Question	Answer	Marks	Partial Marks
1	$\frac{dy}{dx} = \cos x - e^{-x}$	**B2**	**B1** for $\cos x$ or $-e^{-x}$
	$\delta y = their \left.\frac{dy}{dx}\right\|_{x=\frac{\pi}{4}} \times h$	**M1**	
	$0.251h$	**A1**	
2	Squares: $(1-\sqrt{5})^2 = 1-\sqrt{5}-\sqrt{5}+5$	**B1**	or rationalises $\frac{10+2\sqrt{5}}{(1-\sqrt{5})^2} \times \frac{(1+\sqrt{5})^2}{(1+\sqrt{5})^2}$
	Rationalises, e.g. $\frac{10+2\sqrt{5}}{6-2\sqrt{5}} \times \frac{6+2\sqrt{5}}{6+2\sqrt{5}}$	**B1**	or squares $(1+\sqrt{5})^2 = 1+\sqrt{5}+\sqrt{5}+5$
	Multiplies out, e.g. $\frac{60+20\sqrt{5}+12\sqrt{5}+4(5)}{36-20}$	**M1**	Multiplies out $\left[\frac{10+2\sqrt{5}}{(1-\sqrt{5})^2} \times \frac{6+2\sqrt{5}}{(1+\sqrt{5})^2} = \right] \frac{60+20\sqrt{5}+12\sqrt{5}+4(5)}{(1-5)^2}$
	$5+2\sqrt{5}$	**A2**	A1 for $k+2\sqrt{5}$ or $5+k\sqrt{5}$
3	$x-3 = k^2x^2+5kx+1$	**M1**	
	$k^2x^2+(5k-1)x+4=0$ soi	**A1**	
	$(5k-1)^2-4(k^2)(4)$	**M1**	
	$9k^2-10k+1*0$	**M1**	
	Critical values: $\frac{1}{9}$ and 1 soi	**A1**	
	$k<\frac{1}{9}$ or $k>1$	**A1**	

Question	Answer	Marks	Partial Marks
4	Factorised form: $(x+n)(x-n)(2x-1)$ oe	**B1**	
	Multiplies out correctly	**M1**	**FT** *their* factorised form provided of equivalent difficulty
	Correct expanded form in terms of n: $2x^3-x^2-2n^2x+n^2$	**A1**	
	Uses (*their* n^2) $=4$ in *their* expression	**M1**	
	$2x^3-x^2-8x+4$	**A1**	If **A0A0** then **SC1** for $(x+n)(x-n)(x-0.5)$ giving $n^2=8$ leading to $x^3-\frac{1}{2}x^2-8x+4$
			Alternative method: **B1** for factorised form: $(x+n)(x-n)(2x-1)$
			M1 for *their* $n^2=4$
			A1 for $n=2$
			M1 for multiplying out $(x+their\,2)(x-their\,2)(2x-1)$
			A1 for $2x^3-x^2-8x+4$ If **A0A0** then **SC1** for $(x+n)(x-n)(x-0.5)$ giving $n^2=8$ leading to $x^3-\frac{1}{2}x^2-8x+4$
5(a)	Finds coordinates of mid-point (8, –2)	**B1**	
	$m_{AB}=\frac{3+7}{4-12}\left[=-\frac{5}{4}\right]$ oe soi	**B1**	
	$m_L=\frac{-1}{-5/4}$ oe	**M1**	
	$y+2=\frac{4}{5}(x-8)$ oe isw	**A1**	

Question	Answer	Marks	Partial Marks
5(b)	$y-12=-\frac{5}{4}(x-5)$	**B1**	
	Attempts to solve *their* equations	**M1**	
	(13, 2)	**A2**	**A1** for $x=13$ or $y=2$
6(a)	$\frac{\mathrm{d}y}{\mathrm{d}x}=\sec^2 2x$	**B1**	
	$their\left.\frac{\mathrm{d}y}{\mathrm{d}x}\right\|_{x=\frac{\pi}{8}}=their2$	**B1**	**FT** *their* $\frac{\mathrm{d}y}{\mathrm{d}x}$
	$x=\frac{\pi}{8},\quad y=4$	**B1**	
	$y-their4=(their2)\left(x-\frac{\pi}{8}\right)$ oe	**M1**	
	$2x-y=\frac{\pi}{4}-4$	**A1**	
6(b)	$\sqrt{\left(\frac{\pi}{8}-2\right)^2+\left(4-\frac{\pi}{4}\right)^2}$ oe	**M1**	
	3.59 or 3.59[03…] rot to four or more figs	**A1**	
7(a)	$2\ln(5x+2)$	**B2**	**B1** for $k\ln(5x+2)$
	$2\left(\ln(22)-\ln(2)\right)$ oe soi	**M1**	
	$2\ln 11$ or $\ln 121$ or $\ln 11^2$	**A1**	
7(b)	$\int \mathrm{e}^{8x+4}\mathrm{d}x$	**M1**	
	$\left[\frac{1}{8}\mathrm{e}^{8x+4}\right]_0^{\ln 2}$	**M1**	
	$\frac{1}{8}\left(\mathrm{e}^{\ln 2^8}\times\mathrm{e}^4-\mathrm{e}^4\right)$ oe	**M2**	**M1** for $\frac{1}{8}\left(\mathrm{e}^{\ln 2^8+4}-\mathrm{e}^4\right)$
	$\frac{255}{8}\mathrm{e}^4$ or exact equivalent	**A1**	

Question	Answer	Marks	Partial Marks
8(a)	$3(\text{cosec}^2 x - 1) - 14\,\text{cosec}\, x - 2 [= 0]$	**M1**	
	$3\text{cosec}^2 x - 14\text{cosec}\, x - 5 = 0$	**A1**	
	$(\text{cosec} x - 5)(3\text{cosec} x + 1)$	**M1**	
	$\sin x = \frac{1}{5}$ nfww	**A1**	
	11.5 and 168.5 nfww	**A1**	
8(b)	Correct use of $\sin^2 y + \cos^2 y = 1$	**B1**	
	Factorises using the difference of 2 squares	**B1**	
	Uses $\frac{1}{\cot y} = \tan y$ or $\cot y = \frac{\cos y}{\sin y}$ correctly	**B1**	
	Full and correct completion to given answer: $\tan y - 2\cos y \sin y$	**B1**	
9(a)	$\frac{3^{10x}}{3^{3x-6}} [= 243]$ oe or $\log 9^{5x} - \log 27^{x-2} = \log 243$ oe	**B1**	
	$3^{7x+6} = 3^5$ soi oe or $5x(\log 9) - (x-2)\log 27 = \log 243$	**M1**	
	$x = -\frac{1}{7}$	**A1**	

Question	Answer	Marks	Partial Marks
9(b)	$\frac{1}{2}\log_a b - \frac{1}{2} = \frac{1}{\log_a b}$ or $\frac{\frac{1}{2}}{\log_b a} - \frac{1}{2} = \log_b a$	**B2**	**B1** for bringing down the power of $\frac{1}{2}$ e.g. $\frac{1}{2}\log_a b$ or for a change of base e.g. $\frac{1}{\log_a b}$
	Clears the fraction and rearranges $\frac{1}{2}(\log_a b)^2 - \frac{1}{2}\log_a b = 1$ oe $(\log_a b)^2 - \log_a b - 2 = 0$ oe or let $x = \log_a b$ $x^2 - x - 2 = 0$ oe or $\frac{1}{2} - \frac{1}{2}\log_b a = (\log_b a)^2$ $0 = 2(\log_b a)^2 + \log_b a - 1$ oe or let $y = \log_b a$ $2y^2 + y - 1 = 0$	**M1**	
	$(\log_a b - 2)(\log_a b + 1)$ oe or $(2\log_b a - 1)(\log_b a + 1)$	**M1**	
	[$\log_a b = 2$, $\log_a b = -1$ or $\log_b a = \frac{1}{2}$, $\log_b a = -1$ leading to] $b = a^2$, $b =$ oe	**A1**	
10(a)(i)	$4 \times (-0.5)^{19}$	**M1**	
	$-\frac{1}{131072}$ or -7.63×10^{-6} or $-7.62939... \times 10^{-6}$ rot to four or more figs	**A1**	
10(a)(ii)	Valid explanation e.g. the common ratio is between −1 and 1	**B1**	
	$\frac{4}{1-(-0.5)} = \frac{8}{3}$	**B1**	

Question	Answer	Marks	Partial Marks
10(b)(i)	$a+9d=15(a+d)$	**B1**	
	$\frac{6}{2}\{2a+5d\}=87$	**B1**	
	Solves *their* equations for d e.g. $2\left(-\frac{3}{7}d\right)+5d=29$	**M1**	
	$d=7$	**A1**	
10(b)(ii)	$a=-3$ soi	**B1**	
	$6990=their(-3)+(n-1)(their7)$	**M1**	
	$n=1000$	**A1**	
11(a)	[perimeter =] $\frac{4}{3}\pi r$ soi	**B2**	**B1** for angle $ACB=\frac{2}{3}\pi$
	$\left(their\frac{4}{3}\pi r\right)=4\pi$ oe	**M1**	
	$r=3$	**A1**	
11(b)	$\frac{1}{2}\times their3^2\times their\frac{2\pi}{3}$ oe	**M1**	
	$\frac{1}{2}\times their3^2\times\sin their\frac{2\pi}{3}$ oe	**M1**	
	For subtracting and doubling: $their3^2\times their\frac{2\pi}{3}-$ $their3^2\times\sin their\frac{2\pi}{3}$	**M1**	
	$6\pi-\frac{9}{2}\sqrt{3}$ or exact equivalent	**A1**	