Question	Answer	Marks	Guidance
2	$x^2+2x=kx-3$ $\left[\Rightarrow x^2+(2-k)x+3=0\right]$	**M1**	
	$(2-k)^2-12*0$	**M1**	**Dep** on previous **M** mark *Allow use of any inequality or equality
	$k^2-4k-8*0$	**A1**	
	$k=\frac{4\pm\sqrt{4^2+4\times8}}{2}$ oe	**M1**	Solve *their* 3-term quadratic equation in k
	$k=2\pm\sqrt{12}$ or $\frac{4\pm\sqrt{48}}{2}$ oe	**A1**	
	$k<2-2\sqrt{3}$, $k>2+2\sqrt{3}$ oe	**A1**	Allow $\sqrt{12}$ for $2\sqrt{3}$
3(a)	$\log_2 x-4=5\frac{\log_2 2}{\log_2 x}$ or $=\frac{1}{\log_2 x}$	**M1**	Correct use of change of base
	$(\log_2 x)^2-4\log_2 x-5=0$	**A1**	Arrange as 3-term quadratic equation in $\log_2 x$
	$(\log_2 x-5)(\log_2 x+1)=0$ or $\log_2 x=\frac{4\pm\sqrt{4^2-4\times(-5)}}{2}$	**M1**	**Dep** on previous **M** mark
	$\log_2 x=5$ or -1	**A1**	For either
	$x=32$ or $x=\frac{1}{2}$	**A1**	Both
	Alternative method		
	$\frac{\log_x x}{\log_x 2}-4=5\log_x 2$	**(M1)**	
	$(5\log_x 2)^2+4\log_x 2-1=0$	**(A1)**	
	$(5\log_x 2-1)(\log_x 2+1)=0$ or $\log_x 2=\frac{-4\pm\sqrt{4^2-4\times(-5)}}{10}$	**(M1)**	**Dep** on previous **M** mark
	$\log_x 2=\frac{1}{5}$ or -1	**(A1)**	For either
	$x=32$ or $x=\frac{1}{2}$	**(A1)**	Both

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Question	Answer	Marks	Guidance
3(b)	$e^{x^2-3-(7-x^2)} = 25$ oe	**M1**	Arrange as equation with one power of e
	$2x^2 - 10 = \ln 25$	**A1**	
	$x^2 = \dfrac{\ln 25 + 10}{2}$	**A1**	
	$x = \pm\sqrt{\frac{\ln 25+10}{2}}$ oe or $\pm\sqrt{\ln 5 + 5}$	**A1**	isw
4(a)	Many-many (mapping) oe or A vertical line meets graph more than once (or twice) oe	**B1**	
4(b)	<table><tr><td></td><td>✓</td><td></td></tr><tr><td>✓</td><td></td><td>✓</td></tr><tr><td></td><td>✓</td><td></td></tr><tr><td>✓</td><td></td><td></td></tr></table>	**4**	**B1** for each correct row
4(c)(i)	$\sin x \geqslant \frac{1}{2}$	**M1**	May be implied. Allow >
	$a = 150$ seen	**A1**	
4(c)(ii)	$0 \leqslant \text{gf}(x) \leqslant \frac{1}{\sqrt{2}}$	**2**	**B1** for each correct value with correct sign associated with it
4(c)(iii)	No. Range of g $\not\subset$ domain of g oe	**B1**	
5(a)	$\frac{10}{2}(6 + 9d) = 4 \times \frac{5}{2}(6 + 4d)$	**M2**	**M1** for either sum correct
	$d = 6$	**A1**	

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