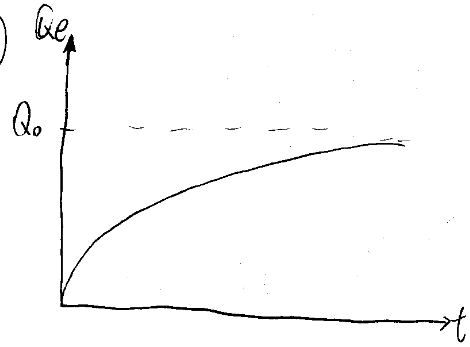
P2) a) Continuidad: $\frac{d\forall}{dt} = Q_a - Q_e$; $Q_a = Q_0$; $Q_e = \alpha \cdot h$; $\forall = A \cdot h$; pero $h = h(t)$

$$\Rightarrow A \cdot \frac{dh}{dt} = Q_0 - \alpha h \Leftrightarrow \frac{dh}{Q_0 - \alpha h} = \frac{1}{A} \cdot dt \Leftrightarrow \int_0^h \frac{dh}{Q_0 - \alpha h} = \frac{1}{A} \int_0^t dt$$

$$\Leftrightarrow \frac{-1}{\alpha} \cdot \ln(Q_0 - \alpha h) \Big|_0^h = \frac{1}{A} \Big|_0^t \Leftrightarrow \frac{-1}{\alpha} \ln\left(\frac{Q_0 - \alpha h}{Q_0}\right) = \frac{t}{A} \Leftrightarrow \ln\left(\frac{Q_0}{Q_0 - \alpha h}\right) = \frac{t\alpha}{A}$$

$$Q_0 = (Q_0 - \alpha h) \cdot e^{\frac{\alpha}{A} \cdot t} \Leftrightarrow Q_0 e^{-\frac{\alpha}{A} t} = Q_0 - \alpha h \Leftrightarrow h(t) = \frac{Q_0}{\alpha}(1 - e^{-\frac{\alpha}{A} t})$$

b)



c) $Q_e = \alpha \cdot h = \cancel{\alpha} \frac{Q_0}{\cancel{\alpha}}(1 - e^{-\frac{\alpha}{A} t})$; $Q_e = 0{,}99 \cancel{Q_0} = \cancel{Q_0}(1 - e^{-\frac{\alpha}{A} t}) \Leftrightarrow 0{,}99 = 1 - e^{-\frac{\alpha}{A} t}$

$$e^{-\frac{\alpha}{A} t} = 1 - 0{,}99 \Leftrightarrow -\frac{\alpha}{A} t = \ln(0{,}01) \Leftrightarrow t = -\frac{A}{\alpha} \cdot -4{,}61 = \frac{4{,}61 A}{\alpha}$$

Notar que cuando $t \to \infty \Rightarrow Q_e \to Q_0(1 - \cancel{e^{-\frac{\alpha}{A} t}}_{\to 0}) = Q_0$