Question	Answer	Marks
1	Commence division and reach a partial quotient $x^2 + kx$	**M1**
	Obtain quotient $x^2 - 2x + 5$	**A1**
	Obtain remainder $-12x + 5$	**A1**
		3

Question	Answer	Marks
2	Plot the four points and draw straight line	**B1**
	State or imply that $\ln y = \ln C + x \ln a$	**B1**
	Carry out a completely correct method for finding $\ln C$ or $\ln a$	**M1**
	Obtain answer $C = 3.7$	**A1**
	Obtain answer $a = 1.5$	**A1**
		5

Question	Answer	Marks
3(i)	Calculate value of a relevant expression or expressions at $x = 2$ and $x = 3$	**M1**
	Complete the argument correctly with correct calculated values	**A1**
		2
3(ii)	Use an iterative formula correctly at least once	**M1**
	Show that (B) fails to converge	**A1**
	Using (A), obtain final answer 2.43	**A1**
	Show sufficient iterations to justify 2.43 to 2 d.p., or show there is a sign change in (2.425, 2.435)	**A1**
		4

Question	Answer	Marks
4(i)	Use correct $\tan(A \pm B)$ formula and express the LHS in terms of $\tan x$	**M1**
	Using $\tan 45° = 1$ express LHS as a single fraction	**A1**
	Use Pythagoras or correct double angle formula	**M1**
	Obtain given answer	**A1**
		4
4(ii)	Show correct sketch for one branch	**B1**
	Both branches correct and nothing else seen in the interval	**B1**
	Show asymptote at $x = 45°$	**B1**
		3

Question	Answer	Marks
5(i)	State or imply $y^3 + 3xy^2 \frac{dy}{dx}$ as derivative of xy^3	**B1**
	State or imply $4y^3 \frac{dy}{dx}$ as derivative of y^4	**B1**
	Equate derivative of the LHS to zero and solve for $\frac{dy}{dx}$	**M1**
	Obtain the given answer	**A1**
		4
5(ii)	Equate numerator to zero	***M1**
	Obtain $y = -2x$, or equivalent	**A1**
	Obtain an equation in x or y	**DM1**
	Obtain final answer $x = -1$, $y = 2$ and $x = 1$, $y = -2$	**A1**
		4

Question	Answer	Marks
6	Separate variables correctly and attempt integration of one side	**B1**
	Obtain term $\tan y$, or equivalent	**B1**
	Obtain term of the form $k \ln \cos x$, or equivalent	**M1**
	Obtain term $-4 \ln \cos x$, or equivalent	**A1**
	Use $x = 0$ and $y = \frac{1}{4}\pi$ in solution containing $a \tan y$ and $b \ln \cos x$ to evaluate a constant, or as limits	**M1**
	Obtain correct solution in any form, e.g. $\tan y = 4 \ln \sec x + 1$	**A1**
	Substitute $y = \frac{1}{3}\pi$ in solution containing terms $a \tan y$ and $b \ln \cos x$, and use correct method to find x	**M1**
	Obtain answer $x = 0.587$	**A1**
		8

Question	Answer	Marks
7(a)	Square $x + \mathrm{i}y$ and equate real and imaginary parts to 8 and -15	**M1**
	Obtain $x^2 - y^2 = 8$ and $2xy = -15$	**A1**
	Eliminate one unknown and find a horizontal equation in the other	**M1**
	Obtain $4x^4 - 32x^2 - 225 = 0$ or $4y^4 + 32y^2 - 225 = 0$, or three term equivalent	**A1**
	Obtain answers $\pm\frac{1}{\sqrt{2}}(5 - 3\mathrm{i})$ or equivalent	**A1**
		5
7(b)	Show a circle with centre $2 + \mathrm{i}$ in a relatively correct position	**B1**
	Show a circle with radius 2 and centre not at the origin	**B1**
	Show line through i at an angle of $\frac{1}{4}\pi$ to the real axis	**B1**
	Shade the correct region	**B1**
		4

Question	Answer	Marks
8(i)	Use a relevant method to determine a constant	**M1**
	Obtain one of the values $A = 2$, $B = 2$, $C = -1$	**A1**
	Obtain a second value	**A1**
	Obtain the third value	**A1**
		4
8(ii)	Integrate and obtain terms $2x + 2\ln(x+2) - \frac{1}{2}\ln(2x-1)$ (deduct **B1** for each error or omission) [The FT is on A, B and C]	**B2 FT**
	Substitute limits correctly in an integral containing terms $a\ln(x+2)$ and $b\ln(2x-1)$, where $ab \neq 0$	***M1**
	Use at least one law of logarithms correctly	**DM1**
	Obtain the given answer after full and correct working	**A1**
		5

Question	Answer	Marks
9(i)	Use correct product or quotient rule	**M1**
	Obtain correct derivative in any form	**A1**
	Equate derivative to zero and obtain a 3 term quadratic equation in x	**M1**
	Obtain answers $x = 2 \pm \sqrt{3}$	**A1**
		4
9(ii)	Integrate by parts and reach $k(1+x^2)e^{-\frac{1}{2}x} + l\int xe^{-\frac{1}{2}x}\,dx$	***M1**
	Obtain $-2(1+x^2)e^{-\frac{1}{2}x} + 4\int xe^{-\frac{1}{2}x}\,dx$, or equivalent	**A1**
	Complete the integration and obtain $(-18-8x-2x^2)e^{-\frac{1}{2}x}$, or equivalent	**A1**
	Use limits $x = 0$ and $x = 2$ correctly, having fully integrated twice by parts	**DM1**
	Obtain the given answer	**A1**
		5

Question	Answer	Marks
10(i)	Equate at least two pairs of components of general points on l and m and solve for λ or for μ	M1
	Obtain correct answer for λ or μ, e.g. $\lambda = 3$ or $\mu = -2$; $\lambda = 0$ or $\mu = -\frac{1}{2}$; or $\lambda = \frac{3}{2}$ or $\mu = -\frac{7}{2}$	A1
	Verify that not all three pairs of equations are satisfied and that the lines fail to intersect	A1
		3
10(ii)	Carry out correct process for evaluating scalar product of direction vectors for l and m	*M1
	Using the correct process for the moduli, divide the scalar product by the product of the moduli and evaluate the inverse cosine of the result	DM1
	Obtain answer 45° or $\frac{1}{4}\pi$ (0.785) radians	A1
		3
10(iii)	*EITHER:* Use scalar product to obtain a relevant equation in a, b and c, e.g. $-a+b+4c=0$	B1
	Obtain a second equation, e.g. $2a+b-2c=0$ and solve for one ratio, e.g. $a : b$	M1
	Obtain $a : b : c = 2 : -2 : 1$, or equivalent	A1
	Substitute (3, –2, –1) and values of a, b and c in general equation and find d	M1
	Obtain answer $2x-2y+z=9$, or equivalent	A1
	*OR*1: Attempt to calculate vector product of relevant vectors, e.g $(-\mathbf{i}+\mathbf{j}+4\mathbf{k})\times(2\mathbf{i}+\mathbf{j}-2\mathbf{k})$	(M1
	Obtain two correct components	A1
	Obtain correct answer, e.g. $-6\mathbf{i}+6\mathbf{j}-3\mathbf{k}$	A1
	Substitute (3, –2, –1) in $-6x+6y-3z=d$, or equivalent, and find d	M1
	Obtain answer $-2x+2y-z=-9$, or equivalent	A1)
	*OR*2: Using the relevant point and relevant vectors, form a 2-parameter equation for the plane	(M1
	State a correct equation, e.g. $\mathbf{r}=3\mathbf{i}-2\mathbf{j}-\mathbf{k}+\lambda(-\mathbf{i}+\mathbf{j}+4\mathbf{k})+\mu(2\mathbf{i}+\mathbf{j}-2\mathbf{k})$	A1
	State three correct equations in x, y, z, λ and μ	A1
	Eliminate λ and μ	M1

Question	Answer	Marks
	Obtain answer $2x - 2y + z = 9$, or equivalent	**A1)**
	*OR*3: Using the relevant point and relevant vectors, form a determinant equation for the plane	**(M1**
	State a correct equation, e.g. $\begin{vmatrix} x-3 & y+2 & z+1 \\ -1 & 1 & 4 \\ 2 & 1 & -2 \end{vmatrix} = 0$	**A1**
	Attempt to expand the determinant	**M1**
	Obtain two correct cofactors	**A1**
	Obtain answer $-2x + 2y - z = -9$, or equivalent	**A1)**
		5