# Math 453 − Homework 7

Peyam Tabrizian

Friday, April 14, 2017

This assignment is due on **Friday, April 14, at 11:50 AM**

**Reading:** Sections 2.3.3(b), 2.3.4, 2.1, beginning of 2.4

**Chapter 2:** Additional Problem, 1, 18

**Additional Problem** Use an energy method similar to Theorem 10 on page 63 (Uniqueness) to show that the only $2\pi$ periodic solution $u = u(x,t)$ to the following nonlinear KdV PDE in one dimension is $u \equiv 0$:

$$\begin{cases} u_t + u\left(u_x\right) + u_{xx} + u_{xxxx} = 0 \text{ in } \mathbb{R} \times [0,T] \\ u(x,0) = 0 \text{ on } \mathbb{R} \times \{t = 0\} \end{cases}$$

**Note:** Beware of the boundary terms! At some point, you'll need the following inequality (which is a consequence of what's called the Poincaré inequality):

$$\int_0^{2\pi} |u_x|^2 \, dx \leq \int_0^{2\pi} |u_{xx}|^2 \, dx$$

**Hint for 1:** It is actually super similar to 14 on HW5.

**Hint for 18:** This problem is very quick!