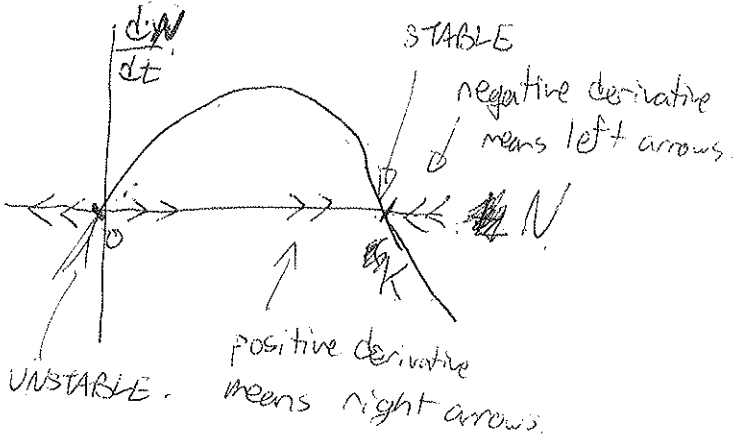
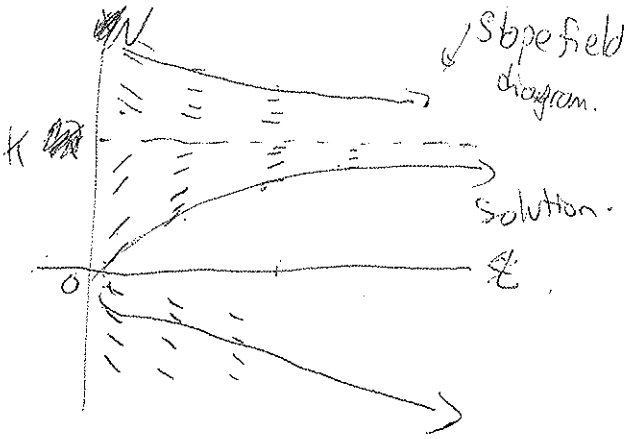
# Stability of Steady States.

Def'n: A steady state is <u>stable</u> if the nearby solutions to the differential equation approach the steady state. Otherwise, the steady state is called <u>unstable</u>.




Logistic Equation: $\frac{dN}{dt} = rN\left(1-\frac{N}{K}\right)$ THINK N as a function of time.

Let's Revisit Population Density.

Old model: $\frac{dy}{dt} = ky. \Rightarrow y = y_0 e^{kt}$ $(k>0)$.

PROBLEM: This grows indefinitely!

In the Logistic Equation model, we account for the "carrying capacity" $K>0$. The $r>0$ value is called the intrinsic growth rate.

Let's solve $\frac{dN}{dt} = rN\left(1-\frac{N}{K}\right)$

Let $y(t) = \frac{N(t)}{K}$. Then $Ky(t) = N(t)$ and $K\frac{dy}{dt} = \frac{dN}{dt}$.