

## MAT132, Paper Homework 9

1. Detective Nick Goodeye arrives at the scene of the crime at 5:13 AM, finding the body of the heiress lying in a pool of her own blood. The M.E. took the temperature of the body at 5:00 am, and determined it was exactly  $74^\circ$  F. Detective Goodeye checks the thermostat, and determines that room is always kept at constant temperature of  $68^\circ$  F. Just before leaving, the M.E. takes the body's temperature again (at exactly 6:00am), and finds it to be  $72^\circ$  F.

Detective Goodeye quickly recalls Newton's Law of Cooling from his calculus class, solves the relevant differential equation, and immediately determines the time of death. He then rushes off to interview suspects. At what time did the heiress die, assuming her body temperature was  $98.6^\circ$  F when she was killed?

2. Solve the differential equation  $y' = x^2 - x + 2y$  with initial condition  $y(0) = 2$  by making the substitution  $u = 2y + x^2$  (so  $y = u/2 - x^2/2$ ).