

Mark Scheme (Results)

June 2012

GCSE Mathematics (2MB01) Higher
5MB2H (Non-Calculator) Paper 01

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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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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 as 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

5MB2H_01				
Question	Working	Answer	Mark	Notes
*1	<p>Angle $BED = 68^\circ$ $180 - (68 + 68)$</p> <p>OR</p> <p>Angle $BEF = 180 - 68 = 112$ Angle $BED = 180 - 112 = 68$ $180 - (68 + 68)$</p>	$x = 44^\circ$	4	<p>M1 for Angle $BED = 68^\circ$ seen in the diagram or correctly used in the working space M1 for $180 - 2 \times "68"$ A1 for $x = 44^\circ$ (accept angle $BDE = 44^\circ$) [Note: 44° only seen in the body of the script without the "$x =$" gets M1M1A0]</p> <p>C1 (dep on at least M1) for <u>alternate angles</u> are equal (or equivalent) and one other reason; either <u>angles</u> in a <u>triangle</u> add to <u>180°</u> or base <u>angles</u> of an <u>isosceles</u> triangle are <u>equal</u> OR for <u>allied angles</u> (or equivalent, eg co-interior) add up to <u>180°</u> and <u>angles</u> on a <u>straight line</u> add up to <u>180°</u> and one other reason; either <u>angles</u> in a <u>triangle</u> add to <u>180°</u> or base <u>angles</u> of an <u>isosceles</u> triangle are <u>equal</u></p>
2		$4n + 2$	2	<p>B2 for $4n + 2$ oe (eg $4 \times n + 2$ or $n4 + 2$, ...) or $n\text{th} = 4n + 2$ (B1 for a linear expression in $4n$ e.g. $4n + a$ ($a \neq 2$) or $n = 4n + 2$) (B0 for $n = 4n$ and $n + 4$)</p>

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Question		Working	Answer	Mark	Notes										
3		$35 \div (5 + 2) = 5$ 5×5 OR <table><tr><td>5</td><td>2</td></tr><tr><td>10</td><td>4</td></tr><tr><td>15</td><td>6</td></tr><tr><td>20</td><td>8</td></tr><tr><td>25</td><td>10</td></tr></table>	5	2	10	4	15	6	20	8	25	10	25	2	M1 for $35 \div (5 + 2)$ or $35 \div 7$ or $35 \times \frac{5}{7}$ A1 for 25 cao OR M1 for listing 5, 10, 15, and 2, 4, 6, to at least 15 and 6 A1 for 25 cao [SC: B1 for an answer of 25:10 if M0 scored]
5	2														
10	4														
15	6														
20	8														
25	10														
4		$\frac{16}{40} + \frac{15}{40} = \frac{31}{40}$ OR <table><tr><td></td><td>2</td><td>5</td></tr><tr><td>3</td><td></td><td>15</td></tr><tr><td>8</td><td>16</td><td>40</td></tr></table> OR 0.4 + 0.375		2	5	3		15	8	16	40	$\frac{31}{40}$ or 0.775	2	M1 for attempt to write both fractions with a common denominator (a multiple of 40) with at least one of them correct A1 for $\frac{31}{40}$ oe OR M1 for 40 in the correct cell and 15 or 16 in the correct cell A1 for $\frac{31}{40}$ oe OR M1 for changing both fractions to decimals with both 0.4 and 0.375 seen A1 for 0.775	
	2	5													
3		15													
8	16	40													

5MB2H_01					
Question		Working	Answer	Mark	Notes
5		$\frac{15}{100} \times 400 = 60$ $400 - 60 =$ OR $\frac{85}{100} \times 400$	340	3	M1 for $\frac{15}{100} \times 400 (= 60)$ oe or $40 + 20$ or 400×0.15 M1 (dep) for $400 - "60"$ A1 for 340 cao OR M1 for $100 - 15 (=85)$ M1 (dep) for $\frac{85}{100} \times 400$ or $'0.85' \times 400$ A1 for 340 [SC: B1 for an answer of 460 if M0 scored]
6	(a)		$5(2a + 1)$	1	B1 for $5(2a + 1)$ or $5 \times (2a + 1)$ or $(2a + 1)5$ or $5(1 + 2a)$, etc
	(b)	$5x + 35 + 3x - 6$	$8x + 29$	2	M1 for $5x + 35$ or $3x - 6$ or $8x$ or 29 A1 for $8x + 29$
	(c)		$3ab(a + 2b)$	2	B2 for $3ab(a + 2b)$ (B1 for correct partial factorisation $a(3ab + 6b^2)$ or $b(3a^2 + 6ab)$ or $3a(ab + 2b^2)$ or $3b(a^2 + 2ab)$ or $ab(3a + 6b)$ OR $3ab(ma + 2b)$ or $3ab(a + nb)$ where $m \neq 1, n \neq 2$) [B0 for partial factorisation using only an integer e.g. $3(a^2b + 2ab^2)$]

5MB2H 01					
Question		Working	Answer	Mark	Notes
7		<div><div><div>515</div><div><div><div>35</div><div>×</div></div><div>2575</div><div>15450</div><div>18025</div></div></div><div><div>10 × 515 = 5150</div><div>10 × 515 = 5150</div><div>10 × 515 = 5150</div><div>5 × 515 = 2575</div><div>18025</div></div></div>	£180.25	4	<div>M1 for 515 × 0.35 or 515 × 35 This may be implied from an incomplete method of multiplication</div> <div>M1 for a complete method with relative place value correct. Condone one multiplication error, addition not necessary</div> <div>Or for a complete grid, condone one multiplication error, addition not necessary</div> <div>Or for sight of a complete partitioning method. Condone one multiplication error final addition not necessary</div> <div>M1 (dep on the previous M1) for addition of appropriate elements of the calculation</div> <div>A1 for £180.25(p) or 18025p (with ‘£’ sign deleted)</div>

5MB2H_01					
Question		Working	Answer	Mark	Notes
		OR $3307 \times 35 = 115\,745$ $2792 \times 35 = 97720$ $115745 - 97720$			OR M1 for $3307 \times 0.35 - 2792 \times 0.35$ or $3307 \times 35 - 2792 \times 35$ M1 for a correct method of multiplication of at least one product, using digits 3307 and 35 or 2792 and 35 Condone one multiplication error, addition not necessary M1 (dep on the previous M1) for addition of appropriate elements of the calculation A1 for £180.25 or 18025p (with ‘£’ sign deleted)

5MB2H 01					
Question		Working	Answer	Mark	Notes
8		Triangular ends $\frac{1}{2} \times 5 \times 12 = 30$ $\frac{1}{2} \times 5 \times 12 = 30$ Base $20 \times 5 = 100$ Vertical face $20 \times 12 = 240$ Slant face $20 \times 13 = 260$ Total area $= 30 + 30 + 100 + 240 + 260$ OR $(5 + 12 + 13) \times 20 + 2 \times \frac{1}{2} \times 5 \times 12$	660	3	M1 for $\frac{1}{2} \times 5 \times 12 (= 30)$ or $20 \times 5 (= 100)$ or $20 \times 12 (= 240)$ or $20 \times 13 (= 260)$ M1 (dep) for adding at least 3 areas found from correct methods (of no more than 5 faces) A1 cao OR M1 for $(5 + 12 + 13) \times 20$ or $\frac{1}{2} \times 5 \times 12 (= 30)$ M1 (dep) for adding “ $(5 + 12 + 13) \times 20$ ” to at least “ $1 \times \frac{1}{2} \times 5 \times 12$ ” A1 cao Note: Sight of $\frac{1}{2} \times 5 \times 12 \times 20$ or 600 (ie a volume calculation) scores no marks

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Question	Working																
9	<p>Table of values</p> <table border="1"> <tr> <td>x</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td></tr> <tr> <td>y</td><td>-7</td><td>-5</td><td>-3</td><td>-1</td><td>1</td></tr> </table> <p>OR</p> <p>Using $y = mx + c$ Gradient 2 intercept -3</p>					x	-2	-1	0	1	2	y	-7	-5	-3	-1	1
x	-2	-1	0	1	2												
y	-7	-5	-3	-1	1												
Single line drawn from (-2, -7) to (2, 1)					3												
					<p>(Table of values) M1 for at least 2 correct attempts to find points by substituting values of x. M1 (dep) ft for correctly plotting at least 2 of their points (any points plotted from their table must be plotted correctly) A1 for the correct line from (-2, -7) to (2, 1) OR (No table of values) M2 for at least 2 correct points (and no incorrect points) correctly plotted or for a line segment of the graph of $y = 2x - 3$ drawn (ignore any additional incorrect line segments) [M1 for at least 3 correct points plotted with no more than 2 incorrect points] A1 for the correct line from (-2, -7) to (2, 1) OR (Use of $y = mx + c$) M2 for a single straight line of gradient 2, passing through (0, -3) [M1 for a single straight line of gradient 2 or for a single straight line passing through (0, -3)] A1 for the correct line from (-2, -7) to (2, 1)</p>												

5MB2H 01					
Question		Working	Answer	Mark	Notes
10		$\frac{1}{2} (6 + 4) \times 3$ OR $6 \times 3 - \frac{1}{2} \times 2 \times 3$ OR $4 \times 3 + \frac{1}{2} \times 2 \times 3$	15 cm ²	4	M2 for $\frac{1}{2} (6 + 4) \times 3$ oe A1 for 15 cao B1 for cm ² OR M1 for $6 \times 3 (=18)$ or $\frac{1}{2} \times 2 \times 3 (=3)$ M1 (dep on “ 6×3 ” and “ $\frac{1}{2} \times 2 \times 3$ ”) for “18” – “3” from correct methods A1 for 15 cao B1 for cm ² OR M1 for $4 \times 3 (=12)$ or $\frac{1}{2} \times 2 \times 3 (=3)$ M1 (dep on “ 4×3 ” and “ $\frac{1}{2} \times 2 \times 3$ ”) for “12” + “3” from correct methods A1 for 15 cao B1 for cm ²

5MB2H 01					
Question		Working	Answer	Mark	Notes
11		$10\,000 \times 0.8$ $8000 \times 0.9 = 7200$ OR $10\,000 - \frac{20}{100} \times 10\,000 = 8000$ $8000 - \frac{10}{100} \times 8\,000$ OR $10\,000 \times 0.8 \times 0.9$	7200	3	M1 for $10\,000 \times 0.8 (= 8000)$ M1 (dep) for “8000” $\times 0.9 (= 7200)$ A1 for £7200 cao OR M1 for $10\,000 - \frac{20}{100} \times 10\,000$ oe M1 (dep) for “8000” $- \frac{10}{100} \times “8\,000”$ oe A1 7200 cao OR M1 for $0.8 \times 0.9 (=0.72)$ M1 (dep)for $10\,000 \times “0.72”$ A1 for 7200 cao [SC: B1 for an answer of 7000 if M0 scored]
12	(a)		$x^2 - 3x - 40$	2	M1 for 3 terms correct (out of no more than 4 terms) from x^2 , $5x$, $-8x$ and -40 or 4 terms x^2 , $5x$, $8x$ and 40 (ignoring signs) A1 for $x^2 - 3x - 40$ [Note: $x^2 - 3x + 40$ and $x^2 + 3x - 40$ with no working get M0A0]
	(b)		$(x + 4)(x - 4)$	1	B1 for $(x + 4)(x - 4)$ oe
13	(a)		$(0, 2, 4)$	1	B1 cao
	(b)	$\left(\frac{0+6}{2}, \frac{2+2}{2}, \frac{4+4}{2}\right)$	$(3, 2, 4)$	2	M1 for an answer of $(a, 2, 4)$ or $(3, b, 4)$ or $(3, 2, c)$ or for[(“0” + 6) $\div 2$, (“2” + 2) $\div 2$, (“4” + 4) $\div 2$] This may be implied by their answer with no working seen A1 for $(3, 2, 4)$ cao

5MB2H 01					
Question		Working	Answer	Mark	Notes
14	(a)	$x = 0.25555\dots$ $10x = 2.555\dots$ $100x = 25.5555\dots$ $90x = 25 - 2 = 23$ OR $x = 0.25555\dots$ $10x = 2.555\dots$ $100x = 25.5555\dots$ $9x = 2.3$ OR $0.2 + (x = 0.0555\dots)$ $10x = 0.555\dots$ $100x = 5.5555\dots$ $0.2 + 5/90$	$\frac{23}{90}$	3	M1 for 0.255(5....) or 0.2 + 0.055(5...) This can be implied in subsequent working M1 for 2 correct recurring decimals which when subtracted will leave an integer or a terminating decimal number A1 for $\frac{23}{90}$ [Note: $\frac{2.3}{9}$ gets A0] [SC: B1 for an answer of $\frac{25}{99}$ oe (= 0.2 $\dot{5}$), with or without working if M0 scored]
	(b)	$\frac{12}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} = \frac{12\sqrt{6}}{6}$	$2\sqrt{6}$	2	M1 for multiplying numerator and denominator by $\sqrt{6}$ A1 for $2\sqrt{6}$ (accept $\frac{2\sqrt{6}}{1}$)

5MB2H 01				
Question	Working	Answer	Mark	Notes
*15	$180 - (90 + 20) = 70$ $2 \times 70 = 140$ $(180 - 40) \div 2 = 70$ $180 - 2 \times (90 - 70) = 140$	Angle $TOR = 140^\circ$	4	<p>M1 for angle PTO (PRO) = 90° or seeing it marked on the diagram with a right angle or as 90°</p> <p>M1 (dep) for $180 - (90 + 20)$ ($=70^\circ$) or for $360 - (90 + 90 + 40)$ ($=140$)</p> <p>A1 for (angle) $TOR = 140^\circ$ or for 140° seen in the correct place in the diagram</p> <p>[140° alone without the '$TOR =$' gets A0]</p> <p>C1 (dep on at least M1) for angle between a <u>tangent</u> and a <u>radius</u> = 90° plus at least one other correct reason from:</p> <p>Sum of <u>angles</u> in a <u>triangle</u> is 180°</p> <p>Sum of <u>angles</u> in a <u>quadrilateral</u> is 360°</p> <p><u>Triangles</u> PTO and PRO are <u>congruent</u></p> <p><u>Tangents</u> from a <u>point</u> are <u>equal</u> in length</p> <p>OR</p> <p>M1 for angle PTO (PRO) = 90° or seeing it marked on the diagram with a right angle or as 90°</p> <p>M1 for $(180 - 40) \div 2$ ($=70$) and [$180 - 2 \times (90 - "70")$] ($=140$)</p> <p>A1 for (angle) $TOR = 140^\circ$ or for 140° seen in the correct place in the diagram</p> <p>[140° alone without the '$TOR =$' gets A0]</p> <p>C1 (dep on at least M1) for angle between a <u>tangent</u> and a <u>radius</u> = 90° plus at least one other correct reason from:</p> <p>Sum of <u>angles</u> in a <u>triangle</u> is 180°</p> <p>Base <u>angles</u> of an <u>isosceles triangle</u> are <u>equal</u></p> <p><u>Triangles</u> PTO and PRO are <u>congruent</u></p> <p><u>Tangents</u> from a <u>point</u> are <u>equal</u> in length</p>

5MB2H 01				
Question	Working	Answer	Mark	Notes
16	$80 \times \frac{5}{8} = 50$ 50×2.75 OR $80 \times 2.75 = 220$ $220 \times \frac{5}{8}$	136 to 138 inc.	3	M1 for $80 \times \frac{5}{8}$ or $80 \div 1.6$ oe (= 50) M1 (indep) for “50” $\times$ 2.75 [accept ”50” $\times$ 165 (=8250)] or ”50” + ”50” + ”50” $\div$ 2 (=25) + ”25” $\div$ 2 (=12.5) Note: ”50” is what is considered to be their speed in miles per hour calculated using an explicitly stated conversion factor A1 for an answer in the range 136 to 138 inc. OR M1 for 80×2.75 (=220) [accept 80×165 (=13200)] or $80 + 80 + 80 \div 2$ (=40) + ”40” $\div$ 2 (=20) M1 (indep) for “220” $\times$ $\frac{5}{8}$ Note: ”220” is what is considered to be their distance in kilometres calculated using an explicitly stated conversion factor A1 for an answer in the range 136 to 138 inc.
17	$y = -\frac{1}{2}x + 2.5$ <i>mm</i> ’ = -1 shows gradient is 2 $y = 2x + c$ goes through (3, 7) $7 = 2 \times 3 + c$	$y = 2x + 1$	4	M1 for establishing gradient of original line is $-\frac{1}{2}$ or sight of $y = -\frac{1}{2}x + c$ M1 (indep) for (gradient of perpendicular) $\times$ “ $-\frac{1}{2}$ ” = -1 This can be implied by a gradient of 2 or ft on “ $-\frac{1}{2}$ ” M1 (dep on the previous M1) for substituting (3, 7) into $y = “2”x + c$ A1 for $y = 2x + 1$ (or equivalent algebraic equation)

5MB2H_01					
Question		Working	Answer	Mark	Notes
18		$\frac{2x^2 - 9x - 5}{4x^3 + 2x^2}$ $\frac{(2x + 1)(x - 5)}{2x^2(2x + 1)}$	$\frac{x - 5}{2x^2}$	3	M1 for factorising the numerator correctly M1 for fully factorising the denominator correctly A1 for $\frac{x - 5}{2x^2}$ oe eg. $\frac{-5 + x}{2x^2}$

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