Question	Answer	Marks	Guidance
7(b)	**Alternative 3** final 2 marks $\frac{-1}{a-1} - \ln 7 + \ln\left(\frac{e(2a+3)}{(a-1)}\right)$ oe	**2**	**A1** for $\frac{-1}{a-1} - \ln 7$ Allow 1.946 or better for ln 7 **A1** for $\ln\left(\frac{e(2a+3)}{(a-1)}\right)$
8(a)	With the sisters: 70 or ${}^{8}C_{4}$ oe	**B1**	
	Without the sisters: 28 or ${}^{8}C_{6}$ oe	**B1**	
	Total: 98	**B1**	
8(b)(i)	60480	**B1**	
8(b)(ii)	The start of the password and the end of the password can each be chosen 6 ways	**B1**	6 or ${}^{3}P_{2}$ oe seen twice
	The remaining characters can be chosen in 20 ways	**B1**	20 or ${}^{5}P_{2}$ oe seen
	Total number of ways: 720	**B1**	

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Question	Answer	Marks	Guidance
9	When $x = 0,\ y = \ln 2$ soi	**B1**	May be implied in later work
	$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{(x+1)\frac{6x}{\left(3x^2+2\right)} - \ln\left(3x^2+2\right)}{(x+1)^2}$	**3**	**B1** for $\frac{6x}{\left(3x^2+2\right)}$ allow when seen **M1** for attempt at a quotient or product **A1** for all other terms apart from $\frac{6x}{\left(3x^2+2\right)}$ correct
	When $x = 0, \frac{\mathrm{d}y}{\mathrm{d}x} = -\ln 2$	**M1**	**Dep** on previous **M** mark for attempt to find the gradient using *their* $\frac{\mathrm{d}y}{\mathrm{d}x}$
	Equation of normal: $y - \ln 2 = \frac{1}{\ln 2}x$	**M1**	For attempt at a normal equation using *their y* (not 3 ln2) and $-\frac{1}{\textit{their}\left(-\ln 2\right)}$, must be from an attempt at differentiation
	When $y = 0,\ x = -(\ln 2)^2$	**M1**	For attempt to find the value of x when $y = 0$ using *their* normal equation
	Gradient $BC = \frac{3\ln 2}{(\ln 2)^2}$	**M1**	**Dep** on both previous **M** marks
	$\frac{3}{\ln 2}$ or $3(\ln 2)^{-1}$	**A1**	Must have correct exact working throughout