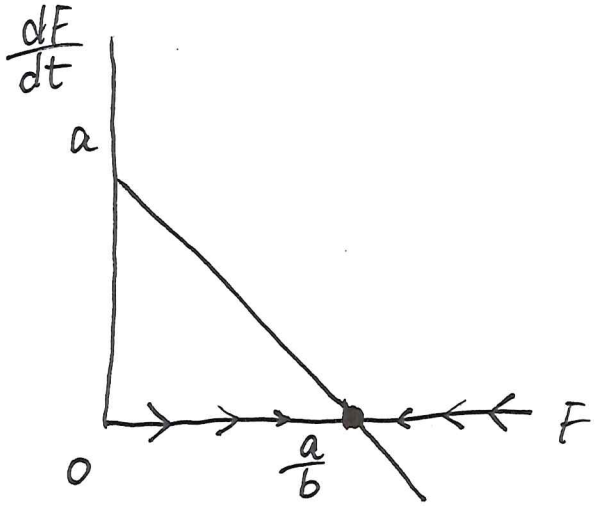
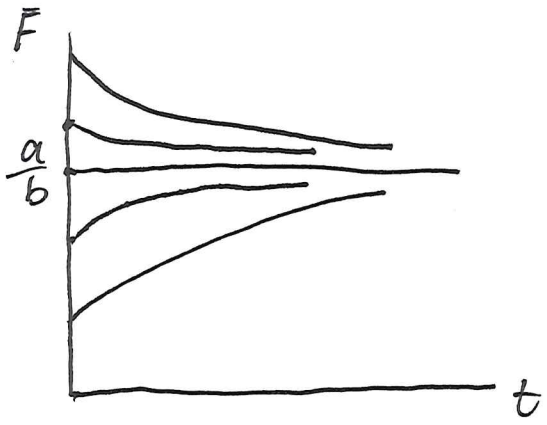
State-space diagram of $\frac{dF}{dt} = a - bF \quad (b>0)$

steady states: $a - bF = 0 \Rightarrow F = \frac{a}{b}$



$\Rightarrow$ one stable SS. $F = \frac{a}{b}$

rough sketch of the sol'n curves.



analytical sol'n: $F = \frac{a}{b} + \underbrace{(F_0 - \frac{a}{b})\, e^{-bt}}_{\text{exponential decay}}$

$\lim_{t\to\infty} F = \frac{a}{b}$. Yes! agrees with the result of qualitative analysis.

Biological switch.

$$\frac{dx}{dt} = \underbrace{P(x)}_{\text{production}} - \underbrace{D(x)}_{\text{decay}}.$$

$$P(x) = \frac{x^2}{1+x^2}$$

$$D(x) = mx$$