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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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

5MB3H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
1		$15 \div 3 \times 4 =$	20 cm	3	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.
2		$\frac{3}{100} \times 500 \times 4$ OR $\frac{500 \times 3 \times T}{100} = 60$ $T = \frac{60 \times 100}{500 \times 3}$	4	3	M2 correct method to calculate simple interest over 4 years eg, $\frac{3}{100} \times 500 \times 4$ or "15" × 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 OR 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 SC Award B1 for 4 from compound interest methods.
3		$\frac{10}{3} \div \frac{19}{4} = \frac{10}{3} \times \frac{4}{19}$ OR $3.33\ldots \div 4.75$	$\frac{40}{57}$ or 0.70175(4386…)	2	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…)

5MB3H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
4	(a)	650 × 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 × 100 =	15	2	M1 for $\frac{39}{260} \times 100$ oe A1 cao
	(c)	44.79 ÷ 3 × 8	119.44	2	M1 for 44.79 ÷ 3 (=14.93) or 44.79 × 8 (=358.32) A1 cao
5		1.89÷2 (=0.945) 4.30÷5 (=0.86) 8.46÷9 (=0.94) OR 2÷1.89 (=1.058..) 5÷4.30 (=1.162..) 9÷8.46 (=1.063…)	5kg box	4	M2 for all of 1.89÷2 (=0.945), 4.30÷5 (=0.86) and 8.46÷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÷1.89 (=1.058..), 5÷4.30 (=1.162..) or , 9÷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)

5MB3H_01					
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 eg = $\frac{400}{10} = \frac{200}{5}$	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 2×65 + 2×39 + 2×52 = 156×2 = $\sqrt{39^2 + 52^2} = \sqrt{4225}$	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 × "65" + 2 × 39 + 2 × 52 (= 156 × 2) or 130 + 182 A1 cao

5MB3H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
10		40 ÷ 5 = 8 8 × 1.5 = 12 (37.6–12)÷(40–8) = 25.6÷32 =	0.8	4	M1 for 40 ÷ 5 (=8) or at least 3 multiples of 1:4 M1 "8" × 1.5 (=12) M1 (37.6 – "12") ÷ (40 – "8") or 25.6 ÷ 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"×1.5 + "32"×w = 37.6 A1 for 0.8, accept 800 g
11	(a)	(–2,7), (–1,1), (0,–1), (1,1), (2,7)	1, –1, 7	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
	(b)		Curve drawn	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
	(c)		0.6 to 0.8 –0.6 to –0.8	2	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 (±½ square)

5MB3H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
12		$\frac{3.45 \times 10^{10}}{2650}$ =13018867.92 =	1.3×10^{7}	3	M1 for time = distance ÷ 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…) $\times10^{n}$ A1 $1.3(0)\times10^{7}$ – 1.31×10^{7}
13	(a)	$y = kx$ $10 = 600k$ $k = 10\div600 = \frac{1}{60}$	$y = \frac{1}{60}x$	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 × "k"

5MB3H_01					
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 $BX = BO + OX = -\mathbf{b} + 2\mathbf{a} - \mathbf{b} = 2(\mathbf{a} - \mathbf{b})$

5MB3H_01					
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 1st 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

5MB3H_01					
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 $h_a=\frac{171700\times 3}{\pi\times40^2}$ $=102.47589$ $h_b = h_a\times2=204.95..$ $vol_b= \frac{1}{3}\pi\times80^2\times204.95..$	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 $h_a\times2$ and used to find vol_b A1 cao
18		$DB^2 = 5.6^2 + 8.2^2 - 2 \times5.6 \times 8.2\cos78$ $DB^2 = 79.505…$ $DB = 8.9165795..$ $\frac{8.9165..}{\sin 80} = \frac{DC}{\sin 40}$ $DC = \frac{8.9165..\times \sin 40}{\sin 80}$ $=8.9165..\times0.6572..$ $=5.8198$	5.82	6	M1 Cosine rule: $DB^2=5.6^2+8.2^2-2\times5.6\times8.2\times\cos78$ M1 $\sqrt{}79.505…$ (=8.9165795..) A1 for DB = 8.90 to 8.92 M1 $\frac{"8.9165.."}{\sin 80} = \frac{DC}{\sin 40}$ 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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