since

$$\frac{1}{N}\sum_{k=0}^{N-1} e^{\frac{j2\pi k(n-m)}{N}} = \begin{cases} 1 & n = m \text{ (modulo } N) \\ 0 & \text{otherwise} \end{cases}$$

- $\frac{1}{N}\sum_{k=0}^{N-1} |Y_k|^2$ This sum was intended to recall Parceval's equation for the DFT. So either from that relation directly or from

$$\begin{aligned}
\frac{1}{N}\sum_{k=0}^{N-1} |Y_k|^2 &= \frac{1}{N}\sum_{k=0}^{N-1} Y_k Y_k^* \\
&= \frac{1}{N}\sum_{k=0}^{N-1} Y_k \left(\sum_{n=0}^{N-1} X_n e^{\frac{-j2\pi kn}{N}}\right)^* \\
&= \sum_{n=0}^{N-1} X_n^* \frac{1}{N}\sum_{k=0}^{N-1} Y_k e^{\frac{j2\pi kn}{N}} \\
&= \sum_{n=0}^{N-1} X_n^* X_n = \sum_{n=0}^{N-1} |X_n|^2
\end{aligned}$$

Since $X_n = e^{jn\Theta}$ has magnitude 1 for all Θ, the answer is just N.

4. The last problem counted for about 1 point. If $X_n = e^{jn\Theta_n}$, then X_n becomes iid. The mean of X_0 changes to 0, but the remaining means and the autocorrelation are unchanged. The process is now strictly stationary since all iid processes are. All of the sums remain as before except the second sum, which now converges in distribution to a Gaussian random vector from the central limit theorem (both the real and imaginary parts converge to Gaussian random variables).