1. Run the code from the "Computational Physics" webpage or use my code on our coursepage.

2. (a) Use Euler's method with $h = 0.2$ to approximate $x(2)$ and then find the error by comparing with the exact solution $x(2)$. Repeat with $h = 0.02$. How do the errors compare with your understanding of the saying, "halve the stepsize, halve the error." If $h = 0.2$ then error $= 0.4396874$ and if $h = 0.02$ then error $= 0.0526879$.

   (b) Use RK2 (= explicit trapezoid p.494.) method with $h = 0.2$ to approximate $x(2)$ and then find the error by comparing with the exact solution $x(2)$. Repeat with $h = 0.02$. How do the errors compare with your understanding of the saying, "halve the stepsize, quarter the error." If $h = 0.2$ then error $= 0.07241732$ and if $h = 0.02$ then error $= 0.000779726$.

   (c) Use RK4 method with $h = 0.2$ to approximate $x(2)$ and then find the error by comparing with the exact solution $x(2)$. Repeat with $h = 0.02$. How do the errors compare with your understanding of the saying, "halve the stepsize, $\frac{1}{16}$th error." If $h = 0.2$ then error $= 0.0001089498$ and if $h = 0.02$ then error $= 1.13953229e - 08$.

3. (a) Calculate the left endpoint Riemann sum approximation using $40, 400$, and 4000 equally-spaced subintervals. How many decimal places have stabilized? $40 : 6.133338, 400 : 6.220269, 4000 : 6.228990$.

   (b) Approximate the integral using the trapezoid method with $40, 400$, and 4000 equally-spaced subintervals. How many decimal places have stabilized? $40 : 6.2302699, 400 : 6.22996249, 4000 : 6.2299594$.

   (c) Approximate the integral using Simpson's method with $40, 400$, and 4000 equally-spaced subintervals. How many decimal places have stabilized? $40 : 6.229959413978, 400 : 6.2299593878862, 4000 : 6.2299593878837$

4. (a) Approximate the solution to the IVP using RK2 (trapezoid method) with stepsize $h = \frac{3-1}{4000}$. How does this compare with your approximation of the integral in the previous problem? 6.229959418937354

   (b) Approximate the solution to the IVP using RK4 with stepsize $h = \frac{3-1}{4000}$. How does this compare with your approximation of the integral in the previous problem? 6.2299593878837 MATLAB: 6.229959387883647