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

Summer 2022 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 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$7x < 35$	M1	This mark is given for a method to solve the inequality
	$x < 5$	A1	This mark is given for a correct answer only

Question 2 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	2, 2, 31	M1	This mark is given for a complete method to find the prime factors (for example, using a factor tree with no more than one error)
	$2 \times 2 \times 31$	A1	This mark is given for a correct answer (or equivalent)

Question 3 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$160 \div (3 + 7) = 16$	P1	This mark is given for the first step in a process to find the number of cars
	$16 \times 3 = 48$	P1	This mark is given for a full process to find the number of cars
	$48 \times \frac{1}{8} = 6$	P1	This mark is given for a process to find the number of cars that use electricity
	$48 \times 0.25 = 12$	P1	This mark is given for a process to find the number of cars that use diesel
	$48 - 6 - 12 = 30$	A1	This mark is given for the correct answer only

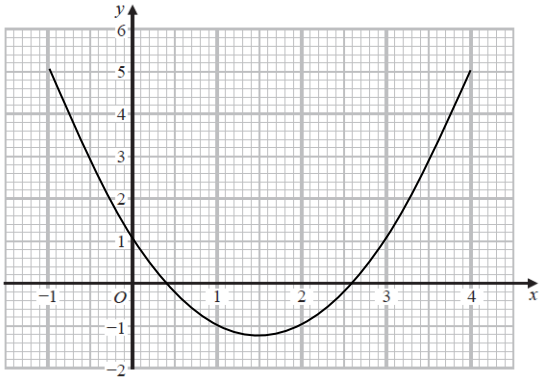
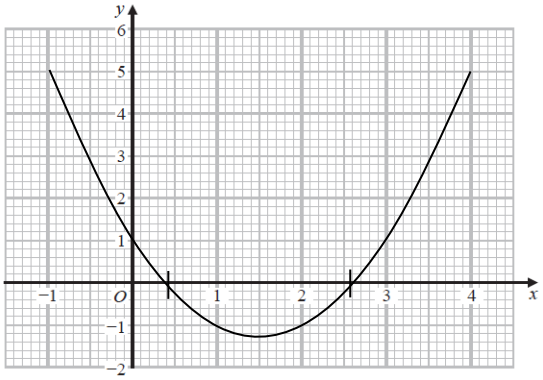
Question 4 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	0.00163	B1	This mark is given for the correct answer only
(b)	4.38×10^5	B1	This mark is given for the correct answer only
(c)	$4 \times 6 \times 10^3 \times 10^{-5}$	M1	This mark is given for a method to find the answer
	2.4×10^{-1}	A1	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
	Hexagon: $360 \div 6 = 60$ or $180 \times 4 \div 6 = 120$ Pentagon: $360 \div 5 = 72$ or $180 \times 3 \div 5 = 108$	M1	This mark is given a method to find an exterior angle or an interior angle of one of the shapes
	$60 + 72$ or $360 - 120 - 108$	M1	This mark is given for a complete method to find the size of the angle x
	132	A1	This mark is given for the correct answer only

Question 6 (Total 6 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	<table><tr><td>x</td><td>–1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>y</td><td>5</td><td>1</td><td>–1</td><td>–1</td><td>1</td><td>5</td></tr></table>	B2	This mark is given for a fully correct table (B1 is given for two or three correct values)
(b)		M1	This mark is given for at least four of the points (–1, 5), (0, 1), (1, –1), (2, –1), (3, 1) and (4, 5) plotted correctly
		A1	This mark is given for a fully correct curve drawn
(c)		M1	This mark is given for showing marks indicating the interception of the curve with the x-axis
	x = 0.4 and x = 2.6	A1	Accept answers in the range 0.2 to 0.6 and 2.4 to 2.8

Question 7 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Volume of cube **A** = $3^3 = 27$ Volume of cube **B** = $4^3 = 64$	P1	This mark is given a process to find the volume of at least one cube
	Density of cube **A** = 81 ÷ 27 = 3 Density of cube **B** = 128 ÷ 64 = 2	P1	This mark is given a process to find the density of at least one cube
	3 : 2	A1	This mark is given for the correct answer only (or equivalent)

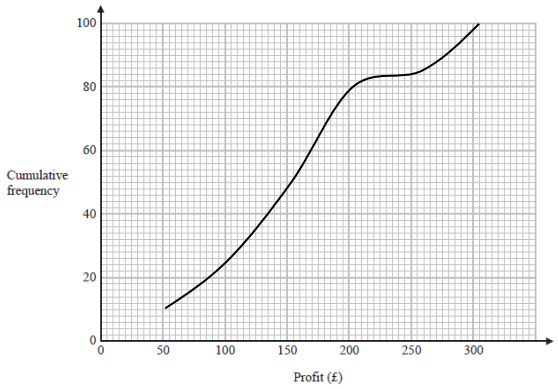
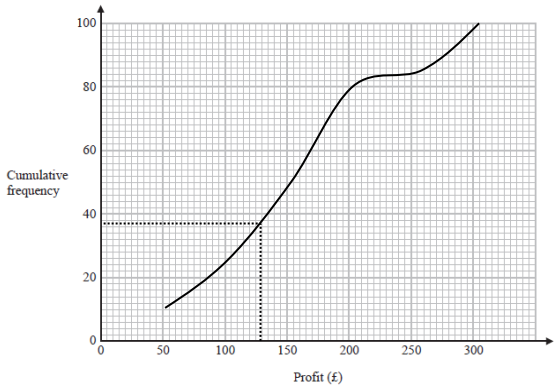
Question 8 (Total 3 marks)

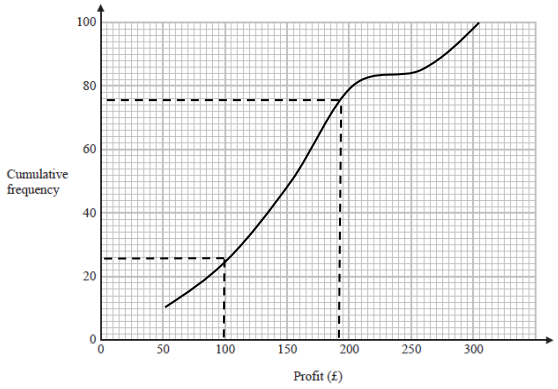
Part	Working or answer an examiner might expect to see	Mark	Notes
	For example: $a \times 8$ for the first product, where $0 \leq a \leq 10$	M1	This mark is given for finding five products within the intervals (including end points)
	$\frac{(5\times8)+(15\times10)+(25\times7)+(35\times2)+(45\times3)}{8+10+7+2+3}$ $= \frac{40+150+175+70+135}{30} = \frac{570}{30}$	M1	This mark is given for a method to work out an estimate for the mean amount of snow per day
	19	A1	This mark is given for the correct answer only

Question 9 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$4 \times 4 = 16$ $5 \times 6 = 30$ $5 \times 7 = 35$ $6 \times 7 = 42$	M1	This mark is given for working out at least three areas found on the solid
	$(2\times30)+(2\times35)+(2\times42)+(5\times16)-(4\times4)$ $= 60 + 70 + 84 + 80 – 16$	M1	This mark is given for a complete method to find the total surface area of the solid
	278	A1	This mark is given for the correct answer only

Question 10 (Total 6 marks)

<table>
<tr><th>Part</th><th>Working or answer an examiner might expect to see</th><th>Mark</th><th>Notes</th></tr>
<tr><td>(a)</td><td>
<table>
<tr><th>Profit £(x)</th><th>Cumulative frequency</th></tr>
<tr><td>$0 \leq x \leq 50$</td><td>10</td></tr>
<tr><td>$0 \leq x \leq 100$</td><td>25</td></tr>
<tr><td>$0 \leq x \leq 150$</td><td>50</td></tr>
<tr><td>$0 \leq x \leq 200$</td><td>80</td></tr>
<tr><td>$0 \leq x \leq 250$</td><td>85</td></tr>
<tr><td>$0 \leq x \leq 300$</td><td>100</td></tr>
</table>
</td><td>B1</td><td>This mark is given for the correct answer only</td></tr>
<tr><td rowspan="2">(b)</td><td rowspan="2"> 
</td><td>M1</td><td>This mark is given for five or 6 points correctly plotted from the table in part (a)</td></tr>
<tr><td>A1</td><td>This mark is given for a fully correct graph</td></tr>
<tr><td>(c)</td><td> 

37</td><td>B1</td><td>This mark is given for a correct answer in the range 35 to 39</td></tr>
<tr><td rowspan="2">(d)</td><td> 

185 – 95</td><td>M1</td><td>This mark is given for finding the difference between readings taken from the profit axis at cf 75 and cf 225</td></tr>
<tr><td>90</td><td>A1</td><td>This mark is given for a correct answer in the range 85 to 95</td></tr>
</table>

Question 11 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{3}{7} = \frac{9}{9+4+x}$	P1	This mark is given for a process to equate relative frequencies
	$9 + 4 + x = 3 \times 7 = 21$	P1	This mark is given for a process to set up an equation to be solved
	$x = 8$	A1	This mark is given for the correct answer only

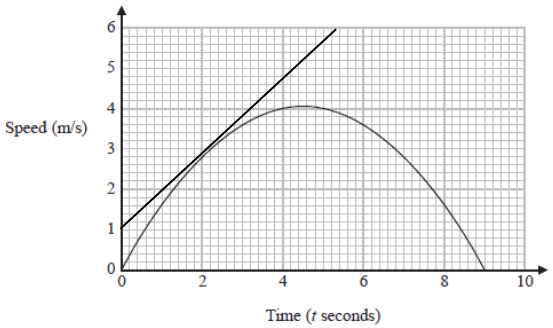
Question 12 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$1000x = 117.1717\ldots$	M1	This mark is given for setting up an initial equation
	$10x = 1.1717\ldots$ $1000x - 10x = 117.1717\ldots - 1.1717\ldots$ $990x = 116$	M1	This mark is given for a method to find an equation which eliminates the recurring decimal
	$\frac{116}{990}$	A1	This mark is given for a correct answer (or equivalent, for example $\frac{58}{495}$)

Question 13 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Let the diameter of semicircle **A** = a, that of **B** = b and that of **C** = c Using Pythagoras' theorem, $a^2 = b^2 + c^2$	M1	This mark is given for a method to show the relationship using Pythagoras' theorem,
	Area of semicircular region **A** = $\frac{\pi}{2}\left(\frac{a}{2}\right)^2 = \frac{\pi}{8}a^2$ Area of semicircular region **B** = $\frac{\pi}{2}\left(\frac{b}{2}\right)^2 = \frac{\pi}{8}b^2$ Area of semicircular region **C** = $\frac{\pi}{2}\left(\frac{c}{2}\right)^2 = \frac{\pi}{8}c^2$	M1	This mark is given for a method to find the areas of the semicircular regions using $\frac{\pi r^2}{2}$
	$a^2 = b^2 + c^2$ and multiplying each term by $\frac{\pi}{8}$ gives $\frac{\pi}{8}a^2 = \frac{\pi}{8}b^2 + \frac{\pi}{8}c^2$, so area of region **A** = area of region **B** + area of region **C**	C1	This mark is given for a full explanation

Question 14 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	 For example, gradient = $\frac{5}{5.5} = 0.9$	M1	This mark is given for drawing a tangent at $t = 2$
		M1	This mark is given for a method to find the gradient
		A1	This mark is given for a correct gradient
(b)	For example: distance travelled	C1	This mark is given for a correct statement

Question 15 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\overrightarrow{AC} = 5(3\mathbf{a} + 4\mathbf{b})$	M1	This mark is given for a method to find $\overrightarrow{AC}$ in terms of $\overrightarrow{AB}$
	$\overrightarrow{AC} = 5\ \overrightarrow{AB}$ and so they are on the same line and in the same direction	C1	This mark is given for a correct proof with reason given
(b)	$\overrightarrow{DF} = (3\mathbf{e} + 6\mathbf{f}) + (-10.5\mathbf{e} - 21\mathbf{f})$ $= (-7.5\mathbf{e} - 15\mathbf{f})$	P1	This mark is given for a process to find the length of $\overrightarrow{DF}$
	$\overrightarrow{DF} = -2.5\ \overrightarrow{DE}$	P1	This mark is given for a process to find a multiplicative relationship between $\overrightarrow{DE}$ and $\overrightarrow{DF}$
	5 : 2	A1	This mark is given for the correct answer only (or equivalent)

Question 16 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$1 - 0.75 = 0.25$	M1	This mark is given for a method to find the probability of failing the theory test
	Let x be the probability of passing the practical test and $(1 - x)$ be the probability of failing the practical test. Then $0.75(1 - x) + 0.25x$	M1	This mark is given for a method to form an expression for the probability of passing only one of the two tests (awarded for $0.75(1 - x)$ or $0.25x$ seen)
	$0.75(1 - x) + 0.25x = 0.36$	M1	This mark is given for a method to form an equation for the probability of passing only one of the two tests (may be seen on a tree diagram)
	$0.75 - 0.75x + 0.25x = 0.36$ $0.75 - 0.5x = 0.36$ $0.5x = 0.39$ $x = 0.78$	A1	This mark is given for the correct answer only (or an equivalent fraction or percentage)

Question 17 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$y = k\sqrt{t}$ or $y \propto \sqrt{t}$ $t = \frac{k}{x^3}$ or $t \propto \frac{1}{x^3}$	P1	This mark is given for a process to set up proportionality (the mark is awarded for any one of these four expressions seen)
	$15 = k\sqrt{9}$ so $k = 5$ $8 = \frac{k}{2^3}$ so $k = 64$	P1	This mark is given for a process to find the constants of proportionality
	$y = 5\sqrt{\frac{64}{x^3}}$	P1	This mark is given for a process to combine equations
	$y = \frac{40}{\sqrt{x^3}}$ or $\frac{40}{x^{\frac{3}{2}}}$	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
	$\left(5\frac{4}{9}\right)^{-\frac{1}{2}} = \left(\frac{49}{9}\right)^{-\frac{1}{2}} = \left(\frac{9}{49}\right)^{\frac{1}{2}} = \frac{3}{7}$	M1	This mark is given for a method to simplify $\left(5\frac{4}{9}\right)^{-\frac{1}{2}}$
	$\frac{3}{7} \times \left(4\frac{2}{3}\right) = \frac{3}{7} \times \frac{14}{3} = 2$	M1	This mark is given for a method to simplify the numerator
	$\frac{2}{2^{-3}} = 2 \times 2^3$	M1	This mark is given for a method to divide by the denominator
	16	A1	This mark is given for a correct answer only

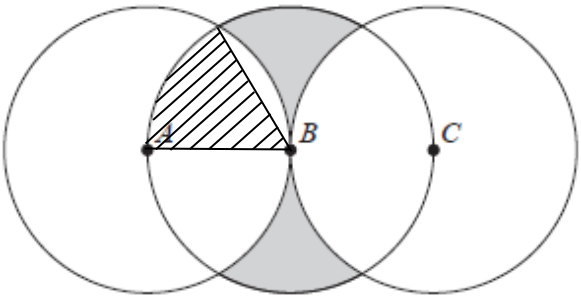
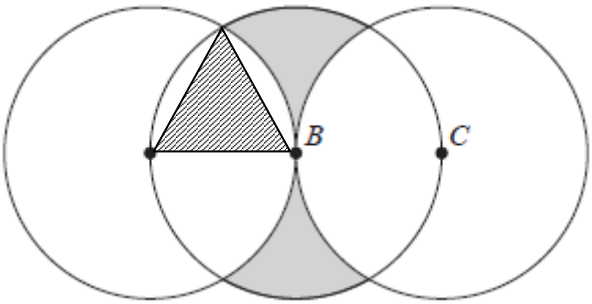
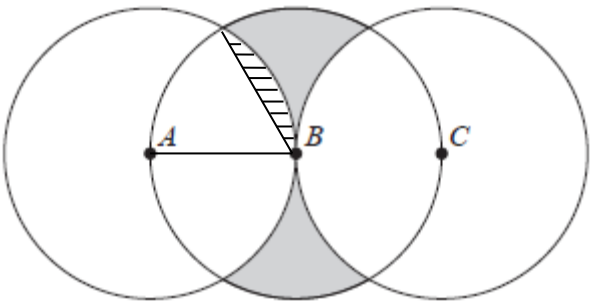
Question 19 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\frac{(x-1)+3(2x-1)}{(2x-1)(x-1)} = 1$	M1	This mark is given for a method to find a common denominator
	$7x - 4 = 2x^2 - 3x + 1$ $2x^2 - 10x + 5 = 0$	M1	This mark is given for a method to rearrange to find a quadratic
	$\frac{10 \pm \sqrt{100 - 4 \times 2 \times 5}}{2 \times 2} = \frac{10 \pm \sqrt{60}}{4}$	M1	This mark is given for a method to solve the quadratic equation
	$\frac{5 \pm \sqrt{15}}{2}$	A1	This mark is given for the correct answer in the form $\frac{p + \sqrt{q}}{2}$

Question 20 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{8-3}{6--1} = \frac{5}{7}$	P1	This mark is given for a process to find the gradient from the centre of the circle to the point (6, 8)
	Gradient of tangent to the circle at $A = -\frac{7}{5}$	P1	The mark is given for a process using $mn = -1$ to find the gradient to the tangent
	$y = -\frac{7}{5}x + c$ so $5y = -7x + c$ $40 = -42 + c,\ c = 82$	P1	This mark is given for a process to find the equation of the tangent
	$7x + 5y - 82 = 0$	A1	This mark is given for a correct answer only in the form $ax + by + c = 0$

***Question 21 (Total 5 marks)**

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\pi \times 4^2 \times \frac{60}{360} = \frac{8\pi}{3}$	P1	This mark is given for a process to find the area of a sector of angle 60° 
	$\frac{1}{2} \times 4 \times 4 \times \sin 60° = 4\sqrt{3}$	P1	This mark is given for a process to find the area of the equilateral triangle 
	$\frac{8\pi}{3} - 4\sqrt{3}$	P1	This mark is given for a process to subtract the area of the equilateral triangle from the area of the sector 
	$16\pi - \left(\left(4 \times \frac{8\pi}{3}\right) + 4\left(\frac{8\pi}{3} - 4\sqrt{3}\right)\right) =$ $\frac{48\pi}{3} - \frac{32\pi}{3} - \frac{32\pi}{3} + 16\sqrt{3}$	P1	This mark is given for full process to find the shaded area: (the area of the circle) minus (the area of four sectors plus four lots of the equilateral triangle subtracted from the sector)
	$16\sqrt{3} - \frac{16\pi}{3}$	A1	This mark is given for the correct answer (or equivalent)

*This is one way of solving this problem – there are plenty of others.