$$\boxed{\frac{dN}{dt}} = \underbrace{\text{Birth}} - \underbrace{\text{Death}}$$

The change in the population over time

Total

$$\frac{dN}{dt} = \underbrace{\boxed{b}N}_{\text{Total number of births}} - dN$$

Djed

jedi

per-capita birth rate = b

Total # of births = bN

- If every female gives birth to $\frac{0.01}{\text{month}} \times 100$

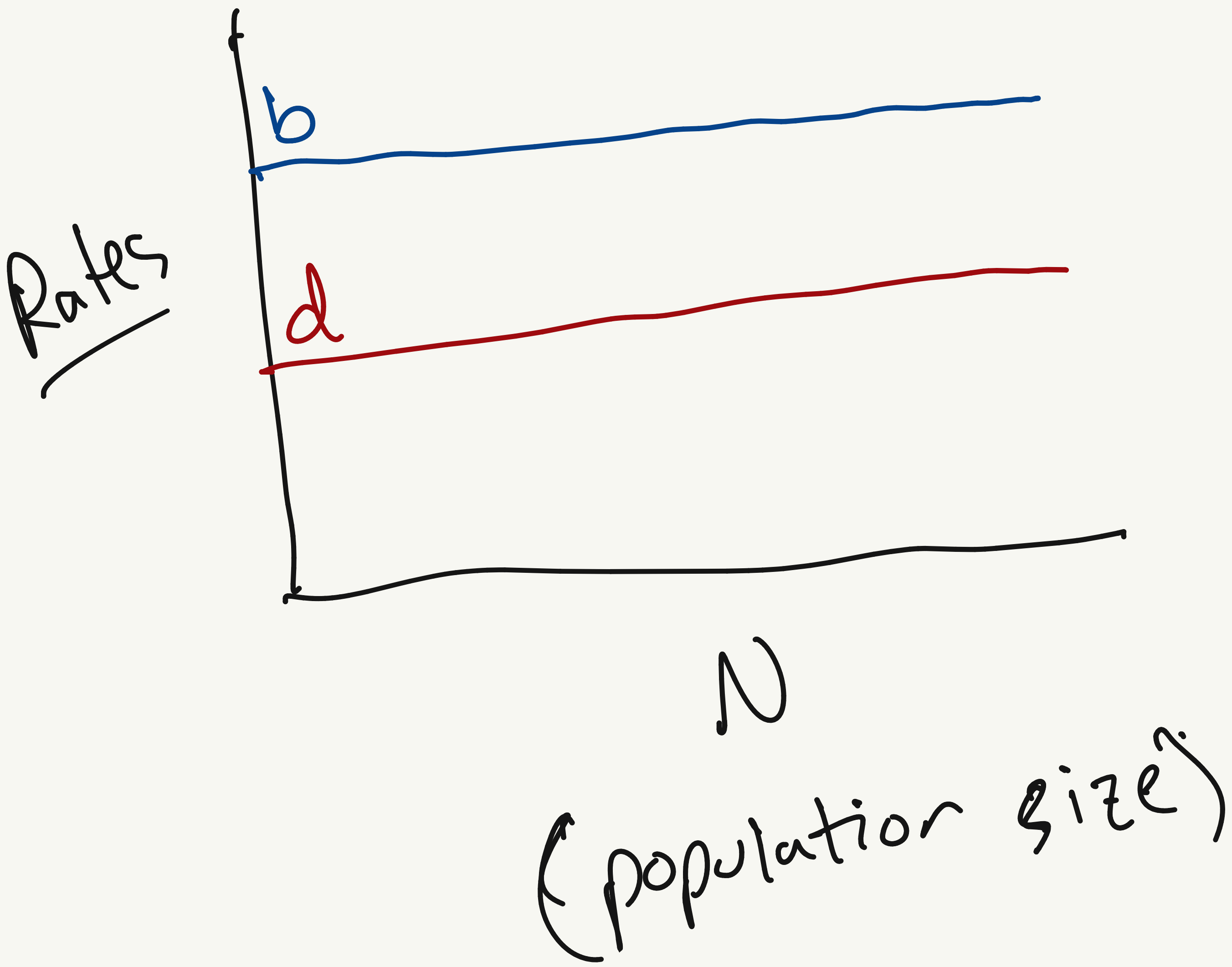
$$\underbrace{\frac{1 \text{ offspring}}{100 \text{ months}}}$$

$$\frac{1 \text{ offspring}}{100 \text{ months}} \times N = \text{Total number of offspring}$$

$$\frac{dN}{dt} = \underbrace{bN} - \underbrace{dN}$$

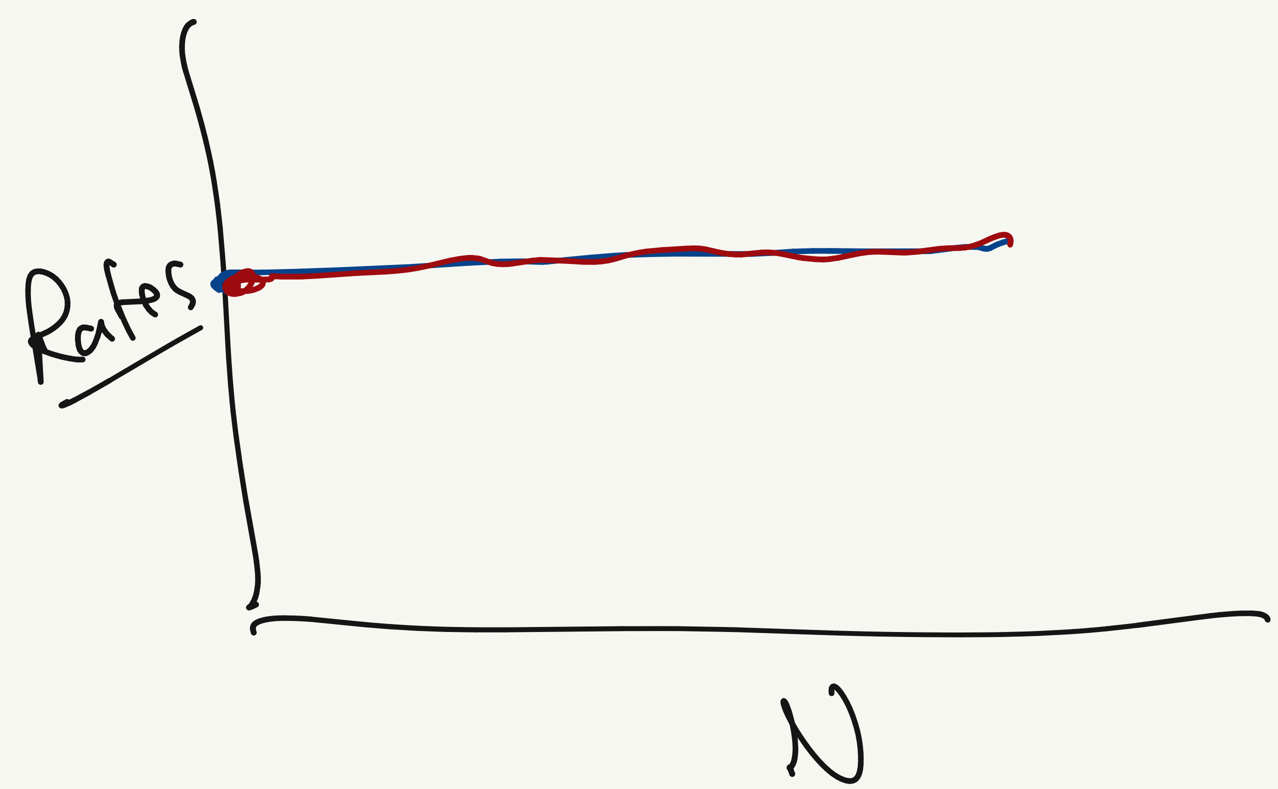
- Density independent
  per-capita birth, death rates

- Density-Dependent
  total number of births, deaths



$$\frac{dN}{dt} = \emptyset \quad \text{i.e.} \quad b\cancel{N} = d\cancel{N}$$

$$b = d$$



$$\emptyset = bN - dN$$

$$b\cancel{N} = d\cancel{N}$$

$$b = d$$

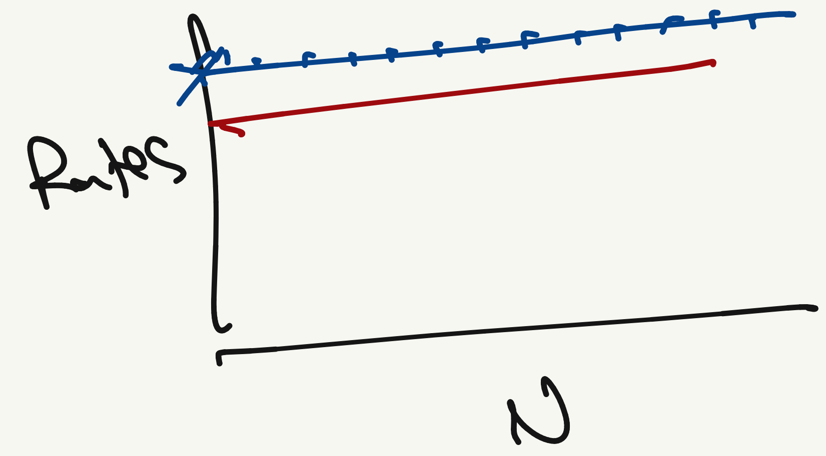
$$\frac{dN}{dt} = bN - dN = (\underbrace{b-d}_{r})N = rN$$

$$\frac{\emptyset}{N} = \frac{(b-d)N}{N}$$

$$\emptyset = (b-d) \quad \boxed{b=d}$$

$$b' = \underbrace{b - aN}_{\emptyset}$$

r = instantaneous rate of growth



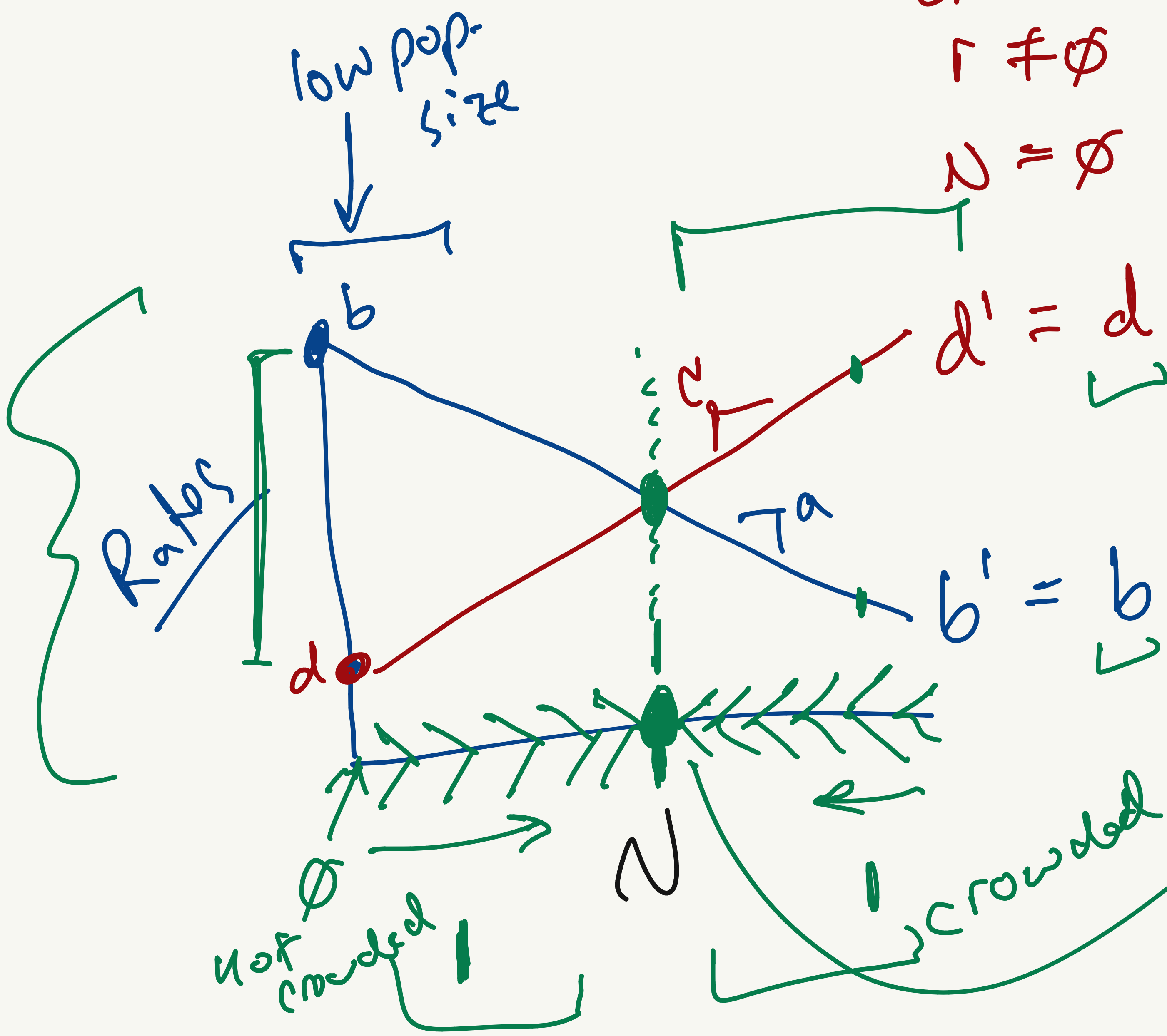
$$\frac{dN}{dt} = rN \qquad \emptyset = rN \,?$$

$r = \emptyset$ in other word $b = d$

or

$r \neq \emptyset$

$N = \emptyset$ this is the special case of population extinction

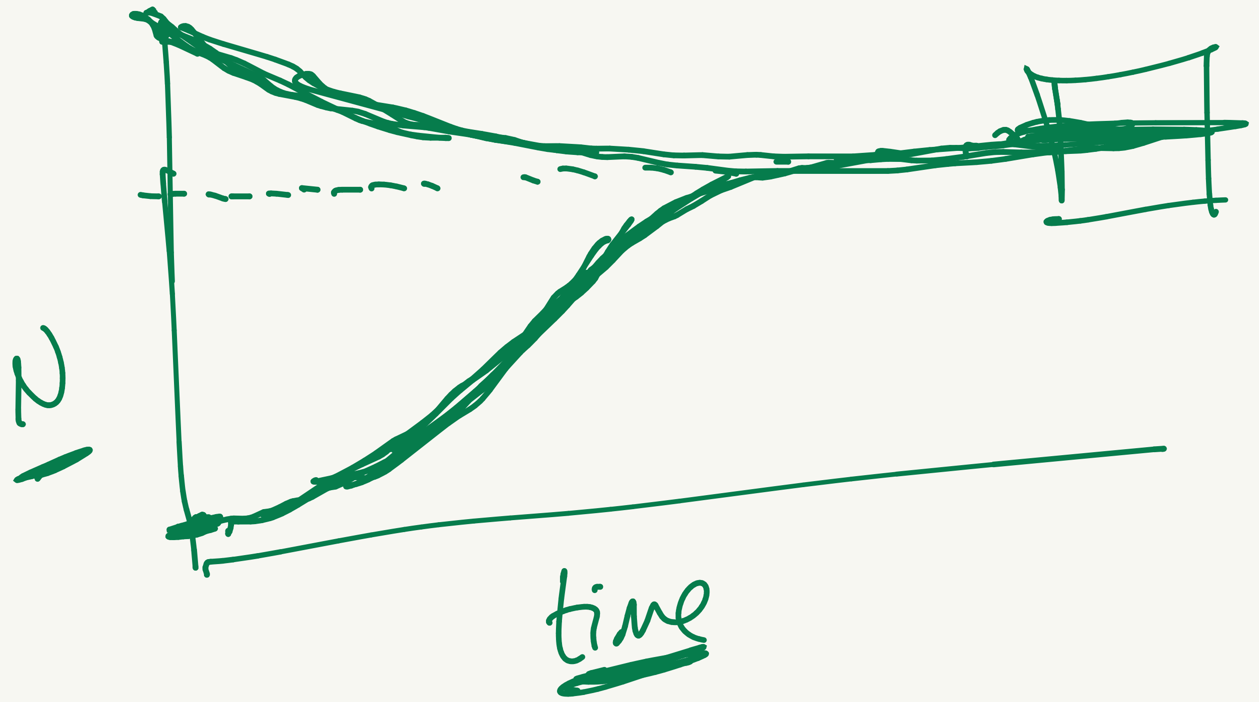


$$d' = d + cN$$

$$b' = b - aN$$

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

This is a stable value of N, represented by $N^* = K$



Carrying Capacity of the population

LOGISTIC

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

$$\rightarrow \quad 0 = \underbrace{r}_{>0} N\left(1 - \frac{N}{K}\right)$$

$\rightarrow \quad N = 0$ (extinction)

$$\rightarrow \quad \left(1 - \frac{N}{K}\right) = 0$$

$$1 = \frac{N}{K}$$

$$K = N \quad \text{or} \quad \boxed{N = K}$$