$y_1(t)$
$y_2(t)$
⋮
$y_n(t)$

$\bar{y}'$

$y'_1(t)$
$y_2'(t)$

$y_n'(t)$

$\bar{y}' = A \cdot y$     $A : n \times n$

$y(0)$ known   Then Solution:

$y(t) = \exp(tA).y(0)$

$\exp(A) = I + A + A^2/2! + \dots + A^k/(k!) + \dots$

$y' = F(y)$

======================================================================

Total Population: N (e.g., N = 100000)

$S + I + R = N$      (*)

- Removed population varies with I:
  $R' = I/t \rightarrow t = 1/\mu$
  $R' = \mu I$ ;  $1/\mu$ = infection period [e.g., 5 days or 10 days]

  "rate of variation of R is proportional to I"

– Susceptible population :

  $S' = c\,(S/N) \times I$

  $S' = -\beta S I$

  $\beta$ written in the form  $\beta = \mu R_0 / N \implies R_0 = \beta N/\mu$
  reproduction number

  Because of (*) we have $S'+I'+R' = 0 \implies$

$I' = -S'-R' = \beta S I - \mu I = [\beta S - \mu] I$

$$y = \begin{pmatrix} S \\ I \\ R \end{pmatrix} \implies y' = \begin{pmatrix} -\beta I & 0 & 0 \\ 0 & \beta S-\mu & 0 \\ 0 & \mu & 0 \end{pmatrix} . \begin{pmatrix} S \\ I \\ R \end{pmatrix}$$

of the form: $y' = A(y).\, y$

Forward Euler: $y_0\ y_1\ \ldots\ y_k$ at times 0, 1, ....k

$(y(t+\delta t)-y(t)) / \delta t \sim y'(t)$

$$y_{k+1} = y_k + \delta t\, A(y_k)\, y_k$$