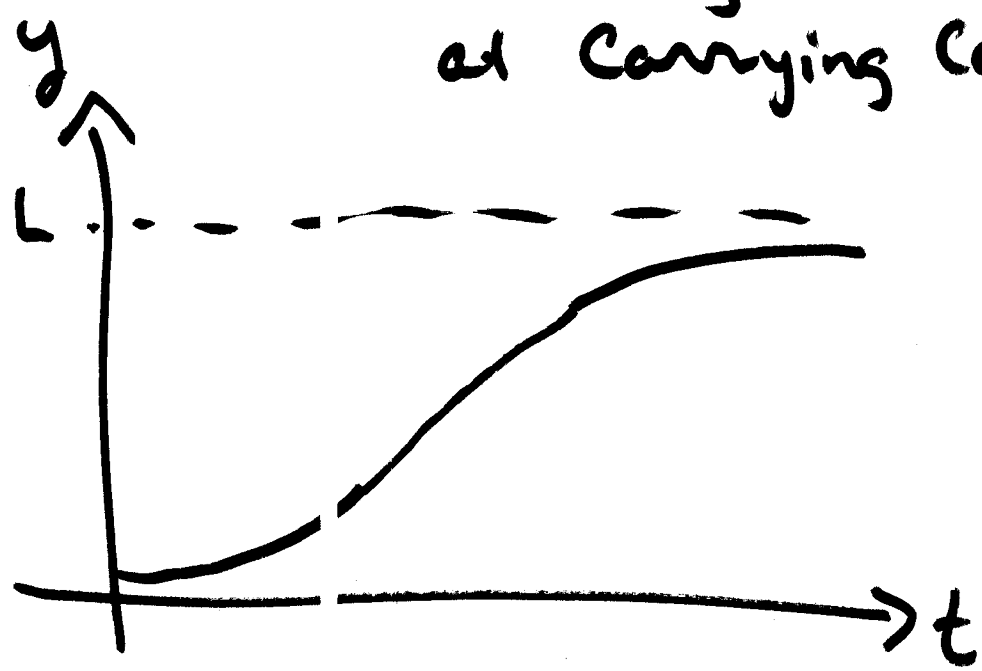
Logistic Model

Capture · Early Exponential Growth r%

· Leveling off at Carrying Capacity L

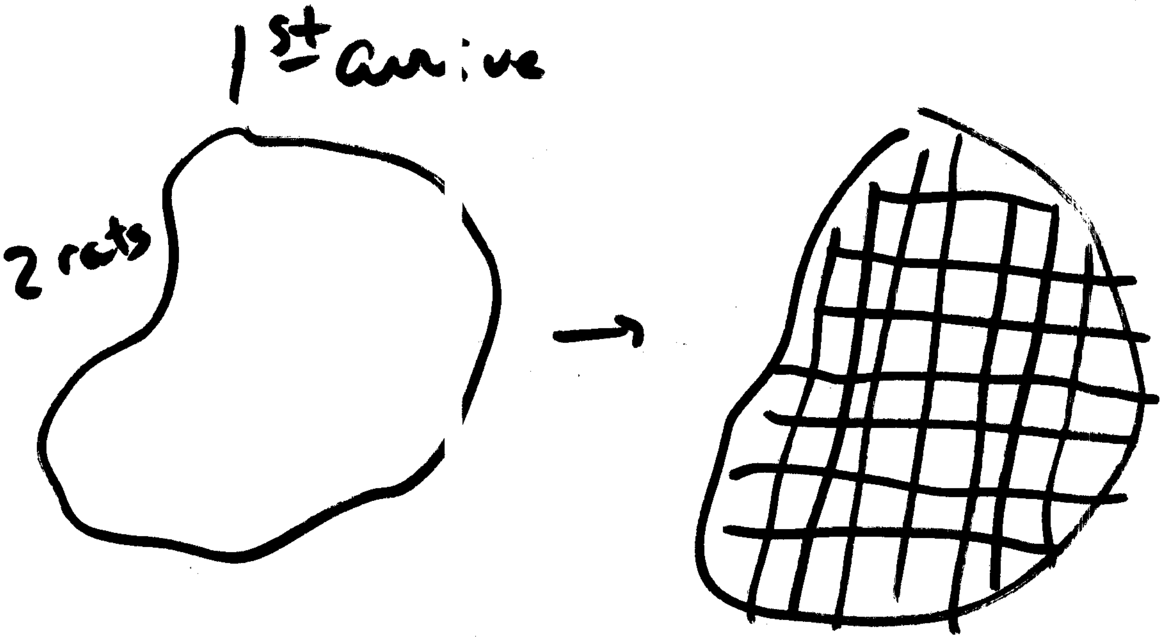


$$\frac{\Delta y}{\Delta t} = r y \left(1 - \frac{y}{L}\right)$$

Rat Eden

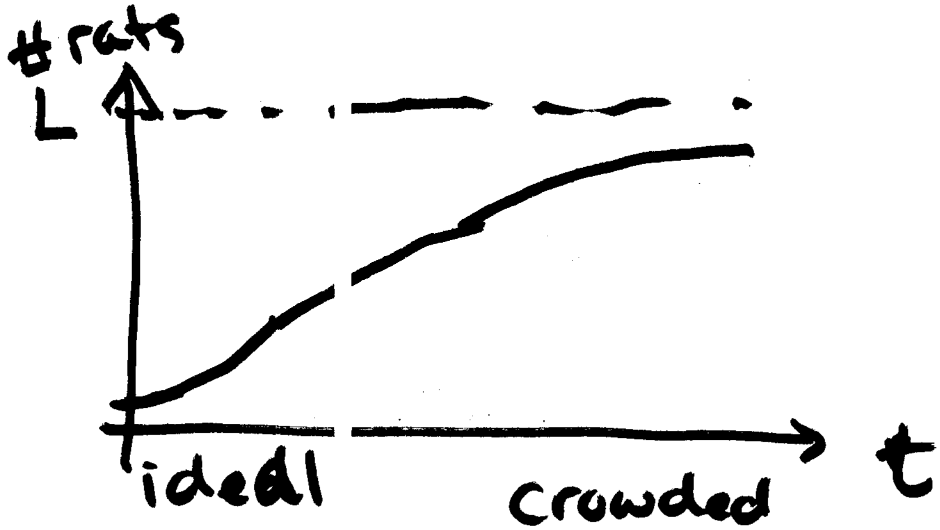
Age of Exploration Rats

went to New World on boats.



Unlimited Food, No Competition

Competition for Food



$$\frac{\Delta y}{\Delta t} = r \cdot y \cdot (1 - y/L)$$

Rats in Eden: $r = .41$ $L = 10{,}000$

$\Delta t = 1$

t	y	Δy
0	2	$.41 \cdot (2) \cdot (1 - 2/10{,}000) = .83$
1	2.83 +1.17	$.41(2.83)(1 - 2.83/10{,}000) = 1.17$
2	4.00	

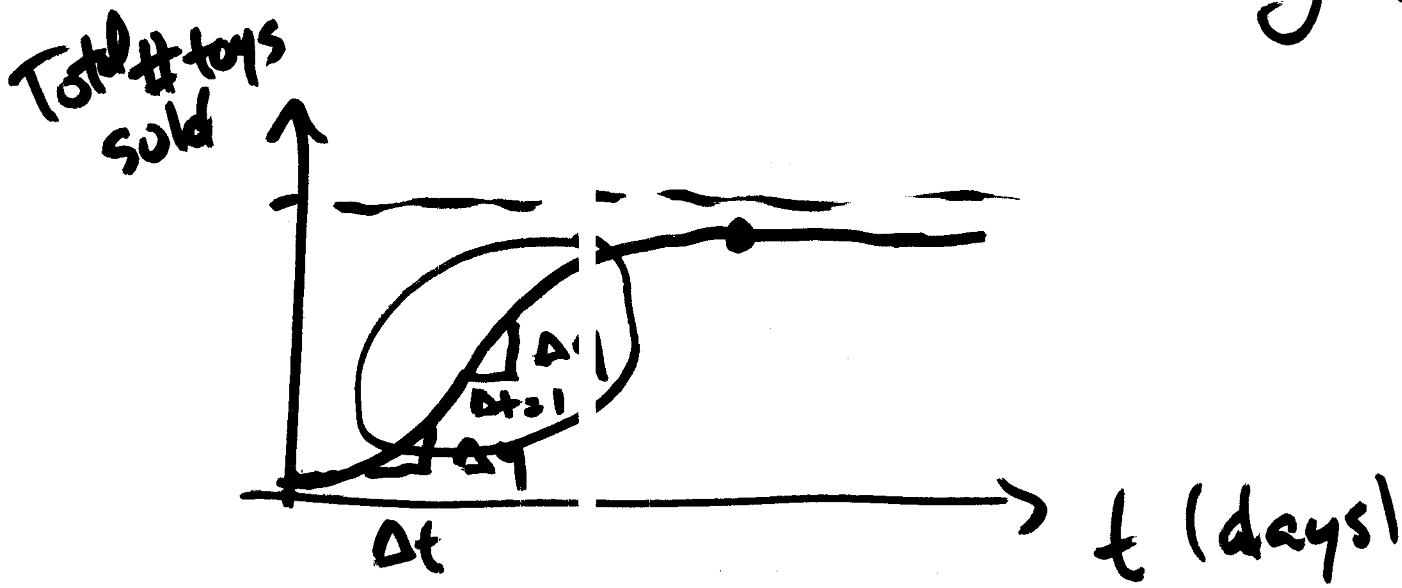
(new y = old y + Δy)

$\Delta y = .41 \cdot y \cdot (1 - y/10{,}000)$

? ~~500~~	5000	$\Delta y = 1025$ $= .41(5000)\left(1 - \frac{5000}{10000}\right)$
?+1		
?	9900	40
?+1		
?	10,100	$-41.$
?+1		

Observations on Logistic Model.

- Δy is greatest when $y = \frac{L}{2}$



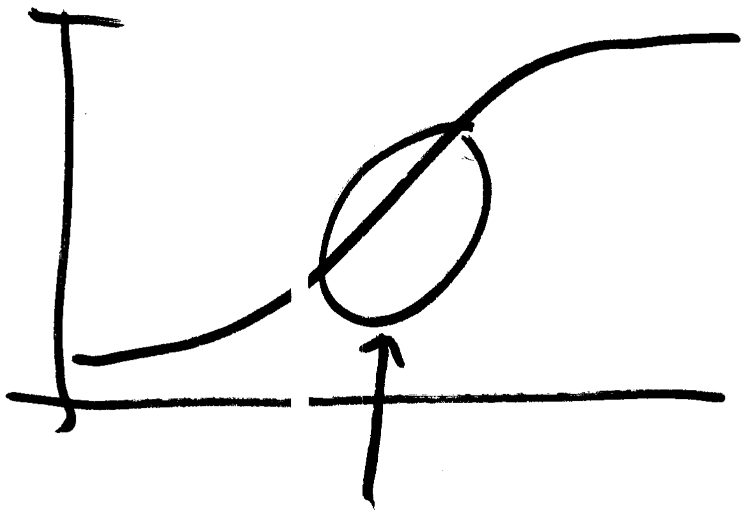
$\Delta t = 1 \Rightarrow \Delta y = $ # toys sold that day.

- If $y > L$ then Δy is negative

So a population will <u>decrease</u> if it exceeds L

- If $y \approx L$ then $\Delta y \approx 0$

Logistic Growth
Sri Lanka



$\frac{\Delta P}{\Delta t}$ is getting bigger, then smaller

& % growth getting less

≈ 280

$\frac{\Delta P}{\Delta t}$ = maximum in 1967

Then $P = 11716 = \frac{L}{2}$

So $L = 2 \cdot 11716$

$= 23{,}432$ thousand