

$F = \text{foxes}$  $R = \text{rabbits}$ 

} functions of time.

$$\frac{dR}{dt} = bR - eFR$$

 $e = \text{eating coefficient}$ 

$$\frac{dF}{dt} = kFR - dF$$

Problem: maximum value of  $R$  happens when?

$$R' = bR - eFR = 0$$

$$bR - eFR = 0$$

$$R(b - eF) = 0$$

$$R = 0 \text{ or } b = eF \Rightarrow F = \frac{b}{e}$$

max or min? second derivative!

$$R' = bR - eFR$$

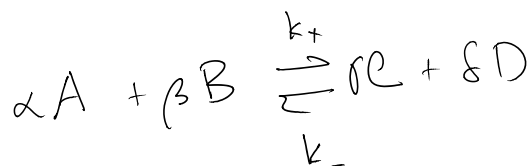
$$R'' = bR' - eF'R - eFR'$$

want this when  $R' = 0$ 

$$R'' = -eF'R$$

if  $F' > 0$ 

(foxes inc.) Rabbits at max

ready, remove  $C$  at some const rate, aski max concentration of  $B$ ?

$k_+$  cur at B?  
 rate  $\rightarrow k_+ A^\alpha B^\beta = \frac{\text{Reacts}}{\text{time}}$  each reaction  $\rightarrow$  gives  $\gamma$  C's &  $\delta$  D's

rate  $\leftarrow k_- C^\gamma D^\delta = \frac{\text{react}}{\text{time}} \rightarrow \frac{dC}{dt} = k_+ A^\alpha B^\beta \gamma$

$\leftarrow \frac{dC}{dt} = -k_- C^\gamma D^\delta \gamma$

in total:  $\Rightarrow \frac{dC}{dt} = k_+ A^\alpha B^\beta \gamma - k_- C^\gamma D^\delta \gamma$

$\frac{dC}{dt} = 0 \Rightarrow k_+ A^\alpha B^\beta \gamma = k_- C^\gamma D^\delta \gamma$

$1 = \frac{k_+}{k_-} \frac{A^\alpha B^\beta}{C^\gamma D^\delta}$

$\frac{k_-}{k_+} = \frac{A^\alpha B^\beta}{C^\gamma D^\delta}$

$\frac{C^\gamma D^\delta}{A^\alpha B^\beta} = \frac{k_+}{k_-}$

instead  $\frac{\partial C}{\partial t} = k_+ A^\alpha B^\beta \gamma - k_- C^\gamma D^\delta \gamma - rC$   
 $\uparrow$   
rate of removal

maximize C!

$\text{set } = 0 \quad k_+ A^\alpha B^\beta \gamma - k_- C^\gamma D^\delta \gamma - rC = 0$  what is max C?

$k_+ A^\alpha B^\beta \gamma = k_- C^\gamma D^\delta \gamma + rC$

solve for C?

$$X = Y C^{\delta} - Z C$$

$\delta = 1$  factor & solve

$\delta = 2$  quad formula.

$\delta = \text{cubic formula.}$

$\delta = 4$  quartic

$\delta = 5$  out of luck.