

Consider a thin rod of length  $L$  lying on the  $z$ -axis. Find an algebraic expression for the mass density of the rod if the charge density at  $z = 0$  is  $\lambda_0$  and at  $z = L$  is  $7\lambda_0$  and you know that the mass density increases linearly.

### Solution

$$\lambda(z) = \beta + \alpha z \quad (1)$$

$$\lambda(0) = \beta = \lambda_0 \quad (2)$$

$$\Rightarrow \beta = \lambda_0 \quad (3)$$

$$\lambda(L) = \lambda_0 + \alpha L = 7\lambda_0 \quad (4)$$

$$\Rightarrow \alpha = \frac{6\lambda_0}{L} \quad (5)$$

$$\lambda(z) = \lambda_0 \left( 1 + \frac{6}{L} z \right) \quad (6)$$