Lab 6 Pre-Lab

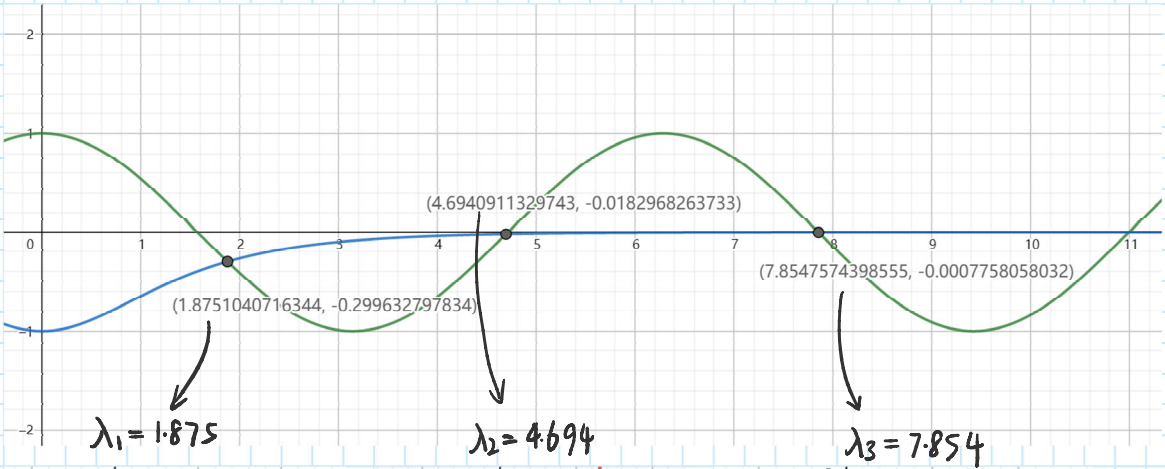
1. The mode shapes $\gamma_n(x)$ of a cantilever beam are multiples of the function

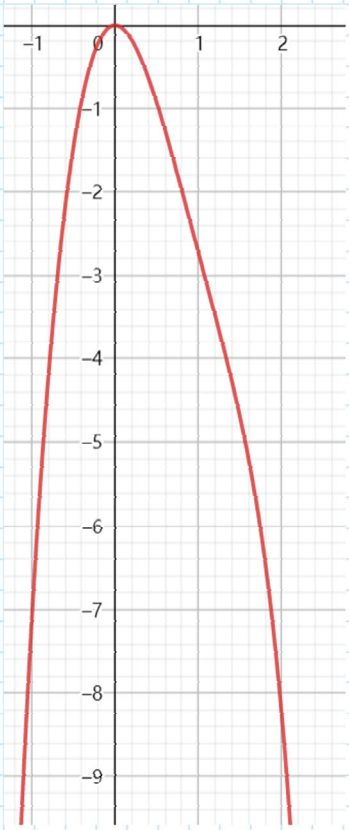
$$\sinh \lambda_n z - \sin \lambda_n z - \frac{\sinh \lambda_n + \sin \lambda_n}{\cosh \lambda_n + \cos \lambda_n}(\cosh \lambda_n z - \cos \lambda_n z)$$

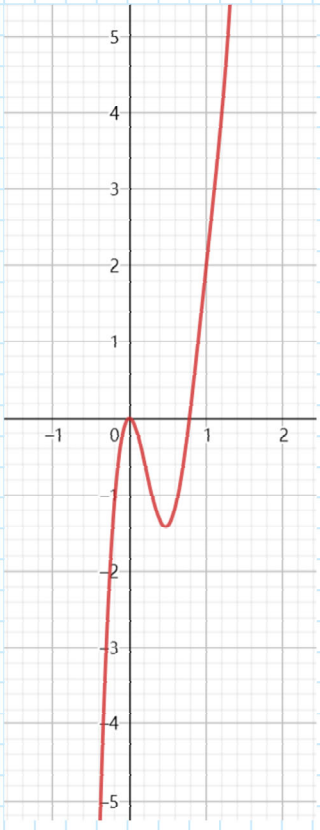
where $z = x/l$ and λ_n are roots of the equation

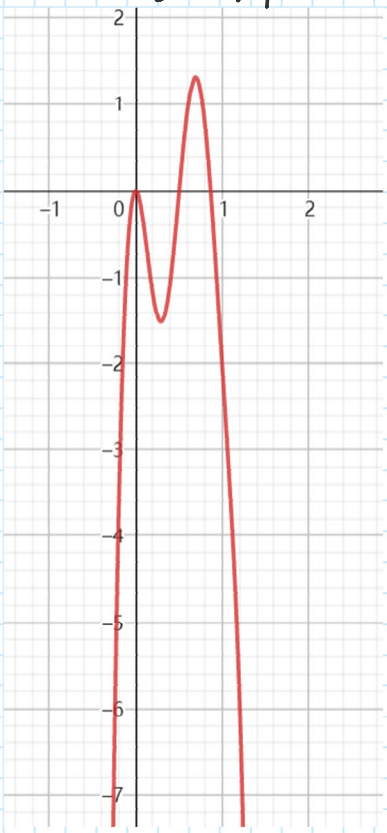
$$\cos \lambda = -\frac{1}{\cosh \lambda}.$$

Plot the first three mode shapes of the cantilever beam. (Hint: Compute the first three roots of λ and substitute in the mode shape relation).









2. For a given mode shape, a **node** along the beam is a location where the displacement $y(x,t) = \gamma(x)e^{j\omega t} = 0$ for all t. Determine the number of nodes for the first two natural frequencies of the cantilevered beam. How many nodes do you expect for the nth mode shape?

For $\lambda_1 = 1.875$ # node = 1

For $\lambda_2 = 4.694$ # node = 2

Therefore, from observation, I think the n^{th} mode shape there will have n nodes