Problem Set 9 (12/4, 6, 9)
Due on Wed, Dec 11

1) Let us consider

$$\begin{cases} \dfrac{\mathrm{d}x}{\mathrm{d}t} = \sin x, \quad 0 < t < 10, \\ x(0) = 1. \end{cases} \tag{1}$$

The solution is obtained as

$$x(t) = 2\tan^{-1}\left(\mathrm{e}^t \tan\frac{1}{2}\right).$$

Submit a code (or codes) to solve Eq. (1)

(a) with Euler's method,
(b) with modified Euler's method,
(c) with Heun's method, and
(d) with the fourth-order Runge-Kutta method.

Furthermore,

(e) Plot curves from (a) through (d) together with the analytical solution.