Question	Answer	Marks	Guidance
9(a)	$d = 12$	**B1**	
	$\frac{n}{2}\left(-8+(n-1)12\right) > 2000$ $3n^2 - 5n - 1000 > 0$	**M1**	For use of sum formula to obtain a three term quadratic inequality or equation
	$n = \frac{5 \pm \sqrt{25+12000}}{6}$ $n = 19.1$	**M1**	**Dep** for attempt at critical value(s) using *their* quadratic, may be using a calculator, so may be implied by a correct answer of 20.
	$n = 20$	**A1**	
9(b)(i)	$r = 3$	**2**	**M1** For $ar^6 = 27$ and $ar^8 = 243$ with an attempt to eliminate a to obtain r^2. Allow other valid methods.
9(b)(ii)	3^{26}	**2**	**B1** for $a = \frac{1}{27}$ or 3^{-3} nfww
9(c)	Common ratio or $r = \sin\theta$	**B1**	May be implied by e.g. $\frac{1}{1-\sin\theta}$ or $\frac{1-\sin^n\theta}{1-\sin\theta}$
	$-1 < \sin\theta < 1$ or $\lvert\sin\theta\rvert < 1$ or $-1 < r < 1$ or $\lvert r\rvert < 1$ with no incorrect statements seen.	**B1**	**Dep** on previous B1
10(a)	$\frac{1}{\sin\alpha} + \frac{1}{\cos\alpha} \quad (=0)$	**B1**	For dealing correctly with $\text{cosec}^2\alpha$ and $\sec^2\alpha$ to obtain an expression in $\sin\alpha$ and $\cos\alpha$ only
	$\tan\alpha = -1$ or $\sin\alpha = -\cos\alpha$	**B1**	For an equation in $\tan\alpha$, may be implied by a correct solution.
	$\alpha = -\frac{\pi}{4}$ or -0.785 $\alpha = \frac{3\pi}{4}$ or 2.36	**2**	**B1** for one correct solution **B1** for a second correct solution and no extra solutions in the range.

Question	Answer	Marks	Guidance
10(b)(i)	$\frac{\cos^2\theta+1-2\sin\theta+\sin^2\theta}{\cos\theta(1-\sin\theta)}$	**M1**	For dealing with the fractions correctly and expansion of $(1-\sin\theta)^2$
	$\frac{1+1-2\sin\theta}{\cos\theta(1-\sin\theta)}$ or better	**M1**	**Dep** for use of identity, may be implied by $\frac{2(1-\sin\theta)}{\cos\theta(1-\sin\theta)}$
	$\frac{2(1-\sin\theta)}{\cos\theta(1-\sin\theta)}$	**M1**	**Dep** on previous M mark for simplification
	$\frac{2}{\cos\theta}=2\sec\theta$	**A1**	Need to see this detail for A1 Need to have had θ in every trigonometric ratio.
	Alternative 1 $\left(\frac{\cos\theta}{1-\sin\theta}\times\frac{1+\sin\theta}{1+\sin\theta}\right)+\frac{1-\sin\theta}{\cos\theta}$	**(M1)**	
	$\frac{\cos\theta(1+\sin\theta)}{\cos^2\theta}+\frac{1-\sin\theta}{\cos\theta}$	**(M1)**	**Dep** for use of identity
	$\frac{1+\sin\theta}{\cos\theta}+\frac{1-\sin\theta}{\cos\theta}$	**(M1)**	**Dep** on previous M mark for simplification
	$\frac{2}{\cos\theta}=2\sec\theta$	**(A1)**	Need to see this detail for A1 Need to have had θ in every trigonometric ratio.
	Alternative 2 $\frac{(1-\sin^2\theta)+(1-\sin\theta)^2}{\cos\theta(1-\sin\theta)}$	**(M1)**	For dealing with the fractions and using $\cos^2\theta=1-\sin^2\theta$.
	$\frac{(1-\sin\theta)(1+\sin\theta)+(1-\sin\theta)^2}{\cos\theta(1-\sin\theta)}$	**(M1)**	**Dep** for factorising $1-\sin^2\theta$
	$\frac{1+\sin\theta+1-\sin\theta}{\cos\theta}$	**(M1)**	**Dep** for simplification
	$\frac{2}{\cos\theta}=2\sec\theta$	**(A1)**	Need to see this detail for A1 Need to have had θ in every trigonometric ratio.

Question	Answer	Marks	Guidance
10(b)(ii)	$\cos 3\phi = \frac{1}{2}$	**B1**	
	$\phi = 20^\circ, 100^\circ, 140^\circ$	**3**	**M1** for one correct solution of *their* $\cos 3\phi = k$ using a correct order of operations **A1** for 2 correct solutions **A1** for a third correct solution with no extra solutions in the range
11	$\frac{dy}{dx} = \frac{(2x-3)\frac{2x}{x^2+2} - 2\ln(x^2+2)}{(2x-3)^2}$	**3**	**B1** for $\frac{2x}{x^2+2}$ **M1** for differentiation of a quotient
	When $x = 2$, $\frac{dy}{dx} = \frac{4}{6} - 2\ln 6$, –2.92 Gradient of normal = 0.3428	**M1**	For $-\frac{1}{\textit{their } \frac{dy}{dx}}$
	When $x = 2$, $y = \ln 6$ or $1.79(176)$	**B1**	
	Equation of normal: $y - \ln 6 = -\frac{1}{\textit{their } \frac{dy}{dx}}(x-2)$ or $\ln 6 = -\frac{1}{\textit{their } \frac{dy}{dx}} \times (2) + c$	**M1**	**Dep** for equation of normal using $-\frac{1}{\textit{their } \frac{dy}{dx}}$ and *their y* with $x = 2$.
	When $x = 0$, $y =$ awrt 1.11	**A1**	Must be evaluated.