Math 471: Assignment 1 – due Mon 09/11

1. Do exercise 1.2.9 in the textbook
2. Do exercise 1.3.2 in the textbook
3. Consider a bar with an initial temperature profile $f(x) = \frac{3}{2}\sin \pi x - \frac{1}{2}\sin 3\pi x$, $0 \leq x \leq 1$, with ends held at 0° C.
   (a) You already know that the bar will cool as $t \to \infty$, and approach a steady-state temperature 0° C. But will all parts of the bar start cooling immediately, or will some parts initially become hotter? Justify your answer by finding how the sign of $u_t(x, 0)$ is related to the shape of the initial temperature profile.
   (b) How is the sign of $u_t(x, t)$, $t > 0$, related to subsequent temperature profiles? Plot (e.g. using Matlab) the temperature profile for $t = 0, 0.25, 0.5, 0.75, 1$ on the same graph.