**1E Part 1 Finite Summations**

1. Given that $z=cos\left(\frac{π}{n}\right)+isin\left(\frac{π}{n}\right)$, where $n$ is a positive integer, show that:

$$1+z+z^{2}+..+z^{n-1}=1+icot\left(\frac{π}{2n}\right)$$

Notes for $e^{iθ}+e^{2iθ}+e^{3iθ}+..+e^{niθ}$

1. $S=e^{iθ}+e^{2iθ}+e^{3iθ}+..+e^{8iθ}$, for $θ\ne 2nπ$, where $n$ is an integer
2. Show that

$$S=\frac{e^{\frac{9iθ}{2}}sin4θ}{sin\left(\frac{θ}{2}\right)}$$

Let: $P=cosθ+cos2θ+cos3θ+..+cos8θ and Q=sinθ+sin2θ+sin3θ+..+sin8θ$

1. Use your answer to part a to show that $P=cos\frac{9θ}{2}sin4θcosec\frac{θ}{2}$, and find similar expressions for $Q$ and $\frac{P}{Q}$