

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

## November 2020 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 5 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$n^{3+5} = n^8$	B1	This mark is given for the correct answer only
(b)	$c^{3-2} \times d^{4-1}$	M1	This mark is given for either $c$ or $d^3$ seen
	$cd^3$	A1	This mark is given for the correct answer only
(c)	$5x > 14$	M1	This mark is given for a method to remove the fraction from the inequality
	$x > \frac{14}{5}$	A1	This mark is given for the correct answer only

**Question 2 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{30}{24} = 1.25, \frac{12}{8} = 1.5$	P1	This mark is given for a process to find out how many hours Andy cycles and runs for
	1 hour 15 minutes + 1 hour 30 minutes	P1	This mark is given for a process to convert into hours and minutes
	2 hours and 45 minutes	A1	This mark is given for the correct answer only

**Question 3 (Total 2 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$9.35 \leq m < 9.45$	B1	This mark is given for 9.35 in the correct position
		B1	This mark is given for 9.45 in the correct position

**Question 4 (Total 5 marks)**

<b>Part</b>	<b>Working or answer an examiner might expect to see</b>	<b>Mark</b>	<b>Notes</b>
(a)	$5 \times 9 = 45$ <span style="float: right;">3 kg</span> $10 \times 14 = 140$ <span style="float: right;">5 boxes = 10 kg</span>	P1	This mark is given for a process to find the areas of the lawns and the amount of grass seed required
	$\frac{140}{45} = 3.111\dots$	P1	This mark is given for a process to find the comparative sizes of the lawns
	$3 \times 3.111\dots = 9.333\dots$ kg	P1	This mark is given for a process to find the amount of grass seed needed for the larger lawn
	Yes, Maisie has enough grass seed	C1	This mark is given for a valid conclusion supported by correct working
(b)	Yes, there is an effect. 9 kg is not enough grass seed since 9.333... kg is required	C1	This mark is given for a valid conclusion supported by correct working

**Question 5 (Total 4 marks)**

<b>Part</b>	<b>Working or answer an examiner might expect to see</b>	<b>Mark</b>	<b>Notes</b>
(a)	$\frac{1}{3}, \frac{2}{3}, \frac{1}{3}, \frac{2}{3}, \frac{1}{3}, \frac{2}{3}$	B2	These marks are given for six fully correct probabilities  (B1 is given for at least two correct probabilities)
(b)	$\frac{1}{3} \times \frac{2}{3}$	M1	This mark is given for a method to find the probability
	$\frac{2}{9}$	A1	This mark is given for the correct answer only

**Question 6 (Total 2 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$x = -2, y = 4$	B1	This mark is given for the correct answer only
(b)	0.6, 3.4	M1	This mark is given for correct answers shown on the graph or given as coordinates (for example (0.6, 0) and (3.4, 0))
		A1	This mark is given for the correct answer only (in the ranges 0.55 to 0.6 and 3.4 to 3.45)

**Question 7 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$18 \times 16.2 = 291.6$ $27 \times 16.7 = 450.9$	M1	This mark is given for a method to find the total ages of the boys and the total ages of the girls
	$\frac{291.6 + 450.9}{45}$	M1	This mark is given for a method to find the mean age
	16.5	A1	This mark is given for the correct answer only

**Question 8 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$1 - 0.32 - 0.2 = 0.48$	P1	This mark is given for a process to find the total of the unknown probabilities
	$0.48 \times \frac{1}{6} = 0.08$	P1	This mark is given for a process to find the probability the counter will be yellow
	$0.08 \times 300 = 24$	A1	This mark is given for a correct answer only

**Question 9 (Total 5 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$h = 5 \tan 40^\circ$	P1	This mark is given for a process to find the height of the triangle
	$= 4.195$	P1	This mark is given for finding the height of the triangle
	$(\frac{1}{2} \times 10 \times 4.195) + (10 \times 12) = 140.975$	P1	This mark is given for a process to find the area of the cross-section of the prism
	$140.975 \times 20$	P1	This mark is given for a process to find the volume of the cross-section of the prism
	2820 (to 3 significant figures)	A1	This mark is given for a correct answer only

**Question 10 (Total 4 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$10^5 \times 81 \times 365 = 2.9565 \times 10^9$	P1	This mark is given for a process to estimate the number of heartbeats
	$3.0 \times 10^9$ (to 2 significant figures)	A1	This mark is given for a correct answer in the range $2.4 \times 10^9$ to $3.2 \times 10^9$
(b)	$\frac{90}{2 \times 10^{12}}$	P1	This mark is given for a process to find the mass of one blood cell
	$4.5 \times 10^{-11}$	A1	This mark is given for a conclusion and reason

**Question 11 (Total 3 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
		M1	<p>This mark is given for a method to find the positions of triangles Q and R</p> <p><b>Q</b> has coordinates <math>(-1, -2)</math>, <math>(-1, -5)</math> and <math>(-2, -5)</math></p> <p><b>R</b> has coordinates <math>(4, -4)</math>, <math>(4, -7)</math> and <math>(3, -7)</math></p>
	Rotation of $180^\circ$ about $(2.5, -1)$	A2	<p>These marks are given for a fully described transformation</p> <p>(A1 is given for any two of the three aspects)</p>
(b)	$(2.5, -1)$	A1	This mark is given for the correct answer only

**Question 12 (Total 6 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{2x(x+2) + x(x-4)}{(x-4)(x+2)}$	M1	This mark is given for a method to find a common denominator
		M1	This mark is given for a method to find an unsimplified numerator
	$\frac{3x^2}{(x-4)(x+2)}$	A1	This mark is given for a correct answer only
(b)	$(x-3)(2x+3) = 2x^2 - 6x + 3x - 9$ <p>or</p> $(2x+3)(4x+5) = 8x^2 + 12x + 20x + 15$	M1	This mark is given for a method to find the product of two brackets
	$(2x^2 - 3x - 9)(4x + 5) =$ <p>or</p> $(x-3)(8x^2 + 22x + 15) =$	M1	This mark is given for a method to find the product of two further brackets
	$8x^3 - 2x^2 - 51x - 45$	A1	This mark is given for a correct answer only

**Question 13 (Total 5 marks)**

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)		M2	These marks are given for a method to draw 3 of lines $x = 2$ , $y = x + 3$ , $2x + 3y = 6$ correctly (M1 is given for 2 lines drawn correctly)
		M1	This mark is given for region a region $R$ which satisfies at least 2 of the inequalities $x \leq 2$ , $y \leq x + 3$ and $2x + 3y \geq 6$
		A1	This mark is given for a fully correct graph
(b)	Geoffrey is incorrect; $4 < 8$ , $4 > 1$ and $2 + 4 = 6$ so $(2, 4)$ satisfies all the inequalities	B1	This mark is given for a valid conclusion with a correct reason given

**Question 14 (Total 4 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\angle DBF = 180 - 100 = 80$ Opposite angles of a cyclic quadrilateral add up to $180^\circ$	M1	This mark is given for a method to find the size of $\angle DBF$
	$\angle BFD = 180 - 80 - 40 = 60$ Angles in a triangle add up to 180	M1	This mark is given for a method to find the size of $\angle BFD$
	$\angle ABD = 60$ Alternate segment theorem	A1	This mark is given for the correct answer only
		C1	This mark is given for all three reasons stated

**Question 15 (Total 2 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	Let $10x = 7.333\dots$ Then $100x = 73.333\dots$ $90x = 66$	M1	This mark is given for a method to find an equation without a recurring decimal
	$x = \frac{66}{90} = \frac{11}{15}$	A1	This mark is given for showing the recurring decimal in as a rational number

**Question 16 (Total 4 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{30 \times 9}{2}$	M1	This mark is given for a method to find the area of a triangle with coordinates (0, 0), (30, 0) and (30, 9)
	135	A1	This mark is given for a correct estimate of the distance the car travelled
(b)	underestimate, since the area between the line and the curve is not included	C1	This mark is given for a valid conclusion and reason given
(c)	For example: Julian's method gives average speed in first 60 seconds Julian has not drawn a tangent at time 60 seconds Julian has not worked out the gradient at time 60 seconds	C1	This mark is given for a correct explanation



**Question 17 (Total 4 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$(7.2 - 6.4) \times 10 = 8$ $(7.6 - 7.2) \times 50 = 20$	P1	This mark is given for a process to find at least one frequency
	$(8.0 - 7.6) \times 100 = 40$ $(8.2 - 8.0) \times 60 = 12$	P1	This mark is given for a process to find at all frequencies
	$\frac{(6.8 \times 8) + (7.4 \times 20) + (7.8 \times 40) + (8.1 \times 12)}{8 + 20 + 40 + 12}$ $= \frac{6116}{80}$	P1	This mark is given for a process to find an estimate of the mean
	7.645	A1	This mark is given for the correct answer only

**Question 18 (Total 4 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	Lower bound for $AH = 11.25$	M1	This mark is given for a method to find the lower bound for the length $AH$
	Let $a$ = the length of one side of the cube $a^2 + a^2 + a^2 = 11.25^2$	M1	This mark is given for a method to use $a^2 + a^2 + a^2$ as the length of the diagonal
	$3a^2 = 11.25^2$	M1	This mark is given for a method to write an equation to find the length of a side
	$a = 6.5$	A1	This mark is given for the correct answer in the range 6.49 – 6.50

**Question 19 (Total 4 marks)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\text{Area } ABCDEF = 6 \times \frac{1}{2} \times x \times x \times \sin 60$	P1	This mark is given for a start to the process to find the area of $ABCDEF$
	$= \frac{6\sqrt{3}}{4}x^2 = \frac{3\sqrt{3}}{2}x^2$	P1	This mark is given for a full process to find the area of $ABCDEF$
	$\text{Area } FGHIJK = 6 \times \frac{1}{2} \times px \times px \times \sin 60$ $= \frac{6\sqrt{3}}{4}p^2x^2 = \frac{3\sqrt{3}}{2}p^2x^2$	P1	This mark is given for a process to find the area of $FGHIJK$
	The shaded region of the diagram is $\frac{3\sqrt{3}}{2}p^2x^2 - \frac{3\sqrt{3}}{2}x^2 = \frac{3\sqrt{3}}{2}(p^2 - 1)x^2$	C1	This mark is given for fully correct algebra to show the result required

**Question 20 (Total 1 mark)**

Part	Working or answer an examiner might expect to see	Mark	Notes
	$98^{91}$	B1	This mark is given for a process to find the total amount of money shared

**Question 21 (Total 5 marks)**

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$5c + d = c + 4d$ $4c = 3d$	P1	This mark is given for process to isolate terms in $c$ to obtain $4c = 3d$
	$3 : 4$	A1	This mark is given for the correct answer only
(b)	$6x^2 - 7xy - 20y^2 = 0$	P1	This mark is given for a process to form a quadratic equation equal to 0
	$(2x - 5y)(3x + 4y) = 0$	P1	This mark is given for a process to factorise the quadratic equation
	$5 : 2$	A1	This mark is given for the correct answer only