

## GCSE Mathematics (1MA1) – Higher Tier Paper 3H

### November 2017 student-friendly mark scheme

**Please note that this mark scheme is not the one used by examiners for making scripts. It is intended more as a guide to good practice, indicating where marks are given for correct answers. As such, it doesn't show follow-through marks (marks that are awarded despite errors being made) or special cases.**

**It should also be noted that for many questions, there may be alternative methods of finding correct solutions that are not shown here – they will be covered in the formal mark scheme.**

#### NOTES ON MARKING PRINCIPLES

##### Guidance on the use of codes within this mark scheme

M1 – method mark. This mark is generally given for an appropriate method in the context of the question. This mark is given for showing your working and may be awarded even if working is incorrect.

P1 – process mark. This mark is generally given for setting up an appropriate process to find a solution in the context of the question.

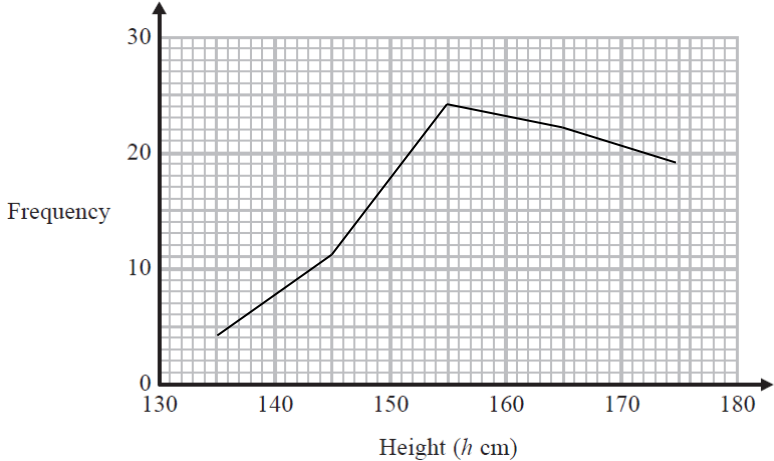
A1 – accuracy mark. This mark is generally given for a correct answer following correct working.

B1 – working mark. This mark is usually given when working and the answer cannot easily be separated.

C1 – communication mark. This mark is given for explaining your answer or giving a conclusion in context supported by your working.

Some questions require all working to be shown; in such questions, no marks will be given for an answer with no working (even if it is a correct answer).

**Question 1 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$160 < h \leq 170$	1	This mark is given for the correct answer only
(b)		2	<p>These marks are given for a fully correct frequency polygon with line segments joining the points (135, 4), (145, 11), (155, 24), (165, 22) and (175, 19)</p> <p>(1 mark is given if any points are incorrect)</p>

**Question 2 (Total 3 marks)**

Part	Working an or answer examiner might expect to see	Mark	Notes
	Cost of 1 litre of petrol in NY = $\$ \frac{2.83}{3.785} = \$0.7476\dots$	1	This mark is given for finding out the cost of a litre of petrol in New York in dollars
	Cost of 1 litre of petrol in NY = $\frac{0.7476\dots}{1.46} p = 51.2p$	1	This mark is given for finding out the cost of a litre of petrol in New York in pence
	Petrol; is better value for money in New York ( $0.51.2 < 108.9p$ )	1	This mark is given for a correct conclusion supported by working

**Question 3 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$12.5 \times 1000$	1	This mark is given for converting kg to g
	$12500 \div 19.3$	1	This mark is given for a method to find the density of the gold bar
	648	1	This mark is given for the correct answer only

**Question 4 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	Ratio of blue pens : green pens : red pens is 8 : 20 : 5	1	This mark is given for a method to find ratios of the three colours of pens
	$\frac{5}{33}$ pens are red; greatest number of pens = 99	1	This mark is given for finding the fraction of red pens
	15	1	This mark is given for the correct answer only

**Question 5 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{1}{1.6} = 0.625$	1	This mark is given for the correct answer only
(b)		1	This mark is given for 9.75 and 9.85 seen
	$9.75 \leq x < 9.85$	1	This mark is given for the correct answer only

**Question 6 (Total 5 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	Width = $x$ Length = $x + 7$	1	This mark is given for forming expressions for the length and width of the rectangle
	$x + x + 7 + x + x + 7 + 7 + x + x + 7 + x + x + 7 + 7 = 70$ $8x + 42 = 70$	1	This mark is given for forming an equation for the width of the shape
	$x = \frac{70 - 42}{8}$	1	This mark is given for finding an expression for $x$
	width = 3.5, length = 10.5	1	This mark is given for finding values for the width and the length of the shape
	$4 \times 3.5 \times 10.5 = 147$	1	This mark is given for finding the area of the shape

**Question 7 (Total 2 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$13.8 \times 5.4 \times 10^7 \times 10^{-12}$ $= 74.52 \times 10^{-5}$ $= 7.452 \times 10^{-4}$	1	This mark is given for the digits 7452 seen
	0.000 745 2	1	This mark is given for the correct answer only

**Question 8 (Total 2 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	Mel's results will give the best estimate since she drops the greatest number of drawing pins	1	This mark is given for a correct comment
(b)	$\frac{100}{150} \times \frac{50}{150} = \frac{2}{3} \times \frac{1}{3}$	1	This mark is given for a probability of point down multiplied by the probability of point up
	$\frac{2}{9}$	1	This mark is given for the correct answer only

**Question 9 (Total 5 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	10625 9031.25 7676.5625 6525.078125 5546.316406	1	This mark is given for evaluating $(0.85)^n$ for at least one value of $n$
	5	1	This mark is given for the correct answer only
(b)	$79.20 \div 0.6 = 132$	1	This mark is given for finding the amount of interest before tax is deducted
	$(132 \div 5500) \times 100$	1	This mark is given for a method to find $R$
	2.4	1	This mark is given for the correct answer only

**Question 10 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$1 - (0.2 + 0.35 + 0.4) = 0.05$	1	This mark is given for the correct answer only
(b)	20	1	This mark is given for stating that (at least) 20 counters are required
	The number of counters of each colour must be a whole number	1	This mark is given for a correct explanation

**Question 11 (Total 4 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	57	1	This mark is given for the correct answer only
(b)	Not necessarily, since the maximum weight might be less than 80 and the minimum weight less than 40	1	This mark is given for a correct explanation
(c)		1	This mark is given for reading the graph at weight 65 (=49) and at cumulative frequency 45 (= 63)
	25% of 60 would be 15 potatoes, but only 11 have a weight of 65g (so less than 25%)	1	This mark is given for a correct explanation

**Question 12 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$0.25 \times 0.6 = 0.15$ $0.75 \times 0.4 = 0.3$	1	This mark is given for finding the probability that both spinners land on red and the probability that both spinners land on white
	$\frac{24}{0.15} = 160$	1	This mark is given for finding how many time Alan spins both spinners
	$160 \times 0.3 = 48$	1	This mark is given for the correct answer only

**Question 13 (Total 2 marks)**

Part	Working an or answer examiner might expect to see	Mark	Notes
	$x^2 + 6x - 7 = x^2 + 2ax + a^2 + b$	1	This mark is given for a method to complete the square
	$(x + 3)^2 - 16$	1	This mark is given for the correct answer only

**Question 14 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	Lengths ratio = $\sqrt[3]{27} : \sqrt[3]{8} = 3 : 2$	1	This mark is for finding a ratio of the lengths associated with the cone
	Areas ratio = $3^2 : 2^2 = 9 : 4$	1	This mark is for finding a ratio of the areas associated with the cone
	Thus the surface area of cone <b>B</b> $= \frac{297}{9} \times 4 = 132$	1	This mark is given for the correct conclusion following correct arithmetic

**Question 15 (Total 9 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$f(0) = -5$ and $f(1) = 3$ ,	1	This mark is given for showing the sign changes between $f(0)$ and $f(1)$
	Thus since there is a sign change, the solution is between $x = 0$ and $x = 1$	1	This mark is given for a correct comment
(b)	$x^2 + 7 = \frac{5}{x}$ (dividing both sides by $x$ )	1	This mark is given for the first step in a rearrangement
	Thus $x = \frac{5}{x^2 + 7}$	1	This mark is given for clear steps showing the complete rearrangement
(c)	$x_1 = 0.625$	1	This mark is given for the first correct iteration
	$x_2 = 0.6765327696$	1	This mark is given for the second correct iteration
	$x_3 = 0.6704483001$	1	This mark is given for the third correct iteration
(d)	$(0.670)^2 + (7 \times 0.670) - 5 = 0.134$	1	This mark is given for substituting 0.670 into $x^2 + 7x - 5$
	This is an accurate estimate of the root since the calculation is very close to zero	1	This mark is given for a correct comment

**Question 16 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	Lower bound for distance travelled is 147.5 Upper bound for petrol used is 11.85	1	This mark is given for finding the bounds
	$\frac{100 \times 11.85}{147.5} = 8.03$	1	This mark is given for finding the maximum possible petrol consumption
	Yes, Nathan could be wrong – his car might have used over 8 litres of petrol	1	This mark is given for a correct conclusion supported by working

**Question 17 (Total 5 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\text{Area of triangle } ADC = \frac{1}{2} ab \sin C$ $= 0.5 \times 11 \times (CD \times \sin 105^\circ) = 56$	1	This mark is given for finding an equation for the area of triangle $ADC$
	$CD = \frac{56}{0.5 \times 11 \times \sin 105^\circ} = \frac{56}{5.312\dots}$ $= 10.54$	1	This mark is given for finding the length of $CD$
	$AC^2 =$ $11^2 + (10.54)^2 - 2 \times 11 \times 10.54 \times \cos 105^\circ$ $= 232.0916 + 60.01496$ $= 292.10656$ $AC = 17.091125$	1	This mark is given for using the cosine rule $c^2 = a^2 + b^2 - 2ab \cos C$ to find the length of $AC$
	$\frac{AB}{\sin 48^\circ} = \frac{AC}{\sin 118^\circ}$ $\frac{AB}{0.743} = \frac{17.09}{0.883}$ $AB = \frac{17.09 \times 0.743}{0.883}$	1	This mark is given for a method to use the sine rule to find the length of $AB$
	14.38	1	This mark is given for an answer in the range 14.3 – 14.4

**Question 18 (Total 4 marks)**

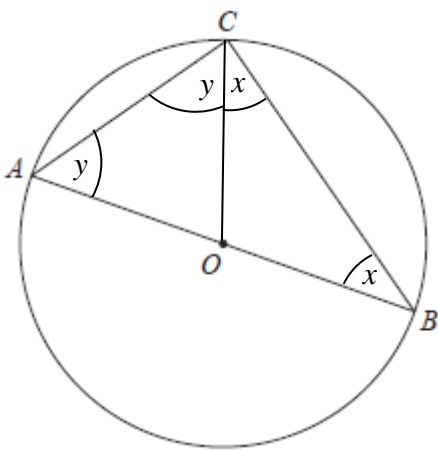
Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$0.5 \times 5 \times 2 = 5 \text{ or}$ $0.5 \times 5 \times (2 + 5) = 17.5 \text{ or}$ $0.5 \times 5 \times (5 + 10) = 37.5 \text{ or}$ $0.5 \times 5 \times (10 + 18) = 70$	1	This mark is given for splitting the area into 4 strips and finding the area of one triangle or trapezium
	$5 + 17.5 + 37.5 + 70$	1	This mark is given for a method to find and add up the totals of the four shapes
	130	1	This mark is given for the correct answer only
(b)	My answer to part (a) is an overestimate because the area measured is greater than the area below the curve	1	This mark is given for a correct statement



**Question 19 (Total 5 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$x = 10 + 2y$ $(10 + 2y)^2 + y^2 = 20$	1	This mark is given for a method to start the process by finding a value for $x$ in terms of $y$ and substituting
	$(100 + 20y + 20y + 4y^2) + y^2 = 20$ $4y^2 + 20y + 20y = 100$	1	This mark is given for expanding brackets on the expression obtained
	$5y^2 + 40y + 80 = 0$	1	This mark is given for forming a quadratic equation to be solved
	$(5y + 20)(y + 4) = 0$ $y = -4, x = 2$	1	This mark is given for solving the quadratic equation for $y$ and so find the value of $x$
	The line intersects the circle at only one point $(2, -4)$ , so must be a tangent	1	This mark is given for a fully correct statement to conclude the proof

**Question 20 (Total 4 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	 <p>base angles of an isosceles triangle are equal</p>	1	This mark is given for drawing the line $OC$ to make an isosceles triangles $OBC$ and $AOC$
	$x + x + y + y = 180^\circ$ angles in a triangle add up to 180	1	This mark is given for finding the sum of the angles in triangle $ABC$
	$2x + 2y = 2(x + y) = 180,$ so $x + y = \text{angle } ACB = 90^\circ$	1	This mark is given for a complete proof to show $ACB = 90^\circ$
		1	This mark is given for a complete proof with all reasons given

**Question 21 (Total 5 marks)**

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$	1	This mark is given for finding a vector expression for $\overrightarrow{AB}$
	$\overrightarrow{MN} = -\frac{1}{2}\mathbf{b} + \mathbf{a} + 2\mathbf{a}$ $= -\frac{1}{2}\mathbf{b} + 3\mathbf{a}$	1	This mark is given for finding a vector expression for $\overrightarrow{MN}$
	$\overrightarrow{PN} = -k(\mathbf{b} - \mathbf{a}) + 2\mathbf{a}$ $= -k\mathbf{b} + (2 + k)\mathbf{a}$	1	This mark is given for finding a vector expression for $\overrightarrow{PN}$
	Since $\overrightarrow{MN}$ is a multiple of $\overrightarrow{PN}$ $\frac{-\frac{1}{2}}{-k} = \frac{3}{(2+k)}$ $-\frac{1}{2}(2+k) = -3k$	1	This mark is given for recognising that $\overrightarrow{MN}$ is a multiple of $\overrightarrow{PN}$ and comparing coefficients of $\mathbf{a}$ and $\mathbf{b}$
	$k = \frac{2}{5}$	1	This mark is given for the correct answer only