Mathematics 554 Homework.

Problem 1. We will be working with partial derivatives. For review of these do problems 1, 2, 3, 6, 17, 21 on page 74 of *Vector Calculus*.

Problem 2. For practice in finding tangent planes do problems 1, 2, 3 on page 77 of *Vector Calculus*.

Let $\mathbf{F}$ be a vector field in the plane, that is

$$\mathbf{F}(x, y) = P(x, y)\mathbf{i} + Q(x, y).$$

Then discussed in class today how to evaluate the line integral

$$\int_C P\,dx + Q\,dy.$$

where C is a curve. Anther notation for this is

$$\int_C \mathbf{F} \cdot d\mathbf{r}.$$

This is a reasonable notation for if $\mathbf{r}(t) = x(t)\mathbf{i} + y(t)\mathbf{j}$ then, using notation like that in calculus,

$$d\mathbf{r} = \big(x'(t)\mathbf{i} + y'(t)\mathbf{j}\big)\,dt$$

so

$$\begin{aligned}\mathbf{F}(\mathbf{r}(t)) \cdot d\mathbf{r}(t) &= \big(P(x(t), y(t))\mathbf{i} + Q(x(t), y(t))\mathbf{j}\big) \cdot \big(x'(t)\mathbf{i} + y'(t)\mathbf{j}\big)\,dt \\ &= \big(P(x(t), y(t))x'(t) + Q(x(t), y(t))y'(t)\big)\,dt\end{aligned}$$

Thus

$$\int_C \mathbf{F} \cdot d\mathbf{r}$$

reduces to the samething as the $\int_C P\,dx + Q\,dy$.

Problem 3. In *Vector Calculus* look at section 4.1 pages 135–142. On page 142 do problems 6–10, 13, and 14.