Homework # 1

1. Using Taylor series expansions, derive a fourth-order approximation for $\dfrac{\partial \phi}{\partial x}$ and $\dfrac{\partial^2 \phi}{\partial x^2}$.

2. Consider solving the one-dimensional advection equation

$$\frac{\partial \phi}{\partial t} + C \frac{\partial \phi}{\partial x} = 0$$

We have derived the Lax-Wendroff scheme in class. Examine the truncation error to determine the order of this scheme in time and space.