This is the basic population model. We can vary the parameters β and δ, even allowing them to depend on t or P.

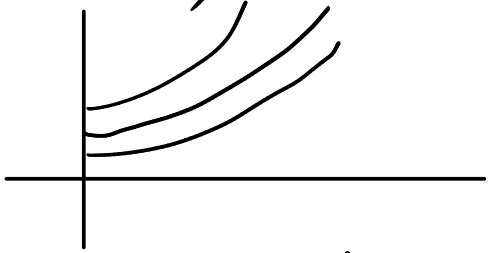
The point is to understand how the behavior of the population over time depends on the choice of parameters β, δ in the construction of the model.

Simplest case: β and δ are constant.

$$\frac{dP}{dt} = kP, \text{ where } k = \beta - \delta$$

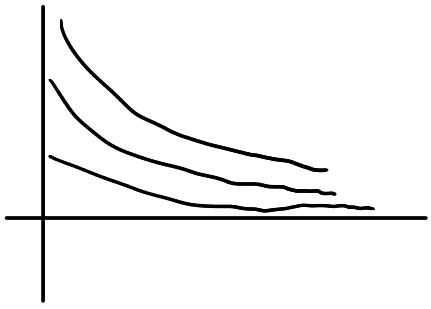
Solution: $P(t) = P_0 e^{kt}$ where $P_0 = P(0)$ is initial pop.

If $\beta > \delta$ then $k > 0$, and we have exponential growth.



EXPLOSION!

If $\beta < \delta$ then $k < 0$, and we have exponential decay



EXTINCTION!

What if β and δ depend on P?