Calculus III Homework on Lecture 17 and 18

1. Show the field \mathbf{F} has scalar potential f; find f. Compute the indicated line integral.

We recall that f is scalar potential for \mathbf{F} if $\mathbf{F} = \nabla f = (f_x, f_y)$.

- (a) $\mathbf{F} = (3 + 2xy)\mathbf{i} + (x^2 3y^2)\mathbf{j}$. Compute $\int_C \mathbf{F} \cdot d\mathbf{r}$, where C is any curve from (1,0) to (0,1).
- (b) $\mathbf{F} = (e^{xy}y + 2x)\mathbf{i} + (e^{xy}x + 1)\mathbf{j}$. Compute $\int_C \mathbf{F} \cdot d\mathbf{r}$, where C is any curve from (1,0) to (0,1).
- 2. Compute the line integral.
 - (a) $\int_C \left(-y^3 + e^{x^3 + \arctan x}\right) dx + \left(x^3 + \arctan\left(e^{y^2} + y\right)\right) dy$, where C is the positively oriented boundary of the unit disk.
 - (b) $\int_C (\sin(\cos x) + y) dx + (\cos(\sin y) + 2x) dy$, where C is the oriented curve consisting of the four segments connecting (0, -1), (1, 0), (0, 1), (-1, 0), (0, -1) in this order.