Numerical Methods I

Lab Session 1

September 11, 2003

Consider the sequences

$$x_0 = 0, \qquad x_{k+1} = \cos(x_k) \tag{1}$$

$$y_0 = 1, \qquad y_{k+1} = 1 - \cos(y_k) \tag{2}$$

$$z_k = \sum_{j=1}^{k} \frac{1}{j^2} \tag{3}$$

1. What are the limits ξ, η, and ζ for each of the sequences? Use Octave to compute the first few members of each sequence. Which ones converge fast, which ones converge slowly?

2. By plotting k vs. $\log|\xi - x_k|$, etc., determine for each of the sequences whether it converges linearly, sublinearly, or superlinearly.

3. By performing a log-log plot of $|\eta - y_k|$ vs. $|\eta - y_{k+1}|$, demonstrate that the convergence of y_n is in fact quadratic.