write down a <u>series</u> of (fairly trivial) epidemic models.

- what assumptions?
- what can we say about the models?
- <u>CRITICISM</u>

suppose we want to model an epidemic of a DIRECTLY TRANSMITTED inf. dis.

- what should we assume?
  biological or math assumptions?
  - # deaths is correlated w/ inf.
    (deaths $\propto$ number of cases)
  - infected: die or recover
    reinfection???
  - <u>DIRECT transmission</u>. <u>compartmental</u>

$\boxed{S} \rightarrow \boxed{I}$

INSTANTANEOUS infectivity

<u>INFECTIVE</u> = can infect others
(no <u>exposed</u> or <u>latent</u>)

- <u>homogeneous</u>. <u>fixed</u> pop size

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TIME - invariant
transmission rate

"stock"

$I(t)$ = PREVALENCE (infected at time t)

$\Delta \cancel{I} = \underbrace{\beta I}\, \Delta t$

INCIDENCE?

= # NEW cases

"rate" "flow"

??

$\frac{\Delta I}{\Delta t} = \beta I$

$\lim_{t \to 0} \quad \frac{dI}{dt} = \beta I \Rightarrow \int \frac{dI}{I} = \int \beta \, dt$

$\log I(t) - \log I(0) = \beta(t - t_0)$

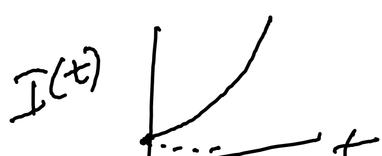
$\log I(t) = \beta t + \log(I_0)$

$I \in \mathbb{R}, I \geq 0$

β?

$I(t) = I(0) e^{\beta t}$

$\beta > 0$



RECOVER or DIE

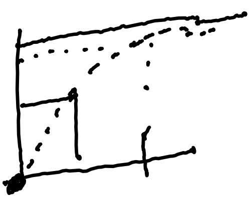
$$\frac{dI}{dt} = (\beta - \gamma) I$$

how long does AN infected person stay infected?

$1/\gamma$: $I(t) = I(0) \exp(-\gamma t)$

proportion have recovered =

$$1 - e^{-\gamma t}$$



cumulative distrib fn

(fraction inf per $< t$)

density function = $\dfrac{d(CDF)}{dt}$ =

$$PDF = \gamma e^{-\gamma t}$$

$x = \gamma t$

$dx = \gamma dt$

$dt = \dfrac{dx}{\gamma}$

mean?

$E(t)$

$$\int t \cdot \gamma e^{-\gamma t} dt$$

$$\Rightarrow \frac{1}{\gamma}$$