1. Find the gradient vector field ∇f of f and sketch it.

   (a) $f(x,y) = \frac{1}{2}(x^2 - y^2)$

   (b) $f(x,y) = \ln \sqrt{x^2 + y^2}$

2. Compute the following line integrals.

   (a) $\int_C y \, ds$, where $C : (x(t), y(t)) = (t^2, 2t), 0 \le t \le 3$.

   (b) $\int_C \mathbf{F} \cdot d\mathbf{r}$, where $\mathbf{F}$ is a vector field

   $$\mathbf{F}(x,y) = \left(-\frac{y}{x^2 + y^2}, \frac{x}{x^2 + y^2} \right)$$

   and C is a circle $x^2 + y^2 = a^2$ with parametrization given by $\mathbf{r}(t) = (a \cos t, a \sin t)$, $0 \le t \le 2\pi$.