Mark Scheme (Results)

June 2011

Methods in Mathematics (GCSE)
Unit 2: Methods 5MM2H_01

NOTES ON MARKING PRINCIPLES

1 All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.

2 Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.

3 All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.

4 Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.

5 Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

6 Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

i) *ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear*
Comprehension and meaning is clear by using correct notation and labeling conventions.

ii*) select and use a form and style of writing appropriate to purpose and to complex subject matter*
Reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning.

iii) *organise information clearly and coherently, using specialist vocabulary when appropriate*.
The mathematical methods and processes used are coherently and clearly organised and the appropriate mathematical vocabulary used.

7   With working
If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.
If there is no answer on the answer line then check the working for an obvious answer.
Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader.
If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

8   Follow through marks
Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.
Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

9   Ignoring subsequent work
It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect canceling of a fraction that would otherwise be correct
It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.
Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

10   Probability
Probability answers must be given a fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).
Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.
If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.
If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

11   Linear equations
Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

12   Parts of questions
Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

13   Range of answers
Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and includes all numbers within the range (e.g 4, 4.1)

Guidance on the use of codes within this mark scheme
M1 – method mark A1 – accuracy mark B1 – Working mark C1 – communication mark QWC – quality of written communication oe – or equivalent cao – correct answer only ft – follow through sc – special case dep – dependent (on a previous mark or conclusion) indep – independent isw – ignore subsequent working

5MM2H_01				
Question	**Working**	**Answer**	**Mark**	**Notes**
1	*BDC* = 180 – 117 (=63) *CBD* = 180 – 63 – 31 OR *CBD* = 117 - 31	86	5	M1 for 180 – 117 (=63) M1 for 180 – '63' – 31 A1 for x = 86° [Note: For the award of A1, it is NOT enough just to say, or show, that angle CBD = 86°] C2 for all 3 reasons ***angles*** in a ***triangle*** add up to ***180°*** ***angles*** on a ***straight line*** add up to ***180°*** ***corresponding angles*** on parallel lines are equal (C1 for 1 or 2 reasons) OR M2 for 117 - 31 A1 for x = 86° [Note: For the award of A1, it is NOT enough just to say, or show, that angle CBD = 86°] C2 for both reasons ***External (exterior)angle*** of a triangle equals sum of two ***interior opposite angles*** ***corresponding angles*** on parallel lines are equal (C1 for 1 reason)
2	168 ÷ (3 + 4 + 5) (=14) 5 × 14	42, 70, 56	3	M1 for 168 ÷ (3 + 4 + 5) (=14) M1 for 5 × '14' or 4 × '14' or 3 × '14' A1 cao OR M2 for $^3/_{12}$ × 168 or $^4/_{12}$ × 168 or $^5/_{12}$ × 168 (M1 for $^1/_{12}$ × 168) A1 cao [SC: B1 for 1 or 2 correct answers if M0 scored]

Question		Working	Answer	Mark	Notes
3	(a)		0.2125	1	B1 cao
	(b)		0.948259….	2	M1 for $\frac{1008}{1063}$ or 10.08 or 10.63 seen A1 for 0.95 or 0.948(259…..)
4	(a)	$\frac{15}{100} \times 600$ or 0.15×600	90	2	M1 for $\frac{15}{100} \times 600$ or 0.15×600 oe or $60 + 30$ A1 cao
	(b)	$\frac{88}{100} \times 150$ or 0.88×150 OR $150 - \frac{12}{100} \times 150$ or $150 - 0.12 \times 150$	132	2	M1 for $\frac{88}{100} \times 150$ or 0.88×150 or $150 - \frac{12}{100} \times 150$ or $150 - 0.12 \times 150$ oe A1 cao
	(c)	$\frac{28}{35} \times 100$	80	2	M1 for $\frac{28}{35} \times 100$ oe A1 cao
5		$13 \times 18 + 12 \times 18 + 5 \times 18 + \frac{1}{2} \times 5 \times 12 \times 2$	600	3	M1 for 13×18 (=234) or 12×18 (=216) or 5×18 (=90) or $\frac{1}{2} \times 5 \times 12$ (=30) M1 for summing 4 or 5 areas, 3 of which must be correct A1 cao

Question		Working	Answer	Mark	Notes
6	(a)		-1, 0, 1, 2, 3	2	B2 for all 5 values and no others (B1 for 4 correct values and no others or all 5 correct values and one additional incorrect value)
	(b)		$-1 \leq p < 4$	2	B2 for $-1 \leq p < 4$ or just ≥ -1 **and** < 4) [B1 for $-1 \leq p$ or $p < 4$ or $p \geq -1$ oe or ≥ -1 or < 4 or $-1 < p \leq 4$] [Note: accept the use of any letter other than p throughout and ignore any attempt to list integer values]
7		4.7×2 (= 9.4) $\pi \times 9.4$	29.5	3	M1 for 4.7×2 (= 9.4) M1 for $\pi \times$ " 4.7×2 " A1 for 29.5 – 29.55
8		$180 - 150$ (=30) $360 \div$ "30" OR $\frac{N-2}{N} \times 180 = 150$ $(N-2)180 = 150N$ $30N = 360$	12	3	M1 for $180 - 150$ (=30) [Note: the 30° angle may be shown on the diagram] M1 for $360 \div$ "30" A1 cao OR M1 for $\frac{N-2}{N} \times 180 = 150$ M1 for $360 \div$ "30" A1 cao

Question	Working	Answer	Mark	Notes
9	$2x + 2(x \pm 9) < 200$ $2x + 2x \pm 18 < 200$ $4x \pm 18 < 200$ $4x < 182$ (or 218) $x < 45.5$ ($x < 54.5$, so width <45.5) OR $200 \div 4 = 50$ $9 + 9 \div 4 = 4.5$ $50 - 4.5 = 45.5$ OR $200 - 18 = 182$ $182 \div 4 = 45.5$	45	4	B1 for $x \pm 9$ oe seen (it could just be on a diagram) or a rectangle with length 9 cm greater than the width M1 for $2x + 2(x \pm 9)$ oe A1 for 45.5 B1 for answer of 45 OR M1 for $200 \div 4$ (=50) M1 for $(9 + 9) \div 4$ (=4.5) A1 for 45.5 B1 for answer of 45 OR M1 for $200 - 18$ (= 182) M1 for $182 \div 4$ A1 for 45.5 B1 for answer of 45 [SC: B3 for 45.5 seen from any method]
10	$\Pi \times (10.4 \div 2)^2 - 0.5 \times 9.6 \times 4$	65.7	5	M1 for $10.4 \div 2$ (=5.2) M1 for $\pi \times "5.2"^2$ (=84.948....) M1 for $0.5 \times 9.6 \times 4$ (=19.2) M1 (dep on at least one previous M1) for '84.948…' – '19.2' [ie their area of the circle – their area of the triangle] A1 for an answer in the range 65.7 – 65.8

Question		Working	Answer	Mark	Notes
11	(a)		**4**, (-1), (-4), **-5, -4, -1**, (4)	2	B2 for all 4 values correct (B1 for 2 or 3 values correct)
	(b)		Correct graph	2	M1 (dep on at least B1 scored) for their points plotted correctly A1 for a smooth quadratic graph drawn through their points provided there is just **one** turning point [Do not accept points joined with line segments]
	(c)		1.2, -3.2	2	B1 ft from graph for 1.2 to 1.3 B1 ft from graph for -3.2 to -3.3 [Note: If their graph crosses the x-axis at more than 2 points, all solutions are required for B2, one 'correct' solution only for B1]
12		$5^2 + 13^2$ (=194) $\sqrt{194}$	13.9	3	M1 for $(AC^2 =)\ 5^2 + 13^2$ M1 for $\sqrt{'5^{2\,'} + '13^{2\,'}}\ (= \sqrt{194})$ (Note: there must be an attempt to square both 5 and 13) A1 for an answer in the range 13.92 – 13.93
13		$\frac{14000000 + 90000000}{6.3 \times 10^{14}} = \frac{104000000}{6.3 \times 10^{14}}$ $= \frac{1.04 \times 10^8}{6.3 \times 10^{14}} = 1.65\ldots \times 10^{-7}$ $= \sqrt{16.5\ldots \times 10^{-8}}$	4.1×10^{-4}	3	M1 for $14000000 + 90000000$ (=104000000) oe or 63×10^{13} oe or $1.65\ldots \times 10^{-7}$ oe M1 (dep) for $\sqrt{"(1.65\ldots \times 10^{-7})"}$ A1 cao
14		$253 \div 1.15$	220	3	M1 for sight of 1.15 or 115% M1 for $253 \div 1.15$ **or** $\dfrac{253}{115} \times 100$ oe A1 cao

Question		Working	Answer	Mark	Notes
15		$\cos 46 = \dfrac{BD}{11}$ $h = 80$ $11 \times \cos 46$ $\tan x = \dfrac{7.64}{14}$ $x = \tan^{-1}(\dfrac{7.64}{14})$	28.6	6	M1 for $\cos 46 = \dfrac{BD}{11}$ M1 for $BD = 11 \times \cos 46$ (= 7.64…) A1 for answer in the range 7.6 - 8 M1 for $\tan x = \dfrac{"7.64"}{14}$ M1 for $x = \tan^{-1}(\dfrac{"7.64"}{14})$ A1 for 28.4 – 29
16		$3x + 8y = 6$ $20x - 8y = 132$ $23x = 138$ $x = 6$ $18 + 8y = 6$ $y = -1.5$	$x = 6, y = -1.5$	4	M1 for correct method to obtain either x or y (condone one error) A1 for $x = 6$ **or** $y = -1.5$ M1 for correct substitution of found variable into an equation A1 for correct value of second variable [SC: B1 for $x = 6$ or $y = -1.5$ if M0 scored]
17	(a)	$m = kp^2$ $16 = k \times 5^2$	0.64	2	M1 for $16 = k \times 5^2$ A1 for $k = 0.64$ $(= \frac{16}{25})$ oe
	(b)	$36 = \dfrac{16}{25} \times p^2$ $P^2 = \dfrac{25 \times 36}{16}$ $p = \dfrac{5 \times 6}{4} = \dfrac{30}{4}$	7.5	2	M1ft for $36 \div$ "0.64" oe A1ft for 7.5 oe

Question		Working	Answer	Mark	Notes
18		$3x^2 - 5x - 1 = 0$ $$x = \frac{-(-5)\pm\sqrt{(-5)^2 - 4\times3\times(-1)}}{2\times3}$$ $$x = \frac{5\pm\sqrt{37}}{6}$$	1.85, -0.180	3	M1 for substitution into formula , condone incorrect signs M1 for $x = \dfrac{5\pm\sqrt{37}}{6}$ A1 for -0.180 **and** 1.85 (accept 1.84) [SC: B1 for 1.85 **or** -0.180 if M0 scored]
19	(a)		$y = \frac{1}{2}x + c$ $(c \neq -1)$	1	B1 for $y = \frac{1}{2}x + c$ $(c\neq-1$ but could be zero)
	(b)	$-1\div \frac{1}{2} = -2$ $1 = -2 \times 4 + c$	$y = 9 - 2x$	3	M1(ft) for gradient = $-1\div \frac{1}{2}$ (= -2) **or** line drawn perpendicular to **L** through (4,1) with an attempt to find it's gradient M1 for $1 = '-2' \times 4 + c$ or $c = 9$ seen or for reading off the value of y where their perpendicular crosses the y-axis A1 cao for $y = 9 - 2x$ oe [SC: B2 for $9 - 2x$ seen if M0 scored]
20		$2a - 2m = 7 - a$ $3a = 7 + 2m$ $a = \dfrac{2m + 7}{3}$	$a = \dfrac{2m + 7}{3}$	3	M1 $2a - 2m = 7 - a$ M1 $2a + a = 7 + 2m$ (isolating correctly all terms in a from "$2a - 2m = 7 - a$" A1 for $a = \dfrac{2m + 7}{3}$ oe
21		$\pi\times4^2\times9$ (=452.38..) $\frac{1}{3} \times \pi \times 4^2 \times 10$ (=167.55)	620	4	M1 for $\pi\times4^2\times9$ (= 452.39..) M1 for $\frac{1}{3} \times \pi \times 4^2 \times 10$ (= 167.55..) M1 (dep on 1 previous M1) for "$\pi\times4^2\times9$" + "$\frac{1}{3} \times \pi \times 4^2 \times 10$" [Note: both parts must be volumes] A1 answer in the range 619 – 621 [SC: B2 for an answer in the range 2475 to 2484 if M0 scored, ie consistently taking the radius as 8 cm]

Question	Working	Answer	Mark	Notes
22	$\dfrac{100}{360} \times \pi \times 6.8 \times 2$	25.5	3	M1 for $\dfrac{100}{360} \times \pi \times 6.8 \times 2$ (=11.86..) M1 for "11.86" + 2 × 6.8 oe [Note: "11.86" must be from an attempt to find the length of the arc] A1 for answer in the range 25.4 – 25.6
23	$4.5 \div 3 = 3/2$ $103 \times \left(\dfrac{3}{2}\right)^2$ OR $3 \div 4.5 = 2/3$ $103 \div \left(\dfrac{2}{3}\right)^2$	231.75	3	B1 for 3 ÷ 2 **or** 2 ÷ 3 **or** 1.5 oe **or** $^2/_3$ oe or 103 ÷ 6 × 9 (= 154.5) M1 for $103 \times "\left(\dfrac{3}{2}\right)"^2$ or $103 \div "\left(\dfrac{2}{3}\right)"^2$ oe A1 cao
24	$AC^2 = 11.8^2 + 7.4^2$ $\quad - 2 \times 11.8 \times 7.4 \times \cos132$ $AC = 17.63\ldots$ ½ ×8.2 × "17.63… (= 72.28..) + ½ × 11.8 × 7.4 × sin132 (= 32.445..)	105	6	M1 for $AC^2 = 11.8^2 + 7.4^2 - 2 \times 11.8 \times 7.4 \times \cos132$ M1 for correct order of operations or 310.85… A1 for $AC = 17.63\ldots$ M1 for Area of ABC = ½ ×8.2 × "17.63…" **or** Area of ADC = ½ × 11.8 × 7.4 × sin132 M1 for "½ ×8.2 × "17.63…"" + "½ × 11.8 × 7.4 × sin132" A1 for an answer in the range 104.7 – 105

5MM2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
25	(a)		$x^2 + y^2 = 9$	1	B1 cao
	(b)	$x^2 + y^2 = 25$ $y - 2x = 5$ $y = 2x + 5$ $x^2 + (2x + 5)^2 = 25$ $x^2 + 4x^2 + 20x + 25 = 25$ $5x^2 + 20x = 0$ $5x(x + 4) = 0$ $x = 0, \ x = -4$ $y = 5, y = -3$	$x = 0, y = 5$ $x = -4, y = -3$	5	M1 for clear attempt to draw a circle, centre (0,0) A1 for circle, radius 5, centre (0,0) drawn M1 for clear method seen to draw straight line eg. Calculation of points or use of $y = mx + c$ A1 for $y = 2x + 5$ drawn A1 for $x = 0, y = 5$ **and** $x = -4, y = -3$ **OR** M1 for $x^2 + (2x + 5)^2 = 25$ M1 for $x^2 + 4x^2 + 20x + 25 = 25$ A1 $5x^2 + 20x = 0$ M1 for factorising their quadratic or for a correct method to find BOTH solutions of their quadratic A1 for $x = 0, y = 5$ **and** $x = -4, y = -3$ [SC: B1 for $x = 0, y = 5$ **or** $x = -4, y = -3$ if M0 scored]

Ofqual

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

Rewarding Learning