Mark Scheme (Results)

January 2019

Pearson Edexcel International GCSE
In Mathematics B (4MB0)
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
  - 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 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 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.

Question	Working	Answer	Mark	Notes
1	$\frac{10.4 - 9.58}{10.4} \times 100$ OR $100 - \frac{9.58}{10.4} \times 100$	7.88% (awrt)	2	M1 $\frac{0.82}{10.4} \times 100$ A1 Accept −7.88%
2	$3(x^2 - 4y^2)$ **OR** $(3x - 6y)(x + 2y)$ **OR** $(x - 2y)(3x + 6y)$ **OR** $(\sqrt{3}x - 2\sqrt{3}y)(\sqrt{3}x + 2\sqrt{3}y)$	$3(x - 2y)(x + 2y)$	2	M1 A1
3	$12x^2 + 2x^{-2}$ **OR** $12x^2 + \frac{2}{x^2}$ (1 term correct)	$12x^2 + 2x^{-2}$	2	M1 For one term correct. Allow even if differentiated again for this mark only. A1 Fully correct

<table>
<tr><th>Question</th><th>Working</th><th>Answer</th><th>Mark</th><th colspan="2">Notes</th></tr>
<tr><td>4</td><td>Factors (or factor ladders/trees) for any two of
$72 = 2^3 \times 3^2$ or $2 \times 2 \times 2 \times 3 \times 3$ or $8 \times 3 \times 3$
$120 = 2^3 \times 3 \times 5$ or $2 \times 2 \times 2 \times 3 \times 5$ or $8 \times 3 \times 5$
$264 = 2^3 \times 3 \times 11$ or $2 \times 2 \times 2 \times 3 \times 11$ or $8 \times 3 \times 11$

<table>
<tr><td>2</td><td>72</td><td>120</td><td>264</td></tr>
<tr><td>2</td><td>36</td><td>60</td><td>132</td></tr>
<tr><td>2</td><td>18</td><td>30</td><td>66</td></tr>
<tr><td>3</td><td>9</td><td>15</td><td>33</td></tr>
<tr><td></td><td>3</td><td>5</td><td>11</td></tr>
</table>
or
<table>
<tr><td></td><td>264</td><td>120</td><td>72</td></tr>
<tr><td>12</td><td>22</td><td>10</td><td>6</td></tr>
<tr><td>2</td><td>11</td><td>5</td><td>3</td></tr>
</table>
oe</td><td>24</td><td>2</td><td>M1</td><td>for correct prime factors of any 2 of the 3 numbers – but may use 8 or 4×2 in place of 2^3
Prime numbers might be on the ends of factor trees or on the sides of factor ‘ladders’
(condone 1’s)
OR
use of table method, 2 examples shown, but could have 4, 6, or 8 along the side
OR
A list of at least 4 factors of 2 of 120, 72, 264 excluding the numbers 1, 72, 120, 264</td></tr>
<tr><td></td><td></td><td>24</td><td>2</td><td>A1</td><td>Allow $2^3 \times 3$(dep on M1)</td></tr>
<tr><td>5</td><td>$\frac{7}{28} \times 50$ oe OR $50 \div \frac{28}{7}$ OR $\frac{7}{28} = \frac{x}{50}$ oe</td><td></td><td></td><td>M1</td><td></td></tr>
<tr><td></td><td></td><td>12.5</td><td>2</td><td>A1</td><td>Accept</td></tr>
</table>

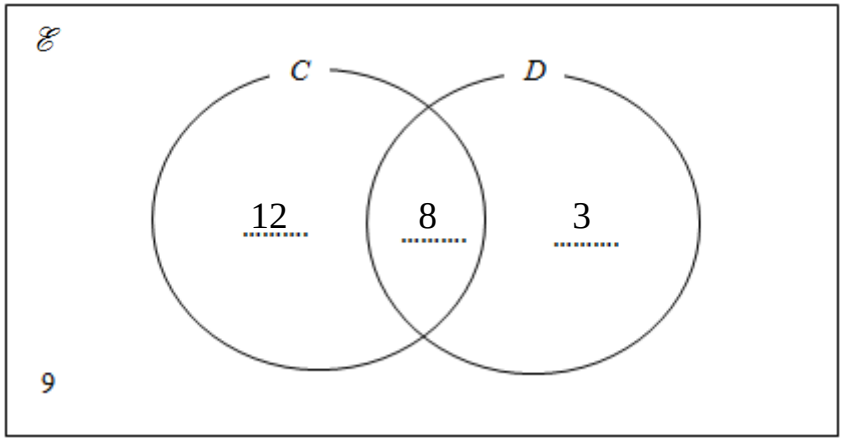
Question	Working	Answer	Mark	Notes
6	$n \geq \frac{29-40}{3}$ oe eg n $\geq -\frac{11}{3}$			M1 allow $n = -\frac{11}{3}$ or just $-\frac{11}{3}$ oe for this mark allow the value $-\frac{11}{3}$ rounded or truncated to at least 2sf or
		−3	2	A1 Allow −3 with any sign
7	4 × 6 – 5 × (−3) seen			M1 Allow $\frac{1}{4\times6-5\times(-3)}$
		39	2	A1 If answer is $\frac{1}{39}$ or the inverse of the matrix, award M1 only
8 (a)		3.56×10^8	1	B1
(b)	$\frac{5.685 \times 10^{26}}{3.302 \times 10^{23}}$ (= 1721.683828)			M1
		1720	2	A1 oe eg 1.72×10^3 or 172×10 etc Must be 3sf

Question	Working	Answer	Mark	Notes	
9	Two of $2\sqrt{3}$, $10\sqrt{3}$ and $3\sqrt{3}$			M1	
	OR $\frac{\sqrt{27}}{\sqrt{27}} \times \frac{\sqrt{12}+\sqrt{300}}{\sqrt{27}}$				
	OR $\frac{\sqrt{3}}{\sqrt{3}} \times \frac{\sqrt{12}+\sqrt{300}}{\sqrt{27}}$				
	$\frac{2\sqrt{3}+10\sqrt{3}}{3\sqrt{3}}$ oe			M1	
	OR $\frac{\sqrt{324}+\sqrt{8100}}{27}$ oe				
	OR $\frac{\sqrt{36}+\sqrt{900}}{\sqrt{81}}$ oe				
	NB: no marks for an answer without working	4	3	A1	Dep on M2
10	$\frac{5}{8}\times\frac{4}{7}(=\frac{5}{14})$ or $\frac{5}{8}\times\frac{3}{7}(=\frac{15}{56})$ or $\frac{3}{8}\times\frac{5}{7}$ or $\frac{3}{8}\times\frac{2}{7}(=\frac{3}{28})$			M1	One correct product
	$\frac{5}{8}\times\frac{4}{7} + \frac{5}{8}\times\frac{3}{7} + \frac{3}{8}\times\frac{5}{7}$ or $1-\frac{3}{8}\times\frac{2}{7}$			M1	Fully correct method
		$\frac{50}{56}$ oe	3	A1	awrt 0.89
					SCM1 for $\frac{5}{8}\times\frac{4}{8} + \frac{5}{8}\times\frac{3}{8}\times 2\left(=\frac{50}{64}\right)$

Question	Working	Answer	Mark	Notes
11		$\frac{3}{x^4y^5}$	3	B3 fully correct eg $\frac{3x^{-4}}{y^5}$ or $\frac{3y^{-5}}{x^4}$ or $3x^{-4}y^{-5}$ Must be single terms (eg x^4 not xx^3) (B2 for 2 terms correct eg $\frac{3y^2}{x^4y^7}$ or $\frac{3x}{x^5y^5}$ etc) (B1 for 1 correct term eg $\frac{3xy^2}{x^5y^7}$ or $\frac{36y^2}{12x^4y^7}$ etc)
12		$\begin{pmatrix} 12 & 5 \\ 6 & -1 \\ 2 & 5 \end{pmatrix}$	3	M1 Correct dimension and at least one correct entry M1 (dep) Any three correct entries A1 All correct
13	$2\pi r = 24\pi$ oe ($r = 12$) Volume = $\frac{1}{3} \times \pi \times "12" \times "12" \times 40$	Volume = 6030 cm^3	3	M1 M1 (dep) A1 for awrt 6030 allow 1920π

Question	Working	Answer	Mark	Notes
14	$\frac{(2^p+1)(2^p+1)}{(2^p-1)(2^p+1)}$ or $\frac{(2^p+1)^2}{(2^p)^2-(1)^2}$ oe			M1
	$\frac{2^{2p}+2^p+2^p+1}{2^{2p}-1}$ oe			M1 (dep) method to expand numerator and denominator, condone one error (may be repeated error)
	$\frac{(2^2)^p+2\times 2^p+1}{(2^2)^p-1}$	$\frac{4^p+2^{p+1}+1}{4^p-1}$	3	A1 all steps shown and fully correct
15 (a) (i)		1, 2, 3, 5, 7, 9	1	B1 No repeats, any order
(ii)		3, 5, 7	1	B1 No repeats, any order
(iii)		1, 2, 3, 4, 5, 6, 7, 8, 9	1	B1 (Accept universal set) No repeats, any order
(b)	eg there are no elements in all three of *A*, *B*, *C* or $A \cap B = \emptyset$ as *A* has even numbers and *B* has odd numbers, so $A \cap B \cap C$ must be $\emptyset$ '*A* and *B* have nothing in common' 'there is nothing in common' 'there are no common elements' oe	reason	1	B1 A correct statement that shows the student knows there are no elements in common in the 3 sets. It is ok to state that A and B have nothing in common as this would also make the intersection of all 3 sets an empty set.

Question	Working	Answer	Mark	Notes	
16	eg $AD^2 + DC^2 = AC^2$ oe			M1	recognition of Pythagoras
	$(x - 4)^2 = x^2 - 4x - 4x + 16$ $(2x + 3)^2 = 4x^2 + 6x + 6x + 9$			M1indep	expansion of one of $(x - 4)^2$ or $(2x + 3)^2$, 3 out of 4 terms correct or 4 correct terms ignoring signs Allow even if not part of Pythagoras statement
	$(x - 4)^2 + (2x + 3)^2$ = "$x^2 - 4x - 4x + 16$" + "$4x^2 + 6x + 6x + 9$" (= $5x^2 + 4x + 25$)			M1	For equation all terms expanded (no brackets) all expansions must be 3 out of 4 terms correct or 4 correct terms ignoring signs
		Correct algebra plus statement	4	A1	fully correct plus statement related to ΔACD is right-angled

Question	Working	Answer	Mark	Notes
17 (a)			2	M1 exactly 4 values in a Venn diagram that total 32 A1 fully correct Venn diagram with all 4 values given
(b)	$\frac{\text{"9" + "12"}}{x}$ where $x >$ "9" + "12" or $\frac{y}{32}$ where $y < 32$ **OR** $1 - \frac{11}{32}$	$\frac{21}{32}$	2	M1 ft from their Venn diagram. If they do not have a total of 32 in their Venn diagram, allow the denominator to be their total A1 awrt 0.66 (0.65625) (not ft)
18	$24 = \frac{k}{4^3}$ oe $k = 1536$ $\therefore h = \sqrt[3]{\frac{\text{"1536"}}{3}}$	$h = 8$	4	M1 A correct equation with values of B and h substituted A1 M1 Must be the cube root. The value of k must be from a correct method A1

Question	Working	Answer	Mark	Notes
19	Rearranging so that the coefficient of x or y is the same in both equations e.g. multiplying just top $7x + 14y = -28$ or just bottom $14x - 2y = 22$ or multiplying both to give the same coefficient of x or y **OR** isolating x or y e.g. $x = -4 - 2y$ or $y = 7x - 11$ Subtracting or adding equations **OR** substitution of x or y to obtain an expression for y or x	$x = \frac{6}{5}$, 1.2 $y = \frac{-13}{5}$, – 2.6	4	M1 or inverse matrix $\begin{pmatrix} \frac{1}{15} & \frac{2}{15} \\ \frac{7}{15} & -\frac{1}{15} \end{pmatrix}$ oe M1 (dep) Or inverse matrix multiplied by $\begin{pmatrix} -4 \\ 11 \end{pmatrix}$ allow total of 1 slip in both Ms A1 oe Dep on M1 A1 Oe Dep on M1

Question	Working	Answer	Mark	Notes
20	30 × 4.5 + 40 × 10 + 30 × 16.5 + 25 × 30 (= 1780) OR 135 + 400 + 495 + 750 (= 1780) "1780" ÷ 125	14	4	M2 M2 for at least 3 correct products added (need not be evaluated) M1 for use of a value within interval (incl end points) for at least 3 products which must be added **OR** correct mid-points used for at least 3 products but not added M1 Dep on at least M1 A1 accept 14.2 or 14.24
21	$6 = -0.5 \times k$ oe $3x - 3 =$ "-12" $\times (x + 2)$ oe	$k = -12$ $-\frac{7}{5}$	4	M1 A1 M1 substitution of k in correct equation to find x dep on 1st M1 A1 oe

Question	Working	Answer	Mark	Notes
22	Lengths in the ratio $\sqrt{240} : \sqrt{1500}$ (= 2 : 5 or 2/5 oe) Volumes in the ratio $(\sqrt{240})^3 : (\sqrt{1500})^3$ (=8 : 125) $600 \times \frac{(\sqrt{1500})^3}{(\sqrt{240})^3}$ or $600 \div \left(\frac{\sqrt{240}}{\sqrt{1500}}\right)^3$ oe	9375	4	M1 M1 M1 complete method A1
23	40 ÷ 5 (=8) oe "8"(2x + 1) + 40 + "8"(x – 1) oe eg "8"(3x + 5) or (20x + 65) ÷ "8" or "8"(2x + 1 + x – 1) oe "8"(2x + 1) + 40 + "8"(x – 1) = 20x + 65 oe eg (20x + 65) ÷ "8" = 3x + 5 or "8"(2x + 1 + x – 1) = 20x + 65 – 40 For 24x – 20x = 65 – 40 oe	$x = \frac{25}{4}$ oe	5	M1 Calculation to work out multiplier or 8 (could be use of 8 in working) M1 A correct expression for total of ratios (ie 8(A + B + C)) or total of ratios A + C (ie 8(A + C)) "8" must be from correct working M1 A correct equation M1 A correct equation with terms in x on one side and constant terms the other A1

Question	Working	Answer	Mark	Notes
24	$\angle CBQ = 180 - 42 - 42$ (= 96) $\text{Ext}_5 = \frac{360}{5}$ (= 72) | $\text{Int}_5 = \frac{(5-2)\times 180}{5}$ (= 108) $\text{Ext}_n = 96 - \text{“72”}$ (= 24) | $\text{Int}_n = 360 - \text{“96”} - \text{“108”}$ (= 156) $n = \frac{360}{24}$ | $\frac{(n-2)\times 180}{n} = \text{“156”}$ (oe)	15	5	M1 may be on diagram M1 may be on diagram M1 may be on diagram M1 A1

Question	Working	Answer	Mark	Notes
25	Area $ABC = \frac{1}{2}(2x+1)(8x-4)\sin 30$ oe			M1 Must correctly use brackets unless recovered
	Area $DEF = \frac{1}{2}\times 10(1-x)$ oe			M1 Must correctly use brackets unless recovered
	$4x^2 + 5x - 6$ (= 0) oe eg $16x^2 + 20x - 24$ (=0)			A1
	For a correct method to solve their 3 term quadratic eg $(x+2)(4x-3)$ (= 0) eg $x = \frac{-\text{"5"} \pm \sqrt{\text{"5"}^2 - 4\times\text{"4"}\times\text{"}-6\text{"}}}{2\times\text{"4"}}$			M1 for solving their 3 term quadratic, dep on M1 previously gained
		$x = \frac{3}{4}$ oe	5	A1
	Note: Inclusion of the solution $x = -2$ in their answer loses the final A mark			

Question	Working	Answer	Mark	Notes
26 (a) (i)	Equal intersecting arcs, centres *C* and *D*	perpendicular bisector drawn	4	M1 A1 a correct bisector with correct arcs
(ii)	Arc centre *B* to intersect *AB* and *BC*, and equal intersecting arcs from these points of intersection	angle bisector drawn		M1 A1 a correct bisector with correct arcs
(b)	Arc 6 cm from *D*	Region *R* indicated		M1 for an arc 6 cm from *D* in tolerance
			2	A1 ft on their angle bisector and perpendicular bisector
27	"2*x*" × 60 × "*x*" = 27000 or 2*CF* × 60 × *CF* = 27000 oe $CF = x = \sqrt{\frac{27000}{60 \times 2}}$ (= 15) $AC = \sqrt{"30"^2 + 60^2}$ $(= \sqrt{4500} = 67.0... = 30\sqrt{5})$ $AF = \sqrt{"15"^2 + "67.08"^2}$ $(= \sqrt{4725} = 68.7.... = 15\sqrt{21})$ eg $FAC = \tan^{-1}\left(\frac{"15"}{"67.0"}\right)$ (= 12.60...°)	Shown with all figures correct	6	M1 Volume must indicate that *AB* = 2*CF* M1 complete method to find *CF* M1 complete method to find *AC* M1 complete method to find *AF* M1 method to find angle *FAC* A1 Allow *AF* = 68.7 – 68.8 and *FAC* = awrt 12.6

Question	Working	Answer	Mark	Notes
28 (a)	$6(-2)^3 - (-2)^2 + k(-2) - 10 = 0$ oe eg $6 \times -8 - 4 - 2k - 10 = 0$ or $-48 - 4 - 2k - 10 = 0$ **OR** $6(-2)^3 - (-2)^2 + -2 \times -31 - 10$			M1 Form an equation in k by substituting $x = -2$ and use of expression = 0 **OR** substitute -31 for k and -2 for x.
	$2k = -62$, $k = -31$ **OR** $6(-2)^3 - (-2)^2 + -2 \times -31 - 10$ **= 0**	$k = -31$	2	A1 Show that $x = -31$ **OR** use of -2 and -31 gives 0
(b)	$6x^3 - x^2 - 31x - 10 = (x + 2)(6x^2 \quad)$ **OR** $6x^3 - x^2 - 31x - 10 = (x + 2)(\quad -5)$		4	M1 Start to find the quadratic
		$6x^2 - 13x - 5$		A1 fully correct
	$6x^2 - 13x - 5 = (3x + 1)(2x - 5)$			M1 For factorising any 3 term quadratic which when expanded, the result gives at least 2 of the 3 terms from their trinomial eg $(3x - 1)(2x + 5)$ will give $6x^2$ and -5 terms
		$(x + 2)(3x + 1)(2x - 5)$		A1 Must see complete factorisation ISW if complete factorisation shown and then values for x found