Question	Answer	Marks	Guidance
5(b)	$\frac{n}{2}\left(20+\left(n-1\right)5\right)\ \ \left(=25\ 000\right)$	**M1**	For attempting the sum to *n* terms using *their a* and *d*
	$5n^2+15n-50\ 000=0$ $n=98.5...$	**A1**	
	$n=99$	**A1**	
6	$1-4x+\frac{68}{9}x^2$	**2**	**B1** for $1-4x$ **B1** for $\frac{68}{9}x^2$ or $7.56x^2$
	$1+9x+27x^2$	**B1**	
	Term in x: $-4x+9x=5x$ or coefficients of x: $-4+9$	**M1**	For $\left(their\ -4\left(x\right)\right)+\left(their\ 9\left(x\right)\right)$
	$a=5$	**A1**	
	Term in x^2: $\frac{68}{9}x^2+27x^2-36x^2$ or coefficients of x^2: $\frac{68}{9}+27-36$	**M1**	For $\left(their\frac{68}{9}\left(x\right)\right)+\left(their27\left(x\right)\right)+$ $\left(\left(their-4\left(x\right)\right)\times\left(their\ 9\left(x\right)\right)\right)$
	$b=-\frac{13}{9}$	**A1**	Must be exact
7(a)	$2\pi r+4x+2x\theta$	**3**	**B1** for $2\pi r$ **B1** for $+4x$ **B1** for $2x\theta$
7(b)	$\pi r^2-x^2\theta$	**B1**	
7(c)	Least value when $x=r$	**B1**	
	Least value = $r^2\left(\pi-\theta\right)$ oe	**B1**	
8	$2\ln\left(x+1\right)-\ln\left(x+2\right)$	**2**	**B1** for $2\ln\left(x+1\right)$ **B1** for $-\ln\left(x+2\right)$
	$\left(2\ln\left(a+1\right)-\ln\left(a+2\right)\right)+\ln2$	**M1**	For attempt to apply limits correctly, dependent on having 2 log terms.
	$\ln\frac{2\left(a+1\right)^2}{\left(a+2\right)}$	**2**	**M1** for use of either power rule or the division rule.

Question	Answer	Marks	Guidance
9	$2\log_p y + \dfrac{10}{\log_p y} - 9 = 0$ or $\dfrac{2}{\log_y p} + 10\log_y p - 9 = 0$	**B1**	For a change of base
	$2\left(\log_p y\right)^2 - 9\log_p y + 10 = 0$ or $10\left(\log_y p\right)^2 - 9\log_y p + 2 = 0$	**M1**	For attempt to obtain a 3-term quadratic equation = 0, in either $\log_p y$ or $\log_y p$
	$\log_p y = \dfrac{5}{2}$, $\log_p y = 2$ or $\log_y p = \dfrac{2}{5}$, $\log_y p = \dfrac{1}{2}$	**M1**	**Dep M** mark for attempt to solve the quadratic to obtain 2 solutions
	$y = p^{\frac{5}{2}}$	**A1**	
	$y = p^2$	**A1**	
10	$\dfrac{65n!}{(n-5)!5!} = \dfrac{2(n-1)(n+1)!}{(n-5)!6!}$ $65 = \dfrac{n^2-1}{3}$	**2**	**B1** for simplifying numerical factorials to 3 **B1** for simplifying algebraic factorials to either $(n-1)(n+1)$ or n^2-1
	$n = 14$	**B1**	
11(a)	$\overrightarrow{AC} = \mathbf{c} - \mathbf{a}$	**B1**	
	$\overrightarrow{AB} = \dfrac{2}{5}(\mathbf{c} - \mathbf{a})$ or $\overrightarrow{BC} = \dfrac{3}{5}(\mathbf{c} - \mathbf{a})$	**B1**	
	$\dfrac{2}{5}(\mathbf{c} - \mathbf{a}) = \mathbf{b} - \mathbf{a}$ or $\dfrac{3}{5}(\mathbf{c} - \mathbf{a}) = \mathbf{c} - \mathbf{b}$	**M1**	For equating two different forms of $\overrightarrow{AB}$ or 2 different forms of $\overrightarrow{BC}$
	$5\mathbf{b} - 3\mathbf{a} = 2\mathbf{c}$	**A1**	Simplification to obtain the given answer
11(b)	$\overrightarrow{XC} = \mathbf{c} - \dfrac{3\mathbf{a}}{4}$	**B1**	
	$\overrightarrow{XC} = \dfrac{5\mathbf{b}}{2} - \dfrac{9\mathbf{a}}{4}$	**B1**	