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

Summer 2023 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 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$k^{(3 \times 4)} = k^{12}$	M1	This mark is given for the correct answer only
(b)	$y^{(6 + 9)} = y^{15}$	A1	This mark is given for the correct answer only
(c)	$5m^4 + 10m^3$	B2	These marks are given for a fully correct answer (B1 is given for $m^4 + 2m^4$ or $5m^4$ or $10m^3$ seen)

Question 2 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$550 \times 0.76 = 418$	P1	This mark is given for a process to find the number of people will eat sandwiches
	$418 \times 3 = 1254$	P1	This mark is given for a process to find the number of sandwiches that will be eaten
	$1254 \times 2 = 2508$	P1	This mark is given for a process to find the number of slices of bread that will be needed
	2500	A1	This mark is given for the correct answer given to the nearest hundred slices
(b)	For example: The amount will need to be less Jenny will need 2244 slices Jenny will need 264 fewer slices	C1	This mark is given for a valid statement

Question 3 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$ACD = 130$ $ACB = 180° - 130 = 50$	M1	This mark is given for a method to find angle ACB
	Corresponding angles are equal Angles on a straight line add to 180	C1	This mark is given for correct reasons stated
	$ABC = 180 - 100 = 80$ Angles on a straight line add to 180	M1	This mark is given for a method to find angle ABC (with reason given)
	$CAB = 180 - 80 - 50 = 50$	M1	This mark is given for a method to find angle CAB
	Triangle ABC has two base angles of 50 and so is isosceles	C1	This mark is given for a full complete explanation supported by correct working

Question 4 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{9 \times 24}{15}$	P1	This mark is given for the start of a process to use inverse proportion
	14.4	A1	This mark is given for a correct answer only (accept 14 hours 24 minutes)

Question 5 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$3^2 \times 5 = 45$	B1	This mark is given for the correct answer only
(b)	2^3 or 3^5 or 5^3 seen	M1	This mark is given for a method to find the lowest common multiple (LCM)
	$2^3 \times 3^5 \times 5^3 = 243\,000$	A1	This mark is given for a correct answer only

Question 6 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{98\,310}{8.7} = 11\,300$	P1	This mark is given for a start to a process to find the number of hours it takes for the sludge to flow
	$\frac{11300}{60 \times 60} = 3.13888\ldots$	P1	This mark is given for complete process to find the number of days (using the number of seconds in an hour)
	3	A1	This mark is given for the correct answer (given to the nearest hour)

Question 7 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	(1, –3)	B1	This mark is given for the correct answer only
	0 **or** 2	B1	This mark is given for a correct answer only

Question 8 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$3.5 = \frac{m}{216}$	M1	This mark is given a for a method to use density = mass ÷ volume, where m is the mass of the cube
	$m = 3.5 \times 216 = 756$	A1	This mark is given for the correct answer only

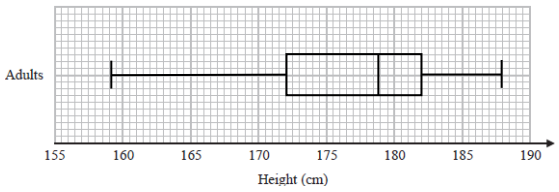
Question 9 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$0.6 \times 0.35 = 0.21$	M1	This mark is given for a method to find the percentage
	21	B1	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
	$AC = 7.3 \times \sin 36 = 4.29\ldots$	M1	This mark is given for a method to find the length AC
	$\tan 48 = \frac{4.29...}{DC}$, $DC = \frac{4.29...}{\tan 48} = \frac{4.29...}{1.110...}$	M1	This mark is given for a full method to find the length DC
	3.9	A1	This mark is given for a correct answer (given to 1 decimal place)

Question 11 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)		M1	This mark is given for a at least two correctly plotted values, including a box and whiskers
		M1	This mark is given for a at least three correctly plotted values (from 159, 188, 179, 172 and 182), including a box and whiskers
		A1	This mark is given for a fully correct box plot
(b)	For example: the median for the heights of gorillas is greater than the median for the heights of chimpanzees the heights of chimpanzees are lower in general since the median is lower	C1	This mark is given for a correct comparison of medians stated
	For example: the interquartile range (IQR) of the heights of gorillas is greater than the interquartile range (IQR) of the heights of chimpanzees the range of the heights of the chimpanzees is less than the range of heights of the gorillas	C1	This mark is given for a correct comparison of spread stated

Question 12 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$(x + 2)(x – 3) = x^2 + 2x – 3x – 6$ **or** $(x – 3)(x + 4) = x^2 – 3x + 4x – 12$ **or** $(x + 2)(x + 4) = x^2 + 2x + 4x + 8$	P1	This mark is given for a method to find the product of two linear expressions
	$(x + 4)(x^2 – x – 6) =$ $x^3 – x^2 – 6x + 4x^2 – 4x – 24$ **or** $(x + 2)(x^2 + x – 12) =$ $x^3 + x^2 – 12x + 2x^2 + 2x – 24$ **or** $(x – 3)(x^2 + 6x + 8) =$ $x^3 + 6x^2 + 8x – 3x^2 – 18x – 24$	M1	This mark is given for a method to obtain all the terms in the expression
	$x^3 + 3x^2 – 10x – 24$	A1	This mark is given for finding the expression in the form $ax^3 + bx^2 + cx + d$

Question 13 (Total 3 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$2n$ and $2n + 2$ or $2n + 4$	M1	This mark is given for a method to describe two consecutive even numbers
	$2n + 2n + 2 + 2n + 4$	A1	This mark is given for a sum of three consecutive even numbers
	$6n + 6 = 6(n + 1)$ For example: Multiplying by 6 results in a multiple of 6	C1	This mark is given for a valid statement following correct working

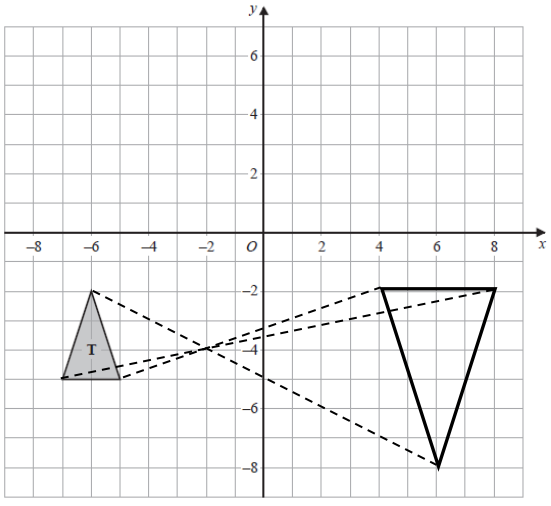
Question 14 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$OB^2 = 10^2 + 8^2 - (2 \times 10 \times 8 \times \cos 32°)$	P1	This mark is given for a method to use the cosine rule to find the length OB
	$OB = \sqrt{100 + 64 - 135.68...} = 5.32…$	P1	This mark is given for the correct answer in the form required
	$\frac{75}{360} \times \pi \times (5.32…)^2$	P1	This mark is given for a process to find the area of OBC
	18.5	A1	This mark is given for the correct answer (to 3 significant figures)

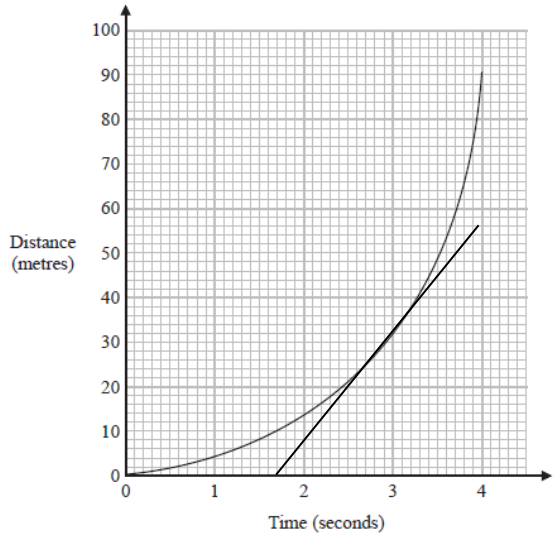
Question 15 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$(p + q)(p - q)$	B1	This mark is given for the correct answer only
(b)	$(3^{30} + 1)(3^{30} - 1)$	M1	This mark is given for a method to factorise the expression $3^{60} - 1$
	3^{30} is odd so both $(3^{30} + 1)$ and $(3^{30} - 1)$ are even		This mark is given for a correct explanation leading to the conclusion

Question 16 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
		B2	These marks are given for a fully correct triangle with coordinates (4, –2), (8, –2) and (6, –8) (B1 is given for the correct shape in the wrong orientation of with at most one incorrect coordinate)

Question 17 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)		M1	This mark is given for a tangent drawn at 3
	For example: $\frac{56-0}{4-1.7}$	M1	This mark is given for a complete method to find the tangent
	24	A1	This mark is given for a correct answer in the range 22 to 28
(b)	Velocity or speed	C1	This mark is given for a correct description of the gradient

Question 18 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$(8 \div 15) \times 3 = 1.6$	P1	This mark is given for a process to find the radius of the base of the small cone
	$(3 \times \pi \times 15) - (1.6 \times \pi \times 8) = 32.2\pi$	P1	This mark is given for a process to find the curved surface area of the frustum
	upper face: $\pi \times 1.6^2 = 2.56\pi$ lower face: $\pi \times 3^2 = 9\pi$	P1	This mark is given for a process to find the surface areas of the two circular faces of the frustum
	$32.2\pi + 2.56\pi + 9\pi = 43.76\pi = 137.5..$	P1	This mark is given for a method to find the total surface area of the frustum
	137	A1	This mark is given for the correct answer (to 3 significant figures)

Question 19 (Total 1 mark)

Part	Working or answer an examiner might expect to see	Mark	Notes
	For example: the curve should go through (0, 1) the curve should not go through (0, 0)	C1	This mark is given for a correct explanation stated

Question 20 (Total 3 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$x = 0.25656\ldots$ **or** $10x = 2.5656\ldots$ **or** $100x = 25.656\ldots$ **or** $1000x = 256.56\ldots$	M1	This mark is given for a method to find a way to represent $0.2\dot{5}\dot{6}$ and appropriate multiples of $0.2\dot{5}\dot{6}$
	For example: $1000x - 10x = 256.56\ldots - 2.5656\ldots$ $990x = 254$	M1	This mark is given for a method to use two recurring decimals to find a terminating decimal
	$0.2\dot{5}\dot{6} = \frac{254}{990} = \frac{127}{495}$	C1	This mark is given for a a completely correct proof

Question 21 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$(2 – 2x) + 4(x + 5) = (2 – 2x)(x + 5)$	M1	This mark is given for a method to rearrange to form an equation without fractions
	$2x + 22 = –2x^2 – 8x + 10$ $2x^2 + 10x + 12 = 0$	M1	This mark is given for a method to rearrange the equation to a quadratic form
	$2(x + 2)(x + 3) = 0$	M1	This mark is given for a method to solve the quadratic equation formed
	–2 and –3	A1	This mark is given for the correct solutions only

Question 22 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$3p + 4q = 26$ $5p + 8q = 50$	M1	This mark is given for a method to set up an equation in p and q
	$6p + 8q = 52$ $5p + 8q = 50$ so $p = 2$ $6 + 4b = 26$, $q = 5$	M1	This mark is given for a method to solve simultaneous equations
	$q = 2.5p$	A1	This mark is given for a correct answer only

Question 23 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$-1 \div -\frac{6}{8} = \frac{8}{6}$	M1	This mark is given for a method to use $mn = -1$ to find the gradient of the tangent to the circle at P
	$y = \frac{8}{6}x + c$ $-6 = \frac{8}{6} \times 8 + c \quad \text{so} \quad c = -\frac{100}{6}$	M1	This mark is given for a method to find an equation of the tangent to the circle at P
	$0 = \frac{8}{6}x - \frac{100}{6}, \quad x = \frac{25}{2}$ $y = \frac{8}{6} \times 13 - \frac{100}{6}, \quad y = \frac{4}{6}$	M1	This mark is given for a method to substitute $y = -\frac{1}{2}$ or $x = 16$
	No; when $x = 13$, $y = \frac{4}{6}$ **or** No; when $y = 0$, $x = \frac{25}{2}$	C1	This mark is given for correct conclusion, supported by correct working

Question 24 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$y = 4x$	P1	This mark is given for a process to use $y = 4x$ (wherever that appears)
	Green: $\frac{x}{4x} \times \frac{x-1}{4x-1}$ Orange: $\frac{6}{4x} \times \frac{5}{4x-1}$ Yellow: $\frac{4x-x-6}{4x} \times \frac{4x-x-7}{4x-1}$	P1	This mark is given for a start to the process to find each of the probabilities of taking two sweets of the same colour
	Green: $\frac{x(x-1)}{4x(4x-1)} = \frac{x^2-x}{16x^2-4x}$ Orange: $\frac{30}{4x(4x-1)} = \frac{30}{16x^2-4x}$ Yellow: $\frac{(3x-6)(3x-7)}{4x(4x-1)} =$ $\frac{9x^2-39x+42}{16x^2-4x}$	P1	This mark is given for a full process to find each of the probabilities of taking two sweets of the same colour
	$\frac{x^2-x}{16x^2-4x} + \frac{30}{16x^2-4x} + \frac{9x^2-39x+42}{16x^2-4x}$	P1	This mark is given for a process to add probabilities
	$\frac{10x^2-40x+72}{16x^2-4x}$	A1	This mark is given for a correct answer in the form required, following correct working