1. (60 pts) Given the following matrix differential equation initial value problem, find the unique solution for $\vec{x}(t)$:

$$\vec{x}'(t) = A \vec{x}(t),$$

where $\vec{x}(t) = \begin{pmatrix} x_1(t) \\ x_2(t) \end{pmatrix}$, $A = \begin{pmatrix} 1 & -4 \\ -1 & 1 \end{pmatrix}$, and $\vec{x}(0) = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$.

2. (30 pts) Use the Euler method with step size $h = 0.1$ to approximate the value of $\vec{x}(0.2)$.

3. (10 pts) Compare your approximation result in #2 with the actual solution of $\vec{x}(0.2)$ from your exact solution in #1 above and determine the percent error for each component. How can you improve these results? List at least two suggestions.