Quiz #9 for Calculus 3 (MATH-UA.0123-001)

Problem 1. Let $\boldsymbol{F}(x,y) = (3 + 2xy)\boldsymbol{i} + (x^2 - 3y^2)\boldsymbol{j}$. Find a function f such that $\boldsymbol{F} = \nabla f$. Be careful of any constants of integration. [*3 points*]

Problem 2. For the same $\boldsymbol{F}$ as in Problem 1, evaluate the line integral $\int_C \boldsymbol{F} \cdot d\boldsymbol{r}$, where C is the curve given by $\boldsymbol{r}(t) = e^t \sin(t)\boldsymbol{i} + e^t \cos(t)\boldsymbol{j}$, for t such that $0 \leq t \leq \pi$. [*3 points*]

Problem 3. Let C be the circle with radius 2 centered at the origin. Evaluate the line integral $\oint_C (x - y)dx + (x + y)dy$ directly and using Green's theorem. [*2 points*]