Pearson Edexcel

Mark Scheme (Results)

January 2021

Pearson Edexcel International GCSE
In Mathematics B (4MB1)
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
  - 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 on the answer line; where no answer is given on the answer line, award the lowest mark from the methods shown.

  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		$\frac{45}{8}-\frac{30}{8}$		2	M1 – both terms with the same common denominator – allow $\frac{45}{8}-\frac{15}{4}=\frac{15}{8}$
		$\frac{15}{8}$	$1\frac{7}{8}$		A1 must-see sufficient working and given as a mixed number only (either their final answer in their working or on the answer line)
					Total 2 marks
2		100 – 52 – 20 (= 28) **or** 100 – 42 – 20 (= 38)		2	M1 allow (52 + 20 + 42) – 100 oe correct method to either get the % of year 8 who did not walk **or** the % of year 7 who did, for example, in words would need to see '48% students are in year 8 and as 20% walked therefore 28% did not walk'
		42 – (100 – 52 – 20) **or** 52 – (100 – 42 – 20)	14		A1
					Total 2 marks
3		$\frac{360}{180-176}$ **or** $180(n-2)=176n$		2	M1
			90		A1
					Total 2 marks
4		10 – (–2 × 3)		2	M1
			16		A1
					Total 2 marks

Question		Working	Answer	Mark	Notes
5		$1-x=-1$ or $-4+3x=x$ or $x+x=4$		2	M1 – setting up at least one linear equation in *x* with corresponding entries of the two matrices – allow 1 sign slip only
			2		A1 – correct working only - so if seen must imply that $\begin{pmatrix}-4+3x & 2x \\ y & 1-x\end{pmatrix}=\begin{pmatrix}x & 4 \\ y & -1\end{pmatrix}$ - any incorrect entries even if answer correct scores M1 only
					Total 2 marks
6		$\frac{2+p}{2}$ or $\frac{1.5+2+p+19.5}{4}$		3	M1 either mean or median stated correctly
		$\frac{1.5+2+p+19.5}{4}=3\times\frac{2+p}{2}$			M1dep setting up an equation in *p* using both expressions for the median and mean (the 3 must be on the correct side of the equation)
			2.2		A1
					Total 3 marks

Question		Working	Answer	Mark	Notes
7		14×20 **or** 12×5 **or** 20×5		3	M1 (possibly seen in working)
		$14\times 20-9\times 12$ **or** $12\times 5+14\times 8$ **or** $20\times 5+8\times 9$			M1dep – correct method for finding the area of the hexagon
			172		A1
					Total 3 marks
8	(a)		If Abdul earned more than Sue it is possible his wage increased by more.	1	B1 Any correct explanation, for example, ‘Abdul has a bigger salary.’ Or by giving an example using any values, however, ignore example if correct comment given first. Not sufficient just to say that ‘wages are unknown’
	(b)	$£7.83\div 1.044$		2	M1
			£7.50		A1
					Total 3 marks

Question		Working	Answer	Mark	Notes
9		$(CD=)\sqrt{4^2-3^2}\ (=2.65)$		3	M1 Complete correct method for *CD* or *BC* e.g. $\cos(CAD)=\frac{3}{4}\Rightarrow CAD=41.409...$ **and** $CD=4\sin(41.409...)$ **or** $BC^2=4^2+8^2-2(4)(8)\cos(CAD)$
		$\tan ABC=\frac{"2.65"}{5}$			M1 Correct method to find angle *ABC* (e.g. $BC^2=5^2+\left(\sqrt{7}\right)^2$ (= 32) and $\cos\left(ABC\right)=\frac{8^2+32-4^2}{2(8)\left(\sqrt{32}\right)}$) or e.g. $\cos\left(ABC\right)=\frac{BC}{5}$
			27.9		A1 awrt 27.9 (For ref: 27.88556…)
					Total 3 marks
10		$\left(2n+1\right)\left(n+1\right)$ or $2\left(n+1\right)$		3	M1 Factorise the numerator or denominator correctly
		$\frac{2n+1}{2}$ or $n+\frac{1}{2}$			A1 Fully correct fully simplified expression
			$2n+1$ is odd. Dividing by 2 means not an integer **or** n is an integer so $n+\frac{1}{2}$ is not		A1 Fully correct reasoning e.g. 2*n* + 1 is odd, (2*n* + 1) / 2 is not an integer (oe comment, for example, ‘gives a decimal’) No marks if numerical examples considered only
					Total 3 marks

Question		Working	Answer	Mark	Notes
11	(a)		$(x+1)(x-1)$	1	B1
	(b)	$(2^{18}+1)(2^{18}-1)$ $p = 2^{18} - 1$ or $q = 2^{18} + 1$		2	M1 ft (a) substituting 2^{18} as x in either factor **or** one value correctly stated, **or** p and q correctly stated the wrong way round
			$p = 262\,143$ $q = 262\,145$		A1 (allow in terms of powers of 2)
					Total 3 marks
12		2795, 2805, 1595 or 1605		3	M1 at least 1 of the listed values seen
		$\frac{2795}{1605}$			M1 must be $2795 \leq$ LB < 2800 and $1600 <$ UB ≤ 1605
			1.74		A1 must-see correct calculation. awrt 1.74 (1.74143302…) but not left as an exact value
					Total 3 marks
13		$\frac{\sqrt{13}+\sqrt{11}}{\sqrt{13}-\sqrt{11}} \times \frac{\sqrt{13}+\sqrt{11}}{\sqrt{13}+\sqrt{11}}$		3	M1 multiplying numerator and denominator by $\sqrt{13}+\sqrt{11}$
		$\frac{13+\sqrt{143}+\sqrt{143}+11}{13+\sqrt{143}-\sqrt{143}-11}$			M1 dep attempt to expand top and bottom, condone a maximum of one error – condone $\frac{\left(\sqrt{13}+\sqrt{11}\right)^2}{\left(\sqrt{13}\right)^2-\left(\sqrt{11}\right)^2} = \frac{24+2\sqrt{143}}{2}$
		$\frac{24+2\sqrt{143}}{2}$	$12+\sqrt{143}$		A1 cao sufficient working must be seen. Correct answer with no working scores no marks
					Total 3 marks

Question		Working	Answer	Mark	Notes
14		$0.1\times 0.05(=0.005)$		3	M1
		$"0.005"+0.9\times 0.01(=0.014)$			M1
		$\dfrac{"0.005"}{"0.014"}$	$\dfrac{5}{14}$		A1 allow awrt 0.357
					Total 3 marks
15	(a)		$5x+2y$	2	B1, B1
	(b)		$8a^6$	2	B2 or B1 $8a^n$ or ka^6
					Total 4 marks
16	(a)	$2a(xb\pm ya)$ or $2a(5b-*)$ or $2a(*-12a)$ or $a(10b-24a)$		2	M1 where x and y are integers and * is any single term.
			$2a(5b-12a)$		A1
	(b)		$(p+12)(p-2)$	2	M1 Expands to give 2 correct terms A1
					Total 4 marks
17	(a)		1.68×10^{111}	2	M1 for $p\times 10^{111}$ or 1.68×10^{q} or 16.8×10^{110} A1 cao
	(b)	2.18×10^{56} or 210×10^{54}		2	M1
			$k = 218$ $n = 54$		A1 Allow 218×10^{54} if given as a final answer in working only. Do not isw if 218×10^{54} seen in working then followed by 2.18×10^{56} either in working or on the answer line
					Total 4 marks

Question		Working	Answer	Mark	Notes
18		$40x+24y=16$ **OR** $15x+9y=6$ $9x-24y=12$ $\quad$ $15x-40y=20$ (+) $49x=28$ $\quad$ (–) $49y=-14$ **OR** $x=\frac{2-3y}{5}$ **and** $3\left(\frac{2-3y}{5}\right)-8y=4$ **OR** $x=\frac{8y+4}{3}$ **and** $5\left(\frac{8y+4}{3}\right)+3y=2$ **OR** $y=\frac{2-5x}{3}$ **and** $3x-8\left(\frac{2-5x}{3}\right)=4$ **OR** $y=\frac{3x-4}{8}$ **and** $5x+3\left(\frac{3x-4}{8}\right)=2$		4	M1 – allow one arithmetic or sign slip only **Correct answer with no working scores no marks**
			$x=\frac{4}{7}$ **or** $y=-\frac{2}{7}$		A1 (oe – awrt x = 0.57(1428…) or y = –0.28(57142…) to at least two decimal places)
		$5\times"\frac{4}{7}"+3y=2$ **or** $3\times"\frac{4}{7}"-8y=4$ **or** $5x+3\times"-\frac{2}{7}"=2$ **or** $3x-8\times"-\frac{2}{7}"=4$			M1dep on M1 Substituting their value into one of the correct equations (give bod if sign slip when substituting value) **or** correct use of elimination or substitution for other variable.
			$x=\frac{4}{7}$ **and** $y=-\frac{2}{7}$		A1 – must see exact values at some point
					Total 4 marks

Question		Working	Answer	Mark	Notes
19	(a)	$3^3 + 3a - 3 = 0$		2	M1 for $3^3 + 3a - 3$ (oe) must be equal to zero (or implied by later working)
			$a = -8$ shown		A1 – must see one line of working from $27+3a-3=0$ to given answer. **OR** M1 for $3^3+3(-8)-3$ then $= 27 - 24 - 3 = 0$ and comment (e.g. shown) for A1
	(b)		$x^2 + 3x + 1$	2	M1 Correct method used to find 2 correct coefficients or $x^2(x-3)+3x(x-3)+1(x-3)$ A1 cao
					Total 4 marks
20	(a)			2	M1 for bisector of AB within lines of overlay
			Accurate bisector		A1 correct bisector + construction lines
	(b)			2	M1 for bisector of angle ACB within lines of overlay
			Accurate bisector		A1 correct bisector + construction lines
	(c)		Correct region labelled R	1	B1 dep on both M1 scored in (a) and (b) (either labelled or R or correctly shaded)
					Total 5 marks

Question		Working	Answer	Mark	Notes
21		$\angle ABC = 90$		5	B1 $\angle ABC = 90$ may be seen on diagram
		$\angle BAE + \angle AED = 180$ **or** $\angle BAC + \angle CAE + \angle AED = 180$			M1 stating that $\angle BAE + \angle AED = 180$ or their values for $\angle BAE + \angle AED$ (even if incorrect) add to 180
		$\angle ACB + 90 + 80 + 120 + 180 = 540$ **or** $\angle BAC = 20$ and $\angle ACB + 90 + \angle BAC = 180$			M1 dependent on both previous marks - fully correct method to find $\angle ACB$
					B1 any correct unknown angle stated together with correct corresponding reason
			70 with reason		A1 correct answer of 70 together with all correct reasons for their method – see below
					Total 5 marks

Method 1

- $\angle ABC = 90$ (angles in a semi-circle **or** right-angled triangle in a semi-circle)
- $\angle BAE + \angle AED = 180$ (co-interior angles **or** allied angles)
- $180 + 90 + 80 +120 + \angle ACB = 540$ (angles in a pentagon) leading to 70

Method 2

- $\angle ABC = 90$ (angles in a semi-circle **or** right-angled triangle in a semi-circle)
- $\angle AED = 100$ (opposite angles in a cyclic quadrilateral) then $\angle CAE = 60$ (**either** opposite angles in a cyclic quadrilateral **or** angles in a quadrilateral) or vice-versa (e.g. find $\angle CAE$ then $\angle AED$)
- $\angle BAC + \angle CAE + \angle AED = 180$ (co-interior angles or allied angles) leading to $\angle BAC = 20$
- $\angle ACB + 90 + 20 = 180$ (angles in a triangle) or $\angle ACB + 90 + 80 + 120 + (20 + 60 + 100) = 540$ (angles in a pentagon) leading to 70

Candidate might extend line *AE* to a point *F* (to the right of *E*) and say, '$\angle AED = 100$ so $\angle DEF = 80$ (angles on a straight line)' and then '$\angle DEF = \angle BAE = 80$' (corresponding angles) (so may not use co-interior/allied angles)
Also note that the correct answer can come from assuming that both $\angle DEA$ and $\angle BAE = 90$ – this can score a maximum of B1M1M0B1A0
Symbols may be used instead of words (e.g. $\angle$ for angle, Δ for triangle, etc.)

Question		Working	Answer	Mark	Notes
22	(a)	$(V =)\frac{1}{3}\times\pi\times10^2\times20$		2	M1
			2090		A1 – allow exact value $\frac{2000}{3}\pi$ or 2090 or better - allow both 2093 (2093.333… from using 3.14) and 2094 (2094.395… using π)
	(b)	$\left(\frac{1}{2}\right)^3\left(=\frac{1}{8}\right)$ or $\frac{1}{3}\times\pi\times5^2\times10$		3	M1 $\frac{1}{8}$ may be seen as a ratio
		$"2090"\times\left(1-"\frac{1}{8}"\right)$ or $"2090"-\frac{1}{3}\times\pi\times5^2\times10$			M1dep allow for $"2090"-\frac{1}{3}\times\pi\times5^2\times10$
			1830		A1 – allow exact value $\frac{1750}{3}\pi$ (= 1832.595715…) or awrt 1830 (most likely to be from 1828 to 1833 to 4 sf)
					Total 5 marks
23		Bar from 10 to 15 height 6.4 cm drawn	Bar from 10 to 15 height 6.4 cm drawn	5	B1
		e.g. $20\times\frac{4\times36}{10\times8}$ or $20\times\frac{7.2\times0.8}{1.6\times2}$ or $20\times\frac{2\times36}{5\times8}$			M1 fully correct method to find the frequency of 15-17 bar.
			36		A1 (correct answer implies previous mark)
		184 – 20 – 80 – “36” (= 48)			M1dep on previous M mark
			48 in table and Bar from 17 to 25 height 2.4 cm drawn		A1 including frequency density axis labelled (1 cm square is 2.5)
					Total 5 marks

Question		Working	Answer	Mark	Notes
24	(a)	$\left(6^2-2\right)-3$		2	M1
			31		A1
	(b)	$\mathrm{h}(x)=(x-3)^2-2$		2	M1
			$\mathrm{h}(x)=x^2-6x+7$		A1 - Answer given, must see no incorrect working. As a minimum $(x-3)^2-2=x^2-6x+9-2=x^2-6x+7$ for full marks
	(c)	3		1	B1
	(d)	$y=(x-3)^2-2$ leading to $(x-3)^2=y+2$		3	M1 using $y=(x-3)^2-2$ (oe notation e.g. interchanging x and y or using h and h^{-1}) and one-step towards making x the subject e.g. $(x-3)^2=y\pm 2$ **or** $\mathrm{h}^{-1}(x)=\mathrm{f}^{-1}\mathrm{g}^{-1}(x)$ and attempt at both inverses
			$\mathrm{h}^{-1}(x)=\sqrt{x+2}+3$		M1 dep $(x-3)^2=y\pm 2$ leading to $x=\pm 3\pm\sqrt{y\pm 2}$ (so sign errors only) **or** $\mathrm{h}^{-1}(x)=\mathrm{f}^{-1}\left(\sqrt{x\pm 2}\right)=\pm 3\pm\sqrt{x\pm 2}$ A1 fully correct and must be in terms of x
					Total 8 marks

Question		Working	Answer	Mark	Notes
25	(a)	$\cos\theta = \frac{17}{32.3}$ or $\cos\theta = \frac{34^2+32.3^2-32.3^2}{2\times34\times32.3}$ $(\theta = 58.24313614\ldots)$ **or** $\sin\left(\frac{1}{2}\alpha\right) = \frac{17}{32.3}$ or $\cos\alpha = \frac{32.3^2+32.3^2-34^2}{2(32.3)(32.3)}$ $(\alpha = 63.51372772...)$		6	M1 where θ is one of the base angles of the isosceles triangles. Where α is the angle at the vertex of the isosceles triangles
		$AN^2 = 34^2 + 16.15^2 - 2\times34\times16.15\times\cos"58.2"$ or $AN^2 = 32.3^2 + 16.15^2 - 2\times32.3\times16.15\times\cos"63.5"$			M1dep on previous M mark
		$AN = 29$			A1 (for reference: 28.96243256… if exact values) 28.817854… if using 63, 29.09921… if using 64, 28.958570… if using 63.5, 28.950296… if using 58.2, 28.894033… if using 58 so check carefully that value of *AN* is accurate with angle used
		$MN = 17$			B1 although exact allow awrt 17 e.g. may come from $MN^2 = 16.15^2 + 16.15^2 - 2\times16.15\times16.15\times\cos(63.51...)$
		"29"+"17"			M1 dep on both previous M1 marks
			46		A1 (correct working only) awrt 46 (for reference: 45.96243256…)

	(b)	$\frac{\sin(\angle BAN)}{16.15}=\frac{\sin"58.2..."}{"28.9..."}$ or $\cos(\angle BAN)=\frac{34^2+"28.9..."^2-16.15^2}{2(34)("28.9...")}$		2	M1 correct complete method to find angle *BAN* Allow this mark for those that consider $\frac{\sin(\angle BNA)}{34}=\frac{\sin"58.2..."}{"28.9..."}$ which leads to either $\angle BNA=86.546...$ or $93.453\ldots$ **and** considers $\angle BAN=180-"58.2..."-\angle BNA$ (if using incorrect value then most likely to see the angle given as 35.21… which scores M1 only)
			28		A1 (correct working only) – must be using a correct *AN* and angles from part (a) – awrt 28. (For reference: 28.303196…)
					Total 8 marks

Question		Working	Answer	Mark	Notes
26	(a)	$\left(\frac{\mathrm{d}s}{\mathrm{d}t}=\right) 10t-3t^2$		4	M1 one term correctly differentiated.
		$"10t-3t^2"=0$			M1 dep – setting their derivative equal to zero
		$10-3t=0$			M1 dep on both previous M marks – reduces their two-term quadratic to a linear equation in *t* (equal to zero) – possibly implied by correct answer
			$\frac{10}{3}$		A1 must be given exact at some stage
	(b)	$s(0)=0$ and $s(5)=0$		3	B1 seen or implied from working
		$\left(s\left("\frac{10}{3}"\right)=\right)=5\times"\frac{10}{3}"^2-"\frac{10}{3}"^3\left(=\frac{500}{27}\right)$			M1
			$\frac{1000}{27}$ oe		A1 cso (so must have scored both previous marks) Allow awrt 37
					Total 7 marks

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