Question	Answer	Marks
1	Commence division and reach partial quotient $3x^2 + kx$	**M1**
	Obtain quotient $3x^2 + 2x - 1$	**A1**
	Obtain remainder $2x - 5$	**A1**
		4

Question	Answer	Marks
2	State or imply $2 \ln y = \ln A + kx$	**B1**
	Substitute values of $\ln y$ and x, or equate gradient of line to k, and solve for k	**M1**
	Obtain $k = 0.80$	**A1**
	Solve for $\ln A$	**M1**
	Obtain $A = 3.31$	**A1**
	Alternative method for question 2	
	Obtain two correct equations in y and x by substituting y- and x- values in the given equation	**B1**
	Solve for k	**M1**
	Obtain $k = 0.80$	**A1**
	Solve for A	**M1**
	Obtain $A = 3.31$	**A1**
		5

Question	Answer	Marks
3	Commence integration and reach $ax^{\frac{5}{2}} \ln x + b\int x^{\frac{5}{2}}.\frac{1}{x}\mathrm{d}x$	**M1***
	Obtain $\frac{2}{5}x^{\frac{5}{2}} \ln x - \frac{2}{5}\int x^{\frac{5}{2}}.\frac{1}{x}\mathrm{d}x$	**A1**
	Complete the integration and obtain $\frac{2}{5}x^{\frac{5}{2}} \ln x - \frac{4}{25}x^{\frac{5}{2}}$, or equivalent	**A1**
	Use limits correctly, having integrated twice e.g $\frac{2}{5}\times 32 \ln 4 - \frac{4}{25}\times 32 - \left(\frac{2}{5}\times 0\right) + \frac{4}{25}$	**DM1**
	Obtain answer $\frac{128}{5}\ln 2 - \frac{124}{25}$, or exact equivalent	**A1**
		5

Question	Answer	Marks
4	Use correct product rule	**M1**
	Obtain correct derivative in any form, e.g. $-\sin x \sin 2x + 2\cos x \cos 2x$	**A1**
	Use double angle formula to express derivative in terms of $\sin x$ and $\cos x$	**M1**
	Equate derivative to zero and obtain an equation in one trig function	**M1**
	Obtain $3 \sin 2x = 1$, or $3 \cos 2x = 2$ or $2 \tan 2x = 1$	**A1**
	Solve and obtain $x = 0.615$	**A1**
		6

Question	Answer	Marks
5(a)	State $R = \sqrt{7}$	**B1**
	Use trig formulae to find α	**M1**
	Obtain $\alpha = 57.688°$	**A1**
		3
5(b)	Evaluate $\cos{-1}\left(\frac{1}{\sqrt{7}}\right)$ to at least 3 d.p. (67.792°) (**FT** is on *their R*)	**B1 FT**
	Use correct method to find a value of θ in the interval	**M1**
	Obtain answer, e.g. 5.1°	**A1**
	Obtain second answer, e.g.117.3°, only	**A1**
		4

6(a)	Use quotient or product rule	**M1**
	Obtain correct derivative in any form e.g. $\frac{\left(1+3x^4\right)-x\times 12x^3}{\left(1+3x^4\right)^2}$	**A1**
	Equate derivative to zero and solve for x	**M1**
	Obtain answer 0.577	**A1**
		4

Question	Answer	Marks
6(b)	State or imply $\mathrm{d}u = 2\sqrt{3x}\,\mathrm{d}x$, or equivalent	**B1**
	Substitute for x and $\mathrm{d}x$	**M1**
	Obtain integrand $\dfrac{1}{2\sqrt{3\left(1+u^2\right)}}$, or equivalent	**A1**
	State integral of the form $a\tan^{-1}u$ and use limits $u = 0$ and $u = \sqrt{3}$ (or $x = 0$ and $x = 1$) correctly	**M1**
	Obtain answer $\dfrac{\sqrt{3}}{18}\pi$, or exact equivalent	**A1**
		5

Question	Answer	Marks
7	Separate variables correctly and integrate at least one side	**B1**
	Obtain term $\ln(y-1)$	**B1**
	Carry out a relevant method to determine A and B such that $\frac{1}{(x+1)(x+3)} \equiv \frac{A}{x+1} + \frac{B}{x+3}$	**M1**
	Obtain $A = \frac{1}{2}$ and $B = -\frac{1}{2}$	**A1**
	Integrate and obtain terms $\frac{1}{2}\ln(x+1) - \frac{1}{2}\ln(x+3)$ $\frac{1}{2}\ln(x+1) - \frac{1}{2}\ln(x+3)$, or equivalent (**FT** is on A and B)	**A1 FT + A1 FT**
	Use $x = 0$, $y = 2$ to evaluate a constant, or as limits in a solution containing terms of the form $a\ln(y-1)$, $b\ln(x+1)$ and $c\ln(x+3)$, where $abc \neq 0$	**M1**
	Obtain correct answer in any form	**A1**
	Obtain final answer $y = 1 + \sqrt{\left(\frac{3x+3}{x+3}\right)}$, or equivalent	**A1**
		9

Question	Answer	Marks
8(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. $x - y = 3$ and $3x + y = 5$	**A1**
	Solve and obtain answer $z = 2 - i$	**A1**
		4
8(b)(i)	Show a point representing $2 + 2i$	**B1**
	Show a circle with radius 1 and centre not at the origin (**FT** is on the point representing the centre)	**B1 FT**
	Show the correct half line from 4i	**B1**
	Shade the correct region	**B1**
		4
8(b)(ii)	Carry out a complete method for finding the least value of $\text{Im}\, z$	**M1**
	Obtain answer $2 - \frac{1}{2}\sqrt{2}$, or exact equivalent	**A1**
		2

Question	Answer	Marks
9(a)	State $\cos p = \dfrac{k}{1+p}$	**B1**
	Differentiate both equations and equate derivatives at $x = p$	**M1**
	Obtain a correct equation in any form, e.g. $-\sin p = -\dfrac{k}{(1+p)^2}$	**A1**
	Eliminate k	**M1**
	Obtain the **given answer** showing sufficient working	**A1**
		5
9(b)	Use the iterative formula correctly at least once	**M1**
	Obtain final answer $p = 0.568$	**A1**
	Show sufficient iterations to justify 0.568 to 3 d.p., or show there is a sign change in the interval (0.5675, 0.5685)	**A1**
		3
9(c)	Use a correct method to find k	**M1**
	Obtain answer $k = 1.32$	**A1**
		2

Question	Answer	Marks
10(a)	State that the position vector of M is $3\mathbf{i} + \mathbf{j}$	**B1**
	Use a correct method to find the position vector of N	**M1**
	Obtain answer $\frac{10}{3}\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$	**A1**
	Use a correct method to form an equation for MN	**M1**
	Obtain correct answer in any form, e.g. $\mathbf{r} = 3\mathbf{i} + \mathbf{j} + \lambda\left(\frac{1}{3}\mathbf{i} + \mathbf{j} + 2\mathbf{k}\right)$	**A1**
		5
10(b)	State or imply $\mathbf{r} = \mu(2\mathbf{i} + 2\mathbf{j} + 3\mathbf{k})$ as equation for OB	**B1**
	Equate sufficient components of MN and OB and solve for λ or for μ	**M1**
	Obtain $\lambda = 3$ or $\mu = 2$ and position vector $4\mathbf{i} + 4\mathbf{j} + 6\mathbf{k}$ for P	**A1**
		3
10(c)	Carry out correct process for evaluating the scalar product of direction vectors for OP and MP, or equivalent	**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	**M1**
	Obtain answer $21.6°$	**A1**
		3