~~B1)~~
B1) Due to the forces present on the system, the ball is only able to equilibriate within a defined space along the plane; Utilizing the characterised EQ points defined in Section [ ], this space can be defined

$$0 = \frac{V^e - Z_3^e R}{L_0 + L_1 e^{-\alpha(\delta - Z_1)}} \Rightarrow V^e = Z_3^e R$$

$$0 = \frac{5}{7m}\left[mg\sin\phi + \frac{c(Z_3^e)^2}{(\delta - Z_1^e)^2} - k(Z_1^e - d)\right]$$

$$0 = mg\sin\phi(\delta - \cancel{Z}Z_1^e)^2 + c(Z_3^e)^2 - k(Z_1^e - d)(\delta - Z_1^e)^2$$

$$c(Z_3^e)^2 = (\delta - Z_1^e)^2\left[k(Z_1^e - d) - mg\sin\phi\right]$$

$$Z_3^e = \frac{(\delta - Z_1^e)\left(k(Z_1^e - d) - mg\sin\phi\right)^{1/2}}{\sqrt{c}}$$

$$\therefore \quad V^e = \frac{R(\delta - Z_1^e)\left(k(Z_1^e - d) - mg\sin\phi\right)^{1/2}}{\sqrt{c}}$$

Evidently from these equations, inputting a value of $Z_1^e(x^e) \leq \left(\frac{mg\sin\phi}{k} + d\right)$ would result in the voltage and current becoming undefined, i.e: resulting in a zero or imaginary value. Futhermore, a value of $Z_1^e(x^e) \geq \delta$ would create a zero or negative result for the equilibrium values which indicate that the electromagnet ~~has~~ polarity has ~~changed~~ switched, thus the ball ~~would~~ would not achieve equilibrium. These derivations enable the space to be defined:

$$x_{min} < x^e < x_{mas}$$

where $x_{min} = d + \frac{mg\sin\phi}{k}$ $\quad x_{max} = \delta$

Furthermore, using equation ($v^2 = \ldots$) the ball's equilibrium position at which the equilibrium voltage attains a maximum can be determined.

[...]

As presented in the figure the maximum voltage is ~~app.~~ equal to 0.2 volts where the equilibrium position is equal to 0.467m.