CSC2302H

Assignment 1

January 21, 2014 University of Toronto **Due:** February 4, 2014

In this assignment you are to use ode45 or ode113 of Matlab to investigate some properties of Jacobian elliptic functions which arise in mathematical physics. In order to access the vector of piecewise polynomials $S(x)$ (and its derivative, $S'(x)$), associated with the approximate solution produced by ode45 or ode113, you can use the routine deval after applying one of these IVP solvers. You might also find it helpful to make use of other options available with these solvers (options are invoked using the routine odeset).

The initial value problem that defines with the Jacobian elliptic functions sn, cn, and dn [Abramowitz and Stegun, Handbook of Mathematical Functions, 1964, section 16.16], corresponding to $m = .59$, is (with $(sn, cn, dn) \equiv (y_1, y_2, y_3)$),

$$y_1' = y_2 y_3, \;\; y_1(0) = 0,$$
$$y_2' = -y_1 y_3, \;\; y_2(0) = 1,$$
$$y_3' = -.59 y_1 y_2, \;\; y_3(0) = 1.$$

1. Using the approximate solution $S(x)$, develop and implement an effective scheme for determining the first seven zeros of $y_2(x)$ and $y_1(x)$.
2. Using a similar approach, identify the value of and location of the first four local maxima of $y_3(x)$.

In writing up your solution, discuss your choice of tolerance and comment on the accuracy you feel is associated with your answers.