1. Consider the dae from Chapter 21 for modeling the spread of an infection:

\[
\begin{align*}
\frac{dI(t)}{dt} &= \tau I(t)S(t) - I(t)/k \\
\frac{dS(t)}{dt} &= -\tau I(t)S(t), \\
1 &= I(t) + S(t) + R(t).
\end{align*}
\]

We are given values for \( \tau \) and for \( I(0), S(0), \) and \( R(0) \).

(a) (7) Write this system in the form \( My' = f(t, y) \), where \( M \) is a \( 3 \times 3 \) matrix.

(b) (3) If \( M \) is nonsingular, then \( \text{ode23s} \) should be used to solve this problem. Otherwise, \( \text{ode15s} \) should be used. Which of these two algorithms would you choose?
2. (10) Let

\[ u'' = \cos(t)u'(t) + \sin(t)u(t), \]

with \( u(0) = 0 \) and \( u(1) = 1 \). Let \( h = 1/8 \) and write a set of finite difference equations that approximate the solution to this problem at \( t = jh, \ j = 0, \ldots, 8 \).