edexcel

Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE
In Mathematics B (2MB01)
Higher (Non-Calculator) Unit 2

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2016
Publications Code 5MB2H_01_1606_MS

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.

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. 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 should 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 award marks for the quality of written communication (QWC).
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 labelling 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.

Partial answers shown (usually indicated in the ms by brackets) can be awarded the method mark associated with it (implied).

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks; transcription errors may also gain some credit. Send any such responses to review for the Team Leader to consider.

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 cancelling 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.

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 (embedded answers).

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)

14 The detailed notes in the mark scheme, and in practice/training material for examiners, should be taken as precedents over the above notes.

Guidance on the use of codes within this mark scheme
M1 – method mark for appropriate method in the context of the question 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

PAPER: 5MB2H/01					
Question		**Working**	**Answer**	**Mark**	
1			132	3	M1 for 0.15 × 520 (=78) or 0.15 × 360 (=54) or for 520 + 360 (=880) M1 (dep) for "78" + "54" or for 0.15 × "880" A1 cao
2			3	2	M1 for substitution eg $2^3 - 5$ or $8 - 5$ A1 cao
3	(a)		15	2	M1 for $\frac{10}{8}$ (= 1.2…) A1 cao
	(b)		$3\frac{3}{4}$ and 4.4	3	B1 for 1 kg = 2.2 lbs M1 for $2\frac{1}{2} \times 1.5$ (= $3\frac{3}{4}$) oe, eg $2\frac{1}{2} \times \frac{12}{8}$ or $2\frac{1}{2} + 1\frac{1}{4}$ A1 for $3\frac{3}{4}$ and 4.4 oe (lbs.) OR B1 for 1 kg = 2.2 lbs M1 for "2.2" × 2 ÷ 2.5 × 8 oe A1 for 14(.08)

PAPER: 5MB2H/01					
Question		**Working**	**Answer**	**Mark**	
4		or	Yes (supported)	4	M1 for attempt to divide corresponding sides eg 500 ÷ 50 (=10) or 250 ÷ 50 (=5) or 200 ÷ 50 (=4) M1 (dep) multiplying divisors eg "10" × "5" × "4" (=200) [consistent units] M1 for use of 3 containers eg "200" × 3 (=600) or use of 500 boxes eg 500 ÷ "200" (=2.5) C1 for yes and 600 (boxes) or 2.5 (containers) oe OR M1 for attempt to find the volume eg 500 × 250 × 200 (=25 000 000) or 50 × 50 × 50 (=125 000) M1 (dep) for dividing volumes [consistent units] eg "25 000 000" ÷ "125 000" (=200) or "125 000" × 500 (=62 500 000) M1 for use of 3 containers eg "25 000 000" × 3 (=75 000 000) or "200" × 3 (=600) or use of 500 boxes eg for "125 000" × 500 (= 62 500 000) and "25 000 000" × 3 (= 75 000 000) or 500 ÷ "200" (=2.5) C1 for yes and 600 (boxes) or 2.5 (containers) or 62 500 000 and 75 000 000 oe
5			$A = 13x + 8$	3	M1 for $5(2x + 1)$ or $3(x + 1)$ or $5 \times 2x + 1 + 3 \times x + 1$ M1 for $5(2x + 1) + 3(x + 1)$ or $13x + 8$ oe A1 for $A = 13x + 8$ oe OR M1 for $8(x + 1)$ or $5x$ or $8 \times x + 1 + 5x$ M1 for $8(x + 1) + 5x$ or $13x + 8$ oe A1 for $A = 13x + 8$ oe OR M1 for $8(2x + 1)$ or $3x$ or $8 \times 2x + 1 - 3x$ M1 for $8(2x + 1) - 3x$ or $13x + 8$ oe A1 for $A = 13x + 8$ oe

PAPER: 5MB2H/01					
Question		**Working**	**Answer**	**Mark**	
6		Table of values x= −2 −1 0 1 2 3 y= −8 −5 −2 1 4 7 OR Using $y = mx + c$, gradient = 3, y intercept = −2	Line	3	B3 for correct line between x = −2 and x = 3 OR B2 for a correct straight line segment through at least 3 of (−2,−8), (−1, −5), (0, −2), (1, 1), (2, 4), (3, 7) **or** for all of these plotted but not joined **or** for a line drawn with a positive gradient through (0, −2) and clear intention to use a gradient of 3 OR B1 for at least 2 correct points stated or plotted **or** for a line drawn with a positive gradient through (0, −2) **or** a line with gradient 3
7		24, 48, 72, 96, 120, 144, 168, 192, 216, 240, 264, **288** 36, 72, 108, 144, 180, 216, 252, **288**	12 boxes of book marks 8 packs of dust covers	4	M1 attempts multiples of either 24 or 36 (at least 3 but condone errors if intention is clear) M1 attempts multiples of both 24 and 36 (at least 3 but condone errors if intention is clear) M1 (dep on M2) for a division of 250 or 288 by 24 or 36, or counts up "multiples" (implied if answers reversed) A1 for 12 boxes of book marks, 8 packs of dust covers (accept 15b, 10p), (18b, 12p), etc. SC B1 for 11b, 7p
8			88	4	M1 for (APT =) 180 − (32 + 90) (=58) M1 for (PTR =) "58" M1 for 360 − ("58" + 124 + 90) A1 cao OR (line XY drawn through Q parallel to AB) M1 for (QRD =) 180 − 124 (=56) M1 for (XQR =) "56" M1 for (PQX =) 32 A1 cao

PAPER: 5MB2H/01					
Question		**Working**	**Answer**	**Mark**	
9			142	3	M1 for 3 × 7 (=21) or 3 × 5 (=15) or 5 × 7 (=35) M1 (dep on M1) for 2 × (‘21’ + ‘15’ + ‘35’) A1 cao
10	(a)		a^7	1	B1 cao
	(b)		b^{14}	1	B1 cao
	(c)		1	1	B1 cao
	(d)		$\frac{1}{4}$	1	B1 for $\frac{1}{4}$ oe
11	(a)		5.9×10^{-4}	1	B1 cao
	(b)		380 000	1	B1 cao
12	(a)	$(2a + b)(x - y)$		2	M1 for $2a(x - y)$ or $b(x - y)$ or $x(2a + b)$ or $y(2a + b)$ A1 for $(2a + b)(x - y)$ oe
	(b)		$2n^2 - 2n + 13$	3	B1 for $n^2 + 4n + 4$ or $n^2 - 6n + 9$ (need not be simplified) M1 (dep on B1) for ‘$n^2 + 4n + 4$’ + ‘$n^2 - 6n + 9$’ A1 cao
13			$11\frac{2}{3}$	3	M1 for writing as improper fractions eg $\frac{25}{3}$ or $\frac{7}{5}$ M1 (dep) for multiplying improper fractions eg $\frac{25\times7}{3\times5}$ $(=\frac{175}{15})$ or $\frac{5\times7}{3\times1}$ $(=\frac{35}{3})$ A1 cao

PAPER: 5MB2H/01					
Question		**Working**	**Answer**	**Mark**	
14			$\frac{2x+y}{2}$ (with reasons)	5	M1 for (*POS* =) 360 − (90 + 90 + 2*x*) (= 180 − 2*x*) ie using angles around *O* or (*QOR* =) 360 − (90 + 90 + *y*) (= 180 − *y*) M1 (dep) for (*POQ* =) $\frac{1}{2}$ [360 − ("*POS*" + "*QOR*")] A1 for (*POQ* =) $x + \frac{y}{2}$ oe C1 (dep M1 and supported) for circle theorem angle between tangent and radius is 90 C1 for full reasons and supported eg sum of angles in a quadrilateral is 360 and sum of angles at a point is 360 OR M1 for (*POA*=) 180 − 90 − *x* (= 90 − *x*) ie after having drawn line *AOC* or (*QOC*=) 180 − 90 − $\frac{y}{2}$ (= 90 − $\frac{y}{2}$) M1 (dep and supported) for (*POQ* =) 180 − "*POA*" − "*QOC*" A1 for (*POQ* =) $x + \frac{y}{2}$ oe C1 (dep M1 and supported) for circle theorem for angle between tangent and radius is 90 C1 for full reasons and supported eg sum of angles in a triangle is 180 and sum of angles on straight line is 180 OR M1 for (*ABC* or *ADC* =) $\frac{1}{2}$ (360 − 2*x* − *y*) ie using similar triangles M1 (dep)for (*POQ* =) 360 − 90 − 90 − "*ABC*" A1 for (*POQ* =) $x + \frac{y}{2}$ oe C1 (dep M1 and supported) for circle theorem for angle between tangent and radius is 90 C1 for full reasons and supported eg sum of angles in a quadrilateral is 360 and eg Δ*ABC* similar to Δ*ADC*

PAPER: 5MB2H/01					
Question		**Working**	**Answer**	**Mark**	
15			$y = -\frac{1}{2}x + \frac{17}{2}$	4	M1 for M = $\left(\frac{2+4}{2}, \frac{5+9}{2}\right)$ (= 3,7) M1 for gradient = $-\frac{1}{m}$ or $-\frac{1}{2}$ oe M1 (dep on 1st M1) for substitution of x = "3", y = "7" into their equation A1 for $y = -\frac{1}{2}x + \frac{17}{2}$ oe
16		$\frac{\sqrt{3}}{5} + \frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ $= \frac{3\sqrt{3}}{15} + \frac{10\sqrt{3}}{15}$; $\frac{\sqrt{3}\sqrt{3}+10}{3\sqrt{3}} = \frac{13\sqrt{3}}{5\sqrt{3}\sqrt{3}}$	$\frac{13}{15}$	3	M1 for rationalising a denominator M1 for finding same denominator (dep M1 or with √3) A1 oe Accept $\frac{13}{15}\sqrt{3}$
17			$\frac{2x-1}{x-3}$	3	M1 for $(2x - 1)(x + 3)$ M1 for $(x - 3)(x + 3)$ A1 cao

Modifications to the mark scheme for Modified Large Print (MLP) papers.

Only mark scheme amendments are shown where the enlargement or modification of the paper requires a change in the mark scheme.

The following tolerances should be accepted on marking MLP papers, unless otherwise stated below:
Angles: ±5º
Measurements of length: ±5 mm

PAPER: 5MB2H_01			
Question		**Modification**	**Notes**
Q4		Model provided for all candidates. Diagram enlarged and provided for MLP.	M1 for attempt to divide corresponding sides eg 500 ÷ 50 (=10) or 250 ÷ 50 (=5) or 200 ÷ 50 (=4) M1 (dep) multiplying divisors eg "10" × "5" × "4" (=200) [consistent units] M1 for use of 3 containers eg "200" × 3 (=600) or use of 500 boxes eg 500 ÷ "200" (=2.5) C1 for yes and 600 (boxes) or 2.5 (containers) oe OR M1 for attempt to find the volume eg 500 × 250 × 200 (=25 000 000) or 50 × 50 × 50 (=125 000) M1 (dep) for dividing volumes [consistent units] eg "25 000 000" ÷ "125 000" (=200) or "125 000" × 500 (=62 500 000) M1 for use of 3 containers eg "25 000 000" × 3 (=75 000 000) or "200" × 3 (=600) or use of 500 boxes eg for "125 000" × 500 (= 62 500 000) and "25 000 000" × 3 (= 75 000 000) or 500 ÷ "200" (=2.5) C1 for yes and 600 (boxes) or 2.5 (containers) or 62 500 000 and 75 000 000 oe

PAPER: 5MB2H_01			
Question		**Modification**	**Notes**
Q5		Diagram enlarged. MLP only – x changed to y.	M1 for $5(2x + 1)$ or $3(x + 1)$ or $5 \times 2x + 1 + 3 \times x + 1$ M1 for $5(2x + 1) + 3(x + 1)$ or $13x + 8$ oe A1 for $A = 13x + 8$ oe OR M1 for $8(x + 1)$ or $5x$ or $8 \times x + 1 + 5x$ M1 for $8(x + 1) + 5x$ or $13x + 8$ oe A1 for $A = 13x + 8$ oe OR M1 for $8(2x + 1)$ or $3x$ or $8 \times 2x + 1 - 3x$ M1 for $8(2x + 1) - 3x$ or $13x + 8$ oe A1 for $A = 13x + 8$ oe
Q6		Grid enlarged.	B3 for correct line between $x = -2$ and $x = 3$ OR B2 for a correct straight line segment through at least 3 of $(-2,-8)$, $(-1, -5)$, $(0, -2)$, $(1, 1)$, $(2, 4)$, $(3, 7)$ **or** for all of these plotted but not joined **or** for a line drawn with a positive gradient through $(0, -2)$ and clear intention to use a gradient of 3 OR B1 for at least 2 correct points stated or plotted **or** for a line drawn with a positive gradient through $(0, -2)$ **or** a line with gradient 3

PAPER: 5MB2H_01			
Question		**Modification**	**Notes**
Q8		Diagram enlarged. Wording added 'Angle *TPQ* is a right angle. Angle *PQR* is marked *x*.'	M1 for (*APT* =) 180 − (32 + 90) (=58) M1 for (*PTR* =) "58" M1 for 360 − ("58" + 124 + 90) A1 cao OR (line *XY* drawn through *Q* parallel to *AB*) M1 for (*QRD* =) 180 − 124 (=56) M1 for (*XQR* =) "56" M1 for (*PQX* =) 32 A1 cao
Q9		Model provided for all candidates. Diagram enlarged and provided for MLP.	M1 for 3 × 7 (=21) or 3 × 5 (=15) or 5 × 7 (=35) M1 (dep on M1) for 2 × ('21' + '15' + '35') A1 cao
Q10	(a)	MLP only – *a* changed to *y*. Braille only – *a* changed to *m*.	B1 cao
	(b)	Braille only – *b* changed to *q*.	B1 cao
Q12	(a)	Braille only – *a* changed to *p*, *b* changed to *q* $2ax - 2ay + bx - by$ changed to $2px - 2py + qx - qy$	M1 for $2a(x - y)$ or $b(x - y)$ or $x(2a + b)$ or $y(2a + b)$ A1 for $(2a + b)(x - y)$ oe

PAPER: 5MB2H_01			
Question		**Modification**	**Notes**
Q14		Diagram enlarged. Dot added to centre.	M1 for (*POS* =) 360 − (90 + 90 + 2*x*) (= 180 − 2*x*) ie using angles around *O* or (*QOR* =) 360 − (90 + 90 + *y*) (= 180 − *y*) M1 (dep) for (*POQ* =) $\frac{1}{2}$ [360 − ("*POS*" + "*QOR*")] A1 for (*POQ* =) $x + \frac{y}{2}$ oe C1 (dep M1 and supported) for circle theorem angle between tangent and radius is 90 C1 for full reasons and supported eg sum of angles in a quadrilateral is 360 and sum of angles at a point is 360 OR M1 for (*POA*=) 180 − 90 − *x* (= 90 − *x*) ie after having drawn line *AOC* or (*QOC*=) 180 − 90 − $\frac{y}{2}$ (= 90 − $\frac{y}{2}$) M1 (dep and supported) for (*POQ* =) 180 − "*POA*" − "*QOC*" A1 for (*POQ* =) $x + \frac{y}{2}$ oe C1 (dep M1 and supported) for circle theorem for angle between tangent and radius is 90 C1 for full reasons and supported eg sum of angles in a triangle is 180 and sum of angles on straight line is 180 OR M1 for (*ABC* or *ADC* =) $\frac{1}{2}$ (360 − 2*x* − *y*) ie using similar triangles M1 (dep)for (*POQ* =) 360 − 90 − 90 − "*ABC*" A1 for (*POQ* =) $x + \frac{y}{2}$ oe C1 (dep M1 and supported) for circle theorem for angle between tangent and radius is 90 C1 for full reasons and supported eg sum of angles in a quadrilateral is 360 and eg Δ*ABC* similar to Δ*ADC*

PAPER: 5MB2H_01			
Question		**Modification**	**Notes**
Q15		Diagram enlarged. Crosses changed to filled in circles.	M1 for M = $\left(\frac{2+4}{2}, \frac{5+9}{2}\right)$ (= 3,7) M1 for gradient = $-\frac{1}{m}$ or $-\frac{1}{2}$ oe M1 (dep on 1st M1) for substitution of x = "3", y = "7" into their equation A1 for $y = -\frac{1}{2}x + \frac{17}{2}$ oe
Q16		MLP only – *a* changed to *p*. Braille only – *a* changed to *m*.	M1 for rationalising a denominator M1 for finding same denominator (dep M1 or with √3) A1 oe Accept $\frac{13}{15}\sqrt{3}$

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London WC2R 0RL