$1e{-7} = 1 \times 10^{-7}$

$2e{-7} = 2 \times 10^{-7}$

Given

$$\frac{dX}{dt} = G(X)$$

approximate differential equation

$$\frac{dX}{dt} = G_L(X) \quad \text{where} \quad G_L(X) = G(X_0) + (DG(X_0))(X - X_0)$$

$$\frac{dX}{dt} = G(X_0) + (DG(X_0))(X - X_0)$$

equal

$$\frac{d\overset{\text{const}}{X_0}}{dt} = 0 \qquad \text{and} \qquad G(X_0) = 0$$

by definition of X_0 being the fixed point

$$\frac{d(X - X_0)}{dt} = (DG(X_0))(X - X_0)$$

$$\underbrace{\frac{d(X - X_0)}{dt} \cdot (X - X_0)}_{\frac{1}{2}\frac{d}{dt}|X - X_0|^2} = (DG(X_0))(X - X_0) \cdot (X - X_0)$$

$$\frac{1}{2}\frac{d}{dt}|X - X_0|^2$$

since $|X - X_0|^2 = (X - X_0) \cdot (X - X_0)$

$$\frac{1}{2}\frac{d}{dt}|X - X_0|^2 = \underbrace{(DG(X_0))(X - X_0) \cdot (X - X_0)}$$

almost... this is always negative since eigenvalues of $DG(X_0)$ were negative

Finish next time...