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

November 2021 student-friendly mark scheme

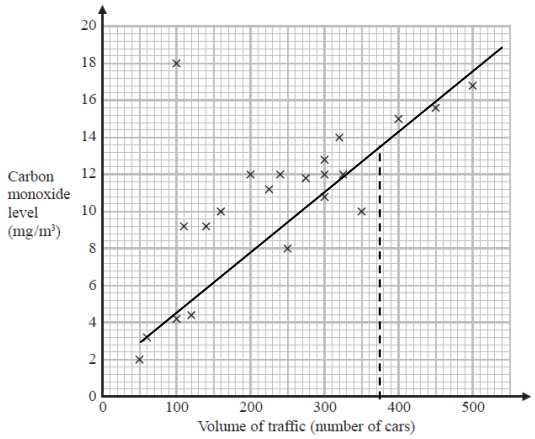
Please note that this mark scheme is not the one used by examiners for marking scripts. It is intended more as a guide to good practice, indicating where marks are given for correct answers. As such, it doesn't show follow-through marks (marks that are awarded despite errors being made) or special cases.

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 or answer an examiner might expect to see	Mark	Notes
(a)	(100, 18)	B1	This mark is given for the correct answer only
(b)		M1	This mark is given for a method to read off a line of best fit or to find a point on the grid at (370, *y*), where *y* is in the range 12.8 to 14.6
	13.7	A1	This mark is given for a correct answer in the range 12.8 to 14.6
(c)	For example: No, this point can be disregarded from the general trend	C1	This mark is given for a correct reason

Question 2 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$9 + 2 + 1 = 12$	M1	This mark is given for a method to work with the ratio given
	$6000 \times \frac{2}{12} = 1000$	M1	This mark is given for a method to find the total weight of the cheese needed
	$\frac{1000}{175} = 5.71\ldots$	M1	This mark is given for a method to find the number of lots of 175 g of cheese needed
	$2.25 \times 5.71\ldots = 12.857\ldots$	A1	This mark is given for a correct truncated or rounded answer of 12.85 or 12.86

Question 3 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	450 000	B1	This mark is given for a correct answer only
(b)	7×10^{-3}	B1	This mark is given for a correct answer only
(c)	$4200 + 530 = 4730$	M1	This mark is given for a method to find the calculation as an ordinary number
	4.73×10^3	A1	This mark is given for the correct answer only

Question 4 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Company **A**: $\frac{2400}{8} \times 1.666 = 500$ minutes	P1	This mark is given for a process to find the amount of time taken by Company **A**
	$2.2 \times 4.54 = 9.988$ litres per minute	P1	This mark is given for a process to convert gallons to litres
	Company **B**: $\frac{2400}{9.988} = 240.29\ldots$ minutes	P1	This mark is given for a process to find the amount of time taken by Company **B**
	$500 - 240.29\ldots = 259.71\ldots$ 260	A1	This mark is given for the correct answer (to the nearest minute) only

Question 5 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Fifth term $= 3a + 5a = 8a$	P1	This mark is given for a process to find the value of the fifth term of the sequence
	$a + 2a + 3a + 5a + 8a = 19a$ $19a = 228$	P1	This mark is given for finding an equation in a to be solved
	$a = \frac{228}{19} = 12$	A1	This mark is given for the correct answer only

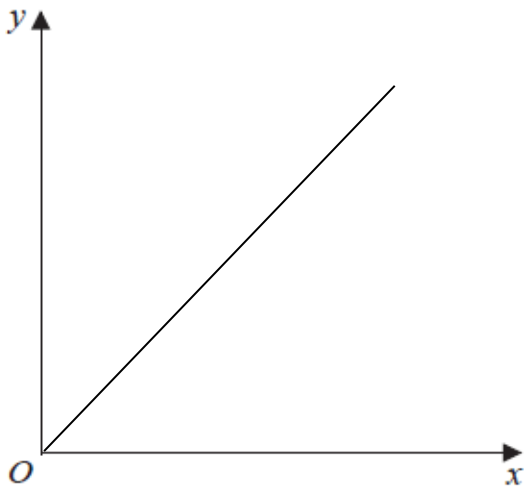
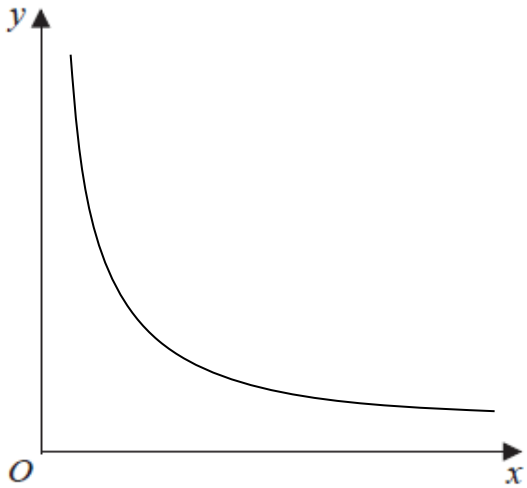
Question 6 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$1 - 0.05 - 0.15 = 0.8$	P1	This mark is given for a process to find the probability of picking a green or pink counter
	0.5, 0.3	A1	This mark is given for the correct answer only
(b)	$\frac{18}{0.15}$	M1	This mark is given for a method to find the total number of counters in the bag
	120	A1	This mark is given for the correct answer only

Question 7 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Area of triangle = $\frac{1}{2} \times 8 \times 8 = 32$	P1	This mark is given for a process to find the area of the triangle
	Area of $\frac{1}{4}$ circle = $\frac{\pi r^2}{4} = \frac{64}{4\pi} = 16\pi$	P1	This mark is given for a process to find the area of the quarter circle
	Area of shaded section = $16\pi - 32$	P1	This mark is given for a process to find the area of the shaded segment
	18.3	A1	This mark is given for a correct answer (to 3 significant figures)

Question 8 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
		C1	This mark is given for a correct graph sketched
		C1	This mark is given for a correct graph sketched

Question 9 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{12 \times 5}{15}$	P1	This mark is given for a process to find out many hours were needed to clean the cars
	4	A1	This mark is given for the correct answer only
(b)	For example: It could take more time It could take less time	C1	This mark is given for a correct statement

Question 10 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{9+6}{6} = 2.5$	P1	This mark is given for a process to find the scale factor
	$AC = 2.5 \times DE = 5$	P1	This mark is given for a process to find the length AC
	$CB = \sqrt{15^2 - 5^2} = \sqrt{200}$	P1	This mark is given for a process to find the length CB
	14.14	A1	This mark is given for the correct answer (given to 2 decimal places)

Question 11 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$6.35 \leq x < 6.45$	B1	This mark is given for 6.35 in the correct position
		B1	This mark is given for 6.45 in the correct position

Question 12 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$x^{\frac{6}{n}} = x^3$, $\frac{6}{n} = 3$ $a^{\frac{1}{n}} = 7$	P1	This mark is given for a method to find the product of two linear expressions
	$n = 2$ When $n = 2$, $a = 49$	A1	This mark is given for two correct answers only

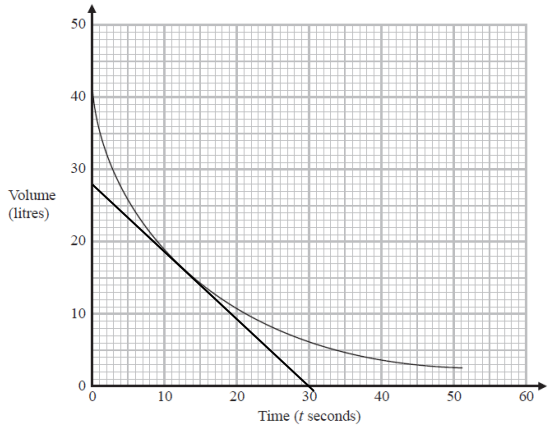
Question 13 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$l + l - w = 11 - 3$	P1	This mark is given for a process to set up and equation for the width of the pattern
	$l + l + w = 20 - 4$	P1	This mark is given for a process to set up and equation for the height of the pattern
	$l + l - w = 8$ $l + l + w = 16$ $4l = 24$ so $l = 6$ and $w = 4$	P1	This mark is given for a process to find the length and width of the rectangles used in the pattern
	(3 + 6, 4 + 4)	P1	This mark is given for a process to find the coordinates of C
	(9, 8)	A1	This mark is given for the correct answer only

Question 14 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Assume Olivia and Jessica have $(9 + 1)a$ sweets shared in ratio $9a : a$	P1	This mark is given for a process to find how many sweets Olivia and Jessica have
	Then Fran and Gary have $20a$ sweets shared in ratio $2: 3 = 8a : 12a$	P1	This mark is given for a process to find how many sweets Fran and Gary have
	$w : x : y : z$ are in ratio $8a : 12a : 9a : a$	P1	This mark is given for a process to find an unsimplified ratio
	8 : 12 : 9 : 1	A1	This mark is given for the correct answer only

Question 15 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
		M1	This mark is given for a tangent to the curve drawn at $t = 12$
	For example: $28 \div 30$	M1	This mark is given for a method to find the gradient of the tangent
	0.933	A1	This mark is given for an answer in the range 0.7 to 1.0

Question 16 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$x^2 + 3x - 3 = 5x - 4$	M1	This mark is given for a method to eliminate y
	$x^2 - 2x + 1 = 0$	M1	This mark is given for a method to rearrange to form a quadratic equation
	$(x - 1)(x - 1) = 0$ $x = 1$	M1	This mark is given for correctly factorising and solving the quadratic equation
	There is only one value of x, so only one point (set of coordinates) in common	C1	This mark is given for a correct answer only

Question 17 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$x = ky^2$ $y = cz^3$	M1	This mark is given for setting up an equation of proportionality
	$x = k(cz^3)^2$ $x = kc^2z^6$	M1	This mark is given for setting up an equation of proportionality eliminating y
	When $z = 2$, $x = kc^2 \times 64$ Constant $kc^2 = \frac{1}{2}$	M1	This mark is given for substituting $z = 2$ and $x = 32$ to find the value of the constant
	$x = \frac{1}{2}z^6$	A1	This mark is given for a correct answer only

Question 18 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\overrightarrow{DB} = \frac{3}{5}OB$	P1	This mark is given for a process to find a relationship involving $\overrightarrow{DB}$
	$\overrightarrow{DB} = \frac{3}{5}(\mathbf{a} + \mathbf{b})$	P1	This mark is given for a process to find a vector expression for $\overrightarrow{DB}$
	$\overrightarrow{BE} = \frac{1}{5}\overrightarrow{BC} = \frac{1}{5}(-\mathbf{b} - \mathbf{a} + 3\mathbf{b})$	P1	This mark is given for a process to find a vector expression for $\overrightarrow{BE}$
	$\overrightarrow{DE} = \overrightarrow{DB} + \overrightarrow{BE} = \frac{2}{5}\mathbf{a} + \mathbf{b}$	A1	This mark is given for a correct answer only

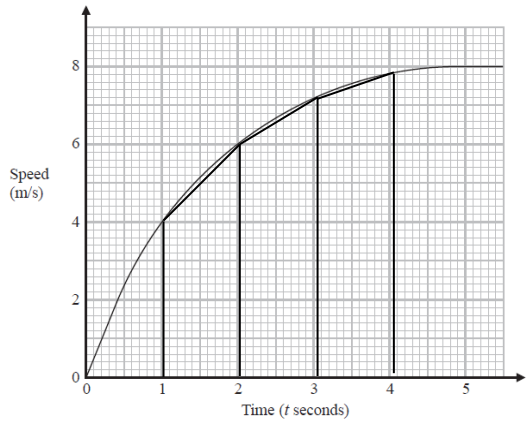
Question 19 (Total 3 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	Population in 2017 = 4000 Population in 2018 = $4000k$ Population in 2019 = $4000k^2 = 3160$	P1	This mark is given for a process to use the formula for the population
	$k^2 = \frac{3160}{4000}$, $k = \sqrt{\frac{3160}{4000}}$	P1	This mark is given for a process to find k
	0.95	A1	This mark is given for a correct answer only

Question 20 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\left(\frac{1}{2}\right)^n$	M1	This mark is given for a finding the probability that Pat throws *n* heads or *n* tails
	$1-\left(\frac{1}{2}\right)^n-\left(\frac{1}{2}\right)^n$	A1	This mark is given for the correct answer only

Question 21 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)		M1	This mark is given for stating an upper or lower bound for *l* or *T*
	$\frac{1}{2}((4+6)+(6+7.2)+(7.2+7.8))$	M1	This mark is given for a complete method to find an estimate for the area under the graph
	19.1	A1	This mark is given for a correct answer in the range 19 to 20
(b)	Distance travelled by the object	C1	This mark is given for a correct statement

Question 22 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{6x^3}{(9x^2-144)} \times \frac{3(x-4)}{2x^4}$	M1	This mark is given for a method to invert the fraction and multiply
	$\frac{6x^3}{3(x+4)\times 3(x-4)} \times \frac{3(x-4)}{2x^4}$ $= \frac{6x^3}{(x+4)\times 6x^4}$	M1	This mark is given for a method to simplify the fraction
	$\frac{1}{x(x+4)}$	A1	This mark is given for the correct answer only

Question 23 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	For triangle *ABD*, area = $\frac{1}{2} \times AB \times AD \times \sin x$ For triangle *ADC*, area = $\frac{1}{2} \times AD \times AC \times \sin x$	M1	This mark is given for a method to use area = $\frac{1}{2}ab \sin C$ to find the areas of *ABD* and *ADC*
	For triangle *ABD*, area = $\frac{1}{2} \times h \times BD$ For triangle *ADC*, area = $\frac{1}{2} \times h \times DC$	M1	This mark is given for a method to find another expression for the areas of *ABD* and *ADC*
	$\frac{0.5\times AB\times AD\times \sin x}{0.5\times AD\times AC\times \sin x} = \frac{0.5\times h\times BD}{0.5\times h\times DC}$	M1	This mark is given for a method to find the ratio of the areas of the triangles
	$\frac{AB}{AC} = \frac{BD}{DC}$ thus $\frac{AB}{BD} = \frac{AC}{DC}$	C1	This mark is given for a full method to arrive at the given answer