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 \( (sn, cn, dn) \equiv (y_1, y_2, y_3) \)),

\[
\begin{align*}
y_1' &= y_2 y_3, \quad y_1(0) = 0, \\
y_2' &= -y_1 y_3, \quad y_2(0) = 1, \\
y_3' &= -.59 y_1 y_2, \quad y_3(0) = 1.
\end{align*}
\]

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.