Mark Scheme (Results)

Summer 2019

Pearson Edexcel International GCSE In Mathematics B (4MB1) Paper 01

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Summer 2019
Publications Code 4MB1_01_2019_MS

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.
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 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 to another.

<table>
<tr><th colspan="2">Question</th><th>Working</th><th>Answer</th><th>Mark</th><th>Notes</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>8700</td><td>1</td><td>B1 oe</td></tr>
<tr><td></td><td>(b)</td><td></td><td>0.037</td><td>1</td><td>B1 oe</td></tr>
<tr><td colspan="6">Total 2 marks</td></tr>
<tr><td>2</td><td></td><td>$18=2\times3^2$ or $18=6\times3$ or
$30=2\times3\times5$ $30=6\times5$
$48=2^4\times3$ $48=6\times8$
or oe
<table>
<tr><td>2</td><td>18</td><td>30</td><td>48</td></tr>
<tr><td>3</td><td>9</td><td>15</td><td>24</td></tr>
<tr><td></td><td>3</td><td>5</td><td>8</td></tr>
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<table>
<tr><td>2</td><td>18</td><td>30</td><td>48</td></tr>
<tr><td>2</td><td>9</td><td>15</td><td>24</td></tr>
<tr><td>2</td><td>9</td><td>15</td><td>12</td></tr>
<tr><td>2</td><td>9</td><td>15</td><td>6</td></tr>
<tr><td>3</td><td>9</td><td>15</td><td>3</td></tr>
<tr><td>3</td><td>3</td><td>5</td><td>1</td></tr>
<tr><td>5</td><td>1</td><td>5</td><td>1</td></tr>
<tr><td></td><td>1</td><td>1</td><td>1</td></tr>
</table></td><td></td><td></td><td>M1 Prime factors for two of 18, 30, 48 (or equivalent) or

lists multiples of 18, 30 and 48 (at least 2 multiples, not inc number itself for all three of the numbers, ie (18),36,54, … (30),60,90, … (48),96,144,…) or

table method</td></tr>
<tr><td></td><td></td><td></td><td>720</td><td>2</td><td>A1</td></tr>
<tr><td colspan="6">Total 2 marks</td></tr>
<tr><td>3</td><td>(a)</td><td></td><td>Second row first square</td><td>1</td><td>B1 Or row four third square</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Second row third square</td><td>1</td><td>B1</td></tr>
<tr><td colspan="6">Total 2 marks</td></tr>
<tr><td>4</td><td></td><td>$\frac{9}{4}\times\frac{6}{23}$ or $\frac{9}{4}\div\frac{23}{6}$</td><td></td><td></td><td>M1 Or equivalent method for dividing two fractions</td></tr>
<tr><td></td><td></td><td>$\frac{54}{92}=\frac{27}{46}$ or $\frac{9}{2}\times\frac{3}{23}=\frac{27}{46}$ or $\frac{9}{2}\div\frac{23}{3}=\frac{27}{46}$ or $\frac{27}{12}\div\frac{46}{12}=\frac{27}{47}$ oe</td><td>$\frac{27}{46}$</td><td>2</td><td>A1 Dependent on all working seen</td></tr>
<tr><td colspan="6">Total 2 marks</td></tr>
</table>

Question		Working	Answer	Mark	Notes
5					M1 One term differentiated correctly
			$8x^3+\frac{6}{x^3}$	2	A1 oe (e.g. $8x^3+6x^{-3}$)
					Total 2 marks
6		$\frac{5-(-10)}{-3-2}$			M1 Condone one sign error or award if gradient of 3
			-3	2	A1
					Total 2 marks
7		$8x^2+12x-10x-15$			M1 Four terms seen with at least three correct (with signs) or two terms correct in a three term expression
			$8x^2+2x-15$	2	A1 Correct answer with no working scores both marks. Do not ignore subsequent working.
					Total 2 marks
8		$(24-5(3))+(24-5(10))$			M1 Or both terms correct but not added. Terms are 9 and -26
			-17	2	A1
					Total 2 marks
9		$\frac{360}{9}$ or $9n=360$ or $180(n-2)=171n$ oe			M1
			40		A1
					Total 2 marks
10		7.60×0.85			M1 Or for working out 15% of £7.60 (=£1.14 or 114p) and taking away from £7.60 or 760. Units not needed
			£6.46	2	A1 accept 646p
					Total 2 marks

Question		Working	Answer	Mark	Notes
11	(a)		$6x^7$	1	B1
	(b)				M1 for two terms correct as part of a product. Do not ISW
			$64a^6b^9$	2	A1
					Total 3 marks
12	(a)		$f(x) \geqslant -2$	1	B1 or $y \geqslant -2$ or $f \geqslant -2$ or set notation $[-1, \infty)$ or $f : x \geqslant -2$ but do not allow $x \geqslant -2$
	(b)	$[fg(2) =]f\left(\frac{12}{2^3+4}\right)[=f(1)]$ or $[fg(x) =]\left(\frac{12}{x^3+4}\right)^2 - 2$			M1 Evidence of correct first step eg $\frac{12}{2^3+4}$ or g(2) = 1 or f(1) or $\left(\frac{12}{x^3+4}\right)^2 - 2$
			-1	2	A1 Must not come from any incorrect working
					Total 3 marks
13	(a)		192	1	B1
	(b)	$3(c^2 + 2c)$ or $c(3c + 6)$			M1
			$3c(c+2)$	2	A1 allow $(3c + 0)(c + 2)$ Do not IS
					Total 3 marks

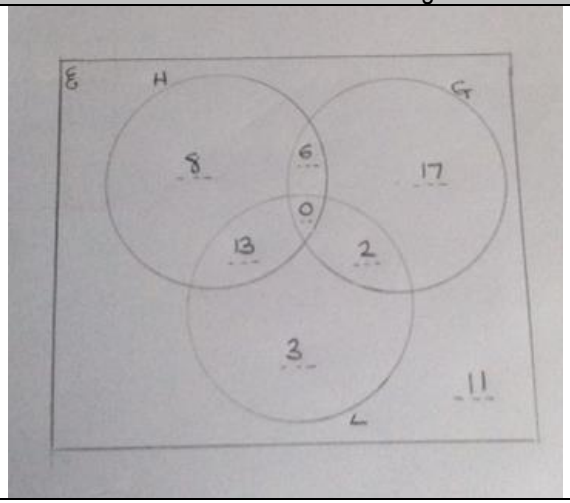
Question		Working	Answer	Mark	Notes
14		$\frac{(x-3)(3x+1)}{4(x-3)(x+3)}$			M1 allow any one correct factorisation of numerator or denominator $4(x^2-9)$, $(2x+6)(2x-6)$, $(4x-12)(x+3)$, $(x-3)(4x+12)$, $2(x-3)(2x+6)$ $2(2x-6)(x+3)$ oe or $(x-3)(3x+1)$ These may appear on their own rather than as part of the fraction
					M1 Both numerator and denominator factorised correctly. These may appear on their own rather than as part of the fraction. The denominator does not need to have a common factor but it must have a pair of correct brackets. (not $4(x^2-9)$) but allow other factorisation.
			$\frac{3x+1}{4(x+3)}$	3	A1 Final answer – allow $4x + 12$ in the denominator. Do Not allow $2(2x + 6)$
					Total 3 marks

Question		Working		Answer	Mark	Notes
15		**Side/Angle**	**Reason**			
		$BQ = QC$	Q is **midpoint/bisection** of BC			M1 Identifying a pair of equal sides/angles with a reason. They must state the pair of sides/angles and the reason must include the words in bold. M1 identifying a second relevant pair of equal sides/angles with a reason. They must state the pair of sides/angles and the reason must include the words in bold.
		$PQ = RC$	$\boldsymbol{AR = RC}$ and $\boldsymbol{AR = PQ}$ (opposite side of a **parallelogram** are equal)			
		$QR = BP$	$\boldsymbol{AP = PB}$ and $\boldsymbol{AP = RQ}$ (opposite side of a **parallelogram** are equal)			
		$\angle PBQ = \angle RQC$	**Corresponding** angles			
		$\angle BQP = \angle QCR$	**Corresponding** angles			
		$\angle BPQ = \angle QRC$	$\angle BPQ = \angle PQR$ and $\angle PQR = \angle QRC$ **Alternate** angles **or** $\angle APQ = \angle ARQ$ & angle on a **straight line**			
				SSS or SAS or ASA or AAS with the third relevant angle or side shown to be equal.	3	A1 must state SSS, SAS, ASA or AAS and have all 3 relevant sides/angles shown to be equal **NB** There may be alternative reasons. Look for at least 1 correct mathematical word for each pair
						Total 3 marks
16	(a)			15	1	B1
	(b)	$0.05 + 0.1 + (2x - 0.1) + 0.2 + 0.3 + (3x + 0.2) = 1$ **oe**				M1 Using $\sum p = 1$. You may award the mark if this is seen in part (a) Award if they get $x = 0.05$ oe
						M1ft for subst their x into $3x + 0.2$ need to see working (or into $2x - 0.1$ and doing $1 - 0.65 - (\text{“their } 2x - 0.1\text{”})$) to find the probability of 6. (x must be between 0 and 0.27)
				0.35	3	A1 Allow 35%, $\frac{7}{20}$ oe
						Total 4 marks

Question		Working	Answer	Mark	Notes
17	(a)	$\frac{1}{2}(2)(6)\sin 30^\circ$ oe			M1
			3	2	A1
	(b)	$\cos x^\circ = \frac{4}{12}$ or $\sin x° = \frac{[(\sin 90)]\sqrt{12^2-4^2}}{12}$ or $\tan x° = \frac{\sqrt{12^2-4^2}}{4}$ or $\cos x° = \frac{12^2+4^2-(\sqrt{12^2-4^2})^2}{2\times 12\times 4}$			M1 Complete method (e.g. Pythagoras followed by sine, cosine rule, etc.) Allow $8\sqrt{2}$ or awrt 11.3 for $\sqrt{12^2-4^2}$
			70.5	2	A1 awrt 70.5
					Total 4 marks

Question		Working	Answer	Mark	Notes
18					M1 One of $\frac{3}{9}\times\frac{2}{11}$ or $\frac{2}{9}\times\frac{4}{11}$ or P(*R*, not *R*) ie $\frac{3}{9}\times\frac{9}{11}$ accept $\left(\frac{3}{9}\times\frac{4}{11}+\frac{3}{9}\times\frac{5}{11}\right)$ or P(*Y*, not *Y*) ie $\frac{2}{9}\times\frac{7}{11}$ accept $\left(\frac{2}{9}\times\frac{2}{11}+\frac{2}{9}\times\frac{5}{11}\right)$ or P(*G*, not *G*) ie $\frac{4}{9}\times 1$ accept $\left(\frac{4}{9}\times\frac{2}{11}+\frac{4}{9}\times\frac{4}{11}+\frac{4}{9}\times\frac{5}{11}\right)$
		$\left(\frac{3}{9}\times\frac{2}{11}\right)+\left(\frac{2}{9}\times\frac{4}{11}\right)$			M1 Or two of $\frac{3}{9}\times\frac{9}{11}$ accept $\left(\frac{3}{9}\times\frac{4}{11}+\frac{3}{9}\times\frac{5}{11}\right)$ or $\frac{2}{9}\times\frac{7}{11}$ accept $\left(\frac{2}{9}\times\frac{2}{11}+\frac{2}{9}\times\frac{5}{11}\right)$ or $\frac{4}{9}\times 1$ accept $\left(\frac{4}{9}\times\frac{2}{11}+\frac{4}{9}\times\frac{4}{11}+\frac{4}{9}\times\frac{5}{11}\right)$
		$1-\left(\left(\frac{3}{9}\times\frac{2}{11}\right)+\left(\frac{2}{9}\times\frac{4}{11}\right)\right)$			M1dep on both previous method marks being awarded. Attempt at correct calculation (oe)
			$\frac{85}{99}$	4	A1 oe awrt 0.86 awrt 85%
					Total 4 marks
19		UB of 1.32 is 1.325			B1 1.325 seen implied by correct answer
		LB of 9.8 is 9.75			B1 9.75 seen implied by correct answer
		$6.28\sqrt{\frac{1.325}{9.75}}$			M1 Subst in their $L > 1.32$ and $g < 9.8$
			2.32	4	A1 awrt 2.32
					Total 4 marks
20		fd = 1.6 , 0.5, 1.4, 0.6, 0.2			M1 for use of area to work out freq density. Implied by the

Question		Working	Answer	Mark	Notes
					frequency of 30 – 45 being 9 or a bar drawn at the correct height
			7, 9 Heights at 0.5 and 0.2	4	A3 for all four correct, A2 for three and A1 for two The heights must be drawn on the histogram and be for 10 – 20 10 small squares high, for 45 – 60 4 small square high
					Total 4 marks
21		$x(3w-2y)-15(3w-2y)=3(x+2y)$ or $(3w-2y)(x-15)=3(x+2y)$			M1 Multiply through by $(3w-2y)$ and 3 – not necessarily at the same time
		$3x+2xy-3xw=24y-45w$			M1 Collect x terms on one side and other terms on the opposite side (indep of first M)
		$x(3+2y-3w)=24y-45w$			M1 taking x out as a common factor of an equation correctly
			$x=\dfrac{24y-45w}{3+2y-3w}$	4	A1 Final answer – or equivalent – but must a single fraction . The numerator and denominator need not be simplified. Do not ISW
					Total 4 marks
22		$BF=\sqrt{0.5^2+1.2^2}$ $[\Rightarrow BF=1.3]$			M1 Award for $\sqrt{0.5^2+1.2^2}$ or 1.3 or correct method using trig to find an angle and then to find FB
		[Area of triangle *ABF* (or *CDE*)] = $0.5\times0.5\times1.2$ [=0.3] or [area of *ABF* + *DCE* =] $2\times0.5\times0.5\times1.2$ [=0.6]			M1 Allow use of $\frac{1}{2}ab\sin c$ with a correct method used to find the angle
		[Area of rectangle *ADEF*] = 0.5×2.3 [=1.15] **and** [Area of rectangle *ABCDJ* =1.2×2.3 [=2.76]			M1
		[Area of rectangle *BCEF*]= $2.3\times$"1.3" [=2.99]			M1 dep on 1st M1 being awarded – allow their 1.3
			7.5	5	A1 cao
					Total 5 marks

Question		Working	Answer	Mark	Notes
23	(a)			3	B3 for all 8 correct B2 for 6 or 7 correct B1 for 4 or 5 correct If all other numbers are correct allow a blank for zero. Allow if written as a sum eg 18 – 2 – 13 Do not allow entries in terms of a letter eg *x*
	(b)		14	1	B1ft Allow ft for "their 8"+"their 6" but do not award ft if one of the required areas is a blank or if in terms of *x*
	(c)		22	1	B1ft Allow ft for "their 17"+"their 2"+"their 3" but do not award ft if one of the required areas is a blank
					Total 5 marks

Question		Working	Answer	Mark	Notes
24	(a)	$\overrightarrow{YX} = \overrightarrow{YO} + \overrightarrow{OX}$ or $\overrightarrow{YX} = \overrightarrow{OX} - \overrightarrow{OY}$ or $3\mathbf{a} - 5\mathbf{b} + 2\mathbf{a} + 3\mathbf{b}$			M1do not accept $\overrightarrow{XY}$
			$5\mathbf{a} - 2\mathbf{b}$	2	A1 oe
	(b)	$\left[\overrightarrow{YZ} = \overrightarrow{OZ} - \overrightarrow{OY} =\right]\left(-\frac{2}{9}\mathbf{a} + \frac{35}{9}\mathbf{b}\right) - \left(-3\mathbf{a} + 5\mathbf{b}\right)$ $\left[\overrightarrow{ZX} = \overrightarrow{ZO} + \overrightarrow{OX} =\right] - \left(-\frac{2}{9}\mathbf{a} + \frac{35}{9}\mathbf{b}\right) + 2\mathbf{a} + 3\mathbf{b}$ $\left[\overrightarrow{ZX} = \overrightarrow{YX} - \overrightarrow{YZ} =\right]\left("5\mathbf{a} - 2\mathbf{b}"\right) - \left(\frac{25}{9}\mathbf{a} - \frac{10}{9}\mathbf{b}\right)$ $\left("5\mathbf{a} - 2\mathbf{b}"\right) = k\left("\frac{20}{9}\mathbf{a} - \frac{8}{9}\mathbf{b}"\right)$ $j\left("5\mathbf{a} - 2\mathbf{b}"\right) = \left("\frac{20}{9}\mathbf{a} - \frac{8}{9}\mathbf{b}"\right)$			M1 any 1 correct method. ft their $\overrightarrow{YX}$ from part a. and their KZ in the 4/5th line. May be implied by one of $\overrightarrow{YZ} = \frac{25}{9}\mathbf{a} - \frac{10}{9}\mathbf{b}$ $\overrightarrow{ZX} = \frac{20}{9}\mathbf{a} - \frac{8}{9}\mathbf{b}$ $k = \frac{4}{9}$ $j = \frac{9}{4}$
		$\overrightarrow{YZ} = \frac{25}{9}\mathbf{a} - \frac{10}{9}\mathbf{b}$ **and** $\overrightarrow{ZX} = \frac{20}{9}\mathbf{a} - \frac{8}{9}\mathbf{b}$ **or** $k = \frac{4}{9}$ **or** $j = \frac{9}{4}$			A1 accept decimals for fractions if meaning clear
			$5:4$	3	A1 Allow $\frac{5}{4}:1$ **or** $1:\frac{4}{5}$ **or** 1.25 : 1 **or** 1 : 0.8 do not allow $\frac{4}{5}\overrightarrow{YX} = \overrightarrow{ZX}$ oe
					Total 5 marks

Question		Working	Answer	Mark	Notes
25	(a)		54		B1
		eg The sum of the **opposite** angles in a **cyclic** quadrilateral is **180**°	Reason	2	B1 need bold – other reasons may be given - must be associated with method used (see below for bold words)
	(b)	$\angle BOD = 108^\circ$			M1
		360 – (108 + 126 + 62)			M1ft their 108 but must be clear it is *BOD*
			64		A1
		Angle at **centre** of a circle is **twice** angle at the **circumference** **or** angles in a **quadrilateral** add up to **360**° **or** angles at a **point** add up to **360**°	Reason	4	B1 need one reason only and bold words – must be associated with method used
		<u>Alternative method marks 1</u> $\angle BCO = 62^\circ$			M1
		$\angle OCD = 126 - 62$			M1ft their 62 but must be clear it is *BCO*
			64		A1
		Base(oe) angles of an **isosceles** triangle are the same			B1 need bold words – must be associated with method used
		<u>Alternative method marks 2</u> Let $\angle ODA = y \ \ \therefore \angle ABO = "54" + y$			M1ft Using their part (a)
		$\angle CDA = 360 - 126 - 62 - "54" - ("54" + y)$			M1
			64		A1
		Isosceles triangle, angles in a **triangle** add up to **180**° and angles in a **quadrilateral** add up to **360**°	Reason		B1 need one reason only and bold words – must be associated with method used
					Total 6 marks

Question		Working	Answer	Mark	Notes
26		$\mathbf{A}^2 = \begin{pmatrix} -11 & 9 \\ -15 & -14 \end{pmatrix}$			M1Condone one error
		$\mathbf{AB} = \begin{pmatrix} 11 & 2k-3 \\ -19 & -5k-1 \end{pmatrix}$			M1 Condone one error
		$\mathbf{A}^2 - \mathbf{AB} = \begin{pmatrix} -22 & 12-2k \\ 4 & 5k-13 \end{pmatrix}$			A1 cao
		$\det\left(\mathbf{A}^2 - \mathbf{AB}\right) = -22(5k-13) - 4(12-2k)$			M1 ft their $\mathbf{A}^2 - \mathbf{AB}$
		$-22(5k-13) - 4(12-2k) = 3k + 28 \Rightarrow k = ...$			M1dep on previous M1- Sets their determinant equal to $3k + 28$ and attempts to solve for k
			$k = 2$	6	A1
					Total 6 marks
27		Area of large semicircle = $\frac{1}{2}\pi x^2$ **or** half large semicircle = $\frac{1}{4}\pi x^2$			M1
		Area of small circle = $\pi\left(\frac{x}{2}\right)^2$ **or** half small circle = $\frac{1}{2}\pi\left(\frac{x}{2}\right)^2$			M1
		Shaded region = $\frac{1}{2}\left(\frac{1}{2}\pi x^2 - \pi\left(\frac{x}{2}\right)^2\right)\left[= \frac{1}{8}\pi x^2\right]$			A1
		Perimeter = $x + \frac{1}{4}(2\pi x) + \frac{1}{2}\left(2\pi\left(\frac{x}{2}\right)\right)\left[= \pi x + x\right]$			M1 dep on first two methods.
		$"\frac{\pi x^2}{8}" = "\pi x + x"$			M1 Equates their expressions for the perimeter and area of shaded region
			$x = \frac{8(\pi+1)}{\pi}$	6	A1 Or equivalent
					Total 6 marks

Question		Working	Answer	Mark	Notes
28	(a)	$[v=]-9t^2+12t+k$			M1 A three term expression is needed with 1 correct term or a 4 term expression with 2 terms correct
		$-9(2)^2+12(2)+k=9$			M1dep Substituting $t = 2$ into their equation and equating to 9 Allow substitution of 21 and showing it equals 9
			$k=21$	3	A1 stating $k = 21$ following a fully correct solution with no errors. Note that answer given in question
28	(b)	$-9t^2+12t+21=0$			M1
		eg $(3t-7)(t+1)=0$			M1 Solving their trinomial quadratic. For factorising any 3 term quadratic which when expanded, the result gives at least 2 of the 3 terms from their trinomial. correct use of formula by substituting values in correctly or completing the square. Allow one slip.
			$\frac{7}{3}$	3	A1 oe awrt 2.3 with negative value rejected
28	(c)	$OA=-3("7/3")^3+6("7/3")^2+21("7/3")+4$			M1ft Substitute their positive t from part (b) into expression for x
			48	2	A1 cao do not ISW
					Total 8 marks

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