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Mark Scheme (Results)

Summer 2024

Pearson Edexcel International GCSE
In Mathematics B (4MB1) 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
- awrt – answer which rounds to
- eeoo – each error or omission
- cas – Correct answer scores full marks (unless from obvious incorrect working)
- wr – working required

- **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 award the lowest mark, unless the subsequent working 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.

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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.

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Question		Working	Answer	Mark	Notes
1	(a)		7400	2	B1 accept 7.4×10^{3} and 7.400×10^{3} and 74×10^{2} and 740×10^{1}
	(b)		0.04		B1 accept 4×10^{-2}
					Total 2 marks

Question		Working	Answer	Mark	Notes
2		$\frac{3-2\times7^{2}}{2}+5\times7$		2	M1 for fully correct substitution of $x = 7$ into given expression Allow $(7)^2$ or 49 **and** 5×7 or 35 implied by (–95/2 **or** – 47.5) **and** 35
		cas	–12.5		A1 oe we can ISW incorrect attempt to simplify $-\frac{25}{2}$
					Total 2 marks

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Question		Working	Answer	Mark	Notes
3		$AB^2 = 8.7^2 - (12-6)^2$ $[= 6.3]$ Or $8.7^2 = AB^2 + (12-6)^2$ Or $\cos ADC = \left(\frac{6}{8.7}\right)$ $[= 46.39...]$ **and** $AB^2 = 6^2 + 8.7^2 - 2\times 6\times 8.7\times \cos"46.39..."$ Or $\cos ADC = \left(\frac{6}{8.7}\right)$ $[= 46.39...]$ **and** $\frac{AD}{\sin"46.39..."} = \frac{6}{\sin(90-"46.39...")}$ Or $\cos ADC = \left(\frac{6}{8.7}\right)$ $[= 46.39...]$ **and** $\frac{AD}{\sin("46.39...")} = \frac{8.7}{\sin 90}$		3	M1 for a correct expression involving *AB* and no other unknowns or [*AB*=] 6.3 Allow using their $h = (12-6)$ if marked on their diagram providing *h* is less than 8.7 A correct Pythagoras calculation, eg or a complete method to find *AB* using trigonometry
		Area $= \frac{1}{2}(12+6)\times"6.3"$ Or $6\times"6.3"+\frac{1}{2}\times"6.3"\times(12-6)$ Or $6\times"6.3"+\frac{1}{2}\times 6\times 8.7\times\sin"46.39..."$ Or $12\times"6.3"-\frac{1}{2}\times"6.3"\times(12-6)$ Or $12\times"6.3"-\frac{1}{2}\times 6\times 8.7\times\sin"46.39..."$			M1 for a correct method to find the area of a trapezium using their *AB*. "6.3" can be any number other than 6, 12 or 8.7 eg $6\times"6.3"+\frac{1}{2}\times"6.3"\times(12-6)$
		cas	56.7		A1 awrt 56.7
					Total 3 marks

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Question		Working	Answer	Mark	Notes
4	(a)		$\begin{pmatrix} 1 & -6 \\ -9 & 3 \end{pmatrix}$	1	B1
	(b)	$n\begin{pmatrix} 3 & -2 \\ -5 & 1 \end{pmatrix} - 2\times\begin{pmatrix} -2 & -4 \\ -4 & 2 \end{pmatrix} = \begin{pmatrix} 13 & 2 \\ -7 & -1 \end{pmatrix}$ oe $3n - 2\times(-2) = 13$ $-2n - 2\times(-4) = 2$ $-5n - 2\times(-4) = -7$ $n - 2\times(2) = -1$		2	M1 for setting up the matrices so a relevant equation can be formed or a correct relevant equation eg $3n+4=13, -2n+8=2$, $-5n+8=-7$, $n-4=-1$ oe
		cas	3		A1
					Total 3 marks

Question		Working	Answer	Mark	Notes
5		$\frac{6--14}{-3-2}[=-4]$ oe $\frac{-14-6}{2--3}[=-4]$ oe		3	M1 correct method to find the gradient. May be implied by an equation with the correct gradient.
		$6="-4"\times-3+c$ or $-14="-4"\times2+c$ or $y-6="-4"(x-(-3))$ or $y-(-14)="-4"(x-2)$ oe			M1 for a correct expression involving the intercept, (commonly c but can be any letter) for their gradient. Must be clearly identified if incorrect or have come from correct working. Or a correct un-simplified equation or a correct equation not in the required form eg $y+4x=-6$ May be implied by an equation with the correct intercept.
		cas	$y=-4x-6$		A1 accept $y=-4x+(-6)$
					Total 3 marks

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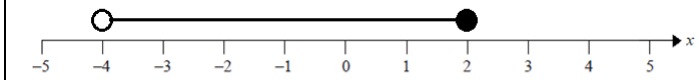
Question		Working	Answer	Mark	Notes
6	(a)	$-5w \leqslant 15$ or $-15 \leqslant 5w$ or $15 \geqslant -5w$ or $5w \geqslant -15$		2	M1 allow for -3 Allow use of any inequality symbol or = for the M mark
		cas	$w \geqslant -3$		A1 accept $-3 \leqslant w$
	(b)	a single line joining $x = -4$ and $x = 2$		2	M1 Do not allow lines with arrows at end points
					A1 **Both** end points identified using the correct symbols **and** one correct line drawn between the two correct points.
					Total 4 marks

Question		Working	Answer	Mark	Notes
7	(a)		$9a^6b^{10}$	2	B2 fully correct (B1 for an expression in the form ma^pb^q with 2 of m, p and q correct, or a^6b^{10})
	(b)		$\frac{1}{2}c^{-\frac{1}{2}}$	1	B1 allow $\frac{1}{2\sqrt{c}}$ or $\frac{1}{2c^{\frac{1}{2}}}$ or $0.5c^{-\frac{1}{2}}$ or $\frac{1}{\sqrt{4c}}$
					Total 3 marks

Question		Working	Answer	Mark	Notes
8			$y \leqslant 2x+3$ $x \leqslant 0$ $y \geqslant 0$	2	B2 All 3 correct (B1 for 2 correct) Allow equivalent inequalities and condone < for $\leqslant$ and > for $\geqslant$ for both marks but not =
					Total 2 marks

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Question		Working	Answer	Mark	Notes
9		$\tan 10 = \frac{BT}{20}$ or $20 \times \tan 10 = BT$ oe or $\tan 80 = \frac{20}{BT}$ or $BT = \frac{20}{\tan 80}$ oe or $\frac{BT}{\sin 10} = \frac{20}{\sin 80}$ oe or $\cos 10 = \frac{20}{AT}$ and $BT = \sqrt{("20.30...")^2 - 20^2}$ oe		3	M2 for a fully correct equation or method. Other letters can be used for *BT* (M1 for $TAB = 10$ (may be seen on diagram) or $\cos 10 = \frac{20}{AT}$ or a correct trig statement from an incorrect diagram eg *BTA*=10° and $\tan 10 = \frac{20}{BT}$ or $\frac{BT}{\sin 80} = \frac{20}{\sin 10}$ oe or *BT*= awrt 113... oe)
		cas	3.53		A1 awrt 3.5 allow answer of 3.4 or 3.6 from correct working
					Total 3 marks

Question		Working	Answer	Mark	Notes
10		*BC* is **<u>common</u>** *MC = NB* **<u>midpoints</u>** [of *AB* and *AC* and *AB* = AC] $\angle MCB = \angle NBC$ **<u>isosceles</u>** triangle		3	M2 two correct with reasons, equivalent of bolded words needed for reasons. (M1 one correct with reason or all 3 stated with no reasons) Allow $\angle ACB$ for $\angle MCB$ and $\angle ABC$ for $\angle NBC$ Allow shortened versions of key words
		wr	SAS		A1 SAS stated with all 3 correct, including reasons
					Total 3 marks

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Question		Working	Answer	Mark	Notes
11		$\det = 3\times1-(-2\times-5)[=-7]$ or $\begin{pmatrix}1 & 2\\ 5 & 3\end{pmatrix}$		2	M1 for correct method to find the determinant or the correct matrix without the determinant. May be seen as part of the final answer.
		cas	$-\frac{1}{7}\begin{pmatrix}1 & 2\\ 5 & 3\end{pmatrix}$		A1 oe ISW incorrectly multiplying through the matrix by $-\frac{1}{7}$ or if $-\frac{1}{7}$ is missing on the answer line but is seen in the working. Condone decimal equivalents correct to 2dp (awrt 0.14, 0.29, 0.71, 0.43)
					Total 2 marks

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Question		Working	Answer	Mark	Notes
12		eg $xy+3y=4x-4$ **or** $x+3=\frac{4x}{y}-\frac{4}{y}$		3	M1 for multiplying all terms by y and remove brackets correctly to a form a correct equation **or** for multiplying out the bracket correctly on the numerator and separating RHS into 2 fractions to a form an equation This mark can be implied by a correct equation with x terms on one side and terms without x on the other
		eg $xy-4x=-4-3y$ **or** $3y+4=4x-xy$ **or** $x-\frac{4x}{y}=-\frac{4}{y}-3$			M1 for collecting terms in x on one side of the equation and terms without x on the other side of the equation allow one sign error. Allow ft of their equation providing there are 4 distinct terms with exactly 2 in terms of x
		cas	$x=\frac{-4-3y}{y-4}$		A1 oe eg $x=\frac{3y+4}{4-y}$ or $x=\frac{-\frac{4}{y}-3}{1-\frac{4}{y}}$ do not ISW except allow correct fraction without x = on the answer line if given correctly with x = in the working
					Total 3 marks

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Question		Working	Answer	Mark	Notes
13		$8^2 + r^2 = R^2$ OR $OD^2 = OA^2 - 8^2$		3	M1 for realising tangent is 90° to radius and use Pythagoras correctly to form an equation Allow any value for either (r or R) or (OD or OA)
		Area = $\pi\left(8^2 + r^2\right) - \pi r^2$ or $\pi\left(R^2\right) - \pi\left(R^2 - 8^2\right)$ oe			M1 dep on M1 for substituting in for R^2 or r^2 to eliminate one variable Or full working with their (r or R) or (OD or OA) to find the shaded area
			64π		A1 cao Allow $8^2\pi$ dep on both previous M marks NB an answer of 64π will score full marks (an awrt 201 scores 2 marks only)
					Total 3 marks

Question		Working	Answer	Mark	Notes
14	(a)	$2\times3\times15$ or $2\times3\times3\times5$ or $2\times3^2\times5$ $2\times3\times22$ or $2\times2\times3\times11$ or $2^2\times3\times11$ $2\times3\times72$ or $2\times2\times2\times2\times3\times3\times3$ or $2^4\times3^3$		2	M1 for writing 2 or 3 numbers correctly in prime factor form or as $2\times3\times\ldots$ eg Or two correct trees
		wr	6		A1 cao
	(b)	$2\times2\times7$ and 5×7 or 28, 56, 84, 112, 140 or 35, 70, 105, 140		2	M1 for expressing both numbers as prime factors or two correct trees, or lists at least 4 correct multiples of 28 or 35
		cas	28 , 140		A1 SCB1 for an answer of 140 given if no marks awarded
					Total 4 marks

	90	132	432
2	45	66	216
3	15	22	72

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Question		Working	Answer	Mark	Notes
15	(a)	$6(a+4ab)$ or $a(6+24b)$ or $3a(2+8b)$ or $2a(3+12b)$ or $3(2a+8ab)$ or $2(3a+12ab)$ or $...(1+4b)$		2	M1 for a correct but partially factorised expression.
			$6a(1+4b)$		A1
	(b)		$(x-4)(x-3)$	2	B2 correct factorisation allow $(-x+4)(-x+3)$ (B1 for a factorisation which multiplies out to give 2 correct terms) Do not ISW. Mark the answer line, if nothing on the answer line, mark final line of working.
					Total 4 marks

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Question		Working	Answer	Mark	Notes
16		$\frac{15}{8}[\times]\frac{14}{5}$ or $\left(1+\frac{7}{8}\right)\left(2+\frac{4}{5}\right)$		4	M1 for both improper fractions correct. Do not need the multiplication sign. Or for correctly writing product in brackets
		$\left[\frac{15}{8}\times\frac{14}{5}=\right]\frac{15\times14}{8\times5}$ **oe or** $\frac{210}{40}$ **or** $\frac{3}{4}\times\frac{7}{1}$ **Or** $2+\frac{14}{8}+\frac{4}{5}+\frac{28}{40}$ $\left[=2\frac{130}{40}\right]$ **oe**			M1 dependent on 1st M1 for correct method to multiply Or correct method to expand the bracket Note $\frac{21}{4}$ is not sufficient to gain this mark
		$\frac{2}{12}+\frac{63}{12}$ **or** $\frac{2}{12}+\frac{3}{12}$ **oe** $\frac{4}{24}+\frac{126}{24}$ **or** $\frac{4}{24}+\frac{6}{24}$ **oe** $\frac{8}{48}+\frac{252}{48}$ or $\frac{8}{48}+\frac{12}{48}$ **oe** **Or** $\frac{20}{120}+\frac{630}{120}$			M1 (indep) for correct method to add $\frac{1}{6}$ to another fraction. Same denominator used. (May be written as single fraction with 2 terms on the numerator). Must be two fractions, a denominator of 1 is not acceptable for this mark.
		wr	$\frac{65}{12}=5\frac{5}{12}$		A1 dep on all 3 M's awarded. Must see a correct improper fraction, eg $\frac{65}{12}$, $\frac{130}{24}$, $\frac{260}{48}$, $\frac{650}{120}$
					Total 4 marks

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Question		Working	Answer	Mark	Notes
17		[Total weight of the 9 green apples] $=9\times154\left[=1386\right]$ Or [Total weight of the 10 green apples] = $154\times9+148$ [=1534] Or $8x+9\times154+148=2394$		4	M1 for correct method to find the total weight of remaining green or the weight of all 10 green apples Or forms a suitable equation
		[Weight of the 8 red apples] = $2394-"1386"-148$ $\left[=860\right]$ or $2394-"1534"$ $\left[=860\right]$ Or $8x=2394-9\times154-148$			M1 dep on M1 for correct method to find the total weight of red Or method to isolate term in x
		Mean = $\frac{"860"}{8}$			M1dep on both M's awarded
		cas	107.5		A1 Allow 108
					Total 4 marks

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Question		Working	Answer	Mark	Notes
18		$2x+\frac{x-54}{2}=180$ oe		4	M1 setting up a correct equation in x
		$4x+x=360+54$ or $2x+\frac{1}{2}x=180+27$ $\left[\Rightarrow x=82.8\right]$			M1 dep on M1 for a correct method to collect the x terms together on one side of the equation and the numerical terms together on the other side. Award of this mark implies the previous mark.
		$\frac{360}{(180-2\times"82.8")}$ or $\frac{360}{\left(\frac{"82.8"-54}{2}\right)}$ Or $2\times"82.8"=\frac{90(2n-4)}{n}$ or $\frac{"82.8"-54}{2}=\frac{360}{n}$ Or $2\times"82.8"=\frac{180(n-2)}{n}$			M1 for correct substitution to find n. x must be clearly identified if incorrect or come from correct working.
		cas	25		A1
Question		**Working**	**Answer**	**Mark**	**Notes**
18 Alt		$2x=\frac{90(2n-4)}{n}$ **and** $\frac{x-54}{2}=\frac{360}{n}$ Or $2x=\frac{180(n-2)}{n}$ **and** $\frac{x-54}{2}=\frac{360}{n}$		4	M1 for forming a pair of simultaneous equations in x and n
		$2n\left(\frac{720+54n}{n}\right)=180n-360$ $\left[\Rightarrow 72n=1800\right]$ Or $\frac{360}{180-2x}=\frac{720}{x-54}$ $\left[\Rightarrow x=82.8\right]$			M1 for a correct method to substitute to eliminate one variable. Award of this mark implies the previous mark.
		$\left[n=\right]\frac{1800}{72}$			M1 for a correct method to solve equation in n
		cas	25		A1
					Total 4 marks

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Question		Working	Answer	Mark	Notes
19		$[y =]\frac{k}{\sqrt[3]{x}}$		3	M1 for $\frac{k}{\sqrt[3]{x}}$ oe allow other letter for the constant and use of $\propto$
		$k = 6\times\sqrt[3]{3.375}\,[=9]$ or $k = 6\times 1.5\ [=9]$			M1 dep on M1 for a correct method to find the value of *k*, condone use of $\propto$ Award of this mark implies the previous M mark if not already awarded
		cas	2.25		A1 oe
					SC B1 for awrt 3.6 or 16 [from $6 = \frac{k}{3.375^3}$ or $6 = k\sqrt[3]{3.375}$]
					Total 3 marks

Question		Working	Answer	Mark	Notes
20		$\left(4\sqrt{3}\right)^2$ or $27+3+2\times\sqrt{81}$		4	M1 for squaring out the brackets on the numerator
		$\frac{"48"}{\sqrt{45}+3}\times\frac{\sqrt{45}-3}{\sqrt{45}-3}$ or $\frac{"48"}{3\sqrt{5}+3}\times\frac{3\sqrt{5}-3}{3\sqrt{5}-3}$ or $\frac{"48"\div 3}{\sqrt{5}+1}\times\frac{\sqrt{5}-1}{\sqrt{5}-1}$			M1 for multiplying by $\frac{\sqrt{45}-3}{\sqrt{45}-3}$ or $\frac{3\sqrt{5}-3}{3\sqrt{5}-3}$ or $\frac{\sqrt{5}-1}{\sqrt{5}-1}$ or $\frac{3-\sqrt{45}}{3-\sqrt{45}}$ or $\frac{3-3\sqrt{5}}{3-3\sqrt{5}}$ or $\frac{1-\sqrt{5}}{1-\sqrt{5}}$ this may be seen earlier
		$\frac{"48"\left(\sqrt{45}-3\right)}{36}$ or $\frac{"48"\left(3\sqrt{5}-3\right)}{36}$ or $\frac{"16"\left(\sqrt{5}-1\right)}{4}$			M1 for changing $\sqrt{45}$ to $3\sqrt{5}$ this may be seen earlier or for simplifying the denominator to an integer
		wr	$4\sqrt{5}-4$		A1 dep on 3 M marks awarded
					Total 4 marks

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Question		Working	Answer	Mark	Notes
21		$[x_{LB} =]85, [x_{UB} =]95, [a_{LB} =]105, [a_{UB} =]115,$ $[y_{LB} =]34.5, [y_{UB} =]35.5, [b_{LB} =]55, [b_{UB} =]65,$		4	M1 for one correct LB or UB stated or used allow $114.\dot{9}$ for 115, $84.\dot{9}$ for 85, $64.\dot{9}$ for 65 and $35.4\dot{9}$ for 35.5
		$\frac{x}{a}$ where $105 \leqslant x \leqslant 115$ and $85 \leqslant a \leqslant 95$ **or** $\frac{y}{b}$ where $34.5 \leqslant y \leqslant 35.5$ and $55 \leqslant b \leqslant 65$			M1 for a correct method to find the time travelled by one car
		$\frac{x_{UB}}{a_{LB}} - \frac{y_{LB}}{b_{UB}} = \frac{115}{85} - \frac{34.5}{65}$ $(=1.352... - 0.530...)$			M1 for a correct method to find the difference in time where $110 < x_{UB} \leqslant 115$ and $85 \leqslant a_{LB} < 90$ and $34.5 \leqslant y_{LB} < 35$ and $60 < b_{UB} \leqslant 65$
		wr	0.822		A1 dep on 3 M marks awarded and calculation with correct figures seen. awrt 0.82
					Total 4 marks

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Question		Working	Answer	Mark	Notes
22		$\left[12x^2+7x-10=\right](4x+5)(3x-2)$		4	M1 Factorise denominator of the divisor, must factorise to 2 brackets and must multiply to give at least 2 correct terms These method marks can be awarded in any order.
		$\frac{2(x+4)-3(3x-2)}{(3x-2)(x+4)}$ Or $\frac{2(4x+5)(3x-2)(x+4)-3(4x+5)(3x-2)(3x-2)}{7(3x-2)(x-2)(x+4)}$ oe $\frac{2(x+4)(12x^2+7x-10)-3(3x-2)(12x^2+7x-10)}{(3x-2)(x+4)(12x^2+7x-10)}$			M1 writing the difference as a correct fraction over a common denominator – need not be expanded and may be 2 separate fractions. Allow one sign error if the numerator is expanded. The denominator may be expanded eg $(3x^2+10x-8)$ This may be done after the multiplication
		$\frac{14-7x}{(3x-2)(x+4)}\times\frac{(4x+5)(3x-2)}{7x-14}$			M1 indep Attempt to invert divisor and multiply.
		wr	$\frac{-5-4x}{x+4}$		A1allow $\frac{4x+5}{-x-4}$ or $-\left(\frac{4x+5}{x+4}\right)$
					Total 4 marks

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Question		Working	Answer	Mark	Notes
23	(a)		$0 < d \leqslant 2$	1	B1 accept unambiguous response
	(b)		$2 < d \leqslant 5$	1	B1 accept unambiguous response
	(c)	$1\times 22 + 3.5\times 13 + 7.5\times 9 + 15\times 12 + 30\times 4$ [= 435] Or $22 + 45.5 + 67.5 + 180 + 120$ [= 435]		4	M2 for at least 3 correct products with clear intention to add (need not be evaluated) (M1 for use of a value within interval (incl upper end points but not lower) for at least 3 products with clear intention to add **OR** correct mid-points used for at least 3 products but not added)
		$\frac{"435"}{60}$			M1 dep on at least M1 awarded for dividing their sum by 60
		cas	7.25		A1 oe
	(d)		$\frac{4}{15}$	1	B1 oe eg $\frac{16}{60}$ (0.266666…) allow 0.26 or 0.27 or better ISW incorrect cancelling
					Total 7 marks

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Question		Working	Answer	Mark	Notes
24		$\left(\sqrt[3]{\frac{30000}{6480}}\right)^2 \left[=\frac{25}{9}\right]$ or $\left(\sqrt[3]{\frac{6480}{30000}}\right)^2 \left[=\frac{9}{25}\right]$ Or $\frac{965.48...}{347.57...}$ or $\frac{347.57...}{965.48...}$		5	M2 for method to find the correct area scale factor (M1 for $\sqrt[3]{\frac{6480}{30000}} \left[=\frac{3}{5} \text{ or } \frac{18.64...}{31.07...}\right]$ or $\sqrt[3]{\frac{30000}{6480}} \left[=\frac{5}{3} \text{ or } \frac{31.07...}{18.64...}\right]$ or $\left(\frac{6480}{30000}\right)^2 \left[=0.0466...\right]$ or $\left(\frac{30000}{6480}\right)^2 \left[=21.4...\right]$)
		$\frac{25}{9}SA_B + SA_B = 8432$ or $\frac{9}{25}SA_A + SA_A = 8432$ Or $\frac{25}{9} = \frac{8432 - SA_B}{SA_B}$ or $\frac{9}{25} = \frac{SA_B}{8432 - SA_B}$			M1 dep on at least one of the previous M marks awarded. For equation using their area SF May be implied by award of the 4th M1
		$SA_B = \frac{8432}{1+\frac{25}{9}} \left[=2232\right]$ or $SA_A = \frac{8432}{\frac{9}{25}+1} \left[=6200\right]$ or $\left[SA_B\right]\frac{9}{34} \times 8432 \left[=2232\right]$			M1 dep on previous M mark. For making SA_B the subject or correct method to calculate SA_B
		cas	2232		A1 awrt 2230
					Total 5 marks

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Question		Working	Answer	Mark	Notes
25		$\angle EOC = \frac{40\pi \times 360}{10^2 \pi} \left[= 144\right]$		6	M1 for a correct method to find angle *EOC*
		$EC = 2 \times 10 \sin\left(\frac{"144"}{2}\right) \left[= 19.02...\right]$ Or $EC = 2 \times 10 \cos\left(\frac{180 - "144"}{2} \left[= 18\right]\right)$ Or $EC = \frac{10}{\left(\sin\left(\frac{180 - "144"}{2} \left[= 18\right]\right)\right)} \times \sin"144"$ Or $EC^2 = 10^2 + 10^2 - 2 \times 10 \times 10 \cos"144"$			M1 for a expression to find the length of *EC* angle *EOC* must be clearly identified if not correct or come from correct working
		$15 \times \left(15 + 1 + x\right) = x \times \left(x + "19.02..."\right)$			M1 for correct use of the intersecting chord theorem, $BF \times AF = CF \times EF$ Just stating is not enough, must be used. Allow use of their *EC* rounded to 2sf or better. *EC* must be clearly identified if not correct or come from correct working
		$x^2 + \left("19.02" - 15\right) x - 240 = 0$ $x^2 + \left("EC" - 15\right) x - 240 = 0$			M1dep on 3rd M for reducing to a 3 term quadratic Where their value of $"EC" - 15$ is rounded correct to the nearest integer or better. *EC* must be clearly identified if not correct or come from correct working
		$x = \frac{-"4.02..." \pm \sqrt{"4.02..."^2 + 4 \times 240}}{2}$			M1 dep on previous M1 for a correct method to solve their 3 term quadratic. If they have incorrect 3 term quadratic then working must be seen. May be implied by an answer of 13.6 or −17.6
		cas	13.6		A1 awrt 13.6 do not award if negative answer also given
					Total 6 marks

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Question		Working	Answer	Mark	Notes
26	(a)(i)		$-3\mathbf{a}+5\mathbf{b}$	2	B1
	(ii)		$6\mathbf{a}+2\mathbf{b}$		B1
	(b)	$\overrightarrow{MP}=-2\mathbf{b}+\lambda\left("6\mathbf{a}+2\mathbf{b}"\right)$ **and** $\overrightarrow{MP}=-2\mathbf{b}+3\mathbf{a}+\mu\left("-3\mathbf{a}+5\mathbf{b}"\right)$ **or** $\overrightarrow{MP}=3\mathbf{b}+\varphi\left("3\mathbf{a}-5\mathbf{b}"\right)$ $\overrightarrow{OP}=\lambda\left("6\mathbf{a}+2\mathbf{b}"\right)$ **and** $\overrightarrow{OP}=3\mathbf{a}+\mu\left("-3\mathbf{a}+5\mathbf{b}"\right)$ **or** $\overrightarrow{OP}=5\mathbf{b}+\varphi\left(3\mathbf{a}-5\mathbf{b}\right)$ $\overrightarrow{AP}=\lambda\left("-3\mathbf{a}+5\mathbf{b}"\right)$ **and** $\overrightarrow{AP}=-3\mathbf{a}+\mu\left("6\mathbf{a}+2\mathbf{b}"\right)$ $\overrightarrow{BP}=\lambda\left("3\mathbf{a}-5\mathbf{b}"\right)$ **and** $\overrightarrow{BP}=-5\mathbf{b}+\mu\left("6\mathbf{a}+2\mathbf{b}"\right)$		4	M1 for 2 correct (but different) ways to find $\overrightarrow{OP}$ using $\overrightarrow{OP}=\lambda\overrightarrow{OQ}$ and finding a second vector for $\overrightarrow{OP}$ Allow for $\overrightarrow{PO}$ or $\overrightarrow{AP}$ or $\overrightarrow{PA}$ or $\overrightarrow{BP}$ or $\overrightarrow{PB}$ Must have used different scalar parameters to express the two different ways
		$6\lambda=3-3\mu$ and $2\lambda=5\mu$ oe or $6\lambda=3\varphi$ and $2\lambda=5-5\varphi$ oe or $3\lambda=6\varphi$ and $5\lambda-2=-2+2\varphi$ oe or $5\lambda=2\mu$ and $-3\lambda=-3+6\mu$ oe or $3\lambda=6\mu$ and $-5\lambda=2\mu-5$ oe			M1 dep on previous M1 for equating the coefficients to gain simultaneous equations or use of ratios eg $\frac{6}{3-3\mu}=\frac{2}{5\mu}$ Implied by $\mu=\frac{1}{6}$ or $\lambda=\frac{5}{12}$ or $\varphi=\frac{5}{6}$ or $15\mu=3-3\mu$ or $15-15\varphi=3\varphi$ oe
		$\overrightarrow{MP}=-\frac{2}{5}\times5\mathbf{b}+\frac{5}{12}\left(6\mathbf{a}+2\mathbf{b}\right)$ **or** $\overrightarrow{MP}=-2\mathbf{b}+3\mathbf{a}+\frac{1}{6}\left(-3\mathbf{a}+5\mathbf{b}\right)$ **or** $\overrightarrow{MP}=3\mathbf{b}+\frac{5}{6}\left(3\mathbf{a}-5\mathbf{b}\right)$			M1 For a correct expression for $\overrightarrow{MP}$
		cas	$\overrightarrow{MP}=\frac{5}{2}\mathbf{a}-\frac{7}{6}\mathbf{b}$		A1 oe
					Total 6 marks

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Question		Working	Answer	Mark	Notes
27		$\frac{dy}{dx} = (-1)bx^{-1-1} + (-2)(-9)x^{-2-1}$		5	M1 for an attempt to differentiate $x^n \rightarrow x^{n-1}$ for one of the non-constant terms
		$\frac{dy}{dx} = -bx^{-2} + 18x^{-3}$			M1 differentiating *a* to 0 oe and at least one correct non zero term
		$-b(3)^{-2} + 18 \times (3)^{-3} = 0 [\Rightarrow b = 6]$ oe			M1 dep on 1st M1 being awarded for substituting x = 3 into their $\frac{dy}{dx}$ and equating to 0
		$4.4 = a + 6 \times 3^{-1} - 9 \times 3^{-2}$ $a = 4.4 - 6 \times 3^{-1} + 9 \times 3^{-2}$ oe			M1 for substituting x = 3, their value of b and y = 4.4 into $y = a + bx^{-1} - 9x^{-2}$
		cas	$a = 3.4$		A1 oe
					Total 5 marks

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