Rensselaer Polytechnic Institute  
Department of Math Sciences  
Math 2400 Sections 9 – 16  
Maple Project #2 Spring 05 Due Friday April 15  

( In each of the following problems use Maple commands for all operations )

1 / In this problem notice the beat in the ‘forced oscillation’ (part a) and the resonance phenomenon (part b).

a) Solve the IVP and plot the solution in the interval [0,90]  
\[ y'' + 16y = \cos(3.9t), \; y(0) = 0, \; y'(0) = 0. \]

b) Solve the IVP and plot the solution in the interval [0, 30]  
\[ y'' + 16y = \cos(4t), \; y(0) = 0, \; y'(0) = 0. \]

2 / Using the “laplace” command, solve the IVP  
\[ y'' + 0.2y' + 1.01y = \cos t - (\cos t)u(t - \pi/2), \; y(0) = 3, \; y'(0) = 0, \]

where \( u \) is the unit step function, and plot the solution in [0,30].

3 / Let \( A \) be the following matrix  
\[ A = \begin{pmatrix} -1.02 & 202.01 \\ -0.01 & 1 \end{pmatrix} \]

a) Find the eigenvalues and the eigenvectors of \( A \),

b) Solve the IVP: \( X' = AX, \quad X(0) = \begin{pmatrix} 2 \\ 0 \end{pmatrix} \)

c) Plot the solution in the interval [0, 20\pi].

4 / Let \( A \) be the following matrix  
\[ A = \begin{pmatrix} 1 & 1 & 1 \\ 2 & 1 & -1 \\ -8 & -5 & -3 \end{pmatrix} \]

a) Find the eigenvalues and the eigenvectors of \( A \)

b) Solve the IVP \( X' = AX, \quad X(0) = \begin{pmatrix} -1 \\ 1 \\ 5 \end{pmatrix} \)

c) Can you describe the behavior of the solution b) as \( t \to \infty \)?