

Mark Scheme (Results)

June 2012

GCSE Mathematics (2MB01) Higher
Paper 5MB3H_01 (Calculator)

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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

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Question	Working	Answer	Mark	Notes
1	$15 \div 3 \times 4 =$	20 cm	3	<p>M1 for 4×5 or 3×5 or $\frac{3}{15}$, $\frac{15}{3}$, $\frac{3}{4}$, $\frac{4}{3}$, or equivalent values, or 4:20 oe, or identification of 5 as the scale factor of enlargement. A1 cao C1 (indep) for units: cm stated on answer line or with “20” in the working space if not given on answer line.</p>
2	$\frac{3}{100} \times 500 \times 4$ <p>OR</p> $\frac{500 \times 3 \times T}{100} = 60$ $T = \frac{60 \times 100}{500 \times 3}$	4	3	<p>M2 correct method to calculate simple interest over 4 years eg, $\frac{3}{100} \times 500 \times 4$ or “15” $\times 4$ (M1 correct method to simple calculate interest over one year, eg $\frac{3}{100} \times 500$ oe or 15 seen or 515 seen) A1 cao</p> <p>OR</p> <p>M1 for subs into $\frac{PRT}{100} = I$, eg $\frac{500 \times 3 \times ?}{100} = 60$ oe M1 for $15T = 60$ or attempt to rearrange, eg, $1500T = 6000$ A1 cao</p> <p>SC Award B1 for 4 from compound interest methods.</p>
3	$\frac{10}{3} \div \frac{19}{4} = \frac{10}{3} \times \frac{4}{19}$ <p>OR</p> $3.33... \div 4.75$	$\frac{40}{57}$ or 0.70175(4386...)	2	<p>M1 for $\frac{10}{3}$ oe and $\frac{19}{4}$ oe or 3.33(...) and 4.75 or $40 \div 57$ or 0.7, 0.70, 0.701, 0.702, 0.7017, 0.7018 A1 for $\frac{40}{57}$ or 0.70175(4386...)</p>

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Question	Working	Answer	Mark	Notes
4	(a) $650 \times 0.2 (=130)$ $650 + 130 = 780$ OR 650×1.2	780	3	M2 for 650×1.2 oe (M1 for 650×0.2 oe (=130)) A1 cao
	(b) $\frac{39}{260} \times 100$ $= 0.15 \times 100 =$	15	2	M1 for $\frac{39}{260} \times 100$ oe A1 cao
	(c) $44.79 \div 3 \times 8$	119.44	2	M1 for $44.79 \div 3 (=14.93)$ or $44.79 \times 8 (=358.32)$ A1 cao
5	$1.89 \div 2 (=0.945)$ $4.30 \div 5 (=0.86)$ $8.46 \div 9 (=0.94)$ OR $2 \div 1.89 (=1.058..)$ $5 \div 4.30 (=1.162..)$ $9 \div 8.46 (=1.063...)$	5kg box	4	M2 for all of $1.89 \div 2 (=0.945)$, $4.30 \div 5 (=0.86)$ and $8.46 \div 9 (=0.94)$ (M1 for a method to compare at least two values) A1 for 0.945/0.94/0.95, 0.86, 0.94 or 94/95/94.5, 86, 94 C1 (dep M1) for a comparison of their 3 values leading to a correct deduction. OR M2 for all of $2 \div 1.89 (=1.058..)$, $5 \div 4.30 (=1.162..)$ or $9 \div 8.46 (=1.063...)$, allow values rounded or truncated to 3 dp (M1 a method to compare at least two values) A1 for 1.058..., 1.162..., 1.063.. oe C1 (dep M1) for a comparison of their 3 values leading to a correct deduction.
6		Rotation 90° clockwise centre (1,1)	3	B1 for rotation B1 for 90° clockwise or 270° anticlockwise B1 for (1,1) (B0 for any combination of transformations)

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Question	Working	Answer	Mark	Notes
7	$x=1$ gives 11 $x=2$ gives 28 $x=1.5$ gives 18.(375) $x=1.6$ gives 20.(096) $x=1.7$ gives 21.(913..) $x=1.8$ gives 23.(832..) $x=1.9$ gives 25.(859..) $x=1.75$ gives 22.8(59..) $x=1.76$ gives 23.0(51..) $x=1.77$ gives 23.2(45..)	1.8	4	B2 for a trial $1.7 \leq x \leq 1.8$ evaluated (B1 for a trial $1 \leq x \leq 2$ evaluated) B1 for a different trial $1.7 < x < 1.8$ evaluated B1 (dependent on at least one previous B1) for 1.8 Accept trials correct to the nearest whole number (rounded or truncated) if the value of x is to 1dp but correct to 1dp (rounded or truncated) if the value of x is to 2dp. NB: no working scores no marks even if answer is correct.
8	(a) $\frac{y_2 - y_1}{x_2 - x_1}$ eg = $\frac{300 - 100}{7.5 - 2.5}$ oe $\frac{200}{5}$ eg = $\frac{200}{5}$	35 - 41	2	M1 for use of $\frac{y_2 - y_1}{x_2 - x_1}$ or drawing a right angled triangle against the line, or inverse expression of gradient eg 0.025, 1:40, $\frac{1}{40}$ or correct answer given as algebra (eg $y=40$, $40x$) A1 for 35 – 41 (units not required)
	(b)	Interpretation	1	B1 ft from part (a) or equivalent written explanation placing the gradient into the correct context, linking rate eg distance per gallon, mpg, constant rate of use of petrol, constant rate.
9	$\sqrt{39^2 + 52^2} = \sqrt{4225}$ $= 65$ $2 \times 65 + 2 \times 39 + 2 \times 52 =$ $156 \times 2 =$ $\sqrt{39^2 + 52^2} = \sqrt{4225}$	312	5	M1 for $39^2 + 52^2$ or $1521 + 2704$ or 4225 M1 for $\sqrt{39 \times 39 + 52 \times 52}$ or $\sqrt{1521 + 2704}$ or $\sqrt{4225}$ A1 for 65 seen or diagonal length of 65 (oe) indicated on diagram, or other Pythagorean length justified. M1 for $2 \times "65" + 2 \times 39 + 2 \times 52 (= 156 \times 2)$ or $130 + 182$ A1 cao

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Question	Working	Answer	Mark	Notes
10	$40 \div 5 = 8$ $8 \times 1.5 = 12$ $(37.6 - 12) \div (40 - 8)$ $= 25.6 \div 32 =$	0.8	4	M1 for $40 \div 5 (=8)$ or at least 3 multiples of 1:4 M1 “8” $\times 1.5 (=12)$ M1 $(37.6 - “12”) \div (40 - “8”)$ or $25.6 \div 32$ A1 for 0.8, accept 800 g OR algebraic approach: M1 for (eg) $k=4c$ and $k+c=40$ M1 for (eg) $1.5c+wk=37.6$ M1 for “8” $\times 1.5 + “32”\times w = 37.6$ A1 for 0.8, accept 800 g
11	(a) $(-2,7), (-1,1), (0,-1), (1,1), (2,7)$ (b) (c)	1, -1, 7 Curve drawn 0.6 to 0.8 -0.6 to -0.8	2 2 2	B2 all 3 correct (B1 for 1 or 2 correct) OR M1 for attempt to plot x^2 M1 for attempt to draw x^2 M1 at least 4 points plotted from their table; all points ± 1 small square A1 cao for correct curve drawn OR M1 for curve $2x^2$ seen, or parabolic curve drawn through $(0,-1)$ A1 cao for correct curve drawn M1 for identification of intersection of their curve with x axis, or one solution stated. A1 for both solutions. Accept solutions as 0.6 to 0.8 or -0.6 to -0.8 OR ft from any drawn curve crossing the x -axis ($\pm \frac{1}{2}$ square)

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Question		Working	Answer	Mark	Notes
12		$\frac{3.45 \times 10^{10}}{2650}$ $=13018867.92 =$	1.3×10^7	3	M1 for time = distance \div speed expressed numerically. M1 for 13000000 to 13100000 or digits 130188.. 130189.. or 1.3×10^n to 1.31×10^n where n is a number other than 7, or absent, or digits 13(01...) $\times 10^n$ A1 $1.3(0) \times 10^7 - 1.31 \times 10^7$
13	(a)	$y = kx$ $10 = 600k$ $k = 10 \div 600 = \frac{1}{60}$	$y = \frac{1}{60} x$	3	M2 for $10 = k \times 600$ oe or $10 = \frac{600}{k}$ oe or $k = \frac{1}{60}$ (M1 for $y=kx$ or $y = \frac{x}{k}$ or $y \propto x$, k any letter or value) A1 for $y = \frac{1}{60} x$ oe SC: B2 for $60y = x$ NB: for $1/60$ accept 0.016 to 0.017
	(b)	$y = x \div 60 = 540 \div 60 =$	9	1	B1 for 9 or 8.6 to 9.2 or ft $540 \times "k"$

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Question		Working	Answer	Mark	Notes
14	(a)	listing $-1, 0, 1, 2, 3$ or $-1, 0, 1, 2, 3, 4$	$-1, 0, 1, 2, 3$	2	M1 listing $-1, 0, 1, 2, 3$ or $-1, 0, 1, 2, 3, 4$ A1 for $-1, 0, 1, 2, 3$ (ignore any algebra with the answer)
	(b)		Region identified	4	M1 for any two of the lines $y=1, y=2x-2, y=6-x$ M1 for any two of the lines $y=1, y=2x-2, y=6-x$ with at least one showing shading (in or out) M1 for any two of the lines $y=1, y=2x-2, y=6-x$ with at least two showing consistent and correct shading (in or out) A1 lines drawn, and correct region identified by either shading in, or shading out; the letter R is not required. Accept without shading only with the correct region indicated by R. NB: accept lines that are solid or dotted/dashed etc. or lines defined by unambiguous shading.
15	(a)	i $CA = 2OA$ ii $BA = BO + OA = -\mathbf{b} + \mathbf{a}$ iii $BC = BO + OC = -\mathbf{b} - \mathbf{a}$	$2\mathbf{a}$ $\mathbf{a} - \mathbf{b}$ $-\mathbf{a} - \mathbf{b}$	3	B1 for $2\mathbf{a}$ oe B1 for $\mathbf{a} - \mathbf{b}$ oe B1 for $-\mathbf{a} - \mathbf{b}$ oe
	(b)	i $AX = AO + OX$ $= -\mathbf{a} + 2\mathbf{a} - \mathbf{b} = \mathbf{a} - \mathbf{b}$ ii $AX = BA$ so AX is parallel to BA ; A is on both AX and BA , so B, A, X are all on a straight line	$\mathbf{a} - \mathbf{b}$ explanation	3	M1 for $AX = AO + OX$ A1 for $\mathbf{a} - \mathbf{b}$ oe B1 (dep on M1) for explanation eg $BX = BO + OX = -\mathbf{b} + 2\mathbf{a} - \mathbf{b} = 2(\mathbf{a} - \mathbf{b})$

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Question		Working	Answer	Mark	Notes
16	(a)	$2a + 2t = 5t + 7$ $2a = 3t + 7$ $2a - 7 = 3t$	$\frac{2a - 7}{3}$	3	M1 for expansion of bracket eg $2 \times a + 2 \times t$ or divide all terms by 2 M1 for attempt at rearrangement of t term eg $-2t$ each side; $2a = 3t + ?$ but with separate terms. A1 $\frac{2a-7}{3}$ oe but must have one term in t . NB: for $\frac{2}{3}$ accept working to 2 dp: 0.67, 0.66, 2.33 or better
	(b)		$x = \frac{2}{3}$ $y = -1\frac{1}{2}$	3	M1 for correct process to eliminate either x or y (condone one arithmetic error) M1 (dep on 1 st M1) for correct substitution of their found variable or other acceptable method A1 cao for both $x = \frac{2}{3}$ and $y = -1\frac{1}{2}$ oe SC: B1 for $x = \frac{2}{3}$ or $y = -1\frac{1}{2}$ oe NB: for $\frac{2}{3}$ accept working to 2 dp: 0.67 or 0.66 or better

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Question	Working	Answer	Mark	Notes
17	(a) $1:2^2$ or $2^2:1$ $80 \times 2^2 = 80 \times 4 =$	320	2	M1 for sight of $1:2^2$ or $2^2:1$ or 2^2 or $\frac{1}{4}$ for ratio of area or 80×4 or identification of 4 as the scale factor A1 cao
	(b) $1:2^3$ or $2^3:1$ 171700×2^3 $= 171700 \times 8 =$ OR $h_a = \frac{171700 \times 3}{\pi \times 40^2}$ $= 102.47589$ $h_b = h_a \times 2 = 204.95..$ $vol_b = \frac{1}{3} \pi \times 80^2 \times 204.95..$	1 373 600	3	M1 for sight of $1:2^3$ or $2^3:1$ or 2^3 or $\frac{1}{8}$ for ratio of volumes or identification of 8 as the scale factor M1 for $2^3 \times 171700$ A1 cao OR M1 for complete calculation to find the height of A (=102.47589..) M1 (dep) for $h_a \times 2$ and used to find vol_b A1 cao
18	$DB^2 = 5.6^2 + 8.2^2 - 2$ $\times 5.6 \times 8.2 \cos 78$ $DB^2 = 79.505...$ $DB = 8.9165795..$ $\frac{8.9165..}{\sin 80} = \frac{DC}{\sin 40}$ $DC =$ $\frac{8.9165.. \times \sin 40}{\sin 80}$ $= 8.9165.. \times 0.6572..$ $= 5.8198$	5.82	6	M1 Cosine rule: $DB^2 = 5.6^2 + 8.2^2 - 2 \times 5.6 \times 8.2 \times \cos 78$ M1 $\sqrt{79.505...}$ (=8.9165795..) A1 for $DB = 8.90$ to 8.92 M1 $\frac{"8.9165.." \times \sin 40}{\sin 80} = \frac{DC}{\sin 40}$ M1 $\frac{8.9165.. \times \sin 40}{\sin 80}$ (=5.8198) A1 for answer 5.80 to 5.83 If working in RAD or GRAD award method marks only. RAD: $DB = 13.318..$, $DC = -9.98..$ GRAD: $DB = 8.2152...$, $DC = 5.0773...$

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