OXFORD AQA

INTERNATIONAL QUALIFICATIONS

INTERNATIONAL A-LEVEL

MATHEMATICS

MA03

(9660/MA03) Unit P2 Pure Mathematics

Mark scheme

January 2024

Version: 1.0 Final

241XMA03/MS

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

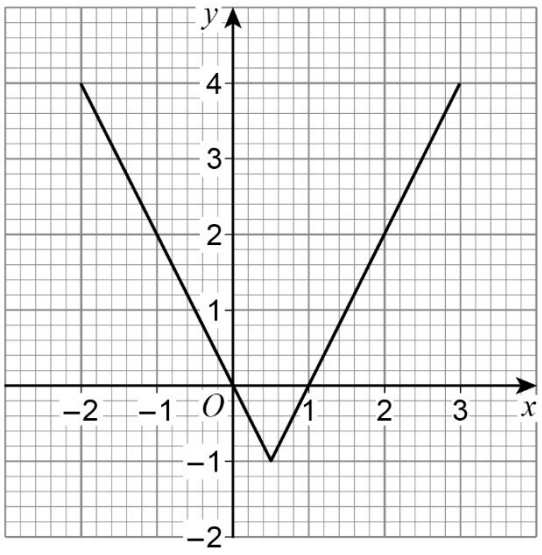
Further copies of this mark scheme are available from oxfordaqa.com

Key to mark scheme abbreviations

M	Mark is for method
m	Mark is dependent on one or more M marks and is for method
A	Mark is dependent on M or m marks and is for accuracy
B	Mark is independent of M or m marks and is for method and accuracy
E	Mark is for explanation
√ **or ft**	Follow through from previous incorrect result
CAO	Correct answer only
CSO	Correct solution only
AWFW	Anything which falls within
AWRT	Anything which rounds to
ACF	Any correct form
AG	Answer given
SC	Special case
oe	Or equivalent
A2, 1	2 or 1 (or 0) accuracy marks
–*x* EE	Deduct *x* marks for each error
NMS	No method shown
PI	Possibly implied
SCA	Substantially correct approach
sf	Significant figure(s)
dp	Decimal place(s)
ISW	Ignore subsequent working

Q	Answer	Marks	Comments
1	$16\left((-0.25)^3\right)+b\left((-0.25)^2\right)+c\left(-0.25\right)+12=11.5$ $16\left((0.5)^3\right)+b\left((0.5)^2\right)+c\left(0.5\right)+12=17.5$ $b-4c=-4$ $b+2c=14$ $b=8$ $c=3$	**M1 A1** **m1 A1**	**M1**: At least one equation correct or use of long division **A1**: Both equations correct **m1**: Attempt to solve **PI** **A1**: Both values correct **ACF**

	Question 1 Total	**4**	

Q	Answer	Marks	Comments
2(a)		B1 B1	Correct for $-2 \le x \le 0.5$ Correct for $0.5 \le x \le 3$
		2	

Q	Answer	Marks	Comments
2(b)	$x \le 0$ $x \ge 2$	M1 A1	Either correct, condone strict inequalities Both correct and no extras
		2	

	Question 2 Total	**4**	

Q	Answer	Marks	Comments
3(a)(i)	$\left[\frac{\mathrm{d}y}{\mathrm{d}x}=\right] a\mathrm{e}^{-0.5x}\sin 3x + b\mathrm{e}^{-0.5x}\cos 3x$	M1	Use of product rule
	$\left[\frac{\mathrm{d}y}{\mathrm{d}x}=\right] -0.5\mathrm{e}^{-0.5x}\sin 3x + 3\mathrm{e}^{-0.5x}\cos 3x$	A1	ISW
		2	

Q	Answer	Marks	Comments
3(a)(ii)	$\left[\frac{\mathrm{d}y}{\mathrm{d}x}=\right] \frac{a(3+\tan 5x)\times(1-2x)^2 - (1-2x)^3\, b\sec^2 5x}{(3+\tan 5x)^2}$	M1 A1	**M1**: Correct use of quotient/product rule **A1**: one numerator term and denom correct
	$\left[\frac{\mathrm{d}y}{\mathrm{d}x}=\right] \frac{-6(3+\tan 5x)\times(1-2x)^2 - (1-2x)^3\, 5\sec^2 5x}{(3+\tan 5x)^2}$	A1	**ACF** All correct (unsimplified) **ISW**
		3	

Q	Answer	Marks	Comments
3(a)(iii)	$1+\frac{1}{xy}\left(x\frac{\mathrm{d}y}{\mathrm{d}x}+y\right) = 3x^2+2y\frac{\mathrm{d}y}{\mathrm{d}x}$	M1 A1	**M1**: One correct use of implicit differentiation **A1**: All correct
	$\frac{\mathrm{d}y}{\mathrm{d}x}\left(\frac{1}{y}-2y\right) = 3x^2-1-\frac{1}{x}$	m1	Attempt to isolate $\frac{\mathrm{d}y}{\mathrm{d}x}$
	$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{3x^2-1-\frac{1}{x}}{\frac{1}{y}-2y}$ or $\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{y(3x^3-x-1)}{x(1-2y^2)}$	A1	**ACF**, **ISW**
		4	

Q	Answer	Marks	Comments
3(b)(i)	$\left[\int \frac{x}{4x^2+5}\,\mathrm{d}x = \right] \; a\ln(4x^2+5)$	M1	
	$\left[\int \frac{x}{4x^2+5}\,\mathrm{d}x = \right] \frac{1}{8}\ln(4x^2+5) \quad [+c]$	A1	ISW
		2	

Q	Answer	Marks	Comments
3(b)(ii)	$u = x \quad \mathrm{d}v = \cos x$ $\mathrm{d}u = 1 \quad v = \sin x$	M1	PI
	$\left[\int x\cos x\,\mathrm{d}x = \right] x\sin x - \int \sin x\,\mathrm{d}x$	m1	Correct use of integration by parts formula
	$= x\sin x + \cos x$	A1	All correct
	$\left[x\sin x + \cos x\right]_0^{\frac{\pi}{2}}$		
	$\left[\int_0^{\frac{\pi}{2}} x\cos x\,\mathrm{d}x\right] = \frac{\pi}{2} - 1$	A1	ACF, ISW
		4	

	Question 3 Total	**15**	

<table>
<tr><th>Q</th><th>Answer</th><th>Marks</th><th>Comments</th></tr>
<tr><td>4(a)</td><td>
<table>
<tr><td>x</td><td>y</td></tr>
<tr><td>0.06</td><td>$4^{-0.06}-0.25 = 0.670187$</td></tr>
<tr><td>0.18</td><td>$4^{-0.18}-0.25 = 0.529165$</td></tr>
<tr><td>0.30</td><td>$4^{-0.30}-0.25 = 0.409754$</td></tr>
<tr><td>0.42</td><td>$4^{-0.42}-0.25 = 0.308644$</td></tr>
<tr><td>0.54</td><td>$4^{-0.54}-0.25 = 0.223029$</td></tr>
</table>
$0.12\left(0.67...+0.53...+0.41...+0.31...+0.22...\right)$

$= 0.2569$
</td><td>B1

M1

m1

A1</td><td>All 5 correct x values (and no extra used)
PI by 5 correct y values

At least 3 correct y values in exact form or decimals, rounded or truncated to 3 dp or better (in table or formula)
PI by AWRT correct answer

Correct sub into formula with $h = 0.12$ oe and at least 3 correct y values either listed, with + signs, or totalled
PI by AWRT correct answer

CAO Must see this value exactly and no error seen</td></tr>
<tr><td></td><td></td><td>4</td><td></td></tr>
</table>

Q	Answer	Marks	Comments
4(b)(i)	$x = 4^{-y} - 0.25$	**M1**	Interchange x and y
	$-y\ln 4 = \ln(x+0.25)$	**M1**	Attempt to isolate **PI**
	$f^{-1}(x) = \dfrac{\ln(x+0.25)}{-\ln 4}$ or $\dfrac{\ln(x+0.25)}{\ln 0.25}$	**A1**	**ACF** eg $-\log_4(x+0.25)$
		3	

Q	Answer	Marks	Comments
4(b)(ii)	$-0.25 < x \leq 0.75$ or $x \in (-0.25,\ 0.75]$	**B2**	If **B2** not awarded, award **B1** for at least one of the two limits correct or $-0.25 \leq x < 0.75$
		2	

Q	Answer	Marks	Comments
4(c)	Reflection [in the line] $y = x$	**B1**	
		1	

	Question 4 Total	**10**	

Q	Answer	Marks	Comments
5(a)(i)	$[10\sin\theta - 24\cos\theta =]$ $R\sin\theta\cos\alpha - R\cos\theta\sin\alpha$ $R = 26$ $\alpha = 1.18$ $26\sin(\theta - 1.18)$	**M1** **B1** **A1**	**PI**
		3	

Q	Answer	Marks	Comments
5(a)(ii)	[Min value =] -26	**B1ft**	
		1	

Q	Answer	Marks	Comments
5(a)(iii)	12.17	**B1**	Condone 12.18
		1	

Q	Answer	Marks	Comments
5(a)(iv)	$[26\sin((x - 1.18) - 0.6) = 6.5]$ $\sin(x - 1.78) = 0.25$ $[x - 1.78 =]$ 0.253 $x = -1.62,\ 2.03$	**M1** **A1, A1**	Attempt to solve $\sin((x - their1.18) - 0.6) = \frac{6.5}{their26}$ Condone -1.61
		3	

Q	Answer	Marks	Comments
5(b)	Let $Y = 2y - 10°$		**oe**
	$16\tan^2 Y - 14 = 4\sec Y$ $16\left(\sec^2 Y - 1\right) = 4\sec Y + 14$	**M1**	Correct use of trig identity
	$8\sec^2 Y - 2\sec Y - 15 = 0$ $\sec Y = -1.25, 1.5$	**m1**	Attempt to solve *their* quadratic
	$Y = 143.1°$ and $48.2°$	**A1**	**PI**
	$y = -67°,\ -19°,\ 29°,\ 77°$	**B2,1**	**AWRT** the correct values Award **B1** for 3 correct answers
		5	

	Question 5 Total	**13**	

Q	Answer	Marks	Comments
6(a)	$f(x) = -x^2 + \ln(12+24x)$ $\quad \frac{dy}{dx} = -2x + \frac{24}{12+24x}$	**M1**	
	$\left[\frac{dy}{dx} = 0\right] \quad 2x = \frac{24}{12+24x} \quad 48x^2 + 24x - 24 = 0$	**m1**	Attempt to solve $\frac{dy}{dx} = 0$
	$x = 0.5 \qquad [, \ -1 \ \therefore \text{ reject}]$	**A1**	
	$\left[x = 0.5, \quad y = -\frac{1}{4} + \ln 24\right]$		
	$x = 1.5, \quad y = -\frac{9}{4} + \ln 48$	**B1**	**PI** by 1.62 AWRT
	$-\frac{9}{4} + \ln 48 \le f(x) \le -\frac{1}{4} + \ln 24$	**A1**	Must be in an exact form
		5	

Q	Answer	Marks	Comments
6(b)(i)	$g(x) = -x^2 + \ln(12+24x) - 2x$ $g(1.1) = 0.24 \qquad g(1.2) = -0.13$	**M1**	or reverse Both values rounded or truncated to at least 1sf
	Change of sign, $1.1 < \alpha < 1.2$	**A1**	Must have both statement and interval in words or symbols **or** comparing 2 sides: $f(1.1) = 2.44 > 2.2$ $f(1.2) = 2.27 < 2.4$ **(M1)** Conclusion as before **(A1)**
		2	

Q	Answer	Marks	Comments
6(b)(ii)	$\ln(12+24x)=x^2+2x \quad 1+\ln(12+24x)=x^2+2x+1$ $(x+1)^2=1+\ln(12+24x)$ $x=-1+\sqrt{1+\ln(12+24x)}$	**B1**	**AG** No errors seen including correct use of brackets Must be convincingly shown
		1	

Q	Answer	Marks	Comments
6(b)(iii)	$x_2=1.156 \qquad x_3=1.164$	**B1, B1**	If 0 scored, **SC1** for **AWRT** 1.156 and 1,164
		2	

Q	Answer	Marks	Comments
6(c)(i)	Translation $\begin{bmatrix}0\\-\ln 12\end{bmatrix}$ or $\begin{bmatrix}0\\\ln\frac{1}{12}\end{bmatrix}$	**B1** **B1**	Allow $\begin{bmatrix}0\\-2.48\end{bmatrix}$ **AWRT** –2.48
		2	

Q	Answer	Marks	Comments
6(c)(ii)	$A-1.5\ln 12$	**B1ft**	**oe**
		1	

	Question 6 Total	**13**	

Q	Answer	Marks	Comments
7(a)	$2x-2y\dfrac{\mathrm{d}y}{\mathrm{d}x}=6\dfrac{\mathrm{d}y}{\mathrm{d}x}-2$	**M1**	LHS or RHS correct
	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{2x+2}{2y+6}$	**A1**	
	OR $y=-3\pm\left((x+1)^2-12\right)^{0.5}$ $\dfrac{\mathrm{d}y}{\mathrm{d}x}=k\left((x+1)^2-12\right)^{-0.5}(x+1)$	**(M1)**	
	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{x+1}{\left((x+1)^2-12\right)^{0.5}}$	**(A1)**	
	At $(3,-1)$ $\dfrac{\mathrm{d}y}{\mathrm{d}x}=2$	**m1**	Attempt to find gradient at (3, –1) **PI** by further work
	$y+1=2(x-3)$ or $y=2x-7$	**A1**	**ACF**
		4	

Q	Answer	Marks	Comments
7(b)(i)	$x=\dfrac{1+\sqrt{17}\cos\theta}{2}$, $\cos\theta=\dfrac{2x-1}{\sqrt{17}}$ $y=-1+\sqrt{17}\sin\theta$, $\sin\theta=\dfrac{y+1}{\sqrt{17}}$ $\cos^2\theta+\sin^2\theta=1$	**M1**	Rearranges for $k\cos\theta$ and $k\sin\theta$
	$(2x-1)^2+(y+1)^2=17$	**A1**	**ACF**, eg $\left(\dfrac{2x-1}{\sqrt{17}}\right)^2+\left(\dfrac{y+1}{\sqrt{17}}\right)^2=1$ $4x^2-4x+y^2+2y=15$
		2	

Q	Answer	Marks	Comments
7(b)(ii)	$4(2x-1)+2(y+1)\frac{\mathrm{d}y}{\mathrm{d}x}=0$	**M1**	Attempt at implicit differentiation
	$\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{4-8x}{2y+2}$	**A1**	All correct
	OR		
	$\frac{\mathrm{d}y}{\mathrm{d}\theta}=\sqrt{17}\cos\theta,\quad \frac{\mathrm{d}x}{\mathrm{d}\theta}=\frac{-\sqrt{17}\sin\theta}{2}$	**(M1)**	Attempt at parametric differentiation
	$\frac{\mathrm{d}y}{\mathrm{d}x}=-2\cot\theta$	**(A1)**	All correct
	$\theta=\cos^{-1}\left(\frac{1}{\sqrt{17}}\right),\quad x=1,\ y=3\ \ \frac{\mathrm{d}y}{\mathrm{d}x}=-0.5$	**m1**	
	$y-3=2(x-1)$ or $y=2x+1$	**A1**	**ACF**
		4	

Q	Answer	Marks	Comments
7(c)	49:1	**B1ft**	**ft** their answers for part **(a)** and part **(b)(ii)** only if both equations have a gradient of 2
		1	

	Question 7 Total	**11**	

Q	Answer	Marks	Comments
8	$y = \dfrac{1}{10-2x} \quad 10-2x = \dfrac{1}{y}$		
	$x = 5 - \dfrac{1}{2y}$	**M1** **A1**	Isolating 'x' Correct
	$\left[x^2 = 25 - \dfrac{5}{y} + \dfrac{1}{4y^2} \right]$		
	$\left[\text{Volume} =\right] \pi \int_{0.1}^{1} \left(25 - \dfrac{5}{y} + \dfrac{1}{4y^2} \right) \mathrm{d}y$	**B1ft**	**PI** by later work
	$\int_{0.1}^{1} \left(25 - \dfrac{5}{y} + \dfrac{1}{4y^2} \right) \mathrm{d}y = 25y - 5\ln y - \dfrac{1}{4y}$	**M1** **A1**	At least 2 terms integrated correctly All terms integrated correctly
	$\left[25y - 5\ln y - \dfrac{1}{4y} \right]_{0.1}^{1} = (25 - 0.25)$ $-(2.5 - 5\ln 0.1 - 2.5)$ $= 24.75 + 5\ln 0.1$	**M1**	Correctly substituting limits into their integration must be in form $py - q\ln y - \dfrac{r}{y}$
	$\left[\text{Volume} =\right] \quad (24.75 - 5\ln 10)\pi$	**A1**	**ACF**

	Question 8 Total	**7**	

Q	Answer	Marks	Comments
9(a)	$\frac{\mathrm{d}y}{\mathrm{d}x} = k\left(3x+4y\right)$	M1 A1	$\frac{\mathrm{d}y}{\mathrm{d}x} = \left(3x+4y\right)$ or $\frac{\mathrm{d}y}{\mathrm{d}x} \propto \left(3x+4y\right)$ All correct
		2	

Q	Answer	Marks	Comments
9(b)(i)	$\frac{\mathrm{d}y}{\mathrm{d}x} = 4x\mathrm{e}^{2y} - \mathrm{e}^{2y} = \mathrm{e}^{2y}(4x-1)$ $\int \mathrm{e}^{-2y}\,\mathrm{d}y = \int 4x-1\,\mathrm{d}x$	M1	Separate variables
	$-\frac{1}{2}\mathrm{e}^{-2y} = 2x^2 - x + c$	m1	Attempt to integrate eg $a\mathrm{e}^{\pm 2y} = 2x^2 + kx$ oe
	$(1,0)\quad -\frac{1}{2} = 1 + c$ $c = -1.5$ $\left[-\frac{1}{2}\mathrm{e}^{-2y} = 2x^2 - x - 1.5\right]$ $\left[\mathrm{e}^{-2y} = -4x^2 + 2x + 3\right]$	m1 A1	Attempt to find c from equation as above
	$y = -\frac{1}{2}\ln(3 + 2x - 4x^2)$	M1 A1	Attempt to isolate y ie $y = a\ln(\mathrm{f}(x))$ Must have scored first **M1** **ACF**
		6	

Q	Answer	Marks	Comments
9(b)(ii)	$y = 0,\quad 1 = 3 + 2x - 4x^2$ $\left[2x^2 - x - 1 = 0\right]$ $\left[(2x+1)(x-1) = 0\right]$	M1	*their* $(3 + 2x - 4x^2) = 1$
	$x = -0.5$	A1	
		2	

	Question 9 Total	10	

Q	Answer	Marks	Comments
10(a)	$\dfrac{x^2}{(3-x)(3+2x)(3-2x)} = \dfrac{A}{3-x} + \dfrac{B}{3+2x} + \dfrac{C}{3-2x}$ $x^2 = A(3+2x)(3-2x) + B(3-x)(3-2x)$ $+ C(3-x)(3+2x)$	B1	Correctly combining RHS **PI**
	$x = 3: \quad 9 = A(9)(-3) \quad A = -\dfrac{1}{3}$ 1	M1	Attempt at finding one constant, could equate coefficients
	$x = 1.5: \quad 2.25 = C(1.5)(6) \quad C = \dfrac{1}{4}$	A1	Two constants correct
	$A = -\dfrac{1}{3} \quad B = \dfrac{1}{12} \quad C = \dfrac{1}{4}$	A1	All correct
		4	

Q	Answer	Marks	Comments
10(b)(i)	$(3-x)^{-1} = 3^{-1}\left(1-\dfrac{x}{3}\right)^{-1}$ $\dfrac{1}{3}\left(1+(-1)\times\left(-\dfrac{x}{3}\right)+\dfrac{(-1)\times(-2)\times\left(-\dfrac{x}{3}\right)^2}{2}\right)$	M1	At least 2 terms correct (unsimplified)
	$= \dfrac{1}{3} + \dfrac{1}{9}x + \dfrac{1}{27}x^2$	A1	All correct, simplied1
		2	

Q	Answer	Marks	Comments
10(b)(ii)	$\lvert x \rvert < 3$ or $-3 < x < 3$	B1	
		1	

Q	Answer	Marks	Comments
10(c)	$(3-2x)^{-1}=\frac{1}{3}\left(1+\frac{2}{3}x+\frac{4}{9}x^2\right)$	**M1**	At least one expansion correct (unsimplified)
	$(3+2x)^{-1}=\frac{1}{3}\left(1-\frac{2}{3}x+\frac{4}{9}x^2\right)$	**A1**	Both expansions correct (unsimplified)
	$\left[\mathrm{f}(x)=\right]$		
	$-\frac{1}{3}\left(\frac{1}{3}+\frac{1}{9}x+\frac{1}{27}x^2\right)+\frac{1}{12}\times\frac{1}{3}\left(1-\frac{2}{3}x+\frac{4}{9}x^2\right)$ $+\frac{1}{4}\times\frac{1}{3}\left(1+\frac{2}{3}x+\frac{4}{9}x^2\right)$	**M1** **A1ft**	Attempt at finding $\mathrm{f}(x)$ All correct, **ft** their A, B and C and their binomial expansions
	$=\frac{1}{27}x^2$	**A1**	Must have scored first 4 marks
		5	

	Question 10 Total	**12**	

Q	Answer	Marks	Comments
11	$2u\dfrac{\mathrm{d}u}{\mathrm{d}x}=-2x$ or $\dfrac{\mathrm{d}u}{\mathrm{d}x}=\dfrac{-x}{(9-x^2)^{0.5}}$ or $\dfrac{\mathrm{d}x}{\mathrm{d}u}=-\dfrac{u}{(9-u^2)^{0.5}}$	B1	
	$\left[\int\dfrac{x^3}{(9-x^2)^{0.5}}\mathrm{d}x=\right]\ \int\dfrac{x^2\times x\,\mathrm{d}x}{(9-x^2)^{0.5}}$		
	$=\int\dfrac{(9-u^2)2u}{u}\dfrac{\mathrm{d}u}{-2}$	M1	All in terms of u, condone omission of $\mathrm{d}u$
	$=\int u^2-9\ \mathrm{du}$	A1	Must see $\mathrm{d}u$ here, or earlier
	$\left[\int\dfrac{x^3}{(9-x^2)^{0.5}}\mathrm{d}x=\right]\ \dfrac{u^3}{3}-9u$	B1	Correct integral
	$\int_0^1\ldots\,\mathrm{d}x=\int_3^{\sqrt{8}}\ldots\mathrm{d}u$	B1	Change of limits, maybe seen earlier (may change back to x and not change limits)
	$=\left(\dfrac{8\sqrt{8}}{3}-9\sqrt{8}\right)-(9-27)$	M1	Correctly substituting correct limits for u into their integral of the form au^3+bu
	$=18-\dfrac{38}{3}\sqrt{2}$	A1	

	Question 11 Total	7	

Q	Answer	Marks	Comments
12(a)	$\overrightarrow{AB} = \begin{bmatrix}4\\2\\3\end{bmatrix} + \lambda\begin{bmatrix}-6\\4\\12\end{bmatrix}$ or $\begin{bmatrix}-2\\6\\15\end{bmatrix} + \lambda\begin{bmatrix}-6\\4\\12\end{bmatrix}$	**M1** **A1**	Correct
	$4-6\lambda = -3p-2$ $2+4\lambda = 2p+6$ $3+12\lambda = 6p+15$ $3p-6\lambda = -6,\ \ p-2\lambda = -2$ $2p-4\lambda = -4,\ \ p-2\lambda = -2$ $6p-12\lambda = -12,\ \ p-2\lambda = -2$	**m1**	Equate 3 pairs of equations or solve a pair of equations **oe**
	Equations are consistent, hence P lies on AB	**A1**	**CSO** Should be convincingly shown
		4	

Q	Answer	Marks	Comments
12(b)(i)2	$\overrightarrow{CP} = \begin{bmatrix}-3p-2\\2p+6\\6p+15\end{bmatrix} - \begin{bmatrix}-1\\10\\6\end{bmatrix}$	**M1**	
	$\overrightarrow{CP} = \begin{bmatrix}-3p-1\\2p-4\\6p+9\end{bmatrix}$	**A1**	**A1**: Correct direction vector **oe**
	$\begin{bmatrix}-3p-1\\2p-4\\6p+9\end{bmatrix} \cdot \begin{bmatrix}-6\\4\\12\end{bmatrix} = 0$ $18p+6+8p-16+72p+108 = 0$ $98p = -98$	**m1**	Correct scalar product
	$p = -1$	**A1**	
		4	

Q	Answer	Marks	Comments
12(b)(ii)	$AB = \sqrt{(4--2)^2 + (2-6)^2 + (3-15)^2}$ $AB = 14$	B1	
	$CP = \sqrt{(-1-1)^2 + (10-4)^2 + (6-9)^2}$	M1	**Ft** *their* p
	$CP = 7$	A1	
	Area $ABC = 49$	A1	
		4	

Q	Answer	Marks	Comments
12(c)	$AC^2 = (4--1)^2 + (2-10)^2 + (3-6)^2 = 98$ $\sin BAC = \frac{7}{\sqrt{98}}$	M1	or $\cos BAC = \frac{\begin{bmatrix}-6\\4\\12\end{bmatrix} \cdot \begin{bmatrix}-5\\8\\3\end{bmatrix}}{14 \times 7\sqrt{2}} = \frac{1}{\sqrt{2}}$
	Angle $BAC = 45°$	A1	**oe**
		2	

	Question 12 Total	**14**	