Solution to the logistic equation:

https://www.youtube.com/watch?v=f2r3QtBlMtk

Logistic Population Growth

$P$ = Pop.

$t$ = time

$M$ = Carrying Capacity

$k$ = "a rate"

$$\frac{dP}{dt} = kP\left(1 - \frac{P}{M}\right)$$

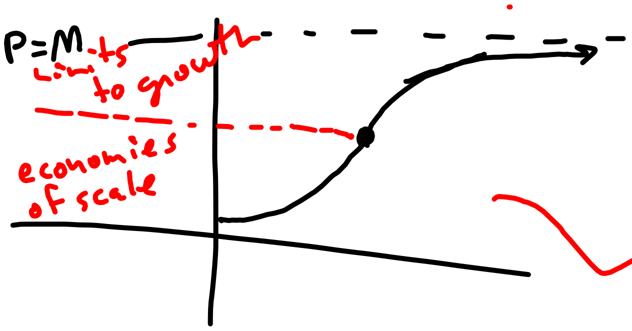
Obeys law of uninhibited growth when $P \approx$ SMALL:

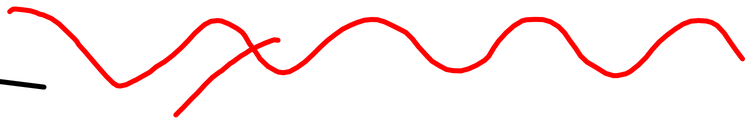
$$\frac{dP}{dt} \approx kP$$

$P \approx M \Rightarrow$

$$\frac{dP}{dt} \approx 0, \text{ b/c } 1 - \frac{P}{M} \approx 0$$

Solutions are an S curve



Solutions look like

$$\frac{K}{1+ce^{-rt}}$$

Slope field

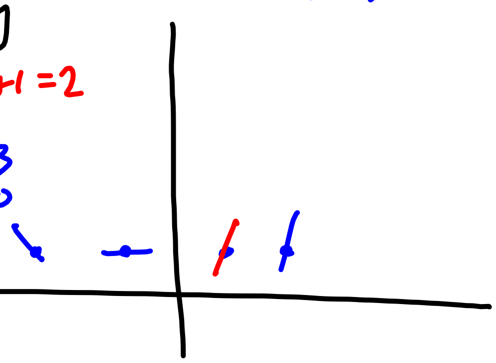
$y' = x + y$

$(1,1)$ $y' = 1+1 = 2$

$(2,1)$ $y' = 3$

$(-1,1)$ $-1+1=0$

$(-2,1)$ $-2+1=-1$



§9.1 Equilibrium Solutions

$$y' = ky\left(1 - \frac{y}{M}\right)$$

$y' = 0$

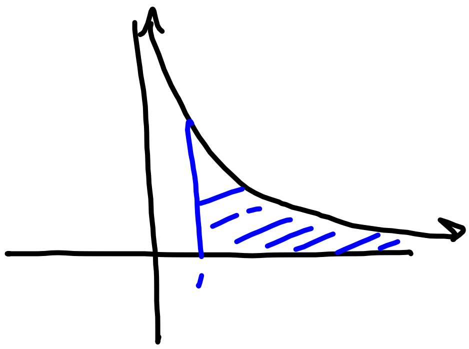
$y = 0$

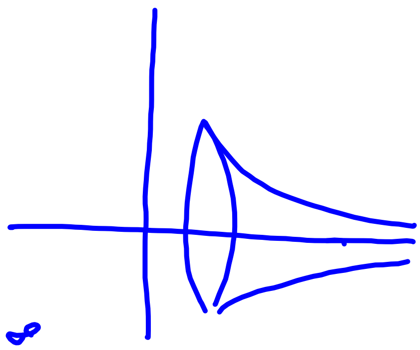
$y = M$

OLD BOOK

§8.2 #25 $y = x,\ 0 \le y \le 1$, about y-axis

$R = \{(x,y) \mid x \ge 1,\ 0 \le y \le \frac{1}{x}\}$ about x-axis





$y = \frac{1}{x}$

$y' = -\frac{1}{x^2}$

$(y')^2 = \frac{1}{x^4}$

$$2\pi \int_1^\infty y \sqrt{1 + \frac{1}{x^4}}\, dx$$

$$= 2\pi \int_1^\infty \frac{1}{x} \sqrt{1 + \frac{1}{x^4}}\, dx$$

$$\frac{1}{x}\sqrt{\frac{x^4+1}{x^4}} = \frac{1}{x^3}\sqrt{x^4+1} \approx \sqrt{x^4} = x^2$$

Acting like

$\frac{1}{x^3} \cdot x^2$ as $x \to$ BIG

$= \frac{1}{x}$ & $\int_1^\infty \frac{1}{x}\, dx = \infty$