Mark Scheme (Results)

January 2019

Pearson Edexcel International GCSE

Mathematics B (4MB1)

Paper 02

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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
  - 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 always check the working in the body of the script 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 are multiple attempts shown, then all attempts should be marked and the highest score on a single attempt should be awarded.
- **Follow through marks**

  Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

- **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 shows that the candidate did not understand the demand of the question.

- **Linear equations**

  Full marks can be gained if the solution alone is given, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

- **Parts of questions**

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

<table>
<tr><th>Question</th><th colspan="4">Working</th><th colspan="2">Answer</th><th>Mark</th><th>Notes</th></tr>
<tr><td>1</td><td colspan="4">$180-\frac{360}{12}=150$

$150-\frac{360-2\times150}{2}=120$ oe

Angles in a quadrilateral/ exterior angles add to 360 or

BE and CD are parallel and co- interior /allied angles add to 180</td><td colspan="2">120°</td><td>4</td><td>M1

M1

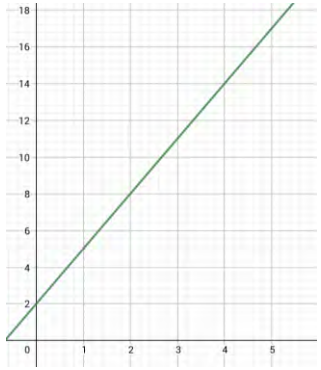
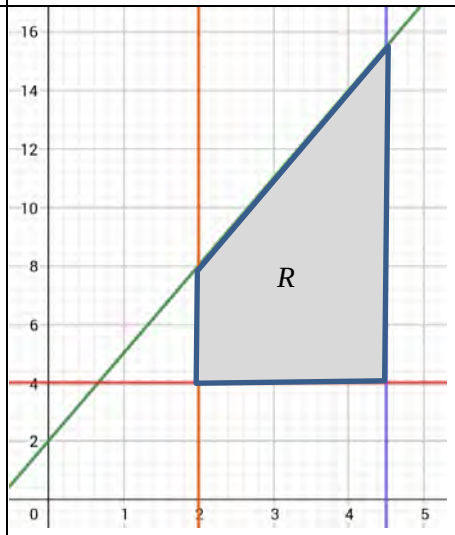
B1d

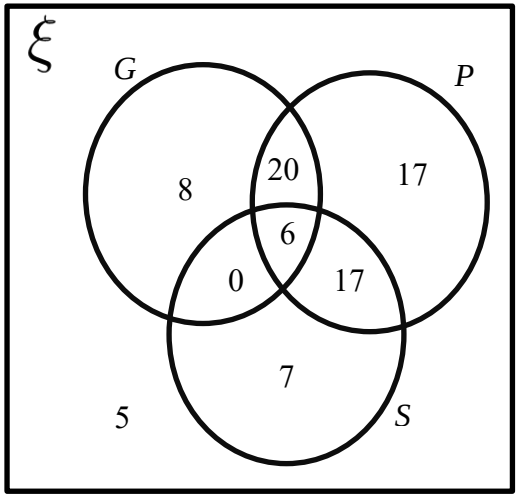
A1</td></tr>
<tr><td rowspan="4">2</td><td>$3x-2y=7$
$3x+18y=45$</td><td>$9x-6y=21$
$x+6y=15$</td><td>$x=15-6y$</td><td>$2y=3x-7$

$x+3(3x-7)$
$=15$</td><td></td><td rowspan="3">4</td><td>M1

M1</td></tr>
<tr><td>$20y=38$</td><td>$10x=36$</td><td>$3(15-6y)$
$-2y=7$</td><td></td><td>$x=3.6$</td><td>A1</td></tr>
<tr><td colspan="4"></td><td></td><td>$y=1.9$</td><td>A1</td></tr>
<tr><td colspan="4">(Dep on at least M1)</td><td colspan="2"></td></tr>
</table>

Question	Working	Answer	Mark	Notes
3 (a)	$\frac{272}{85}\times 100$			M1
		320	2	A1
(b)	220×1.7 or $\frac{272}{1.7}$			M1
	$220\times 1.7-272$ or $220-\frac{272}{1.7}$			M1
		\$102 or £60	3	A1
4 (a)		$2\times 2\times 2\times 7$ or $2^3\times 7$	1	B1
(b)	Method to find the LCM $2\times 2\times 2\times 3$ or 56,112,168 and 24,48,72,96,120,144,168 or 12 00, 12 56, 13 52, 14 48 and 12 00, 12 24, 12 48, 13 12, 13 36, 14 05, 14 00, 14 24, 14 48			M1
	LCM = 168			A1
		14:48 or 2.48 pm	3	A1

Question	Working	Answer	Mark	Notes
5 (a)		Straight line with a gradient of 3 or two correct points plotted or line through (0,2) Correct line.	2	M1 A1
(b)		Line $y = 4$ Lines $x = 2$ and $x = 4.5$ Correct region identified	3	B1 B1 B1

Question	Working	Answer	Mark	Notes
6 (a)		6,17,20,0 8,17,7 5	3	B1 B1 B1
(b)(i)		5	1	B1
(ii)		58	1	B1
(iii)		37	1	B1

Question	Working	Answer	Mark	Notes
7 (a)	$1-0.2-0.1=0.7$ $\frac{"0.7"}{5}["=0.14"]$ $3\times"0.14"\times150$	63	4	M1 M1 M1 A1
(b)	3,4 4,3 4,4 $0.2\times0.1+0.2\times0.1+0.1\times0.1$	0.05 oe	3	M1 M1 A1
(c)	$0.2\times0.1+0.1\times0.1=0.03$ $\frac{0.03}{"0.05"}$	0.6 oe	3	M1 M1 A1

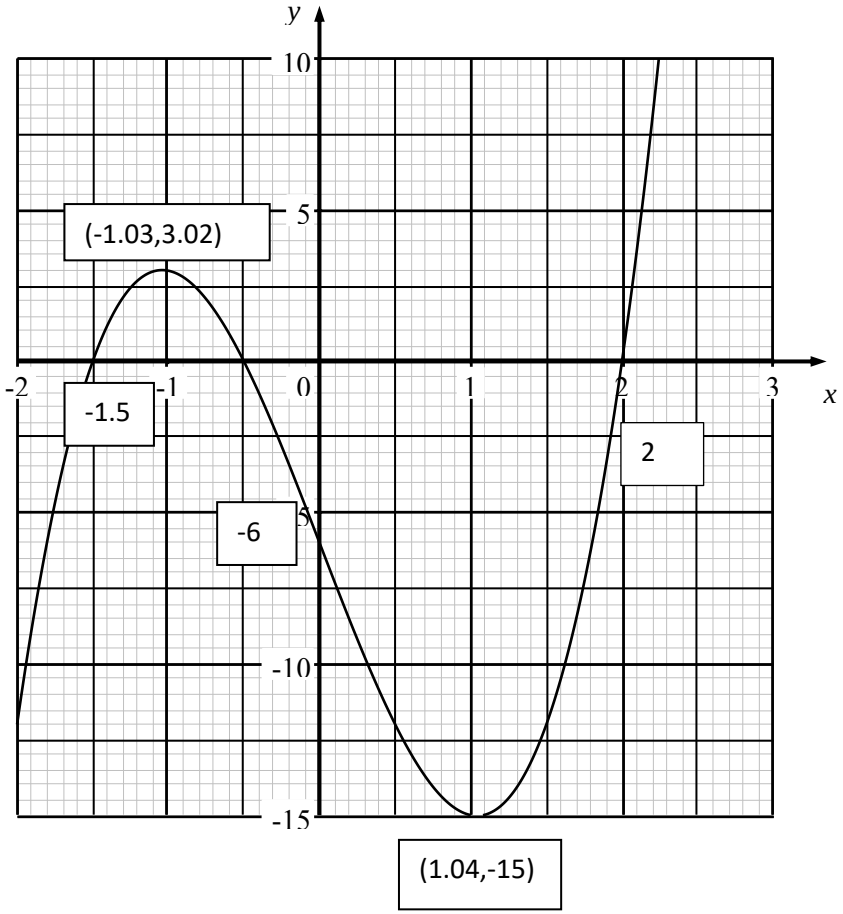
Question	Working	Answer	Mark	Notes
8 (a)	$-\frac{2}{3}\mathbf{a}+\ldots$	$-\frac{2}{3}\mathbf{a}+2\mathbf{b}$	2	M1 A1
(b)	$\overrightarrow{OP}=2\mathbf{a}+k\left(-\frac{2}{3}\mathbf{a}+2\mathbf{b}\right)$ $2\mathbf{a}-\frac{2}{3}k\mathbf{a}=0$ $k=3$ $\overrightarrow{OP}=\text{"3"}\times\text{"2b"}$ Alternative for M1M1 $\overrightarrow{OP}:2\text{a}=2\text{b}:\frac{2}{3}\text{a}$	$6\mathbf{b}$	4	M1 M1 M1 A1
(c)	$\overrightarrow{AQ}=-\frac{4}{3}\mathbf{a}+2\times\left(\text{"}-\frac{2}{3}\mathbf{a}+2\mathbf{b}\text{"}\right)$ $\overrightarrow{AQ}=-\frac{8}{3}\mathbf{a}+4\mathbf{b}$ $\overrightarrow{AB}=-2\mathbf{a}+3\mathbf{b}$ **or** $\overrightarrow{BQ}=-\frac{2}{3}\mathbf{a}+\mathbf{b}$			M1 A1 B1

	$\overrightarrow{AQ}=\frac{4}{3}\overrightarrow{AB}\therefore A,B$ and Q are collinear	$\overrightarrow{AB}=3\overrightarrow{BQ}\therefore A,B$ and Q are collinear		4	A1
ALT	$\overrightarrow{BQ}=-3\mathbf{b}+\frac{2}{3}\mathbf{a}+2\times\left(''-\frac{2}{3}\mathbf{a}+2\mathbf{b}''\right)$ $\overrightarrow{BQ}=-\frac{2}{3}\mathbf{a}+\mathbf{b}$ $\overrightarrow{AB}=-2\mathbf{a}+3\mathbf{b}$ **or** $\overrightarrow{AB}=3\overrightarrow{BQ}\therefore A,B$ and Q are collinear	$\overrightarrow{AQ}=-\frac{8}{3}\mathbf{a}+4\mathbf{b}$ $\overrightarrow{AQ}=4\overrightarrow{BQ}\therefore A,B$ and Q are collinear			(M1) (A1) (B1) (A1)

Question	Working	Answer	Mark	Notes
9 (a)	Condone missing label	Correct triangle drawn	1	B1
(b)	$\begin{pmatrix}3 & -4\\4 & 3\end{pmatrix}\begin{pmatrix}0 & 1 & 0\\0 & 0 & 2\end{pmatrix}$ $\begin{pmatrix}0 & 3 & -8\\0 & 4 & 6\end{pmatrix}$ Condone missing label	Correct triangle drawn	3	M1 A1 A1
(c)	$\sqrt{3^2+4^2}$	5	2	M1 A1
(d)	$\theta = \tan^{-1}\frac{4}{3}$	53.1	2	M1 A1
(e)		Correct triangle drawn	1	B1
(f)	$\begin{pmatrix}1 & 0\\0 & -1\end{pmatrix}\begin{pmatrix}3 & -4\\4 & 3\end{pmatrix}$ or 1st column correct	$\begin{pmatrix}3 & -4\\-4 & -3\end{pmatrix}$	2	M1 A1

Question	Working	Answer	Mark	Notes
10 (a)	Differentiate $x^n \rightarrow x^{n-1}$	$3+18t-3t^2$	2	M1 A1
(b)		$18-6t$	1	B1
(c)	$"18-6t" = 0$ $t = 3$		2	M1 A1
(d)	$"3+18t-3t^2" = 0$ $t = \frac{6 \pm \sqrt{36+4}}{2}$ awrt 6.16, - 0.16 selecting "6.16" since time cannot be negative $5+3\times6.16+9\times6.16^2-6.16^3$ 131.2 with all M and A marks awarded	131.2*	6	M1 M1(dep) A1 B1 M1 A1 cso
(e)	$131.2\times\ 2\ -\ 5$	awrt 257	2	M1 A1

Question	Working	Answer	Mark	Notes
11 (a)	$4\times\left(-\frac{1}{2}\right)^3-13\times\left(-\frac{1}{2}\right)-6$	$=0$ $\therefore (2x+1)$ is a factor	2	M1 A1
(b)	$2x^2-...$ $2x^2-x-6$ $(2x+3)(x-2)$ $(2x+1)(2x+3)(x-2)$		4	M1 A1 M1 A1
(c)	$(2x+1)(2x+3)(x-2)=0$	$\left(-\frac{1}{2},0\right),\left(-\frac{3}{2},0\right),(2,0)$	2	M1 A1
(d)	$\frac{dy}{dx}=12x^2-13$ $12x^2-13=0$ leading to $x^2=...$ Substituting x values into $y=4x^3-13x-6$	$\pm$ awrt 1.04 awrt (1.04, – 15.02) (– 1.04, 3.02)	5	M1 M1 A1 M1 A1
(e)	shape Cross y-axis at (-6) (Drawn at end of MS)	Correct graph with all points of intersection and max/minima labelled	3	M1 B1 A1 ft

Question	Working	Answer	Mark	Notes
12 (a)	$[A=]6ab+2b^2+\ldots$ or $[A=]\ \pi a^2+\pi ab+\ldots$	$[A=]\ 6ab + 2b^2 + \pi a^2 + \pi ab$	2	M1 A1
(b)	$\pi\left(6\sqrt{5}\right)^2$ or $\pi\left(6\sqrt{5}\right)b$ $\pi\left(6\sqrt{5}\right)^2+\pi\left(6\sqrt{5}\right)b=60\pi\sqrt{15}$ $b=\dfrac{60\pi\sqrt{15}-\pi\left(6\sqrt{5}\right)^2}{\pi\left(6\sqrt{5}\right)}$ $b=\dfrac{60\pi\sqrt{15}-\pi\left(6\sqrt{5}\right)^2}{\pi\left(6\sqrt{5}\right)}\times\dfrac{\sqrt{5}}{\sqrt{5}}$ or $b=\dfrac{60\sqrt{15}}{6\sqrt{5}}-\dfrac{\left(6\sqrt{5}\right)^2}{6\sqrt{5}}$ or $b=\dfrac{60\sqrt{75}-180\sqrt{5}}{30}$ $b=10\sqrt{3}-6\sqrt{5}$		5	M1 M1 M1 M1 A1 cso
(c)	$2abh="2ab^2+\dfrac{1}{2}\pi a^2b"$ $\left(h=b+\dfrac{1}{4}\pi a\right)$ $h=10\sqrt{3}-6\sqrt{5}+\dfrac{1}{4}\pi\times6\sqrt{5}$ or awrt 14.4			M1 M1

	$AC = \sqrt{\left(10\sqrt{3} - 6\sqrt{5}\right)^2 + \left(12\sqrt{5}\right)^2}$ or awrt 27.1 $\left[\angle GAC\right] = \tan^{-1}\frac{"14.4"}{"27.1"}$	awrt 28	5	M1 M1 A1