

Mark Scheme (Results)

June 2016

Pearson Edexcel International GCSE Mathematics B (4MB0) 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)
- \circ 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 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If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.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.

International GCSE Maths

Apart from question 15 (where the mark scheme states otherwise) the correct answer, unless obtained from an incorrect method, should be taken to imply a correct method.

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Q	Working	Answer	Mark	Notes
1 a	550×1.852		2	M1
		1019 (km/h) (1018.6)		A1
b	$\frac{500}{1.852}$ (o.e.)		2	M1
		270 (knots) (269.978)		A1
				Total 4 marks

2	$(\mathbf{AB}) = \begin{pmatrix} -8 & -1 \\ 14 & 2 \end{pmatrix}$	5	B2 (-1ee)
			M1
	$\begin{pmatrix} -12 & -8 \\ 20 & 12 \end{pmatrix}$ (at least one term correct)		A1
	OR at least one correct		
	equation in λ		
	$\lambda = 4$		A1 no incorrect working seen
			Total 5 marks

3 a	8	4	5	B1
	$\begin{array}{c} \begin{array}{c} & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & & \\ & & & & \\ & & & & & \\ $			
		8 - x, 13 - x, 7 - x		B1
		16, 13, 9		B1
bi	Equating all their terms, from their diagram, (at least 7 terms) to 60 (o.e.)			M1
bii	x = 5			A1
				Total 5 marks

4 a	-1 = a + b (o.e.)		1	B1	accept $-1 = a \times 1^2 + b$
b	23 = 9a + b (o.e.)		1	B1	accept $23 = a \times 3^2 + b$
c	attempt to eliminate either <i>a</i> or <i>b</i> (allow one slip)		3	M1	
		a = 3, b = -4		A1	
				A1	
d	$f(x) \ge "-4"$		2	B1 ft	This could be in the form
	Critical value identified -4 " in a range				$-4 \le x \le 3$
	statement				
	A correct mathematical statement			B1 ft	Accept strong inequality at
	(Accept: $f(x) \ge -4^{"}, y \ge -4^{"}, [-4^{"},\infty)$,				infinity
	$\{x: f(x) \ge "-4"\}$				
					Total 7 marks

5 a		Seeing a mid-class value	4	B1	
	One correct $f_x/100$			M1	
	OR			1,11	
	a completely correct numerator				
	$5 \times 10 \pm 25 \times 30 \pm 33 \times 45 \pm 22 \times 55 \pm 15 \times 75$			M1	
	$\frac{5\times10+25\times50+55\times45+22\times55+15\times75}{100}$			1111	
	$\left(-\frac{4620}{2}\right)$				
	$\left(-\frac{100}{100}\right)$				
		46.2 (km/h) (accept		A1	
		46 from correct			
		working)			
b		22+15 seen	2	B1	
		37 (0.27, 270())		B1	
		$\frac{100}{100}$ (0.57, 57%)			
С		Heights of 1, 13.2,	4	B1,	Tolerance of $\pm 1/2$ small square
		8.8 and 2 and		B1,	' 1
		correct widths		B1,	
				B 1	
					Total 10 marks

6	attempt to factorise $x^2 + 3x - 28$		5	M1
		(x+7)(x-4)		A1
	$r^{2} + 6r + 9 = 16$ (and another)			M1
	x + 0x + 9 - 10 (one error)			ind
	OR			
	OR			
	(x+3+4)(x+3-4) (one error)			
		(x+7)(x-1)		A1
		(x - 4)		A1 Do not isw
		<u> </u>		
		(x-1)		
				Total 5 marks

7 ai	80° (opposite angles of cyclic quadrilateral)	4	B1 B1
aii	62° (alternate segment)		B1 B1
b	$\angle AOE = 124^{\circ}$ (angle at the centre)	4	B1 B1
	$\angle OAE = \frac{180 - 124}{2}$ (isosceles triangle)		B1 B1
	conclusion (last mark lost if no conclusion)		
	ALT 1 $\angle ADE = 62^{\circ}$ and $\angle DEA = 90^{\circ}$ One reason (i.e. same segment or angle in a semi-circle) $\angle DAE = 180^{\circ} - (62^{\circ} + 90^{\circ})$ Reason: Angle sum of triangle Conclusion (last mark lost if no conclusion)		B1 B1 B1 B1
	ALT 2 $\angle ACD = 90^{\circ}$ and $\angle ECD = 28^{\circ}$ One reason (i.e. angle in a semi-circle) $\angle DAE = 28^{\circ}$ Reason: Angles in same segment		B1 B1 B1 B1
	ALT 3 $\angle OEQ / OEP = 90^{\circ}$ (tangent/radius) $\angle OEA = 90^{\circ} - 62$ and $\angle OAE = 28^{\circ}$ Reason: isosceles triangle		B1, B1 B1 B1

		Alt 4:		
		$\angle DEA = 90^{\circ}$ (angle in a semicircle)		B1
				B1
		$\angle DEP = 28^\circ = (\angle OAE)$ (alternate segment)		B1
				B1
с	"62"–28 or		2	M1
	180-("80"+28+38)			
		34°		A1
				Total 10 marks

8 a	5x.x + 5x(-80) + 192.x + 192(-80)		2	M1	
		$5x^2 - 208x - 15360$ (cwo) (isw)		A1	
b		$\frac{480}{x}$	1	B1	
c	$\frac{480}{x} + 2.5$		2	M1	
		$\frac{480+2.5x}{x}$		A1	$(\text{Accept} \ \frac{960+5x}{2x})$
d		$(x-16)''\left(\frac{480+2.5x}{x}\right)'' = 544$	1	B1 ft	
	(10)(400 - 2.5) 544				· · · · · · · · · · · · · · · · · · ·
e	(x-16)(480+2.5x) = 544x	-	3		removing denominator(s) in x
		$480x + 2.5x^2 - 7680 - 40x = 544x$		AI	
		Correct conclusion from cc work		A1	
f	$5x^2 - 208x - 15360 = (5x + 192)(x)$ OR Correct substitution into formula	-80)	3	M1	
		X=80		A2	
					Total 12 marks

9	ai		$2\mathbf{a} + \mathbf{b}$	3	B1
	aii		$\frac{5}{4}\mathbf{b}$		B1
	aiii		$\mathbf{a} + "\frac{5}{4}\mathbf{b}"$		B1ft
	b		$\mu("2\mathbf{a} + \mathbf{b''})$	1	B1ft
	С		$\mathbf{a} + \lambda \left(\mathbf{a} + \frac{5}{4} \mathbf{b}^{\mathbf{a}} \right)$	1	B1ft
	d	Equating components of one of a or b .		5	M1
			$2\mu = 1 + \lambda$ $\mu = \frac{5}{2}\lambda$		A1
			$\frac{2\mu - 1 + \lambda}{4}$		A1
			2 - 2 - 5		A1
			$x - \frac{1}{3}, \mu - \frac{1}{6}$		A1
	e	20 "5/6"		2	M1
		$\frac{1}{\text{Area of } ADB} = \frac{1}{1 - \frac{5}{6}}$			
		OR			
		$A_{res} ADB = 20.116 11 20$			
		$\frac{1}{5}$			
	_		4 square units		A1
					Total 12 marks

10 a	$\frac{360}{5}$ (=72°) OR		2	M1	
	$(2 \times 5 - 4) \times 90 \ (=540^{\circ})$ $180 - \frac{360}{5} \ (=108^{\circ}) \ AG$ OR			M1 (dep)	
	$\frac{(2\times5-4)\times90}{5}$ (=108°) AG				
b	$AG^2 = 10^2 + 5^2 - 2 \times 10 \times 5 \times \cos^{108^{\circ}}$		3	M1	Penalise incorrect rounding only once in the remainder of the question Only accept 72° for 108 and only award marks for Method
	$= 125 - 100 \cos'' 108^{\circ}''$			M1 (dep)	
		AG = 12.5 (12.48606)		A1	
с	$\frac{5}{\sin\angle GAB} = \frac{"12.5"}{\sin"108^\circ"}$		3	M1	
	$\sin \angle GAB = \frac{5 \times \sin^{"}108^{\circ "}}{"12.5"}$			M1 (dep)	
		$\angle GAB = 22.4$		A1	(Accept 22.3)
	Alt: $5^2 = 10^2 + "12.5"^2 - 2 \times 10 \times "12.5" \times \cos \angle GAB$			M1	
	$\cos \angle GAB = \frac{10^2 + "12.5"^2 - 5^2}{2 \times 10 \times "12.5"}$			M1 (dep)	

d	$\angle GAF = "108" - 2 \times "22.4" (=63.2)$		3	M1	
	Area =			M1	
	$\frac{1}{2}$ × "12.5" × "12.5" × sin(108 - 2 × "22.4")			(dep)	
		69.6 cm^2		A1	(Accept 69.5. 69.6, 69.7, 69.8 or 69.9)
e	$\frac{"69.6"}{172} \times 100$	3	3	M1	
	(1 "69.6") 100 (M1	
	$\left(\frac{1-172}{172}\right)^{\times 100}$ (o.e.)			(dep)	
		59.5%		A1	(Accept 59.4, 59.5 or 59.6)
					Total 14 marks

11	а		h-20	1	B1	
	b		$V = \frac{1}{3}\pi r^2 ("h - 20")$	1	B1 ft	
			(o.e.)			
	С	$V = \frac{1}{3}\pi r^2 (32 - r - 20)$		2	MI	Substituting $32 - r$ into their $\frac{1}{3}\pi r^2$ (" $h - 20$ ")
			correct conclusion (from completely correct working)		A1	
	d		43, 85, 67	3	B1, B1, B1	
	e		-1 mark for: any straight line segments each point missed $(\pm \frac{1}{2}$ small square) each missed segment each point incorrectly plotted $(\pm \frac{1}{2}$ small square) tramlines very poor curve	3	B3	ft from their table values
	f	y = 80 drawn (can be implied by values)	(0, 0, 1, (1, 1/2)) = 11	3	M1	
			square $(\pm 1/2)$ small		A1 A1	

g	$\pi \times 6.8 \times 6.8 \times 20$ or $\pi \times 9.1 \times 9.1 \times 20$		3	M1	For this first M mark, the required expression may be embedded with anything else So, accept $\pi \times "6.8" \times "6.8" \times 20 + 80\pi$ (o.e.) or $\pi \times "9.1" \times "9.1" \times 20 + 80\pi$ (o.e.)
	$\pi \times "9.1" \times "9.1" \times 20 - \pi \times "6.8" \times "6.8" \times 20$			M1 (dep)	For the 2^{nd} M1 (dep), if embedded it must be with a correct expression As for the first M mark accept expressions involving 80π
		$\begin{array}{c} 2300 \text{ cm}^3\\ \text{(Accept answers in the}\\ \text{range } 1900 \rightarrow 2500\text{)} \end{array}$		A1 ft	2300 cm ³ (Accept answers in the range $1900 \rightarrow 2500$)
					Total 16 marks

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