 5 frequency $\div$ class interval <b>and</b> 1 correct block)	
			(B1 for at least 2 correct blocks of different widths <b>or</b> for frequency $\div$ class interval for at least 3 frequencies)	
	(b)	66 to 71	M1 indication of the median in the third interval <b>or</b> proportional method shown	Just stating the interval is sufficient for this mark May be implied by the number on the answer line Median is at (approx.) 68.75 by a proportional method
			A1 ft answer between 66 and 71	
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] $\div$ [lower bound of time] where $487 < [\text{UB of distance}] \leq 487.5$ and $179.5 \leq [\text{LB of time}] < 180$  <b>or</b> for [lower bound of distance] $\div$ [upper bound of time] where $486.5 \leq [\text{LB of distance}] < 487$ and $180 < [\text{UB of time}] \leq 180.5$	
			A1 (dep on all previous marks) for 2.695(2...) <b>and</b> 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... <b>and</b> statement that both LB and UB round to 2.7	



Paper: 1MA1/3H				
Question	Answer	Mark	Mark scheme	Additional guidance
19	$x = -\frac{23}{7}, y = \frac{15}{7}$  $x = 3, y = -1$	M1  M1  A1  M1  A1	for substitution of a rearrangement eg for $2(1 - 2y)^2 - y^2 = 17$ <b>or</b> $2x^2 - \left(\frac{1-x}{2}\right)^2 = 17$ <b>or</b> expansion of $(1 - 2y)^2 = 1 - 4y + 4y^2$ <b>or</b> $\left(\frac{1-x}{2}\right)^2 = \frac{1-2x+x^2}{4}$  for expansion of bracket <b>and</b> substitution eg $2(1 - 4y + 4y^2) - y^2 (= 17)$ <b>or</b> $8x^2 - (1 - 2x + x^2) (= 68)$  for forming quadratic ready for solving eg $7y^2 - 8y - 15 (= 0)$ <b>or</b> $7x^2 + 2x - 69 (= 0)$  ft a 3 term quadratic, factorising eg $(7y - 15)(y + 1) (= 0)$ <b>or</b> $(7x + 23)(x - 3) (= 0)$ <b>or</b> correct use of formula eg $\frac{8 \pm \sqrt{64 + 420}}{14}$ or $\frac{-2 \pm \sqrt{4 + 1932}}{14}$ <b>or</b> completing the square  $x = -\frac{23}{7}$ oe, $y = \frac{15}{7}$ oe <b>and</b> $x = 3, y = -1$	Can be implied by both $x$ values correct or both $y$ values correct.  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  A1	for a complete method to show the transformations  cao	Image at $(-4, 1)$ , $(-3, 1)$ and $(-3.5, -2)$

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:  $\pm 5^\circ$

Measurements of length:  $\pm 5$  mm

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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 to 10.	Standard mark scheme
4	Diagram enlarged. Right axis labelled. Shading changed to dotted 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: $15 \text{ cm}^2$ , $27 \text{ cm}^2$ , $45 \text{ cm}^2$ '	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

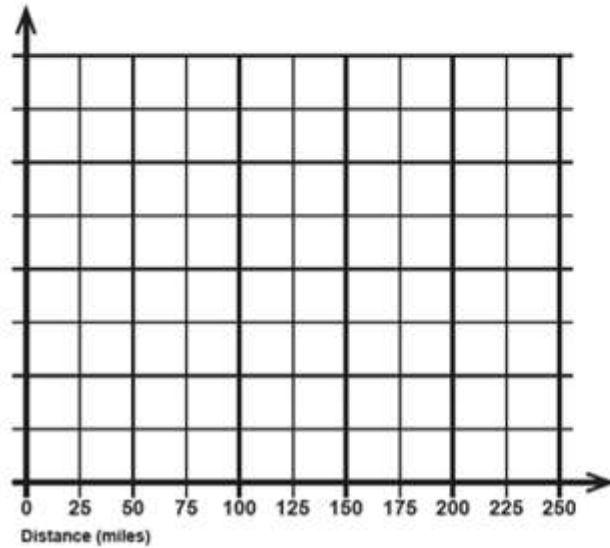
Modification

Mark scheme notes

17

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

Widen the frequency column to allow for working.



**PAPER: 1MA1\_3H**

<b>Question</b>	<b>Modification</b>	<b>Mark scheme notes</b>
20	<p>Diagram enlarged and grid changed as shown below.</p> <p>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.'</p> <p>A cut out shape provided for all versions. Question wording changed as follows:</p> <p>(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).</p> <p>One point on triangle A is invariant under the combined transformation from triangle A to triangle C.</p> <p>(b) Find the coordinates of this point. (1 mark)</p>	<p>Part (a): award 1 mark for a full description of both transformations:</p> <p>A to B: a rotation of <math>180^\circ</math> about <math>(-1,0)</math></p> <p>B to C: a translation of <math>\begin{pmatrix} -3 \\ 2 \end{pmatrix}</math></p> <p>Do <b>not</b> award the mark if there is any ambiguity or any reference to other forms of transformation.</p> <p>Part (b): award 1 mark for <math>(-2.5, 1)</math></p>

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