Pearson Edexcel

Mark Scheme (Results)

January 2020

Pearson Edexcel International GCSE In Mathematics B (4MB1) Paper 01

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January 2020
Publications Code 4MB1_01_2001_MS

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
- awrt – answer which rounds to
- 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.
  If a candidate misreads a number from the question. Eg. Uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review. If there is a choice of methods shown, mark the method that leads to the answer given on the answer line.
  If no answer appears on the answer line, or there is no answer line, mark both methods **then award the lower number of marks.**

  If there is no answer on the answer line then check the working for an obvious answer.

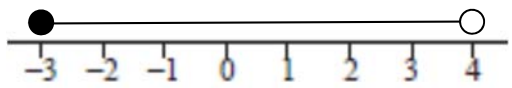
- **Ignoring subsequent work**

  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 to another.

Question		Working	Answer	Mark	Notes
1			3.15×10^{-4}	1	B1
					Total 1 marks
2		124 + 180 oe		2	M1 270 + 34 commonly seen.
			304		A1
					Total 2 marks
3		180 – 135 **or** $\angle BED = 45$ **or** $\angle BEF = 135$ **or** $\angle DEH = 135$ **or** $\angle CBE = 45$ **or** $\angle CBE = p$ **or** $135 + p = 180$ **or** $\frac{360-2\times135}{2}$		2	M1 Allow values marked on the diagram
			45(°)		A1
					Total 2 marks
4		$\frac{15}{8}\times\frac{13}{5}$ **or** $\frac{1\times8+7}{8}\times\frac{2\times5+3}{5}$		2	M1 Or equivalent method for multiplying two fractions
			$4\frac{7}{8}$		A1 Dependent on M mark being awarded.
					Total 2 marks
5	(a)		10, 14, 16, 18, 20, 22, 26, 28	2	B1 Ignore brackets
	(b)		2		B1 Ignore brackets
					Total 2 marks

Question		Working	Answer	Mark	Notes
6		Rearranging scores in ascending/ descending order (at least seven in order) 3,6,11,18,23,23,26,45,56,56,78,87 or 23 and 26 identified		2	M1
			24.5		A1 Accept $\frac{49}{2}$
					Total 2 marks
7				2	M1 for 2 correct terms **or** k , $k-5$, $k-10$ (where k is an integer)
			$-13, -18, -23$		A1
					Total 2 marks
8		$\frac{42}{5\times60}(=0.14)$ oe		3	M1 $\frac{42}{300}$ or $\frac{0.7}{5}$
		$"\frac{42}{5\times60}"\times100$			M1 indep Allow for $\frac{42}{a}\times100$ or $\frac{b}{5}\times100$ for any a or b ≠ 1
			14		A1
					Total 3 marks
9	(a)	Correct circle around one of $x=-3$ or $x=4$ and corresponding line drawn in the correct direction **or** Line joining $x=-3$ and $x=4$		2	M1
			Both end points identified using the correct symbols **and** one correct line drawn between the two correct points.		A1 
	(b)		$-3, -2, -1, 0, 1, 2, 3$		B1
					Total 3 marks

Question		Working	Answer	Mark	Notes
10	(a)		$\begin{pmatrix} 7 & -3 \\ 8 & -1 \end{pmatrix}$	3	B1
			$\begin{pmatrix} -16 & -6 \\ -8 & 10 \end{pmatrix}$		B2 Fully correct B1 for 2 or 3 correct elements in a 2×2 matrix
					Total 3 marks
11		$\frac{5(2+5x)-2(3-2x)}{(3-2x)(2+5x)}$ (oe)		3	M1 for correct single fraction
		$\frac{10+25x-6+4x}{(3-2x)(2+5x)}$			Indep M1 for expansion of the correct numerator in single fraction Must be part of a fraction but ignore denominator for this mark. Allow a maximum of one arithmetic or sign error
			$\frac{4+29x}{(3-2x)(2+5x)}$ oe		A1 allow $6+11x-10x^2$ in the denominator do not ISW for this mark.
					Total 3 marks

Question		Working	Answer	Mark	Notes
12		$4x^3 - 8x^2 - 12x = (2x + k)Q(x)$		3	B1 Eliminate 11 from both sides allow Qx rather than $Q(x)$
		Method 1 $4x(x-3)(x+1)$ **or** $x(2x-6)(2x+2)$ **or** $(2x + 2)(2x^2 - 6x)$ **or** $x(4x - 12)(x + 1)$ **or** $x(x - 3)(4x + 4)$			M1 Factorise to three linear terms or take out $(2x + 2)$ as common factor. To award this mark their factors must expand to give 2 out of the 3 terms correct
		Method 2 $2a + 2k = -8$ and $ak = -12$ **or** $2a + 2k = -8$ and $ak + 2b = -12$ and $kb = 0$ oe			(M1) Equate coefficients after expanding $(2x + k)Q(x)$
		Method 3 $4\left(\frac{-k}{2}\right)^3 - 8\left(\frac{-k}{2}\right)^2 - 12\left(\frac{-k}{2}\right) = 0$ oe			(M1) use factor theorem with $x = -\frac{k}{2}$
		Method 4 $k^2 + 4k - 12 = 0$ oe			(M1) use long division equate remainder to zero
			$k = 2$		A1 NB $k = 2$ seen with no incorrect statements scores all 3 marks. $k = -6$ and $k = 0$ lose this final mark only.
					Total 3 marks
13		$\frac{27x^6y^9}{9xy^2}$		3	M1 Expansion of numerator – at least two components correct
			"3" "x^5" "y^7"		M1 indep. Correct division from their numerator with at least two components correctly following through.
			$3x^5y^7$		A1 Fully correct
					Total 3 marks

Question		Working	Answer	Mark	Notes
14		$12x + 8y = 32$ **or** $27x + 18y = 72$ $-12x + 27y = 66$ $\quad -8x + 18y = 44$ $35y = 98$ $\quad 35x = 28$ **or** $x = \frac{8-2y}{3}$ giving $-4\left(\frac{8-2y}{3}\right)+9y = 22$ **or** $x = \frac{9y-22}{4}$ giving $3\left(\frac{9y-22}{4}\right) + 2y = 8$ **or** $y = \frac{8-3x}{2}$ giving $-4x+9\left(\frac{8-3x}{2}\right) = 22$ **or** $y = \frac{4x+22}{9}$ giving $3x + 2\left(\frac{4x+24}{9}\right) = 8$		4	M1 Fully correct method to obtain equation in a single variable. Allow a maximum of 1 arithmetic or sign error.
			$x = \frac{4}{5}$ **or** $y = \frac{14}{5}$		A1 Allow $x = 0.8$ or $y = 2.8$
		eg $3 \times \frac{4}{5} + 2y = 8$ **or** $3x + 2 \times \frac{14}{5} = 8$			M1 dep Fully correct method to obtain equation in the other variable following through their first result.
			$x = \frac{4}{5}$ **and** $y = \frac{14}{5}$		A1 Allow $x = 0.8$ and $y = 2.8$
					Total 4 marks
15			$y \geq 6 - 2x$	4	B1 Allow strict inequalities
			$y \leq 5 + x$		B1 Allow strict inequalities
		Method to find point of intersection of $y = 6 - 2x$ with the x-axis. Eg $6 - 2x = 0$ seen			M1 Allow (3,0) or $x = 3$ stated
			$x \leq 3$		A1
					SC Allow a total of B2 for $y \leq 6 - 2x$, $y \geq 5 + x$ and $x \geq 3$
					Total 4 marks

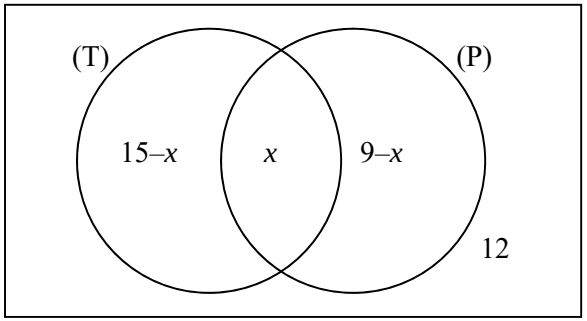
Question		Working	Answer	Mark	Notes	
16		$400^2 : 3^2$ **or** $\left(\frac{400}{3}\right)^2$ **or** $\left(\frac{3}{400}\right)^2$		4	M1 state or use scale factor squared	
		$7200 \times \left(\frac{400}{3}\right)^2$ **or** $\left(\frac{3}{400}\right)^2 = \frac{7200}{x}$ oe			M1 dep correct method to find surface area of ship condone $72 \times \left(\frac{400}{3}\right)^2$	M2 for $0.72 \times \left(\frac{400}{3}\right)^2$
		$\div 100^2$			M1 indep convert from cm^2 to m^2	
			12800		A1	
					Total 4 marks	
17		$(BD^2=)6.5^2-2.5^2$ (=36) Area of $ABD = \frac{1}{2}(2.5)(BD)$(=7.5) Area of $BCD = \frac{1}{2}(4.2)(BD)\sin 35$ (=7.23) Area of $ABCD$ = $\frac{1}{2}(2.5)(BD) + \frac{1}{2}(4.2)(BD)\sin 35$		4	M3 Completely correct method to find area $ABCD$ **or** M2 Completely correct method to find the area of ABD or BCD **or** M1 Correct method to find BD or BD^2 For Area of ABD allow $\frac{1}{2}(6.5)(2.5)\sin BAD$ with $\cos BAD = \frac{2.5}{6.5}$ (BAD = 67.4)	
			awrt 14.7		A1	
					Total 4 marks	
18		$\lvert\mathbf{p}\rvert^2 = x^2 + (2x-1)^2$ and $\lvert\mathbf{q}\rvert^2 = (-9)^2 + 5^2$		4	M1 Attempt at both moduli or both moduli squared (or equivalent)	
		$\lvert\mathbf{p}\rvert=\lvert\mathbf{q}\rvert \Rightarrow 5x^2 - 4x - 105$ (=0)			M1 dep. Forming three term quadratic in x allow a maximum of 1 arithmetic or sign error	
		$(5x+21)(x-5)$(=0)			M1 dep. Factorising trinomial quadratic expression must expand to give 2 of 3 terms correct or completely correct substitution into a completely correct formula.	
			$x = -\frac{21}{5}$ (oe)		A1 Do not allow if $x = 5$ given and not rejected allow –4.2	
					Total 4 marks	

Question		Working	Answer	Mark	Notes
19		$\frac{30}{360}(2\pi)(OB)$ or $\frac{30}{360}(2\pi)(OA)$ (oe)		4	M1 Allow $OA = r$ or $\frac{1}{2}r$ or $OB = r$ or $2r$ Allow any variable used in place of r
		$\frac{30}{360}(2\pi)(2(OA))+\frac{30}{360}(2\pi)(OA)+2(OA)=10$ (oe)			M1 dep. Deriving an equation in a single unknown must include all 4 sides of the shape.
		$\frac{1}{2}\pi OA + 2OA = 10$(oe)			M1 Simplify to equation of the form $a\pi OA + bOA = c$ or $a\pi OB + bOB = c$ Where $a,b,c \neq 0$
			$\frac{20}{4+\pi}$ oe		A1 ISW final answer given as a decimal
					Total 4 marks
20	(a)		$14 < T \leq 17$	5	B1 Condone any indication of interval 14 to 17 (eg $14<T<17$ or 14 to 17)
	(b)	Use of at least 3 correct midpoints			M1
		$\sum fT = 6.5\times3 + 9.5\times12 + 12.5\times12 + 15.5\times16 + 18.5\times6 + 21.5\times1$ (=664) **or** $\Sigma fT = 19.5 + 114 + 150 + 248 + 111 + 21.5$			M1 indep values of T in the interval, including ends and used consistently (eg all lowest value) allow one error/omission
		$\frac{\text{"}6.5\times3+9.5\times12+12.5\times12+15.5\times16+18.5\times6+21.5\times1\text{"}}{50}$ (=13.28)			M1 dep Depends on previous M mark.
			13		A1 cao
					Total 5 marks

Question		Working	Answer	Mark	Notes
21	(a)		$g(x) \geq 1$	5	B1 Allow y or g but not x. Allow set notation but must indicate ≥ 1
	(b)	$gf(2) = g(1)$ **or** $2(3 \times 2 - 5)^2 + 1$ **or** $2(3x - 5)^2 + 1$			M1 Correct order. An answer of 3 with no incorrect working implies this mark
		$gf(2) = 3$			A1
		$3x - 5 = 3$			M1 Dep.
			$x = \frac{8}{3}$ oe		A1 Allow 2.67 or better ISW further rounding
					Total 5 marks
22		UB: $a = 8.455$, $b = 1.935$, $c = 3.4155$		5	M1 Any two correct UB seen
		LB: $a = 8.445$, $b = 1.925$, $c = 3.4145$			M1 Any two correct LB seen
		UB = $\sqrt{\frac{"8.455" - "1.925"}{"3.4145"}}$			M1 indep Must use $8.45 < a \leq 8.455$, $1.925 \leq b < 1.93$ and $3.4145 \leq c < 3.415$
		LB = $\sqrt{\frac{"8.445" - "1.935"}{"3.4155"}}$			M1 indep Must use $8.445 \leq a < 8.45$, $1.93 < b \leq 1.935$ and $3.415 < c \leq 3.4155$
		UB = 1.382907…, LB = 1.380585…	1.38		A1 Must see both values given to at least 3 d.p
					Total 5 marks

Question		Working	Answer	Mark	Notes
23	(a)	$a(10-25b)$ or $5(2a-5ab)$		6	M1
			$5a(2-5b)$		A1 Do not ISW
	(b)		$(x-5)(x+2)$		M1 Factorised expression that expands to give 2 of 3 terms correct A1 cao Do not ISW
	(c)	$2(25x^2-36y^2)$ or $(10x - 12y)(5x + 6y)$ or $(10x + 12y)(5x - 6y)$			M1
			$2(5x-6y)(5x+6y)$		A1 Do not ISW
					Total 6 marks
24		$y = \frac{2kx^2+10x-3kx-15}{x}$		6	M1 Expanding numerator achieving a minimum of 3 correct terms in numerator
		$y = 2kx + 10 - 3k - \frac{15}{x}$			M1 dep Dividing through by x Also allow for a correct application of product or quotient rule
		$\frac{dy}{dx} = 2k + \frac{15}{x^2}$			M1 dep Differentiate. At least one non-constant term correctly differentiated. A1 cao must follow from fully correct working
		$2k + \frac{15}{\left(\frac{1}{2}\right)^2} = 0$			M1 indep Set their $\frac{dy}{dx}$ equal to zero and substitute $x = ½$
			$k = -30$		A1 cao must follow from fully correct working
					Total 6 marks

Question		Working	Answer	Mark	Notes
25	(a)	($\angle ADC$=)180-116(=64)		7	M1
		($\angle OAD$=)"64"–40			M1 dep ft their $ADC < 90$
			24		A1 NB Do not ISW if 24 followed by further values.
			Opposite angles in a **cyclic quad**rilateral sum to 180 and base angles of an **isosceles** triangle are equal		A1 Emboldened text represents the minimum required dependent on both method marks.
	(b)	$\angle AOD = 180 - 2('24')$ (=132)			M1
			66		A1 ft follow through their answer to $\angle OAD < 90$
			Angles in a **triangle** sum to 180 and **angle** at the **centre** is **twice** the angle at the **circumference**		A1 Emboldened text represents the minimum required. Allow **double** instead of **twice** Allow **half angle** at **circumference** is angle at **centre**
					Total 6 marks

Question		Working	Answer	Mark	Notes
26		$15 - x$, x, $9 - x$, 12 seen on Venn diagram  **or** $15 - x + x + 9 - x + 12 = 30$ oe		6	M1 Venn diagram or setting up an equation in one variable. May be inferred from $x = 6$ seen.
		$(x =)$ 6			A1 Value may be seen in Venn diagram
		$\frac{"6"}{9}$ seen			M1 dep May be embedded in working
		$\frac{"6"}{9} \times \frac{"6"-1}{8} \times \frac{9-"6"}{7} \left(= \frac{5}{18}\right)$ oe			M1 dep May be embedded in working allow numerators and denominators in any order
		$3 \times \frac{"6"}{9} \times \frac{"6"-1}{8} \times \frac{9-"6"}{7}$ oe			M1 dep Fully correct expression. Allow numerators and denominators in any order
			$\frac{15}{28}$		A1 awrt 0.536
					Total 6 marks

Question		Working	Answer	Mark	Notes
27		$\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB} = -3\mathbf{a} + 5\mathbf{b}$		5	B1 may be embedded within working
		$\overrightarrow{AC} = \frac{3}{4}("-3\mathbf{a}+5\mathbf{b}")$ oe **or** $\overrightarrow{BC} = -\frac{1}{4}("-3\mathbf{a}+5\mathbf{b}")$ oe			M1
		$\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC} = 3\mathbf{a} + \frac{3}{4}("-3\mathbf{a}+5\mathbf{b}")$ oe **or** $\overrightarrow{OC} = \overrightarrow{OB} + \overrightarrow{BC} = 5\mathbf{b} - \frac{1}{4}("-3\mathbf{a}+5\mathbf{b}")$ oe **or** $\overrightarrow{OD} = \overrightarrow{OB} + \overrightarrow{BD} = 5\mathbf{b} + \frac{7}{4}\mathbf{a} + \frac{15}{4}\mathbf{b}$ oe **or** $\overrightarrow{CD} = \overrightarrow{CB} + \overrightarrow{BD} = \frac{1}{4}("-3\mathbf{a}+5\mathbf{b}") + \frac{7}{4}\mathbf{a} + \frac{15}{4}\mathbf{b}$ oe			M1 $(\overrightarrow{OC} = \frac{3}{4}\mathbf{a} + \frac{15}{4}\mathbf{b})$ $(\overrightarrow{OD} = \frac{7}{4}\mathbf{a} + \frac{35}{4}\mathbf{b})$ $(\overrightarrow{CD} = \mathbf{a} + 5\mathbf{b})$ Finding any one of $\overrightarrow{OC}$, $\overrightarrow{OD}$ or $\overrightarrow{CD}$ Only follow through their result for $\overrightarrow{AB}$
					M1 Finding a second vector from $\overrightarrow{OC}$, $\overrightarrow{OD}$ or $\overrightarrow{CD}$ Only follow through their result for $\overrightarrow{AB}$
			3:4 oe		A1 Allow any equivalent numerical ratio eg. $\frac{3}{4}:1$ PTO for alternative methods

Question	Working	Answer	Mark	Notes
27 ALT 1	$\overrightarrow{OC} = 3\mathbf{a} + \mu(-3\mathbf{a}+5\mathbf{b})$			(B1) $-3\mathbf{a}+5\mathbf{b}$ seen (M1) Correct expression for $\overrightarrow{OC}$
	$\overrightarrow{OC} = \lambda(\mathbf{a}+5\mathbf{b})$			(M1)
	$\lambda = \frac{3}{4}$			(M1)
		3:4 oe		(A1) Allow any equivalent numerical ratio eg. $\frac{3}{4}$: 1
27 ALT 2	$\overrightarrow{OC} = 3\mathbf{a} + \mu(-3\mathbf{a}+5\mathbf{b})$			(B1) $-3\mathbf{a}+5\mathbf{b}$ seen (M1) Correct expression for $\overrightarrow{OC}$
	$\overrightarrow{OC} = \lambda\left(\frac{7}{4}\mathbf{a}+\frac{35}{4}\mathbf{b}\right)$			(M1)
	$\lambda = \frac{3}{7}$			(M1)
		3:4 oe		(A1) Allow any equivalent numerical ratio eg. $\frac{3}{4}$: 1
				Total 5 marks