GCSE Mathematics (1MA1) – Aiming for 9 Paper 1H

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 or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{10}{6+8+9+7+10} \times \frac{10}{6+8+9+7+10}$ $= \frac{10}{40} \times \frac{10}{40} = \frac{100}{1600}$	M1	This mark is given for a method to find the probability of a score of 5 both times
	$\frac{1}{16}$	A1	This mark is given for the correct answer only
(b)	$\frac{6}{40} \times 100$	M1	This mark is given for a method to find the percentage of times a score of 1 is expected
	15	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
	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 3 (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 4 (Total 2 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	(180, –1)	B1	This mark is given for 180
		B1	This mark is given for –1

Question 5 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{4\pi}{2 \times \pi \times 18} = \frac{x}{360}$	P1	This mark is given for a process to use equal proportions
	$x = \frac{4\pi}{36\pi} \times 360$	P1	This mark is given for a process to find the value of x
	40	A1	This mark is given for the correct answer only

Question 6 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{3}{11} \times \frac{8}{10}$ or $\frac{7}{11} \times \frac{4}{10}$ or $\frac{1}{11} \times \frac{10}{10}$	P1	This mark is given for a start to the process to find a probability of two cards of different colours
	$(\frac{3}{11} \times \frac{8}{10}) + (\frac{7}{11} \times \frac{4}{10}) + (\frac{1}{11} \times \frac{10}{10})$	P1	This mark is given for a complete process to find a probability of two cards of different colours
	$\frac{62}{110}$	A1	This mark is given for a correct answer only (accept equivalent fractions, decimals)

Question 7 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$OBA = \frac{180 - x}{2}$ angles in a triangle add up to 180 base angles of an isosceles triangle are equal	M1	This mark is given for a method to find the angle OBA
	$ABC = 90 - \frac{180 - x}{2} = \frac{180}{2} - \frac{180 - x}{2}$ $= \frac{180}{2} - \frac{180}{2} + \frac{x}{2} = \frac{x}{2}$ (or $\frac{1}{2}x$) the tangent to a circle is perpendicular to the radius	M1	This mark is given for a method to find the angle ABC
	or the angle at the centre of a circle is twice the angle at the circumference (alternate segment theorem)	C1	This mark is given for correct reasons given for each stage of working

Question 8 (Total 5 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\frac{(x+1)-x}{x(x+1)} = 4$ so $\frac{1}{x(x+1)} = 4,$	P1	This mark is given for a process to find a common denominator
	$1 = 4x(x + 1)$ $1 = 4x^2 + 4x$ $4x^2 + 4x - 1$	P1	This mark is given for rearranging to express the equation as a quadratic to be solved
	$\frac{-4 \pm \sqrt{4^2 - 4 \times 4 \times -1}}{2 \times 4}$ or $(x + \frac{1}{2})^2 - \frac{1}{2} = 0$	P1	This mark is given for a process to substitute into the quadratic formula or to complete the square
	$\frac{-4 \pm \sqrt{32}}{8}$ or $\pm\sqrt{\frac{1}{2}} - \frac{1}{2}$	A1	This mark is given for finding solutions for the values of x
	$-\frac{1}{2} + \frac{1}{2}\sqrt{2}, \quad -\frac{1}{2} - \frac{1}{2}\sqrt{2}$	A1	This mark is given for answers in the form $a \pm b\sqrt{2}$ as required

Question 9 (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 $ax + by + c = 0$

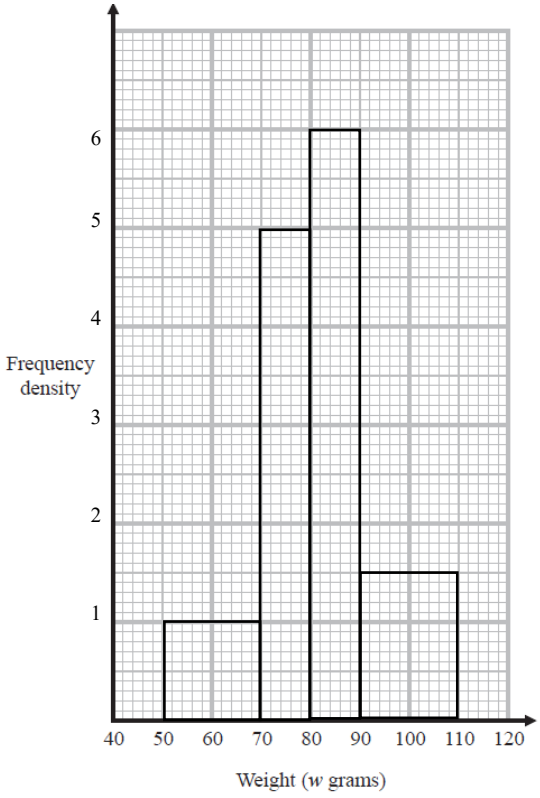
Question 10 (Total 4 marks)

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 11 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$\sin 30° = 0.5$	P1	This mark is given for recognising the sine of 30° is 0.5
	$\frac{6.5}{\sin ABC} = \frac{10.7}{\sin 30}$	P1	This mark is given for the use of the sine rule
	$\sin ABC = \frac{6.5 \times 0.5}{10.7}$	P1	This mark is given for a process to find the value of sin *ABC*
	$\frac{65}{214}$	A1	This mark is given for a correct answer only

Question 12 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
		B3	These marks are given for a fully correct histogram (B2 is given for at least 3 correct blocks or all 4 frequency densities 1, 5, 6 and 1.5 correct) (B1 is given for at least 2 correct blocks or at least 3 frequency densities correct)

Question 13 (Total 5 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	For example: $10 \div \sqrt{5} = 2\sqrt{5}$, $20\sqrt{5} \div 10 = 2\sqrt{5}$, $200 \div 20\sqrt{5} = 2\sqrt{5}$, $400\sqrt{5} \div 200 = 2\sqrt{5}$	P1	This mark is given for a process to identify the common ratio
	$400\sqrt{5} \times 2\sqrt{5} = 4000$	A1	This mark is given for the correct answer only
(b)	$\frac{5\sqrt{2}}{8} \div \frac{5\sqrt{2}}{4} = \frac{1}{2}$	P1	This mark is given for a process to find the ratio of the 4th and 6th terms
	$\frac{5\sqrt{2}}{4} \div \left(\frac{1}{\sqrt{2}}\right)^3 = \frac{5\sqrt{2}}{4} \times 2\sqrt{2} = \frac{10 \times 2}{4}$	P1	This mark is given for a process to find the first term
	5	A1	This mark is given for the correct answer only

Question 14 (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 15 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$(2m + 1)^2 = (4m^2 + 4m + 1)$ $(2n - 1)^2 = (4n^2 - 4n + 1)$	M1	This mark is given for a method to expand $(2m + 1)^2$ or $(2n - 1)^2$
	$(4m^2 + 4m + 1) - (4n^2 - 4n + 1)$ $= 4m^2 + 4m + 1 - 4n^2 + 4n - 1$ $= 4m^2 + 4m\ - 4n^2 + 4n$	M1	This mark is given for a method to find an expression with both expansions correct
	$= 4(m^2 + m\ - n^2 + n)$ $= 4m(m + 1 - n^2 + n)$ $=4(m + n)(m - n + 1)$	C1	This mark is given for a full proof with no errors
(b)	Yes, Sophia is correct. $2m + 1$ and $2n - 1$ are both odd numbers and the right-hand side of the equation is a multiple of 4	C1	This mark is given for a correct reason supported by a valid explanation

Question 16 (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 17 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Enlargement Scale factor $\frac{1}{2}$ Centre (0, 2)	B2	These marks are given for all three aspects of the transformation stated (B1 is given for two aspects stated)

Question 18 (Total 6 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$\frac{4}{3}\pi r^3 = \frac{1}{3}\pi r^2 h$ so $4r = h$	P1	This mark is given for a process to equate the two volumes
	1 : 4	P1	This mark is given for the correct answer only
(b)	$4\pi r^2 = \pi r^2 + \pi rl$	P1	This mark is given for a process to equate the two surface areas
	$4\pi r^2 = \pi r^2 + \pi r\sqrt{h^2 + r^2}$	P1	The mark is given for a process to substitute $l = \sqrt{h^2 + r^2}$
	$3\pi r^2 = \pi r\sqrt{h^2 + r^2}$ $3r = \sqrt{h^2 + r^2}$ $9r^2 = h^2 + r^2$ $8r^2 = h^2$	P1	This mark is given for a process to find an equation in terms of r^2
	1 : √8	A1	This mark is given for the correct answer only

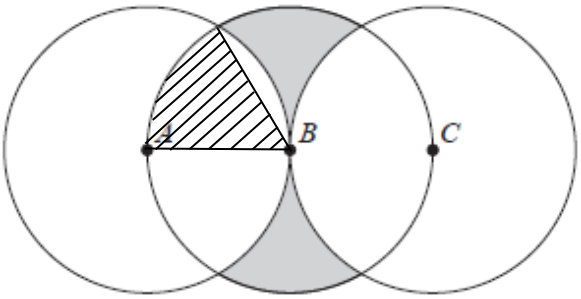
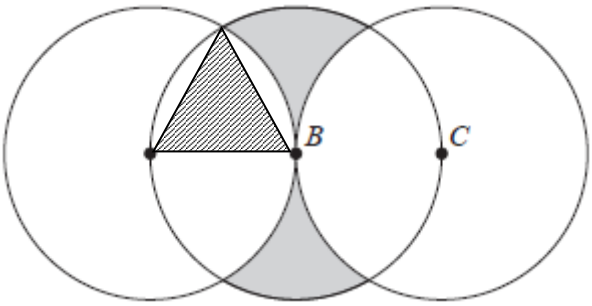
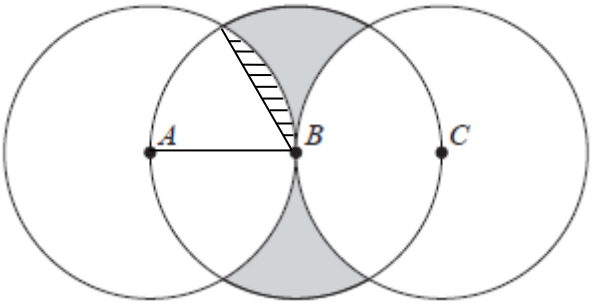
Question 19 (Total 4 marks)

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 20 (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 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.

Aiming for 9 Paper 1H (Set 3)					Edexcel averages: mean scores of students who achieved grade								
Qn	**Skill tested**	**Mean score**	**Max score**	**Mean %**	**ALL**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**U**
1	Samples and theoretical probability distributions	1.32	4	33	1.32	3.85	2.78	2.64	1.95	1.51	0.75	0.35	0.02
2	Measures of central tendency (median, mean, mode and modal class)	1.45	3	48	1.45	2.67	2.17	1.69	1.25	0.84	0.45	0.20	0.10
3	Index notation	1.68	4	42	1.68	3.54	2.92	2.15	1.31	0.58	0.19	0.05	0.02
4	Graphs of trigonometric functions	0.36	2	18	0.36	1.73	1.34	0.98	0.59	0.24	0.11	0.04	0.28
5	Arc lengths, angles and areas of sectors of circles	0.55	3	18	0.55	2.58	2.34	1.69	0.94	0.29	0.08	0.05	0.00
6	Independent and dependent combined events	0.46	3	15	0.46	2.55	2.00	1.44	0.72	0.28	0.07	0.01	0.14
7	Circle theorems	0.41	3	14	0.41	2.42	1.64	1.14	0.61	0.33	0.11	0.02	0.08
8	Solve quadratic equations	0.62	5	12	0.62	4.03	3.24	1.63	1.01	0.32	0.09	0.02	0.13
9	Equation of a circle	1.08	4	27	1.08	3.21	2.30	1.32	0.50	0.12	0.02	0.01	0.01
10	Construct and interpret equations that describe inverse proportion	1.72	4	43	1.72	3.20	2.68	2.18	1.52	0.77	0.28	0.06	0.02
11	Sine and cosine rule	0.71	4	18	0.71	3.18	2.90	2.19	1.25	0.47	0.10	0.01	0.77
12	Histograms with equal and unequal class intervals	0.58	3	19	0.58	2.24	1.89	1.69	0.97	0.45	0.18	0.02	0.05
13	Linear and non-linear sequences of diagrams and numbers	0.80	5	16	0.80	3.61	2.25	1.41	1.06	0.73	0.50	0.32	0.64
14	Vectors	1.44	5	29	1.44	3.56	2.55	1.66	0.96	0.53	0.28	0.09	0.05
15	Mathematical arguments and proofs	0.74	4	19	0.74	2.81	2.09	1.60	1.25	0.77	0.30	0.08	0.29
16	Solve quadratic equations	0.89	4	22	0.89	2.75	1.70	0.99	0.48	0.17	0.05	0.02	0.01
17	Transformations	0.23	2	12	0.23	1.27	0.76	0.65	0.39	0.16	0.06	0.00	0.04
18	Surface area and volume of spheres, pyramids, cones and composite solids	0.56	6	9	0.56	3.60	2.57	1.42	0.93	0.39	0.09	0.05	0.49
19	Independent and dependent combined events	0.47	4	12	0.47	2.04	0.86	0.41	0.16	0.05	0.01	0.01	0.00
20	Mathematical arguments and proofs	0.48	3	16	0.48	1.31	0.80	0.53	0.34	0.17	0.07	0.02	0.01
21	Arc lengths, angles and areas of sectors of circles	0.09	5	2	0.09	0.60	0.10	0.03	0.01	0.01	0.00	0.00	0.00
		16.64	**80**	**21**	**16.64**	**56.75**	**41.88**	**29.44**	**18.20**	**9.18**	**3.79**	**1.43**	**3.15**

Suggested grade boundaries

Grade	**9**	**8**	**7**	**6**	**5**	**4**	**3**
Mark	**49**	**36**	**24**	**14**	**6**	**4**	**1**