Question	Answer	Marks
1	Obtain a correct unsimplified version of the x or x^2 term of the expansion of $(4-3x)^{-\frac{1}{2}}$ or $\left(1-\frac{3}{4}x\right)^{-\frac{1}{2}}$	M1
	State correct first term 2	B1
	Obtain the next two terms $\frac{3}{4}x+\frac{27}{64}x^2$	A1 + A1
	Total:	4

Question	Answer	Marks
2	State or imply $u^2=u+5$, or equivalent in 5^x	B1
	Solve for u, or 5^x	M1
	Obtain root $\frac{1}{2}(1+\sqrt{21})$, or decimal in [2.79, 2.80]	A1
	Use correct method for finding x from a positive root	M1
	Obtain answer $x = 0.638$ and no other answer	A1
	Total:	5

Question	Answer	Marks
3	Integrate by parts and reach $ax\sin 3x+b\int\sin 3x\mathrm{d}x$	M1*
	Obtain $\frac{1}{3}x\sin 3x-\frac{1}{3}\int\sin 3x\mathrm{d}x$, or equivalent	A1
	Complete the integration and obtain $\frac{1}{3}x\sin 3x+\frac{1}{9}\cos 3x$, or equivalent	A1
	Substitute limits correctly having integrated twice and obtained $ax\sin 3x + b\cos 3x$	M1(dep*)
	Obtain answer $\frac{1}{18}(\pi-2)$ OE	A1
	Total:	5

Question	Answer	Marks
4(i)	Use the quotient or product rule	**M1**
	Obtain correct derivative in any form	**A1**
	Equate derivative to zero and obtain the given equation	**A1**
	Total:	**3**
4(ii)	Sketch a relevant graph, e.g. $y = \ln x$	**B1**
	Sketch a second relevant graph, e.g. $y = 1 + \frac{3}{x}$, and justify the given statement	**B1**
	Total:	**2**
4(iii)	Use iterative formula $x_{n+1} = \frac{3+x}{\ln x_n}$ correctly at least once	**M1**
	Obtain final answer 4.97	**A1**
	Show sufficient iterations to 4 d.p.to justify 4.97 to 2 d.p. or show there is a sign change in the interval (4.965, 4.975)	**A1**
	Total:	**3**

Question	Answer	Marks
5(i)	Attempt cubic expansion and equate to 1	**M1**
	Obtain a correct equation	**A1**
	Use Pythagoras and double angle formula in the expansion	**M1**
	Obtain the given result correctly	**A1**
	Total:	**4**
5(ii)	Use the identity and carry out a method for finding a root	**M1**
	Obtain answer 20.9°	**A1**
	Obtain a second answer, e.g. 69.1°	**A1FT**
	Obtain the remaining answers, e.g. 110.9° and 159.1°, and no others in the given interval	**A1FT**
	Total:	**4**

Question	Answer	Marks
6(i)	Carry out relevant method to find A and B such that $\frac{1}{4-y^2} \equiv \frac{A}{2+y} + \frac{B}{2-y}$	**M1**
	Obtain $A = B = \frac{1}{4}$	**A1**
	Total:	**2**
6(ii)	Separate variables correctly and integrate at least one side to obtain one of the terms $a \ln x$, $b \ln (2 + y)$ or $c \ln (2 - y)$	**M1**
	Obtain term $\ln x$	**B1**
	Integrate and obtain terms $\frac{1}{4}\ln(2+y) - \frac{1}{4}\ln(2-y)$	**A1FT**
	Use $x = 1$ and $y = 1$ to evaluate a constant, or as limits, in a solution containing at least two terms of the form $a \ln x$, $b \ln (2 + y)$ and $c \ln (2 - y)$	**M1**
	Obtain a correct solution in any form, e.g. $\ln x = \frac{1}{4}\ln(2+y) - \frac{1}{4}\ln(2-y) - \frac{1}{4}\ln 3$	**A1**
	Rearrange as $\frac{2(3x^4-1)}{(3x^4+1)}$, or equivalent	**A1**
	Total:	**6**

Question	Answer	Marks
7(i)	State answer $R = \sqrt{5}$	**B1**
	Use trig formulae to find $\tan \alpha$	**M1**
	Obtain $\tan \alpha = 2$	**A1**
	Total:	**3**
7(ii)	State that the integrand is $3\sec^2(\theta - \alpha)$	**B1FT**
	State correct indefinite integral $3\tan(\theta - \alpha)$	**B1FT**
	Substitute limits correctly	**M1**
	Use $\tan(A \pm B)$ formula	**M1**
	Obtain the given exact answer correctly	**A1**
	Total:	**5**

Question	Answer	Marks
8(i)	State or imply $3y^2 \dfrac{dy}{dx}$ as derivative of y^3	B1
	State or imply $3y^2 + 6xy \dfrac{dy}{dx}$ as derivative of $3xy^2$	B1
	Equate derivative of LHS to zero and solve for $\dfrac{dy}{dx}$	M1
	Obtain the given answer	A1
	Total:	4
8(ii)	Equate denominator to zero and solve for y	M1*
	Obtain $y = 0$ and $x = a$	A1
	Obtain $y = \alpha x$ and substitute in curve equation to find x or to find y	M1(dep*)
	Obtain $x = -a$	A1
	Obtain $y = 2a$	A1
	Total:	5

Question	Answer	Marks
9(a)	Substitute and obtain a correct equation in x and y	B1
	Use $i^2 = -1$ and equate real and imaginary parts	M1
	Obtain two correct equations in x and y, e.g. $3x - y = 1$ and $3y - x = 5$	A1
	Solve and obtain answer $z = 1 +$ **2(i)**	A1
	Total:	4
9(b)	Show a circle with radius 3	B1
	Show the line $y = 2$ extending in both quadrants	B1
	Shade the correct region	B1
	Carry out a complete method for finding the greatest value of arg z	M1
	Obtain answer 2.41	A1
	Total:	5

Question	Answer	Marks
10(i)	Carry out a correct method for finding a vector equation for AB	M1
	Obtain $\mathbf{r} = 2\mathbf{i} + \mathbf{j} + 3\mathbf{k} + \lambda(2\mathbf{i} - 2\mathbf{k})$, or equivalent	A1
	Equate pair(s) of components AB and l and solve for λ or μ	M1(dep*)
	Obtain correct answer for λ or μ	A1
	Verify that all three component equations are not satisfied	A1
	Total:	5
10(ii)	State or imply a direction vector for AP has components $(2 + t, 5 + 2t, -3 - 2t)$	B1
	State or imply that cos 120° equals the scalar product of $\overrightarrow{AP}$ and $\overrightarrow{AB}$ divided by the product of their moduli	M1
	Carry out the correct processes for finding the scalar product and the product of the moduli in terms of t, and obtain an equation in terms of t	M1
	Obtain the given equation correctly	A1
	Solve the quadratic and use a root to find a position vector for P	M1
	Obtain position vector $2\mathbf{i} + 2\mathbf{j} + 4\mathbf{k}$ from $t = -2$, having rejected the root $t = -\frac{2}{3}$	A1
	Total:	6