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

October 2016 mock paper 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. In some cases full marks can be given for a question or part of questions where no working is seen. However, it is wise to show working for one small slip could lead to all marks being lost if no working is shown. Some questions (such as QWC) 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).

Note that in some cases a correct answer alone will not score marks unless supported by working; these situations are made clear in the mark scheme. Examiners are prepared to award zero marks if the student's response is not worthy of credit according to the mark scheme.

Question 1 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	24, 48, 72, 96, 120, … 20, 40, 60, 80, 100, 120, …	P1	This mark is given for a process to list multiples of 24 and 20 with at least 3 numbers in each list, or an expansion of 24 and 20 into factors
	120 minutes (or 2 hours)	A1	This mark is given for a correct answer identifying the lowest common multiple (LCM)
	9.30 a.m.	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
	$(x + 5)^2(x + 5)^2 =$	C1	This mark is given for a correct for expansion of $(x + 5)^2$ with at least 3 terms correct or for a substitution of the same number into both expressions (counterexample)
	$(x + 5)^2 = x^2 + 10x + 25$ Azmol is wrong; $x^2 + 10x + 25 \neq x^2 + 25$ for all values of x	C1	This mark is given for a correct evaluation of both expressions

Question 3 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$105 \div (5 - 2)$ (= 35) Kim gets £70, Molly gets £175	P1	This mark is given for a strategy to start to solve the problem
	$385 - (2 \times 35) - (5 \times 35)$ (= 140) or $(385 \div 35) - 2 - 5$ (= 4)	P1	This mark is given for a process to find Laura's share
	$\frac{140}{385} \times 100$ or $\frac{4}{11} \times 100$	P1	This mark is given for a process to find the percentage Laura gets
	36.4%	A1	This mark is given for an answer in range 36.3 to 36.4

Question 4 (Total 2 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	Points are joined with a curve, not with line segments	C1	This mark is given for a correct statement
	Points should be plotted at mid-points of the intervals, not end points	C1	This mark is given for a correct statement

Question 5 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	5% = 2.30; 100% = 20 × 2.30	M1	This mark is given for a method to link 5% with 2.30 or 100 ÷ 5 (= 20)
	46	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
	$(180 \times 3) \div 5$ (= 108) or $360 \div 5$ (= 72)	P1	This mark is given for a process to find either an interior or an exterior angle of the pentagon *ABCDE*
	$FCD = CDF = 72$ $CFD = 180 - 72 - 72$	P1	This mark is given for a complete process to find angle *CFD*
	36	A1	This mark is given for a correct answer only

Question 7 (Total 6 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\pi \times 4.2_2 (\div 2)$	P1	This mark is given for a process to find the area of circle or semicircle
	$(8.4 \times 5.6) + \frac{\pi \times 4.2^2}{2}$	P1	This mark is given for a process to find the area of the garden (= 74.7...)
	$74.7 \div 12$ (= 6.22, so 7 boxes required)	P1	This mark is given for a process to find number of boxes required
	7×4.99	P1	This mark is given for a process to find the cost of 7 boxes
	34.93	A1	This mark is given for a correct answer only
(b)	Carol might need to buy fewer boxes	C1	This mark is given for a correct statement

Question 8 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{4}{7}, \frac{3}{7}$	B1	This mark is given for two correct answers only
	$\frac{3}{8}, \frac{5}{8}, \frac{3}{8}, \frac{5}{8}$	B1	This mark is given for four correct answers only
	$\frac{3}{7} \times \frac{5}{8}$	M1	This mark is given for a method to find the probability of two red pens
	$\frac{15}{56}$	A1	This mark is given for a correct answer only

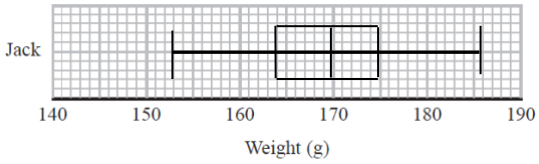
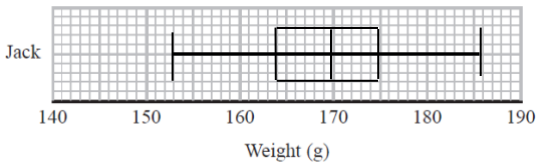
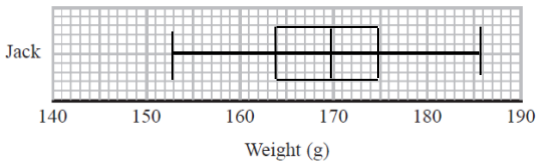
Question 9 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(i)	D	B1	This mark is given for a correct answer only
(ii)	A	B1	This mark is given for a correct answer only

Question 10 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	12, m^5, r^7	M1	This mark is given for 2 of 3 parts correct in a product
	$12m^5r^7$	A1	This mark is given for a correct answer only

Question 11 (Total 6 marks) ***********

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	166 – 158 = 8	B1	This mark is given for a correct answer only
(b)		C1	This mark is given for at least 2 correctly plotted values, including box or whiskers / tails, or 5 correct values and no whiskers / tails
		C1	This mark is given for at least 2 correctly plotted values including box and whiskers / tails
	 Fully correct box plot drawn (minimum = 153, lower quartile = 164, median = 170, upper quartile = 175, maximum = 186)	C1	This mark is given for a fully correct box plot
(c)		C1	This mark is given for a correct comparison of medians
		C1	This mark is given for a correct comparison of a measure of spread For the award of both marks, at least one of the comparisons must be interpretative

Question 12 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$3 \times 20 \times 120$ (= 7200)	P1	This mark is given for a process to find volume of the piece of wood
	8000 ÷ 7200 or 1030 ÷ 1000	P1	This mark is given for a process to find a density of the piece of wood or the density of the sea water
	1.11… and 1.03…	P1	This mark is given for a complete process to find two densities to be compared
	The piece of wood will not float since it has a greater density than the sea water (1.11 > 1.03)	P1	This mark is given for an answer supported by a comparison of the correct densities

Question 13 (Total 7 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$x^2 + 5x - 4 = -4$ when $x = 0$, $x^2 + 5x - 4 = 2$ when $x = 1$	M1	This mark is given for a method to establish at least one root in the interval $0 < x < 1$
	Since there is a sign change, there must be at least one root in $0 < x < 1$	C1	This mark is given for a correct statement
(b)	$x^3 + 5x = 4$ $x^2 + 5 = \frac{4}{x}$	C1	This mark is given for at least one correct step in rearrangement
	$x = \frac{4}{x^2 + 5}$	C1	This mark is given for a fully correct chain of reasoning
(c)	$x_1 = 0.8$ or $x_1 = \frac{4}{5}$	B1	This mark is given for a correct answer only
	$x_2 = \frac{4}{(0.8)^2 + 5}$	M1	This mark is given for a method to substitute x_1 into the iteration formula to find x_2
	0.709… or $\frac{100}{141}$	A1	This mark is given for a correct answer only

Question 14 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$0.5 = \left(1 - \frac{x}{100}\right)^8$ or $0.5 = r^8$	M1	This mark is given for a method to determine an equation to solve the problem
	$r = \sqrt[8]{0.5} = 0.917(\ldots)$	M1	This mark is given for a method to solve the equation found
	$x = 1 - 0.917 = 0.083$ $= 8.3\%$	A1	This mark is given for an answer in the range 8.29 – 8.3

Question 15 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$160 \div (10 \div 8)^2$ or $160 \times (8 \div 10)^2$	M1	This mark is given for a method to determine the ratio of the areas and so find the area of the base of pot **A**
	102.4	A1	This mark is given for a correct answer only

Question 16 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	a: 6.425 or 6.435 (or 6.434999...) b: 5.5135 or 5.5145 (or 5.5144999…)	B1	This mark is given for finding a bound of a or a bound of b
		P1	This mark is given for a process to use the upper bounds and lower bounds in an expression
	Lower bound for $v = \sqrt{\frac{6.425}{5.5145}}$ Upper bound for $v = \sqrt{\frac{6.435}{5.5135}}$	P1	This mark is given for choosing the correct upper and lower bounds
	$\sqrt{\frac{6.425}{5.5145}} = 1.079(4027...)$ $\sqrt{\frac{6.435}{5.5135}} = 1.080(3403...)$	A1	This mark is given for finding 1.079... and 1.080... (both values must clearly come from correct working)
	1.08; both the upper bound and the lower bound round to this value	C1	This mark is given for a correct answer and explanation

Question 17 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Volume of cylinder = $\pi \times (3x)^2 \times h$ Volume of one sphere = $\frac{4}{3}\pi \times (\frac{1}{2}x)^3$	P1	This mark is given for a process of substituting to find volume of cylinder and volume of sphere
	$9x^2\pi h = 270 \times \frac{4}{3}\pi \times \frac{x^3}{8}$	P1	This mark is given for a process to for forming a correct equation
	Cancelling, $x^2h = 5x^3$ ($h =$) $5x$	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
	$(5 + m)f = 4 - 3m$	M1	This mark is given for a method to for multiplying both sides by $5 + m$ as a first step
	$fm + 3m = 4 - 5f$	M1	This mark is given for a method to for correctly moving their m terms to one side and their other terms to the other side
	$(f + 3)m = 4 - 5f$	M1	This mark is given for a method to for factorising
	$m = \frac{4-5f}{f+3}$	A1	This mark is given for a correct answer only

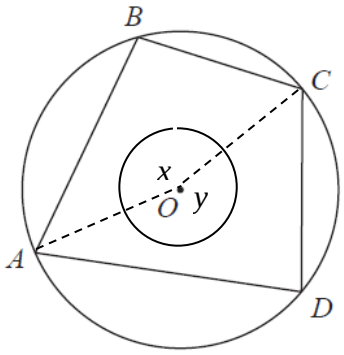
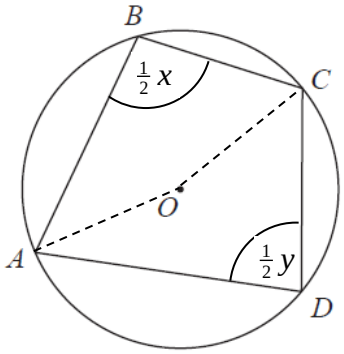
Question 19 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\tan 34° = \frac{CD}{20}$, $CD = 20 \tan 34° = 13.49$	P1	This mark is given for a process to process to find the length of CD
	$\cos 34° = \frac{20}{BD}$, $BD = \frac{20}{\cos 34°} = 24.12$ or $BD^2 = 20^2 + CD^2 = 400 + 181.98 = 581.98$ $BD = \sqrt{581.98} = 24.12$	P1	This mark is given for a process to process to find the length of BD
	$\frac{AD}{\sin 60°} = \frac{BD}{\sin(180 - 60 - 45)°}$ $AD = \frac{BD}{\sin 75°} \times \sin 60° = 21.63$	P1	This mark is given for using the sine rule to find the length of AD
	$\sin DAC = \frac{DC}{AD} = 0.624$	P1	This mark is given for a process to process to find sin DAC
	$\angle DAC = 38.6$	A1	This mark is given for a correct answer only answer in range 38.5 – 38.6

Question 20 (Total 7 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$(-4)^2 + 2 = 18$	B1	This mark is given for a correct answer only
	$(2x - 3)^2 + 2$	C1	This mark is given for a correct first step
	$= 4x^2 - 6x - 6x + 9 + 2$ $= 4x^2 - 12x + 11$	C1	This mark is given for a correct fully correct chain of reasoning that the includes correct expansion of $(2x - 3)^2$
	$2(x^2 + 2) - 3 = 4x^2 - 12x + 11$	P1	This mark is given for a process to process to find fg(x) and form an equation
	$2x^2 + 1 = 4x^2 - 12x + 11$ $2x^2 - 12x + 10 = 0$	P1	This mark is given for a process to reduce the equation to the form $ax^2 + bx + c = 0$
	$(2x - 2)(x - 5) = 0$	P1	This mark is given for a process to solve the quadratic equation
	$x = 1$, $x = 5$	A1	This mark is given for a correct answer only

Question 21 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	 angles at a point add up to 360° $x + y = 360°$	C1	This mark is given for drawing *AO* and *OC* and considering angles around the point *O*
	The angle at the centre of a circle is twice the angle at the circumference $\angle ABC = \frac{1}{2}x$ or $\angle ADC = \frac{1}{2}y$ 	C1	This mark is given for a correct use of "angle at centre..." to find angle *ABC* or angle *ADC*
	$\angle ABC + \angle ADC = \frac{1}{2}x + \frac{1}{2}y$ $= \frac{1}{2}(x + y) = \frac{1}{2}(360°) = 180°$	C1	This mark is given for a conclusion
		C1	This mark is given for a correct complete proof with all reasons given NB: "opposite angles of a cyclic quadrilateral add up to 180°" is not acceptable