Pearson Edexcel

Mark Scheme (Results)

November 2020

Pearson Edexcel International GCSE

In Mathematics B (4MB1)

Paper 02R

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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 the final answer is wrong 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, then award the lowest mark, unless the subsequent working makes clear the method that has been used.
  If there is no answer achieved then check the working for any marks appropriate from the mark scheme.

- **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.
  Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

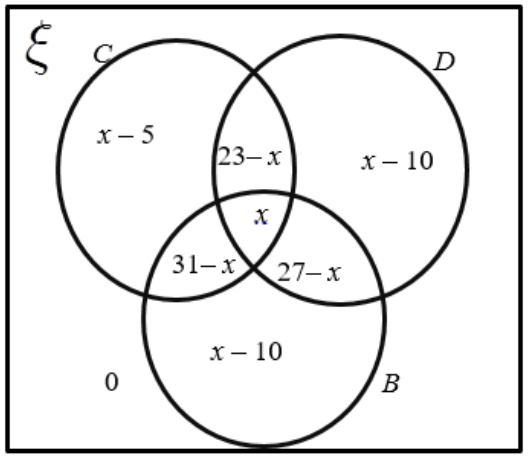
- **Parts of questions**

  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded to another.

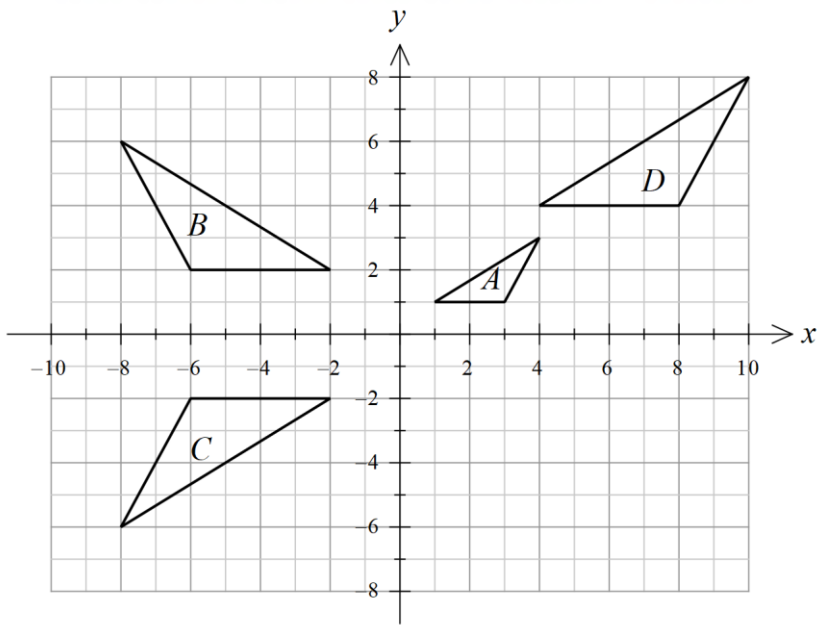
Question	Working	Answer	Mark	Notes
1 (a)	$\frac{23622}{0.93}$			M1 Alt $x - 0.07x = 23\,622$ oe
		($) 25 400	2	A1
(b)	$\frac{23622-19880[=3742]}{23622}\times 100$ **or** $\frac{19880}{23622}\times 100 (=84.158...)$			M1dep
		15.8(%)	2	A1
(c)	$\frac{d}{10}\times 1.4(0)$			M1
	$\frac{d}{10}\times 1.4(0)+938+"3742"=0.4d$ oe			M1 dep ft their 3742 from (b)
	$0.4d-\frac{d}{10}\times 1.4=938+"3742"$ oe			M1 dep collecting like terms on opposite sides
		18 000(km)	4	A1
				Total 8 marks

Question	Working	Answer	Mark	Notes
2 (a)	$75 = 3 \times 5 \times 5$ $90 = 2 \times 3 \times 3 \times 5$ $120 = 2 \times 2 \times 2 \times 3 \times 5$ **or** correct factor trees **or** 3 | 75 90 120 5 | 25 30 40 5 6 8			M1 implied by correct answer
		15	2	A1
(b)	Both could sound together at 9.22 and LCM of 8 and 12 is 24 or 930 938 946 910 922 934 946			M1
		09 46 oe	2	A1
				Total 4 marks

Question	Working	Answer	Mark	Notes
3 (a)	$3a + 5a = 4 - 6$ oe			M1
		$-\frac{1}{4}$	2	A1
(b)	$-3p > 12$ or $-12 > 3p$			M1
		$p < -4$	2	A1
(c)		$w \leqslant 5$	1	B1 allow use of $x \leqslant 5$
(d)		$x \geq -1$ or $x > -1$ and $y \geqslant 0$ or $y > 0$	1	B1 allow $-1 < x < n$ where $n \geq 2$ allow $0 < y < m$ where $m \geq 6$
	$y = -2x + ...$ or $y = ...x + 4$			M1
		$y \leq -2x + 4$ or $y < -2x + 4$ oe	2	A1
				Total 8 marks

Question	Working	Answer	Mark	Notes
4 (a)		x, $23 - x$, $31 - x$, $27 - x$ $x - 5$, $x - 10$, $x - 10$ 0	3	B1 B1 B1
(b)	$x + 56 = 75$			M1ft
		19	2	A1
(c)(i)	17		1	B1ft their "27" – " 10"
(ii)	44		1	B1ft $2x -$"5"+"31"–"20
(d)	$\frac{"19"-5}{49}$			M1 denominator of 49, numerator < 49
		$\frac{14}{49}$	2	A1ft oe (0.2857... allow 2dp truncated or rounded)
				Total 9 marks

Question	Working	Answer	Mark	Notes
5 (a)	Factorising into 2 brackets			M1 When multiplied out it must give at least 2 of the 3 terms correct
		$(x+6)(x-1)$	2	A1
(b)	$\frac{4(x+3)-5(2x-2)}{20}$ or $\frac{x+3}{5}-\frac{x-1}{2}$			M1
	$\frac{4x+12-10x+10}{20}$ or $\frac{2x+6-5x+5}{10}$			M1
		$\frac{-3x+11}{10}$	3	A1oe
				Total 5 marks

Question	Working	Answer	Mark	Notes
				
6 (a)		Triangle *A*	1	B1
(b)	$\begin{pmatrix} -2 & 0 \\ 0 & 2 \end{pmatrix}\begin{pmatrix} 1 & 3 & 4 \\ 1 & 1 & 3 \end{pmatrix}$			M1
	$\begin{pmatrix} -2 & -6 & -8 \\ 2 & 2 & 6 \end{pmatrix}$			A1
		Triangle *B*	3	A1
(c)		Triangle *C*	1	B1

Question	Working	Answer	Mark	Notes
(d)	$\mathbf{N} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} -2 & 0 \\ 0 & 2 \end{pmatrix} = \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$ Or $A \to C$ is an enlargement with centre O and scale factor -2 so that $\begin{pmatrix} 1 \\ 0 \end{pmatrix} \mapsto \begin{pmatrix} -2 \\ 0 \end{pmatrix}$ and $\begin{pmatrix} 0 \\ 1 \end{pmatrix} \mapsto \begin{pmatrix} 0 \\ -2 \end{pmatrix}$			M1 Allow M1 for $\begin{pmatrix} 0 & -2 \\ -2 & 0 \end{pmatrix}$
		$\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$	2	A1
(e)	Rotation 180º about any point			M1
		Triangle D	2	A1
(f)		Enlargement	1	B1
		SF $\frac{1}{2}$	1	B1
		centre (–2, –2)	1	B1
				Total 12 marks

Question	Working	Answer	Mark	Notes
7 (a)		$5 < t \leq 8$	1	B1
(b)	$2.5\times10+6.5\times8+9\times5+12.5\times3+22.5\times2$ $(=204.5)$			M2 for at least 4 correct products added OR (M1 for use of a value within interval (incl. end points) for at least 4 products, which must be added).
	$\frac{"204.5"}{28}$			M1(dep) on at least M1
		awrt 7.3	4	A1
(c)		Bar drawn height 30 little squares	1	B1
(d)		$\frac{5}{35}$ oe	1	B1 (0.14(28571...) or 14(.28571)%)
				Total 7 marks

Question	Working	Answer	Mark	Notes
8	5010, 4990, 10100, 9900, 33.5, 34.5, 68.5, 67.5			M1 at least 1 from each row.
	Colin $\frac{10100}{67.5}$ or $\frac{10.1}{67.5}$			A1
	Jenny $\frac{4990}{34.5}$ or $\frac{4.99}{34.5}$			A1
	$\frac{\left(\frac{10100}{67.5}-\frac{4990}{34.5}\right)\times 60}{1000}$			M1
		0.2995 (km/h)	5	A1
				Total 5 marks

Question	Working		Answer	Mark	Notes
9 (a)	$8y^2 - ... = 400$ **or** $...-2x^2 = 400$ **or** $2y(4y - x) + ... = 400$ **or** $... + x(2y - x) = 400$				M1
	$4y^2 - x^2 = 200$				A1cso
	$10y + 2x + 5 = 2y$ therefore $2y = 2x + 5$			3	B1cso
(b)	$(2x+5)^2 - x^2 = 200$	$4y^2 - \left(\frac{2y-5}{2}\right) = 200$			M1
	$3x^2 + 20x - 175 = 0$	$12y^2 + 20y - 825 = 0$			M1 Rearranging correctly to get a 3 term quadratic
	$(3x+35)(x-5)=0$ $\frac{-20 \pm \sqrt{20^2 - 4\times3\times-175}}{2\times3}$ $3[(x+\frac{20}{6})^2 - (\frac{20}{6})^2] - 175$	$(2y-15)(6y+55)=0$ $\frac{-20 \pm \sqrt{20^2 - 4\times12\times-825}}{2\times12}$ $12[(y+\frac{20}{24})^2 - (\frac{20}{24})^2] - 825$			M1 dep on M1 for solving their quadratic equation using any correct method - if factorising, allow brackets which expanded give 2 out of 3 terms correct (if using formula or completing the square allow one sign error and some simplification – allow as far as eg $\frac{-20 \pm \sqrt{400+2100}}{6}$ or eg $3\left(x+\frac{20}{6}\right)^2 - \frac{625}{3}$)

	$x = 5$	$y = 7.5$			A1 one correct result for x or for y (ignore negative value for this mark)
	$y = \frac{2 \times "5" + 5}{2}$	$x = \frac{2 \times "7.5" - 5}{2}$			M1
			$x = 5$ and $y = 7.5$	5	A1 dep on M2 (positive values only)
					Total 8 marks

Question	Working	Answer	Mark	Notes
10 (a)	$3\times\left(\frac{1}{3}\right)^3-7\times\left(\frac{1}{3}\right)^2+5\times\frac{1}{3}-1$			M1
		= 0, $(3x-1)$is a factor	2	A1
(b)	x^2-2x+1			M1
	$(x-1)(x-1)$			M1
		$x=\frac{1}{3}$ or 1	3	A1
(c)	$\frac{dy}{dx}=9x^2-14x+5$			M1
	$(x-1)(9x-5)=0$			M1
		$1,\ \frac{5}{9}$		A1
	Substituting x values into $y=3x^3-7x^2+5x-1$			M1
		(1, 0) $\left(\frac{5}{9},\frac{32}{243}\right)$	5	A1
(d) (i)		5	1	B1ft (ft $\frac{dy}{dx}$)
(ii)	$y=$"5"$x-1$			M1
		$y=5x-1$	2	A1oe
				Total 13 marks

Question	Working	Answer	Mark	Notes
11 (a)	SF $\frac{1}{5}$			B1 use or statement of the correct SF
	$\frac{1}{3}(\pi)\times 30^2\times 100-\frac{1}{3}(\pi)\times "6"^2\times 20$ oe			M1
		29760	3	A1
(b)		40800π	1	B1
(c)	$\frac{2}{3}\pi\times 30^3+\ldots$			M1
	g = height of small cone $\frac{2}{3}\pi\times 30^3+$ $\frac{1}{3}\pi\times 30^2\times 108-\frac{1}{3}\pi\times\left(\frac{30}{108}g\right)^2\times g="40800\pi"$ or $0.02\,572g^3=9\,600$			M1 Condone $30k^2$ A1 Correct equation
	$g=72$			A1
	$h=30+(108-72)$			M1
		awrt 66	6	A1
Alternate method				
	$V_{\text{hemisphere}}=\frac{2}{3}\pi\times 30^3\ [=18000\pi]$			M1
	$V_{\text{frustrum}}=40800\pi-18000\pi[=22800\pi]$			

	$V_{\text{whole cone}} = \frac{1}{3}\pi \times 30^2 \times 108 \left[= 32400\pi\right]$			
	$V_{\text{top cone}}$ $32400\pi - 22800\pi \left[= 9600\pi\right]$			M1
	$V_{\text{top cone}}$: $V_{\text{whole cone}} = 9600\pi : 32400\pi$			A1
	$= 8 : 27$			
	$H_{\text{top cone}}$: $H_{\text{whole cone}} = 2 : 3$			A1
	$\frac{138 - h}{108} = \frac{2}{3}$			M1
		awrt 66		A1
				Total 10 marks

Question	Working	Answer	Mark	Notes
12 (a)	$\frac{1}{2}\mathbf{b} \pm \frac{1}{5}\mathbf{a}$			M1
		$-\frac{1}{5}\mathbf{a}+\frac{1}{2}\mathbf{b}$	2	A1
(b)	$\overrightarrow{FC}=\frac{4}{5}\mathbf{a}+2\overrightarrow{AB}$			M1 or $\overrightarrow{EC}=-\frac{1}{2}\mathbf{b}+\mathbf{a}+2\overrightarrow{AB}$
	$\overrightarrow{FC}=$ "$\frac{4}{5}$" $\mathbf{a}+2(\mathbf{b}-\mathbf{a})$			M1 or $\overrightarrow{EC}=-\frac{1}{2}\mathbf{b}+\mathbf{a}+2(\mathbf{b}-\mathbf{a})$
	$\overrightarrow{FC}=2\mathbf{b}-\frac{6}{5}\mathbf{a}$			A1 or $\overrightarrow{EC}=\frac{3}{2}\mathbf{b}-\mathbf{a}$
	$2\mathbf{b}-\frac{6}{5}\mathbf{a}$ is not a multiple of $\frac{1}{2}\mathbf{b}-\frac{1}{5}\mathbf{a}$ therefore F, E and C are not collinear.		4	A1 $\frac{5}{3}\mathbf{b}-\mathbf{a}$ is not a multiple of $\frac{1}{2}\mathbf{b}-\frac{1}{5}\mathbf{a}$ therefore F, E and C are not collinear.
(c)	$\overrightarrow{OG}=\mathbf{a}+m(\mathbf{b}-\mathbf{a})$			M1
	$\overrightarrow{OG}=\frac{1}{5}\mathbf{a}+n\left("-\frac{1}{5}\mathbf{a}+\frac{1}{2}\mathbf{b}"\right)$			M1
	$\left(\frac{1}{5}-\frac{1}{5}n\right)=1-m$ or $m=\frac{1}{2}n$			M1
	$n=\frac{8}{3}$ or $m=\frac{4}{3}$			A1

	$\overrightarrow{OG} = \mathbf{a} + \frac{4}{3}(\mathbf{b} - \mathbf{a})$ or $-\frac{1}{3}\mathbf{a} + \frac{4}{3}\mathbf{b}$		5	A1
				Total 11 marks