


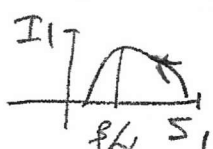
MAT 5-236 Exam 2 solutions.

2. a. $(.1) \cdot (.1)^1 = .01$ b. $(.02) \cdot (.1)^2 = 2 \times 10^{-4}$ c. $.003 \cdot (.1)^4 = 3 \times 10^{-7}$

3. $c_1 e^{-2t} \begin{pmatrix} 1 \\ 1 \end{pmatrix} + c_2 e^{3t} \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ 

4. α : likelihood of disease spread on interaction
 a. β : rate of recovery

b. Line $I=0$. *initial conditions produce larger*

c. $S = .95$ $I = .05$ 

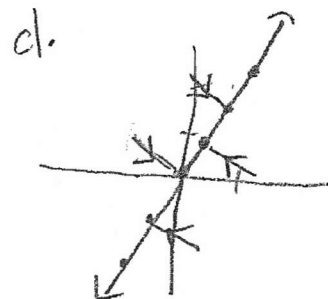
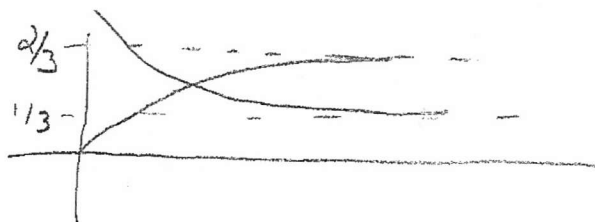
d. *New IVP.* If initial values of S are $< \beta/\alpha$ $\frac{dI}{dt} < 0$ so $I \downarrow$

e. Add $-\gamma R$ to R & $+\gamma R$ to S .

5. $\lambda = 0$ $\lambda = -3$
 \downarrow \downarrow
 $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$ $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$

b. $k_1 \begin{pmatrix} 1 \\ 2 \end{pmatrix} + k_2 e^{-3t} \begin{pmatrix} -1 \\ 1 \end{pmatrix}$

c. $k_1 = 1/3$ $k_2 = -2/3$



MAT 5-236 Exam 2 solutions p2.

b. $\lambda = -2$ mult. 2

$$V_1 = (A - \lambda I) \begin{pmatrix} x_0 \\ y_0 \end{pmatrix} = \begin{pmatrix} -x_0 + y_0 \\ x_0 + y_0 \end{pmatrix}$$

$$y(t) = e^{-2t} \begin{pmatrix} x_0 \\ y_0 \end{pmatrix} + t e^{-2t} V_1$$

b. sink since $\lambda < 0$ (curvy sink is just a sink)

c. $y(0) = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$ so $y(t) = e^{-2t} \begin{pmatrix} -3 \\ 1 \end{pmatrix} + t e^{-2t} \begin{pmatrix} 4 \\ 4 \end{pmatrix}$

7.9 $\lambda = 1 \pm \sqrt{5}i$ text, p 306-7

for $\lambda = 1 + \sqrt{5}i$ eigenvector

$$\begin{bmatrix} 2 \\ 1 + \sqrt{5}i \end{bmatrix}$$

b. $y(t) = k_1 e^t \begin{pmatrix} 2 \cos \sqrt{5}t \\ \cos \sqrt{5}t - \sqrt{5} \sin \sqrt{5}t \end{pmatrix} + k_2 e^t \begin{pmatrix} 2 \sin \sqrt{5}t \\ \sqrt{5} \cos \sqrt{5}t + \sin \sqrt{5}t \end{pmatrix}$

spiral source
clockw.



8. a) over

c) un

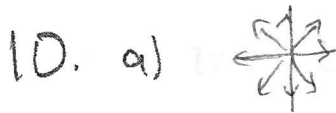
b) under

d) crit.

9. $\begin{pmatrix} 0 & -2\pi \\ 2\pi & 0 \end{pmatrix}$

$$\lambda^2 + 4\pi^2 = 0$$

$$\lambda = \pm 2\pi i$$



b) see text

11 a) iii b) ii c) i d) v