Math 2551 Worksheet Section 16.2

1. Evaluate $\int_C (2x - y)dx$ where C: $\vec{r}(t) = (t^2)\hat{i} + (3t - 2)\hat{j}$, $t \in [0, 1]$.

2. Find the work done by the force $\overrightarrow{F} = xy\hat{i} + (y - x)\hat{j}$ over the straight line from $(1, 1)$ to $(2, 3)$.

3. Find the flow of the field $\overrightarrow{F} = x\hat{i} + y\hat{j}$ around C and its flux across C, where C is

$$\vec{r}(t) = (3\cos t)\hat{i} + (4\sin t)\hat{j}, \quad t \in [0, 2\pi].$$

4. Let $a > 0$. Consider the closed curve C consisting a semicircle and a straight line segment as follow:

$$\vec{r}_1(t) = (a\cos t)\hat{i} + (a\sin t)\hat{j}, \ t \in [0, \pi], \qquad \vec{r}_2(t) = t\hat{i}, \ t \in [-a, a]$$

Let the vector field $\overrightarrow{F}$ be given by
$$\overrightarrow{F}(x, y) = -y^2\hat{i} + x^2\hat{j}.$$

Find the circulation of $\overrightarrow{F}$ around C and the flux across C.