HW 9: Section 16.7, 17.1, 17.2

Due Friday, April 6

1. If R is the triangle bounded by $x + y = 1$, $x = 0$, and $y = 0$, use an appropriate change of variables to evaluate the integral $\int_R \cos(\frac{x-y}{x+y})dxdy$.

2. Consider two points P_0 and P_1 in 3-space.

   (a) Show that the line segment from P_0 to P_1 can be parameterized by

   $$\vec{r}(t) = (1-t)\vec{OP_0} + t\vec{OP_1}, \quad 0 \leq t \leq 1.$$

   (b) What is represented by the parametric equation

   $$\vec{r}(t) = t\vec{OP_0} + (1-t)\vec{OP_1}, \quad 0 \leq t \leq 1?$$

3. Find the parametric equations of each of the following lines:

   (a) The line of intersection of the planes $x + y + z = 3$ and $x - y + 2z = 2$.

   (b) The line perpendicular to the surface $z = x^2 + y^2$ at the point $(1, 2, 5)$.

4. (a) Find a parametric equation for the line through the point $(1, 5, 2)$ and in the direction of the vector $2\vec{i} + 3\vec{j} - \vec{k}$.

   (b) Use the parametric equation you found in part 1, find the exact point on the line which is closest to the origin.

5. A particle travels along the line $x = 1 + t$, $y = 5 + 2t$, $z = -7 + t$, where t is in seconds and x, y, z are in meters.

   (a) When and where does the particle hit the plane $x + y + z = 1$?

   (b) How fast is the particle going when it hits the plane? Give units.