

MAR513: Homework # 6

Consider the equation

$$-u \frac{\partial \phi}{\partial x} = \alpha \frac{\partial^2 \phi}{\partial x^2}$$

where u and α are constant.

- Write down the centered difference approximation.
- Assume $\phi_i = \beta^i$ and solve the difference equation exactly for β .
- Describe the behavior of the solution for various ranges of grid Peclet #, $P_e = u \frac{\Delta x}{\alpha}$
- What does the solution look like as $P_e \rightarrow \infty$
- How does the solution change if you used upwind differences for $\frac{\partial \phi}{\partial x}$?