Homework Assignment 8

Matthew Tiger

November 2, 2015

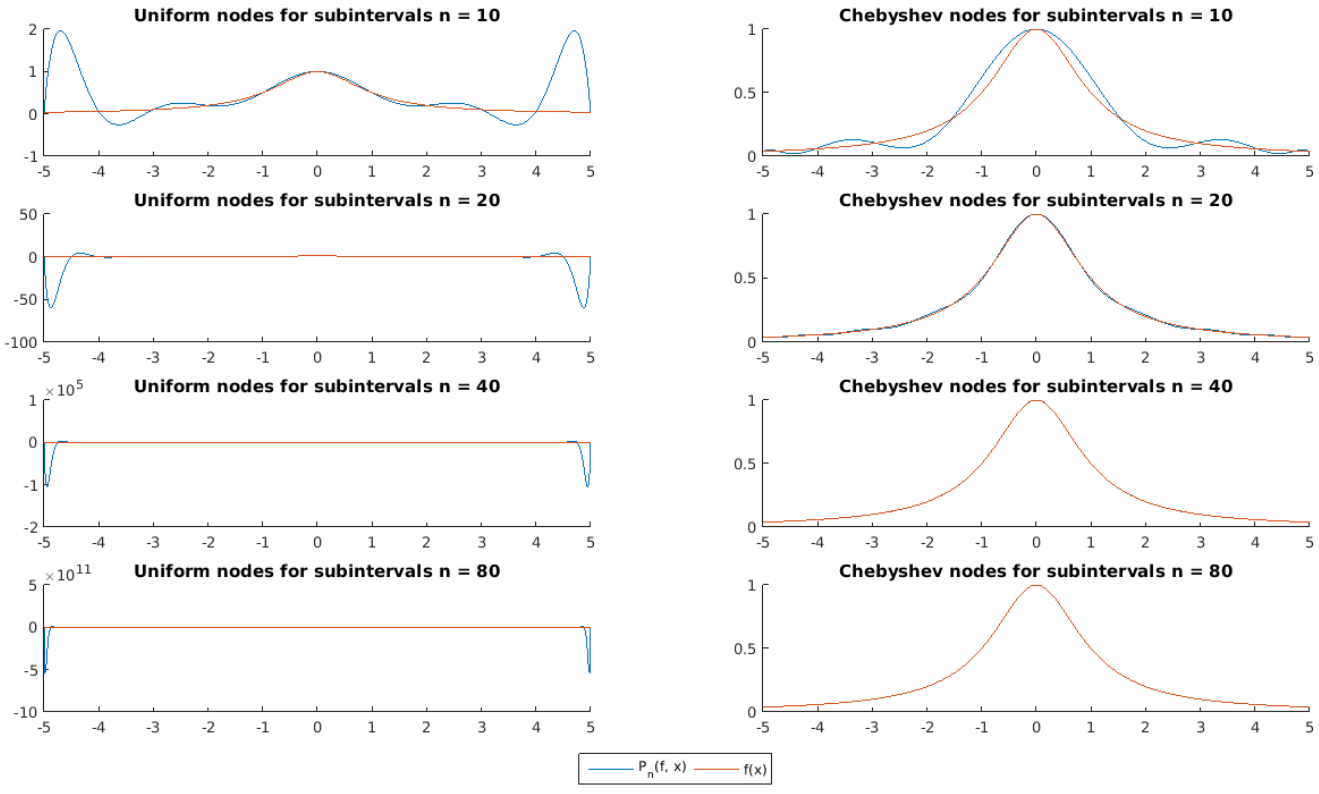
Problem 1. Use uniform and Chebyshev nodes to interpolate

$$f(x) = \frac{1}{1+x^2}, \ x \in [-5, 5].$$

Using MATLAB, plot the graphs of $f(x)$ and the corresponding $P_n(f, x)$ for $n = 10, 20, 40, 80$.

Solution. The plots of the interpolating polynomial for the function $f(x) = 1/(1+x^2)$ using uniform and Chebyshev nodes with n sub-intervals for various values of n can be found in the figure below.

Make note of the large increases in scale as n increases for the uniform nodes while the scale stays the same as n increases for the Chebyshev nodes. Also note the near perfect agreement between $f(x)$ and the interpolating polynomial for large n for Chebyshebv nodes.



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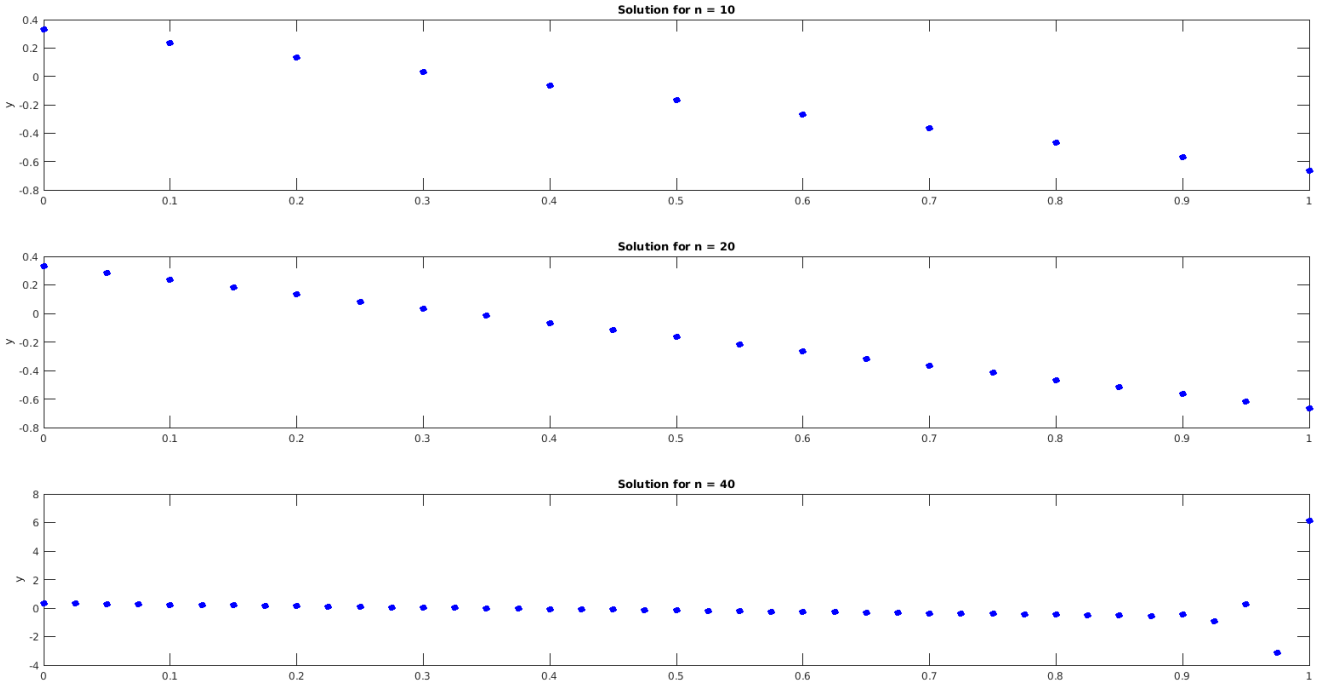
Problem 2. Using MATLAB, code the Euler method for (12.7) on p. 285. Assume $\varepsilon = 0$. Plot your solutions for $n = 10, 20$, and 40.

Solution. The figure below represents the solution to the first-order differential equation $y'(t) = -150y(t) + 49 - 150t$ for $t \in [0, 1]$ with initial condition $y(0) = 1/3$ using Euler's method for n sub-intervals for $n = 10, 20$, and 40. Note that for $n = 40$, we gain some additional data for the solution not present in other plots in the interval [0.9, 1].



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