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Mark Scheme (Results)

January 2017

Pearson Edexcel International GCSE Mathematics B (4MB0) Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- 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.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- **Types of mark**
  - M marks: method marks
  - A marks: accuracy marks
  - B marks: unconditional accuracy marks (independent of M marks)
- **Abbreviations**
  - cao – correct answer only
  - ft – follow through
  - isw – ignore subsequent working
  - SC - special case
  - oe – or equivalent (and appropriate)
  - dep – dependent
  - indep – independent
  - eeoo – each error or omission

- **No working**
  If no working is shown then correct answers normally score full marks
  If no working is shown then incorrect (even though nearly correct) answers score no marks.
- **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 it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.
  Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.
  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 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.
  If there is no answer on the answer line then check the working for an obvious answer.
- **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: eg. 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 eg algebra.
  Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.
- **Parts of questions**
  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

International GCSE Mathematics B				
Question	**Working**	**Answer**	**Mark**	**Notes**
1	$\frac{60\times24\times366}{10}$ (o.e.)		2	M1
		52704		A1 Accept 52700
				Total 2 marks

Question	**Working**	**Answer**	**Mark**	**Notes**
2	Attempt to factorise a quadratic e.g. $(4x + 3y)(4x \pm 3y)$ (ie any attempt giving $16x^2$ and $9y^2$ terms is acceptable)		2	M1
		$(4x + 3y)(4x - 3y)$		A1 (cao)
				Total 2 marks

Question	**Working**	**Answer**	**Mark**	**Notes**
3	Prime factors (or factor ladders/trees) of any two of 60, 84 and 120 ($60 = 2^2 \times 3 \times 5$, $120 = 2^3 \times 3 \times 5$, $84 = 2^2 \times 3 \times 7$)		2	M1 Allow 4 for 2^2 in the factorisations
		12		A1 **SC:** any multiple of 12 scores M1A0
				Total 2 marks

Question	Working	Answer	Mark	Notes
4		$2x-\frac{4}{x^3}$ OR $2x-4x^{-3}$	2	M1 (one term correct)
				A1 (both terms correct)
				Total 2 marks

Question	Working	Answer	Mark	Notes
5	$\frac{1.208\times10^{14}}{9.461\times10^{12}}$		2	M1
		12.8 light years		A1 Accept 1.28×10
				Total 2 marks

Question	Working	Answer	Mark	Notes
6	$x : y = 14 : 35$ and $x : z = 14 : 6$ **OR** $\frac{y}{x}\times\frac{x}{z}=\frac{5}{2}\times\frac{7}{3}$ **OR** $\frac{2y}{5}=\frac{7z}{3}$ (o.e.)		2	M1
		$y : z = 35 : 6$		A1 o.e.
				Total 2 marks

Question	Working	Answer	Mark	Notes
7	Volume = $\pi \times 6^2 \times 8$		2	M1
		288π		A1 cao
				Total 2 marks

Question	Working	Answer	Mark	Notes
8	$76 \times \frac{100}{160}$		2	M1
		47.5 mm		A1
				Total 2 marks

Question	Working	Answer	Mark	Notes
9	$162n = (2n-4) \times 90$ **OR** Exterior angle= 180 – 162 (=18º)		3	M1
	$\frac{360}{18}$			M1(DEP)
		20		A1
				Total 3 marks

Question	Working	Answer	Mark	Notes
10	$\overrightarrow{BC} = \left(= \overrightarrow{BA} + \overrightarrow{AO} + \overrightarrow{OC}\right) = -\begin{pmatrix}3\\2\end{pmatrix} - \begin{pmatrix}1\\1\end{pmatrix} + \begin{pmatrix}5\\6\end{pmatrix}$		2	M1
		$\overrightarrow{BC} = \begin{pmatrix}1\\3\end{pmatrix}$		A1 $\begin{pmatrix}\frac{1}{3}\end{pmatrix}$ and no working seen scores M0 A0
				Total 2 marks

Question	Working	Answer	Mark	Notes
11	$4\times53+3\times490$ (=1682)		3	M1
	$\frac{"1682"}{11.85}$ **OR** $\frac{53}{11.85}$ and $\frac{490}{11.85}$ $4\times"\frac{53}{11.85}"+3\times"\frac{490}{11.85}"$			M1(DEP) (M1) (M1(DEP))
		£142 (awrt)		A1
				Total 3 marks

Question	Working	Answer	Mark	Notes
12	Two of $6\sqrt{2}$, $4\sqrt{2}$ and $2\sqrt{2}$		3	B1
	$\frac{6\sqrt{2}+4\sqrt{2}}{2\sqrt{2}}$ oe			M1
	(OR $\frac{\sqrt{8}}{\sqrt{8}}\times\frac{\sqrt{72}+\sqrt{32}}{\sqrt{8}}$			(B1)
	$\frac{\sqrt{576}+\sqrt{256}}{8}$			(M1)
	OR $\frac{\sqrt{2}}{\sqrt{2}}\times\frac{\sqrt{72}+\sqrt{32}}{\sqrt{8}}$			(B1)
	$\frac{\sqrt{144}+\sqrt{64}}{\sqrt{16}}$			(M1)
	OR Dividing numerator by $\sqrt{8}$ producing one of $\sqrt{9}$ or $\sqrt{4}$)			(B1)
	$\sqrt{9}$ + $\sqrt{4}$			(M1)
		5		A1
				Total 3 marks

Question	Working	Answer	Mark	Notes
13	$\frac{2x^{-2}y^3}{x^5y^6}$ (factor of 2)		3	M1
	$\frac{2y^3}{x^7y^6}$ OR $\frac{2x^{-2}}{x^5y^3}$ (oe, simplifying powers of x or y)			M1
		$\frac{2}{x^7y^3}$		A1 $\left(2x^{-7}y^{-3},\ \frac{2x^{-7}}{y^3} \text{ and } \frac{2y^{-3}}{x^7}\right)$
				Total 3 marks

Question	Working	Answer	Mark	Notes
14	One of $15 \times \tan 20^o$ and $15 \times \tan 35^o$ OR $\tan 35 - \tan 20$		3	M1
	$15 \times \tan 35^o - 15 \times \tan 20^o$ (oe)			M1 (DEP)
		5.04356→5.04 (awrt)		A1
				Total 3 marks

Question	Working		Answer	Mark	Notes
15	$100 = \frac{k}{7^2}$			4	M1
	$k = 4900$	$100 \times 7^2 = 4 \times r^2$ (M1)(A1)			A1
	$\therefore r = \sqrt{\frac{"4900"}{4}}$				M1 (DEP)
			$r = 35$		A1
					Total 4 marks

Question	Working	Answer	Mark	Notes
16 a	$\frac{13-1}{15-(-1)}$		2	M1
		$\frac{12}{16}$, $\left(\frac{3}{4}, 0.75\right)$		A1
b	$\sqrt{\left((15-(-1))^2+(13-1)^2\right)}$	20	2	M1 A1
				Total 4 marks

Question	Working	Answer	Mark	Notes
17 a	$3(x+2) > 5(x-2)$ (remove denominators, oe)		3	M1
	$16 > 2x$ or $-2x > -16$ (isolate x)			M1 (DEP)
		$x < 8$		A1
b	Open circle at/ above/ below $x = 8$ with line drawn in the $-\infty$ direction, arrowed or drawn to or beyond $x = -10$		1	B1ft
				Total 4 marks

Question	Working	Answer	Mark	Notes
18 a	*d*		1	B1
b	*c, d, e*		1	B1
c	*f, g*		1	B1
d	∅		1	B1 Condone (curly) brackets
				Total 4 marks

Question	Working	Mark	Notes
19	**Method (A)** $\angle ABC = 90^o$ (angle in a semicircle)	4	
	$\therefore \angle ABD = 70^o$		B1
	($\angle OBA = 40^o$ (Isosceles Δ)) $\quad \therefore \angle OBD = 30^o$		B1
	$\therefore \angle ODB = 30^o$ (Isosceles Δ)		B1
	2 reasons ("angle in a semicircle", "Isosceles Δ")		B1
	OR		
	Method (B) $\angle ABC = 90^o$ (angle in a semicircle)		
	$\therefore \angle ABD = 70^o$		B1
	($\angle OBA = 40^o$ (Isosceles Δ) and $\angle AOD = 140^o$ ($\angle$ at centre))		
	$\therefore \angle BOD = 120^o$ ($\angle s$ at a point)		B1
	$\therefore \angle ODB = 30^o$ (Isosceles Δs)		B1
	2 different reasons (one of "angle in a semicircle" and " $\angle$ at centre ", one of "Isosceles Δ" , " $\angle s$ at a point ","angle in a semicircle" and " $\angle$ at centre ",)		B1
	OR (using point *E*)		
	Method (C) $\angle ABC = 90^o$ (angle in a semicircle)		
	$\therefore \angle ABD = 70^o$		B1
	$\angle OED = 110^o$ ($\angle$s of Δ, $\angle$s on line) AND $\angle EOD = 40^o$ ($\angle$ at centre, $\angle$s on line)		B1
	$\therefore \angle ODB = 30^o$		B1
	2 different reasons (one of "angle in a semicircle" and " $\angle$ at centre ", one of "$\angle$s in Δ" , "$\angle$s on straight line","angle in a semicircle" and " $\angle$ at centre ")		B1

	Summary of Scheme: $\angle ABD = 70^o$ $\angle OBD = 30^o$ (Method **A**), **OR** $\angle BOD = 120^o$ (Method **B**) **OR** $\angle OED = 110°$ AND $\angle EOD = 40°$ (Method **C**) Answer TWO different reasons including one relevant circle reason plus another relevant reason			B1 B1 B1 B1
				Total 4 marks

NB. A fourth method:

$\angle ABC = 90^\circ$ (angle in a semicircle)

$\angle ACB = 50^\circ$ (angles in a triangle) (B1)

$\angle COD = 40^\circ$ ($\angle$ at the centre) and $\angle BEC (OED) = 110^\circ$ (reason) (B1)

Answer (B1)

Reasons (B1)

Reasons must be consistent with the argument

Question	Working	Answer	Mark	Notes
20	$\frac{a}{b}=\frac{1}{c^2}-\frac{1}{d^2}$ $\frac{1}{d^2}=\frac{1}{c^2}-\frac{a}{b}$ (isolating $\frac{1}{d^2}$) $\frac{1}{d^2}=\frac{b-ac^2}{bc^2}$ (combining fractions) $d^2=\frac{bc^2}{b-ac^2}$ (isolating d^2)	$d=\sqrt{\frac{bc^2}{b-ac^2}}$ oe	5	M1 M1(DEP) M1(DEP) M1(DEP) A1
	OR $a=b\left(\frac{d^2-c^2}{c^2d^2}\right)$ (combining fractions) $ac^2d^2=bd^2-bc^2$ $\left(b-ac^2\right)d^2=bc^2$ (collecting terms in d^2) $d^2=\frac{bc^2}{b-ac^2}$ (isolating d^2) $d=\sqrt{\frac{bc^2}{b-ac^2}}$ (oe)			M1 M1(DEP) M1(DEP) M1(DEP) A1

	OR $a = \frac{b}{c^2} - \frac{b}{d^2}$ $\frac{b}{d^2} = \frac{b}{c^2} - a$ (isolating $\frac{b}{d^2}$) $\frac{1}{d^2} = \frac{b - ac^2}{bc^2}$ (combining fractions) $d^2 = \frac{bc^2}{b - ac^2}$ (isolating d^2) $d = \sqrt{\frac{bc^2}{b - ac^2}}$ (oe)			M1 M1(DEP) M1(DEP) M1(DEP) A1
				Total 5 marks

Question	Working	Answer	Mark	Notes
21		$20 < t \leqslant 25$ 30 students		B1
		$55 < t \leqslant 65$ 100 students		B1ft Award B1ft if their individual number of students is incorrect but the total adds up to 30
		$25 < t \leqslant 40$ 2.0 units		B1
		$40 < t \leqslant 50$ 3.0 units		B1
		$55 < t \leqslant 65$ 5.0 units		B1ft
				Total 5 marks

Question	Working	Answer	Mark	Notes
22 a		10×2^{100}	1	B1 Accept m = 10
b	$4^{48}\left(=2^{48}\times 2^{48}\right)=2^{96}$		4	M1
	$\therefore "10"\times 2^{100}="10"\times 2^{4}\times 2^{96}$			M1(DEP)
	$="10"\times 2^{4}\times 4^{48}$ (**OR** $\frac{"10\times 2^{100}"}{2^{96}}$ 10×2^{4} (oe eg (32 + 128))			M1(DEP) (M1(DEP)) (M1(DEP))) **NB:** 0 marks if no correct working seen
		160×4^{48} (cao)		A1ft
				Total 5 marks

Note: 2nd Alternative

$2^{100}=4^{50}$ (M1)

$"10\times 2^{100}"=10\times 4^{50}$ (M1 (|DEP))

$=10\times 4^{2}\times 4^{48}$ (M1(DEP))

Answers of (a) 10 and (b) 160 earns at most (B0)((M1)(M1)(M1)(A1)

Question	Working	Answer	Mark	Notes
23	$2x^2-4(3x-1)=-6$		5	M1
	$2x^2-12x+10=0$ (o.e.)			A1
	$2(x-1)(x-5)=0$ OR $(x-1)(x-5)=0$ (oe, solving trinomial quadratic)			M1 .
		1, 5		A1, A1
				Total 5 marks

Question	Working	Answer	Mark	Notes
24 a	Arc(s) of equal radii, centred *A*, drawn and intersecting *AB* at *X* and *AC* at *Y*. Arcs of equal radii, centred *X* and *Y*, drawn and intersecting at *Z* (situated in between *AB* and *AC*)		2	M1
	Line drawn from *A* to at least the point of intersection, *Z*, of the above two arcs			A1
b	Arcs, centred *A* and *C*, drawn above and below *AC* and intersecting		2	M1
	Perpendicular bisector drawn above *AC* and intersecting *BC*			A1
c		$\angle BCP = 37^\circ \rightarrow 39^\circ$ (awrt)	1	B1
				Total 5 marks

Question		Working	Answer	Mark	Notes
25	a		9 years	1	B1
	b		12 years	1	B1
	c	6 correct products		3	M1
		Expression fully correct $\left(\frac{8\times8+9\times32+10\times7+11\times1+12\times10+13\times29+14\times10+15\times3}{100}=\frac{1115}{100}\right)$			M1(DEP)
			11.15 years		A1
					Total 5 marks

Question		Working	Answer	Mark	Notes
26	a	$\sin 35=\frac{BD}{7}$	BD = 4.02 (BD = 4.015)	2	M1 A1
	b	$\cos 35=\frac{AD}{7}$ (AD = 5.734) area of ΔABC = $\frac{1}{2}\times(\text{"5.734"}+3)\times\text{"4.015"}$		3	M1 M1(DEP)
		(Area of triangle ABD = 11.51… Area of triangle BDC = 6.03…)	area of ΔABC = 17.53→ **17.5, 17.6** (=17.555-→17.6 from BD = 4.02)		A1
					Total 5 marks

Question	Working	Answer	Mark	Notes
27 a	$f(-2) = 14\times(-2)^3 - 9\times(-2)^2 - 69\times(-2) + 10$		2	M1 NB: f(2) = …scores M0A0
		= 0		A1
b	$a = 14$		4	B1
	$c = 5$			B1
	$2b + c = -69$ OR $2a + b = -9$			M1
	(OR Long division: $14x^2 - 37x + 5$ (At least coef "14" correct) $a = 14$ $b = -37$ $c = 5$	$b = -37$		A1 (M1) (A1) (B1) (B1))
				Total 6 marks

Question	Working	Answer	Mark	Notes
28 a		$1+\frac{1}{2x+3}$ or $\frac{2x+4}{2x+3}$	1	B1
bi	For method marks, accept the interchange of x/y		5	
	$x(2y+3)=2y+4$ (Removing denominators)			M1
	$2xy-2y=4-3x$ (gathering terms in y together) $y(2x-2)=4-3x$			M1(DEP) M1(DEP)
	OR $2x+3=\frac{1}{y-1}$ $2x=\frac{1}{y-1}-3$ $2x=\frac{1-3y+3}{y-1}$			(M1) (M1DEP)) (M1(DEP))
		$(gf)^{-1}: x \mapsto \frac{4-3x}{2x-2}$ (oe)		A1
bii		(x =) 1		B1ft
				Total 6 marks

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