1. A z-directed wire of length \( n\lambda/2 \) has a standing wave current of constant amplitude \( I_0 \), with the following mathematical description:

\[
\tilde{I}(z') = \begin{cases} 
I_0 & \text{for } -\frac{n\lambda}{4} < z' < +\frac{n\lambda}{4} \\
0 & \text{elsewhere}
\end{cases}
\]

where \( n \) is a positive integer number of stacked dipoles and \( u() \) is the unit step function.

a) Assuming ideal efficiency, make a dB-polar plot of the \( \theta \)-pol elevation-cut gain pattern of a base station antenna for the cases of \( n = 1, 2, 3, 4 \) and 5. (10 points)

b) Calculate the radiation resistance, peak gain, and half-power beamwidth in \( \theta \) for each case in (a). Report your values in a table. In the last column of the table, report the product of the linear value of the peak gain and the HPBW angle for each case. What do you notice? (10 points)

*it is OK to perform numerical integration where needed for this part

c) Compare the case of \( n=1 \) to the half-wave dipole result that we calculated in class. How does this antenna compare to the HWDP in terms of peak gain, beamwidth, and radiation resistance (5 points)