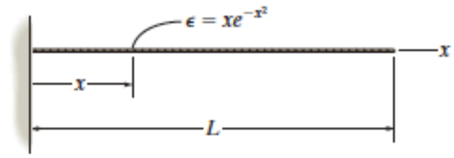
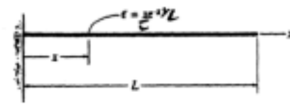
CE 270
Fall 2011
Solutions – Homework 4

***2–28.** The wire is subjected to a normal strain that is defined by $\epsilon = xe^{-x^2}$, where x is in millimeters. If the wire has an initial length L, determine the increase in its length.





$$\delta L = \varepsilon\, dx = x\, e^{-x^2}\, dx$$

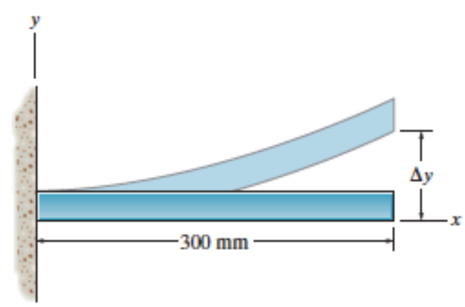
$$\Delta L = \int_0^L x\, e^{-x^2}\, dx$$

$$= -\left[\frac{1}{2}e^{-x^2}\right]\Big|_0^L = -\left[\frac{1}{2}e^{-L^2} - \frac{1}{2}\right]$$

$$= \frac{1}{2}[1 - e^{-L^2}]$$

Ans.

***2–32.** The bar is originally 300 mm long when it is flat. If it is subjected to a shear strain defined by $\gamma_{xy} = 0.02x$, where x is in meters, determine the displacement Δy at the end of its bottom edge. It is distorted into the shape shown, where no elongation of the bar occurs in the x direction.



Shear Strain:

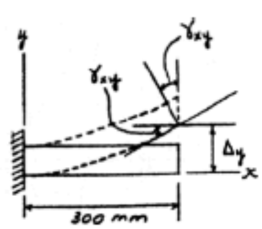
$$\frac{dy}{dx} = \tan \gamma_{xy}; \qquad \frac{dy}{dx} = \tan(0.02\, x)$$

$$\int_0^{\Delta y} dy = \int_0^{300\text{ mm}} \tan(0.02\, x)dx$$

$$\Delta y = -50[\ln\cos(0.02x)]\Big|_0^{300\text{mm}}$$

$$= 2.03\text{ mm}$$

Ans.



(For fundamental problem solutions please see the back of your course textbook)