

## Math 241 Quiz 4

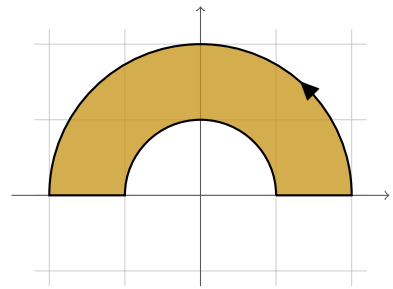
Names: \_\_\_\_\_

**1.** Using a line integral, find the lateral surface area of the portion of the cylinder  $x^2 + y^2 = r^2$  above the plane  $z = 0$  and below the graph of  $z = f(x, y)$ . (Leave the answer as an integral involving  $f$ ).

**2.** Let  $R$  be the set of points in the  $x, y$ -plane which satisfy  $x^2 + y^2 \leq a^2$ . Use Question 1 to explain why

$$\iint_R f(x, y) \, dx \, dy = \int_0^a \int_0^{2\pi} f(r \cos \vartheta, r \sin \vartheta) \, r \, d\vartheta \, dr$$

3. Find the work done by  $\mathbf{F}(x, y) = \langle x^2 - y^2, y \rangle$  moving once around this path: Hint: Green's theorem.



4. Using Green's theorem, find the area enclosed by  $\begin{cases} x = \cos t \sin t, \\ y = \sin t, \end{cases} \quad t \in [0, \pi].$  Hint:  $\langle -y, 0 \rangle$ .

