Math 241, Problem Set #1
(due **in class** Fri.. 9/13/13)

Stewart, section 10.1, problems 4, 6, 10, 17(a), 18, 20, 30, 36. For the last of these problems, you may use the formula proved in Exercise 7.2.33 (formerly known as Exercise 7.2.27), given at the back of the book, which in this assignment you may assume to be true (you don't need to prove it in your write-up). For some of these problems, the technique of "completing the square" will be useful.

Also:

A. Two flies fly past one another between time 0 and time 1. At time t (with $0 \leq t \leq 1$), one fly has position $(0, 0, t)$ and the other has position $(1, 1 - t, 0)$. At what instant are they closest, and how far apart are they at that instant? (Hint: Minimizing the distance between the flies is equivalent to minimizing the square of the distance.)

B. Let L be the length of a line segment in space, and let $L_{x,y}$ be the length of its projection on the x, y plane. Show that $L_{x,y} \leq L$ (that is, the shadow of a line segment cannot be longer than the line segment itself).

C. A needle of length 1 is spinning through the air. Let $L_{x,y}(t)$ be the length of its projection on the x, y plane at time t; let $L_{x,z}(t)$ be the length of its projection on the x, z plane at time t; and let $L_{y,z}(t)$ be the length of its projection on the y, z plane at time t. Show that regardless of the fashion in which the needle is spinning, $[L_{x,y}(t)]^2 + [L_{x,z}(t)]^2 + [L_{y,z}(t)]^2$ stays constant as t varies.

Please don't forget to write down **who you worked on the assignment with** (if nobody, then write "I worked alone"), and record **how much time you spent on each problem** (this doesn't need to be exact) on the time-sheets I gave out in class.