

# Math 112A – Homework 2

Peyam Tabrizian

Thursday, October 10, 2019

**Reading:** Sections 1.2 – 1.6. We will go over those sections pretty quickly because there is lots of useless info. In Section 1.2, this time only read the part on the coordinate method. In Section 1.3, only read Example 1. We will derive some of the other equations later in the course. In Section 1.4, ignore everything from ‘The Vibrating String’ on, unless you’re interested in physical applications. In Section 1.5, ignore the first three examples. Finally, in Section 1.6, ignore the proof on page 29 and everything after Example 1 (but know Example 1).

**Note:** We will probably have started with section 2.1 already, but you won’t be responsible for it until HW 3.

**Note:** AP refers to the additional problem below

- **Section 1.2:** 13 (but assume the right-hand-side is 0, see hint below)
- **Section 1.3:** AP
- **Section 1.4:** Nothing
- **Section 1.5:** 1, 4ab (see hint below), 5, 6
- **Section 1.6:** 1, 2, 4, 6

**Additional Problem:** Solve the transport equation  $u_t + 3u_x = 0$  with initial profile  $u(x, 0) = x^2$ . Sketch  $u(x, 0)$ ,  $u(x, 1)$ , and  $u(x, 2)$  on the same graph and convince yourself that the solution moves to the right with velocity 3.

**Hint for 1.2.13:** Use  $x' = 2x - y$  and  $y' = x + 2y$

**Hint for 1.5.4ab** For (a), what is the easiest function you can think of? For (b), use that  $f = \Delta u$  (by the PDE)  $= \operatorname{div}(\nabla u)$