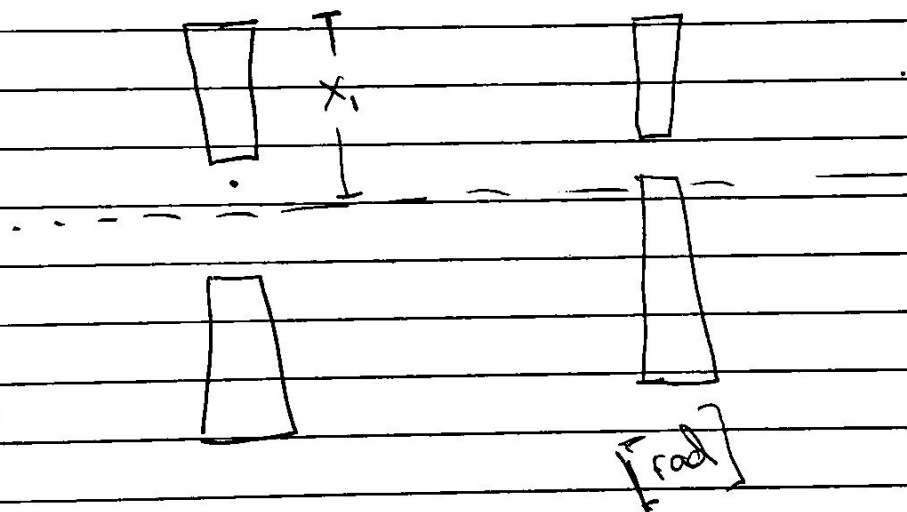


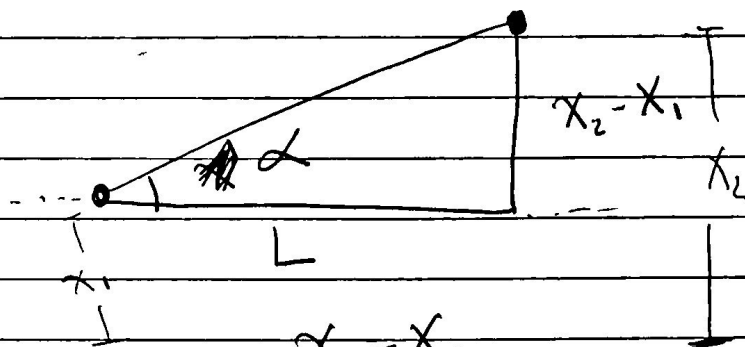
# PROBLEM 1

$$\begin{pmatrix} x_2 \\ x'_2 \end{pmatrix} = \begin{pmatrix} 1 & L \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x'_1 \end{pmatrix}$$



$$x_2 = x_1 + x'_1 L$$

$$x'_2 = x'_1$$



$$\tan \alpha = \frac{x_2 - x_1}{L}$$

$$\alpha = \tan^{-1} \left( \frac{x_2 - x_1}{L} \right)$$

$$x' = \frac{\tan^{-1} \left( \frac{x_2 - x_1}{L} \right)}{L}$$

$$x = x_2 - x' L$$

$$\Delta \approx \frac{X_2 - X_1}{L}$$

$$X' = \frac{X_2 - X_1}{L} = -\frac{1}{L} X_1 + \frac{1}{L} X_2$$

$$X = X_2 - (X_2 - X_1) = \cancel{\frac{1}{L} X_1} + \cancel{X_2 \left(1 - \frac{1}{L}\right)}$$

$$\begin{pmatrix} X \\ X' \end{pmatrix} = \begin{pmatrix} \frac{1}{L} & \left(1 - \frac{1}{L}\right) \\ -\frac{1}{L} & \frac{1}{L} \end{pmatrix} \begin{pmatrix} X_1 \\ X_2 \end{pmatrix}$$

$$\boxed{\begin{pmatrix} X \\ X' \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ -\frac{1}{L} & \frac{1}{L} \end{pmatrix} \begin{pmatrix} X_1 \\ X_2 \end{pmatrix}}$$