Mark Scheme (Results)

January 2021

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

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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			5, 1, -3	2	-1 for every error or omission
					Total 2 marks

2		$60 = 2^2 \times 3 \times 5$ $126 = 2 \times 3^2 \times 7$ $648 = 2^3 \times 3^4$			M1 for prime factors of two of 60, 126, 648 (or equivalent e.g. factor ladder/trees 60 126 648 2: 30 63 324 3: 10 21 108 or listing at least 6 factors of each of the 3 numbers
		HCF(60,126,648) = 2×3	6	2	A1
					Total 2 marks

3		$\frac{325}{3700}$ or $\frac{0.325}{3.7}$ oe			M1 (any fraction that uses compatible units is acceptable) oe but not fully simplified eg $\frac{3.25}{37}$ or 0.0878…. or 8.78…%
			$\frac{13}{148}$	2	A1
					Total 2 marks

4		$3\frac{1}{4}\times 2\frac{2}{3}=\frac{13}{4}\times\frac{8}{3}$			M1 or equivalent method for the intention of multiplying two fractions
		$\frac{104}{12}=\frac{26}{3}=8\frac{2}{3}$ or $2\times\frac{13}{3}=\frac{26}{3}=8\frac{2}{3}$	$8\frac{2}{3}$	2	A1 Dependent on all working seen
					Total 2 marks

5	(a)		0.0129	1	B1
	(b)		0.012885	1	B1 (If B0B0 then SC B1 for 0.0128852…)
					Total 2 marks

6		$180-\frac{360}{18}$			M1 (oe e.g. $\frac{180(18-2)}{18}$)
			160	2	A1
					Total 2 marks

7		$\frac{-4-3}{12-(-2)}$ oe			M1
			$-\frac{1}{2}$	2	A1 oe
					Total 2 marks

8		$\frac{\theta}{360}\times\pi(7)^2=52$ oe			M1 correct use of formula for the area of a sector
			122		A1 or better (121.6073688…)
					Total 2 marks

9	(a)		$3x(2y-1)$	1	B1 oe
	(b)				M1 for either $2b(3a-c)+d(3a-c)$ or $3a(2b+d)-c(2b+d)$ oe
			$(3a-c)(2b+d)$	2	A1
					Total 3 marks

10		$2(9-5x)=3(5x+1)$ $18-10x=15x+3$ or $3-\frac{5}{3}x=\frac{5}{2}x+\frac{1}{2}$			M1 remove fractions and expand brackets
		eg $-10x-15x=3-18$ or $25x=15$ or $\frac{5}{2}x+\frac{5}{3}x=\frac{1}{2}-3$ oe			M1ft collect terms in x one side and number terms on the other side dep on equation in form ax + b = cx + d
			$x=0.6$	3	A1 oe dep on M1
					Total 3 marks

11		eg lengths $\sqrt[3]{\frac{650}{225}}(=1.424...)$ or $26^{\frac{1}{3}}:9^{\frac{1}{3}}$ or $\sqrt[3]{\frac{225}{650}}(=0.702..)$ or $9^{\frac{1}{3}}:26^{\frac{1}{3}}$			M1 for a correct statement for ratio of lengths (may be seen as part of an equation eg $\frac{x}{18}=\frac{225^{\frac{1}{3}}}{650^{\frac{1}{3}}}$)
		eg $18\left(\frac{9}{26}\right)^{\frac{1}{3}}$			M1dep for a fully correct method to find the height
			12.6	3	A1 awrt 12.6
					Total 3 marks

12		$-6x+2x>25-2$ or $2-25>-2x+6x$ or $6x-2x<2-25$ oe eg $-4x>23$ or $-23>4x$ or $4x<-23$			M1 for expanding and collecting like terms – could be in an equation
		$x<-5.75$ oe			A1 for obtaining the critical value of –5.75 oe (may or may not be in a correct inequality)
			-6	3	A1
					Total 3 marks

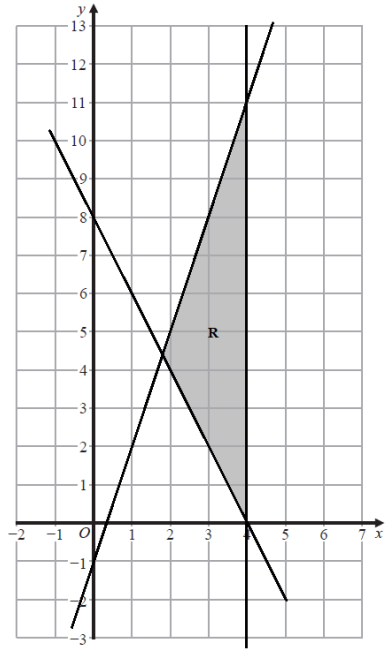
13		$\det \mathbf{A} = 3\sqrt{a}+2$ $\det \mathbf{B} = 20-3(=17)$			M1 for correct determinant of either **A** or **B**
		eg $3\sqrt{a}+2=17$ or $\sqrt{a}=5$ oe			M1dep for a fully correct equation
			$a = 25$	3	A1
					Total 3 marks

14		$\frac{dy}{dx} = 3x^2 + \frac{6}{x^3}$			M1 for one term differentiated correctly
		$\left.\frac{dy}{dx}\right\|_{x=-1} = 3(-1)^2 + \frac{6}{(-1)^3}$			M1dep for substituting $x=-1$ into their derivative -- must be at least 2 terms
			-3	3	A1 dep on 1st M1
					Total 3 marks

15		In $\triangle AEM$ and $\triangle CFM$ AM = CM (as M is the midpoint of AC oe) $\angle EMA = \angle FMC$ oe (as vertically opposite angles or vertically opposite angles) $\angle EAM = \angle FCM$ oe (alternate angles) $\angle AEM = \angle CFM = 90^\circ$ oe (or as AE and CF are each perpendicular to BEMFD)			M2 for two correct reasons (M1 for one correct reason)
			ASA	3	A1 for proof of a side and 2 angles being equal **and** ASA or AAS
					Total 3 marks

16	(a)		$\begin{pmatrix} 5 & -7 \\ 0 & -2 \end{pmatrix}$	2	B2 (-1 for eeoo)
	(b)		$\begin{pmatrix} 5 & 4 \\ 20 & 9 \end{pmatrix}$	2	B2 (-1 for eeoo)
					Total 4 marks

17		$\frac{5x-15}{x^2+x-12}\times\frac{3x^2-48}{x-4}$ oe			M1
		$\frac{5(x-3)}{(x-3)(x+4)}\times\frac{3(x+4)(x-4)}{x-4}$			M1 for factorising either $5x-15$ or x^2+x-12 M1 for factorising fully $3x^2 - 48$
			15	4	A1 dep on M3
		ALT			
		$\frac{15x^3-45x^2-240x+720}{x^3-3x^2-16x+48}$			M3 for all terms correct (M2 with 1 or 2 incorrect terms) (M1 with 3 incorrect terms)
			15	4	A1 dep on M3
					Total 4 marks

18	(a)			3	B1 for each line drawn correctly
	(b)			1	B1 correct region dep on correct lines in (a)
					Total 4 marks

19		$\angle ACB = 63$ or $\angle CAB = 27$			B1 could be seen on diagram or implied by later working
		$\angle ABC = 90$ or $\angle BOA = 126$			B1 could be seen on diagram or implied by later working
		$\sin 63 = \frac{AB}{10}$ or $\cos 27 = \frac{AB}{10}$ oe $[AB^2=]\ 5^2 + 5^2 - 2 \times 5 \times \cos 126$			M1 allow cos 27 = $\frac{AB}{5}$ oe if student multiplies AB by 2
			8.91	4	A1 awrt 8.91
					Total 4 marks

20		$\frac{2-\sqrt{2}}{\left(1+\sqrt{2}\right)^2} = \frac{2-\sqrt{2}}{1+2\sqrt{2}+2}$			M1 for expanding denominator correctly (2, 3 or 4 terms)
		$\left(\frac{2-\sqrt{2}}{3+2\sqrt{2}}\right)\left(\frac{3-2\sqrt{2}}{3-2\sqrt{2}}\right)$			M1ft for a correct method to rationalise their denominator (dep on a surd in the form $a \pm b\sqrt{c}$)
		$\frac{6-4\sqrt{2}-3\sqrt{2}+4}{9-8}$			M1 (dependent on previous M mark) for expanding numerator (3 or 4 terms) allow one error with a denominator of 1 or an implied 1
			$a = 10$ $b = -7$	4	A1 (dependent on M3)
					Total 4 marks

21		$y = \frac{k}{x^3}$			M1
		$k = 3a(2a)^3 \quad (= 24a^4)$			A1
		$y = \frac{'24a^4'}{(4a^2)^3}$			M1dep
			$\frac{3}{8a^2}$	4	A1 $\frac{3}{8}a^{-2}$ or $0.375a^{-2}$ must come from correct working
					Total 4 marks

22		Volume of cylinder $\pi(4)^2$ h oe			B1
		Volume of hemisphere is $\frac{2}{3}\pi(4)^3$ oe			B1
		$\frac{128}{3}\pi + 16\pi h = \frac{920}{3}\pi \quad (h = 16.5)$ oe			M1ft (dep on the sum of 2 volumes and at least B1 previously awarded) for setting up an equation in h
			20.5	4	A1
					Total 4 marks

23		$b_{LB} = 14.25,\ \ b_{UB} = 14.75$ $h_{LB} = 3.95,\ \ \ h_{UB} = 4.05$ $R_{LB} = 49.5,\ \ R_{UB} = 50.5$			B1 for one correct LB or UB stated
		eg $49.5 = \left(\frac{a + 14.75}{2}\right)4.05$ or $2(49.5 \div 4.05) - 14.75$ oe			M1 for use of correct formula for the area of a trapezium with b, h and R substituted (may be used with given figures or incorrect bounds)
		$a_{LB} = 2\left(\frac{R_{LB}}{h_{UB}}\right) - b_{UB}$ eg $a_{LB} = 2\left(\frac{49.5}{4.05}\right) - 14.75$			M1 for rearranging for a and using R_{LB} where $49.5 \le R_{LB} < 50$, h_{UB} where $4 < h_{UB} \le 4.05$ and b_{UB} where $14.5 < b_{UB} \le 14.75$
			9.69	4	A1 awrt 9.69 (for reference: 9.6944444…)
					Total 4 marks

24		$\left[\lvert\mathbf{p}\rvert^2\right] = 4 + (3 - 2x)^2$			B1 for either correct $\lvert\mathbf{p}\rvert^2$ **or** $\lvert\mathbf{p}\rvert$
		$\lvert\mathbf{p} - 2\mathbf{q}\rvert^2 = 64 + (1 - 2x)^2$			B1 for either correct $\lvert\mathbf{p} - 2\mathbf{q}\rvert^2$ **or** $\lvert\mathbf{p} - 2\mathbf{q}\rvert$
		eg $4 + 9 - 12x + 4x^2 = 64 + 1 - 4x + 4x^2$ **or** $13 - 12x = 65 - 4x$ oe eg $8x = -52$			M1 for equating and multiplying out brackets correctly
			$x = -6.5$	4	A1 dep on correct working seen
					Total 4 marks

25		$\left(\frac{5}{12}\right)\times\left(\frac{7}{11}\right)\times\left(\frac{10}{16}\right)\times\left(\frac{9}{15}\right)$ oe (red moved from A to B then choosing 3 yellow) $\left(\frac{5}{12}\right)\times\left(\frac{4}{11}\right)\times\left(\frac{6}{16}\right)\times\left(\frac{5}{15}\right)$ oe (red moved from A to B then choosing 3 red) $\left(\frac{7}{12}\right)\times\left(\frac{6}{11}\right)\times\left(\frac{11}{16}\right)\times\left(\frac{10}{15}\right)$ oe (yellow moved from A to B then choosing 3 yellow) $\left(\frac{7}{12}\right)\times\left(\frac{5}{11}\right)\times\left(\frac{5}{16}\right)\times\left(\frac{4}{15}\right)$ oe (yellow moved from A to B then choosing 3 red)			M3 for three correct expressions, M2 for two correct expressions and M1 for one correct expression
					M1dep – attempt a correct calculation by summing four terms (oe)
			$\frac{907}{3168}$	5	A1 (oe) accept awrt 0.286
		See next page for SC			Total 5 marks

25 **Special cases**				(SCB2 for 3 or 4 of $\left(\frac{7}{11}\right)\times\left(\frac{10}{16}\right)\times\left(\frac{9}{15}\right)$, $\left(\frac{4}{11}\right)\times\left(\frac{6}{16}\right)\times\left(\frac{5}{15}\right)$ $\left(\frac{6}{11}\right)\times\left(\frac{11}{16}\right)\times\left(\frac{10}{15}\right)$, $\left(\frac{5}{11}\right)\times\left(\frac{5}{16}\right)\times\left(\frac{4}{15}\right)$ (SCB1 for 2 of these expressions)) OR (SCB2 for 3 or 4 of $\left(\frac{5}{12}\right)\times\left(\frac{10}{16}\right)\times\left(\frac{9}{15}\right)$, $\left(\frac{5}{12}\right)\times\left(\frac{6}{16}\right)\times\left(\frac{5}{15}\right)$ $\left(\frac{7}{12}\right)\times\left(\frac{11}{16}\right)\times\left(\frac{10}{15}\right)$, $\left(\frac{7}{12}\right)\times\left(\frac{5}{16}\right)\times\left(\frac{4}{15}\right)$ (SCB1 for 2 of these expressions)) OR (SCB2 for 3 or 4 of $\left(\frac{5}{12}\right)\times\left(\frac{7}{11}\right)\times\left(\frac{10}{16}\right)\times\left(\frac{10}{16}\right)$, $\left(\frac{5}{12}\right)\times\left(\frac{4}{11}\right)\times\left(\frac{6}{16}\right)\times\left(\frac{6}{16}\right)$ $\left(\frac{7}{12}\right)\times\left(\frac{6}{11}\right)\times\left(\frac{11}{16}\right)\times\left(\frac{11}{16}\right)$, $\left(\frac{7}{12}\right)\times\left(\frac{5}{11}\right)\times\left(\frac{5}{16}\right)\times\left(\frac{5}{16}\right)$ (SCB1 for 2 of these expressions))

26					B1 for stating or working out that h = AC or AC = HC (may be seen in later working) [eg h = $\sqrt{20a^2}$]
		$\left[(AC)^2\right] = (2a)^2 + (4a)^2$ oe or (AC) = $\sqrt{20a^2}$ (= $2a\sqrt{5}$)oe			M1 for a correct statement for AC² or AC in terms of a
		$\left[(BH)^2\right] = (2a)^2 + h^2$ oe or [BH] = $\sqrt{4a^2 + h^2}$ or [BH] = ($\sqrt{20a^2}$) ÷ ($2\sqrt{a}$) (= $\sqrt{5a}$) [BH] = $\sqrt{24a^2}$ oe			M1 for a correct statement for BH² or BH in terms of a and/or h (ft their value for h) - may be seen in later working [must have correct brackets or correct expansions eg (2a)² or 4a²]
		eg $(2\sqrt{a})(\sqrt{h^2 + 4a^2}) = \sqrt{20a^2}$ or $\sqrt{24a^2} \times (2\sqrt{a}) = 2a\sqrt{5}$ oe **or** $\sqrt{24a^2} = \sqrt{5a}$			M1dep for a correct equation equating two expressions for AC using a correct expression for BH eg $(2\sqrt{a})(\sqrt{h^2 + 4a^2}) = \sqrt{20a^2}$ or 4h² + 16a² = 20a or $5a = 4a^2 + h^2$ oe Or a correct equation equating two expressions for BH eg $\sqrt{24a^2} = \sqrt{5a}$
		eg 96a² = 20a or 5a = 24a² oe or 24a = 5 oe			M1 for a correct two-term quadratic or linear equation in a
			$a = \frac{5}{24}$	6	A1 (0.208…)
					Total 6 marks

27	(a)		$30 \leqslant t < 40$	1	B1
	(b)	$(17.5\times12)+(22.5\times10)+(27.5\times8)$ + $(35\times28)+(45\times14)$ (=2265)			M2 (condone one error only) if not M2 then award M1 for multiplication of all midpoints by frequencies (without addition) or multiplication of frequencies by a consistent value in interval (condone one error only) and addition
		'2265'÷ (12 + 10 + 8 + 28 + 14) [2265 ÷ 72]			M1dep on M1
			31.5	4	A1 awrt 31.5
	(c)	Remaining frequency densities are 2.0, 1.6, 2.8, 1.4 (where 2 cm = FD of 1)			M2 for all correct bars in histogram (M1 for 3 bars correct or stating a value on FD scale)
			Correctly completed histogram	3	A1 correct histogram including numbering frequency density axis correctly (at least one number not contradicted)
					Total 8 marks

28	(a)	A(–2, 0) or x = –2			B1 (either from quadratic or solving $4x+8=0$) for x coordinate of, A may be implied by further working
		eg $2x^2 + 3x – 2 = 4x + 8$ oe or $2x^2 – x – 10 = 0$ oe			M1 for substituting the equation of the line into the equation of the curve
		$(2x – 5)(x + 2) = 0$			M1dep for attempting to solve their 3-term quadratic (if factorising, factors that give 2 of 3 terms correct, if using formula, allow one sign error and some simplification – eg allow as far as $\frac{-1\pm\sqrt{1+80}}{4}$) May be implied by x = 2.5
		4 × "2.5" + 8 (=18)			M1indep for their value for 4 × "2.5" + 8 oe
		eg $AB^2=(2.5+2)^2+18^2$ or $AB^2=\frac{1377}{4}$ or $AB=\frac{\sqrt{1377}}{2}$ oe			M1 indep for a correct calculation for AB^2 or AB using their coordinates for A and B
			$\frac{9}{2}\sqrt{17}$	6	A1 or k = $\frac{9}{2}$ (accept $\frac{9}{2}$ if $\frac{9}{2}\sqrt{17}$ seen) dep on M4
	(b)	$180-\tan^{-1}\left(\frac{'18'}{'4.5'}\right)$ or $180-\cos^{-1}\left(\frac{'4.5'}{'\frac{9}{2}\sqrt{17}'}\right)$ **or** $180-\sin^{-1}\left(\frac{'18'}{'\frac{9}{2}\sqrt{17}'}\right)$ **or** complete method using cosine rule			M1 for complete method to find required angle (oe using their A and B) $\cos^{-1}\left(\frac{\left(\frac{9}{2}\sqrt{17}\right)^2+3^2-\left("\frac{39}{2}"\right)^2}{2\times\frac{9}{2}\sqrt{17}\times3}\right)$ oe
			104	2	A1 awrt 104
					Total 8 marks

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