MATH 202: VECTOR CALCULUS
MONDAY WEEK 1 HANDOUT

Problem 1. (a) Consider two disjoint smooth surfaces in space. (Here *smooth* means there is a well-defined tangent plane at each point of the surface.) Consider pairs of points on each surface. Make a conjecture about the nature of the tangent planes at the pair of points closest to each other in space.

(b) Consider a smooth surface and smooth curve in space which are disjoint. (A *smooth* curve has a well-defined tangent line at each of its points.) Consider pairs of points, one on the surface and one on the curve. Make a conjecture about the nature of the tangent plane and tangent line at the pair of points closest to each other in space.

(c) Make a conjecture about the closest pair of points on two disjoint smooth curves.

Problem 2. A Selective Compliant Articulated Robot Arm (or SCARA) consists of two arms with radial hinges and an effector. An ideal model for a SCARA consists of a unit length line segment with one end hinged at the origin in the plane, and then a second unit length line segment attached to the non-origin end of the first line segment with a hinge. We identify the effector with the end of the second line segment. Let $f(t)$ describe the angle of the first arm at time t, and let $g(t)$ describe the angle of the second arm at time t. Determine $f(t)$ and $g(t)$ so that the effector moves radially in a straight line away from the first hinge with constant velocity.