Mark Scheme (Results)

Summer 2018

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 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 part.

Ques	Working	Answer	Mark	Notes
1 (a)	$x+2x-2+x+1$ **or** $2(2x+3)+2(x+3)$		2	M1oe correct expression for perimeter of either shape
	$3(x+2x-2+x+1)=2(2x+3)+2(x+3)$	Correct equation		A1oe correct equation
(b)	$3(4x-1)=6x+12$ $12x-3=6x+12$ **or** $4x-1=2x+4$		3	M1 for a fully correct equation with all terms expanded and simplified or shows division of $6x + 12$ by 3
	$12x-6x=12+3$ or $4x-2x=4+1$			M1ft for terms in x one one side and numerical terms on the other (only ft a linear equation)
	$6x=15$ $x=15\div6=2.5$	2.5		A1oe dep on M1
				Total 5 marks

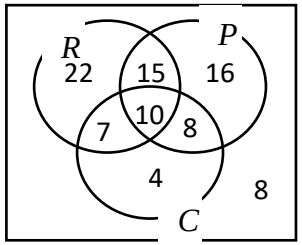
Ques	Working	Answer	Mark	Notes
2 (a)		1, 4, 4, −4	2	B2 all correct or B1 for 2 or 3 correct
(b)		Correct graph	2	B2 for completely correct graph. B1ft for at least 5 points correctly plotted and joined.
(c)		−1.4 & 1.9	2	B1B1 both points ±0.1 ft their graph NB: coordinates gains B1 for both x values correct
				Total 6 marks

3 (a)	$\pi \times 2.5^2 \times 1.6$ (=10 π /31.415...)		5	M1 or $\pi \times 250^2 \times 160 (= 10\,000\,000\,\pi)$
	$10\,000\,\pi \times 1000$ ($10\,000\,\pi$)(litres)			M1 or $10\,000\,000\,\pi \div 1000$
	$\frac{10\,000\pi}{109}$			M1
	288.219... (mins)(=4.80...(hrs))			M1
		4 hours 48 mins		A1
(b)	$\frac{10\,000\pi}{180}$		2	M1 or $\frac{'288.219...'}{180} \times 109$
		175 *l*/min		A1 [allow 174.4 – 175]
				Total 7 marks

4 (a)		3	1	B1
(b)		19	1	B1
(c)	$g(2) = -5$		2	M1
		-11		A1
(d)	$y^2 - 6y - (8 + x) = 0$		3	M1oe e.g. $x = (y-3)^2 - 9 - 8$
	$\frac{6 + \sqrt{36 + 4(8 + x)}}{2}$			M1oe e.g. $x + 17 = (y-3)^2$
		$h^{-1}: x \to 3 + \sqrt{x + 17}$		A1oe
				Total 7 marks

5 (a)	$5x + 5 < x$, $5x - x < -5$ oe		2	M1 for terms in x one side and number terms on the other side of a correct equation or inequality or for $x = -1.25$ or $x > -1.25$
		$x < -1.25$		A1oe cao
(b)			5	M1 for substitution e.g. $3x^2 + (3x + 5)^2 - 7 = 0$
	$3x^2 + 9x^2 + 15x + 15x + 25 - 7$ (= 0) oe			M1 for expansion of bracket after substitution (at least 3 terms correct)
	$12x^2 + 30x + 18$ (=0) or $2x^2 + 5x + 3$ (=0)			M1 for forming quadratic ready for solving e.g. $12x^2 + 30x + 18$ (=0) oe
	e.g. $(2x + 3)(x + 1)$ (=0)			M1ft for factorising or correct use of formula by substituting values in correctly or completing the square.
		$x = -1.5$, $y = 0.5$ $x = -1$, $y = 2$		A1 must be **clearly** paired dep on M2 for all 4 values correct
(c)		$x = -1.5$	1	B1 cao
				Total 8 marks

6	$6x^2 + 6x - 12$		8	B2 fully correct B1 for at least 2 of these 3 terms correct
	$6x^2 + 6x - 12 = 0$ or $x^2 + x - 2 = 0$			M1ft their $dy/dx = 0$ dep on at least B1 scored
	$(x + 2)(x - 1)$ (=0) $x = -2$ or $x = 1$			M1ft for factorising and correct method to find x values or correct use of formula or completing the square. Ft from their dy/dx dep on 3 term quadratic.
	e.g. $y = 2(-2)^3+3(-2)^2-12\times-2+1(=21)$ **and** $2(1)^3+3(1)^2-12\times1+1(=-6)$			M1ft for substitution of x values into formula to find y values
	$m = \frac{21--6}{-2-1}$ $(= -9)$			M1ft correct method to find gradient of line
	$21 = -9 \times -2 + c$ or $-6 = -9 \times 1 + c$ or $y - 21 = -9(x - -2)$ oe or $c = 3$			M1ft for substitution to find c or $c = 3$
		$y = -9x + 3$		A1 oe eg $y - 21 = -9(x + 2)$
				Total 8 marks

7 (a)			3	B3 completely correct B2 for 5 correct entries B1 for 3 correct entries
(b)	Adding all 8 entries oe ft		2	M1ft allow one omission
		90		A1 cao
(c)		12	1	B1ft their Venn diagram
(d)		$\frac{7}{29}$	2	B2ft B1ft for $\frac{n}{29}(0 < n < 29)$ or for $\frac{7}{m}(m > 7)$
				Total 8 marks

8 (a)	$\begin{pmatrix} 2 & -1 \\ \frac{3}{2} & -\frac{1}{2} \end{pmatrix}\begin{pmatrix} -1 & 1 & 0 \\ 1 & 2 & 4 \end{pmatrix}=\begin{pmatrix} -3 & 0 & -4 \\ -2 & \frac{1}{2} & -2 \end{pmatrix}$		4	B1 for correct matrix from coordinates – any order M1 for a correctly calculated coordinate A1 for all coordinates correctly calculated A1 for correct plotting of triangle *B*
(b)	$\begin{pmatrix} 3 & -4 \\ 1 & -2 \end{pmatrix}\begin{pmatrix} -3 & 0 & -4 \\ -2 & \frac{1}{2} & -2 \end{pmatrix}=\begin{pmatrix} -1 & -2 & -4 \\ 1 & -1 & 0 \end{pmatrix}$		3	M1ft a correctly calculated coordinate A1ft for all correctly calculated coordinates B1cao for correctly plotting *C*
(c)		Reflection in $y = -x$	2	B1 reflection B1 $y = -x$ oe
				Total 9 marks

9 (a)	$5\times16+20\times22+32.5\times10+47.5\times40+80\times12$		4	M2 for all correct products, M1 for at least 3 correct products
	$\frac{5\times16+20\times22+32.5\times10+47.5\times40+80\times12}{100}$			M1 for dividing sum of products by 100 dep on previous M1
		37.1		A1 awrt to 37.1, allow 37 if M3 awarded
(b)(i)	$\frac{62}{100}\times\frac{61}{99}$		2	M1
		0.382		A1 awrt (0.382)02020... $\frac{1891}{4950}$
(b)(ii)	$\frac{62}{100}\times\frac{38}{99}+\frac{38}{100}\times\frac{62}{99}$		3	M2 for adding both products, M1 for one correct product (allow M1 only for fully correct method with replacement)
		0.476		A1 0.476 $\frac{1178}{2475}$
				Total 9 marks

10 (a)	0.28 × 250 oe		2	M1oe
		70		A1
(b)	(250 – '70') ÷ 9 = 20 × 4 oe		2	M1oe
		80		A1
(c)	(250 – '70') ÷ 9 = 20 × 5 × 75 (=7500) oe		2	M1oe
		7.5 kg		A1
(d)	0.7 × 4 (=2.8) oe		3	M1
	4 × 204 + 2.8 × 46			M1
		($)944.8(0)		A1 allow ($)945
(e)	eg 160% = 944.8 **or** 1.6c = 944.8 **or** 944.8 − c = 0.6c **or** $\frac{944.8-c}{c} = 0.6$ oe		3	M1ft recognition that 944.8 is 160%
	944.8 ÷ 1.6 oe			M1ft oe
		($)590.5(0)		A1
				Total 12 marks

11 (a)	Recognition of an appropriate triangle		5	B1 may be seen on diagram or evident from further working
	(AN^2 =) $3^2 + 8^2$ (=73) **or** (AN =) $\sqrt{3^2+8^2} = \sqrt{'73'}$ (8.544...)			M1 or $GO = \frac{3}{\cos 54} = \frac{3}{\sin 36} = \frac{6\sin 54}{\sin 72} (= 5.1039...)$ oe
	(NO =) 3 tan 54° **or** $\frac{3}{\tan 36^0}$ (=4.129..)			M1 or $(AO^2 =)"5.10..."^2 + 8^2 (= 90.049...)$ oe
	(AO=) $\sqrt{'4.129'^2 + '73'}$			M1 or (AO =) $\sqrt{"5.10..."^2 + 8^2}$ oe
		9.49		A1
(b)	$OK = \frac{3}{\cos 54}$ (5.10...) **or** N to midpt FJ = 6cos18 or 6sin72°(=5.706...) **or** Midpt FJ to K = 6cos54° or 6sin36°(=3.5267...) **or** $GK^2 = 6^2 + 6^2 - 2 \times 6 \times 6 \times \cos 108$ (=94.249..)		5	M1 for OK or other relevant partial height of pentagon.
	$\frac{3}{\cos 54°} + \frac{3}{\tan 36°}$ ("5.10..."+"4.129...") oe **or** 6 cos 54° + 6 cos 18° ("3.5267..."+"5.706...") **or** $\sqrt{"94.249.."-3^2}$			M1oe complete method to find perpendicular height of pentagon (= 9.233...)
	$\tan\angle = \frac{'9.233..'}{8}$ oe			M1 for correct angle ratio from correct working
	$\angle = \tan^{-1}\left(\frac{'9.233..'}{8}\right)$ oe			M1 for fully correct method from correct working to find required angle
		49.1°		A1 awrt 49.1°
				Total 10 marks

12 (a)	$2x + y + z = 26$ or $2x = 26 - y - z$ oe		4	M1 or correct use in equation of $AR = 14 - x$ or $RC = 12 - x$ oe
	$y + z = 8$ oe			M1 or correct use in equation of $AR = 14 - x$ and $RC = 12 - x$ oe
	$2x + 8 = 26$ or $2x = 26 - 8$ oe			A1 must be a formula in x they can obtain from knowledge of tangents
		9 cm		A1 SCB1 for $BP = 9$ cm without equation
12 (b)	$8^2 = 14^2 + 12^2 - 2 \times 12 \times 14 \times \cos ABC$ or $14^2 = 8^2 + 12^2 - 2 \times 8 \times 12 \times \cos ACB$ or $12^2 = 8^2 + 14^2 - 2 \times 8 \times 14 \times \cos CAB$		7	M1 For method to start to find $\angle CAB, \angle ABC$ or $\angle$ACB
	$CAB = \cos^{-1}\left(\frac{8^2+14^2-12^2}{2\times8\times14}\right)$ (=58.8°)or $ABC = \cos^{-1}\left(\frac{14^2+12^2-8^2}{2\times14\times12}\right)$ (=34.77°)or $ACB = \cos^{-1}\left(\frac{8^2+12^2-14^2}{2\times8\times12}\right)$ (=86.4°)			M1 Complete method to find one angle
	Area of triangle = 0.5×8×14×sin(58.8..°) or 0.5×14×12×sin(34.77..°) or 0.5×8×12×sin(86.4..°) (=47.9061...)			M1 Method to find area of triangle (from fully correct working, ie M2 previously gained) (could use Hero's formula $\sqrt{17(17-14)(17-12)(17-8)}$)
	Radius = 3tan(½×86.4..°) or 5tan(½×58.8..°) or 9tan(½×34.77..°)oe (=2.818...)			M1 Method to find radius of circle from fully correct working Or radius = 47.9061÷(0.5×(12+14+8))

	$\pi \times 2.818..^2$ (=24.947.....)			M1 Method to find area of circle from fully correct working
	$\% = \frac{24.947...}{47.906...} \times 100$			M1 Method to find required %
		52.1		A1 awrt
				Total 11 marks