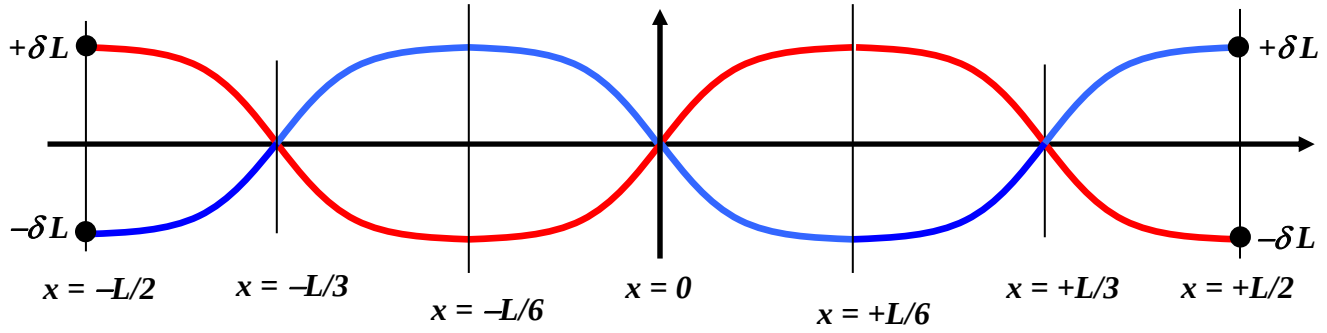
(*i.e.* one octave above) since the wavelength, $\lambda_2 = L$ for this mode of vibration of the rod is half that of the wavelength, $\lambda_1 = 2L$ associated with the fundamental mode. This mode of vibration of the rod has two nodes, located at $x = \pm^1/_4\, L$ and three anti-nodes, one located at the mid-point of the rod at x = 0, and at the two ends of the rod, at $x = \pm^1/_2\, L$.

The next higher, third harmonic mode of vibration of the rod ($n = 3$) is shown in the figure below. The frequency f_3 is three times higher than that of the fundamental frequency, f_1, since the wavelength, $\lambda_3 = {}^2/_3 L$ for this mode of vibration of the rod is one third of that of the wavelength, $\lambda_1 = 2L$ associated with the fundamental mode. This mode of vibration of the rod has three nodes, one node located at $x = 0$, and two others located at $x = \pm^1/_3\, L$. This mode of vibration has four anti-nodes, two located at $x = \pm^1/_6\, L$ and two located at the ends of the rod, at $x = \pm^1/_2\, L$.

Third Harmonic, n = 3

Longitudinal Displacement from Equilibrium Position, δ(x)



The next higher, fourth harmonic mode of vibration of the rod ($n = 4$) is shown in the figure below. The frequency f_4 is four times (i.e. two octaves) higher than that of the fundamental frequency, f_1, since the wavelength, $\lambda_4 = {}^2/_4 L = ½\, L$ for this mode of vibration of the rod is one fourth of that of the wavelength, $\lambda_1 = 2L$ associated with the fundamental mode. This mode of vibration of the rod has four nodes, two nodes located at $x = \pm^1/_8\, L$, and two others located at $x = \pm^3/_8\, L$. There are five anti-nodes, one located at $x = 0$, two located at $x = \pm^1/_4\, L$ and two located at the endpoints, at $x = \pm^1/_2\, L$.

Fourth Harmonic, n = 4

Longitudinal Displacement from Equilibrium Position, δ(x)