1. (6 points) Find the points on the curve $x^2+4y^2 = 8$ where the function $f(x, y) = -x+2y$ attains its maximum *max* and minimum *min*, and say what *max* and *min* are.

max = [ ] at the point(s) [ ]

min = [ ] at the point(s) [ ]

2. (3 points) Let $f : \mathbb{R}^2 \to \mathbb{R}$ be a function with continuous second order partial derivatives at every point. Assume that $f(0,0) = 1$, $f_x(0,0) = 0$, $f_y(0,0) = 0$, $f_{xx}(0,0) = 5$, $f_{xy}(0,0) = 2$, $f_{yx}(0,0) = 2$, $f_{yy}(0,0) = -1$. Determine whether the point $(0,0)$ is critical and, if so, say whether it is a local minimum, a local maximum, or a saddle point for f. Circle your answer.

Not a critical point	A local min	A local max
A saddle	We do not have enough information	

3. (3 points) Let D be the set of points (x, y) in $\mathbb{R}^2$ such that $1 < x^2 + y^2 < 4$. Which of the following are properties of D? Circle all that apply.

open	connected	simply connected

4. (6 points) The vector field $\mathbf{F}(x, y, z) = \langle yz, xz, xy + 2z \rangle$ is conservative. Find a function f so that $\nabla f = \mathbf{F}$. **(No partial credit: You can check your answer!)**

$f(x, y, z) =$

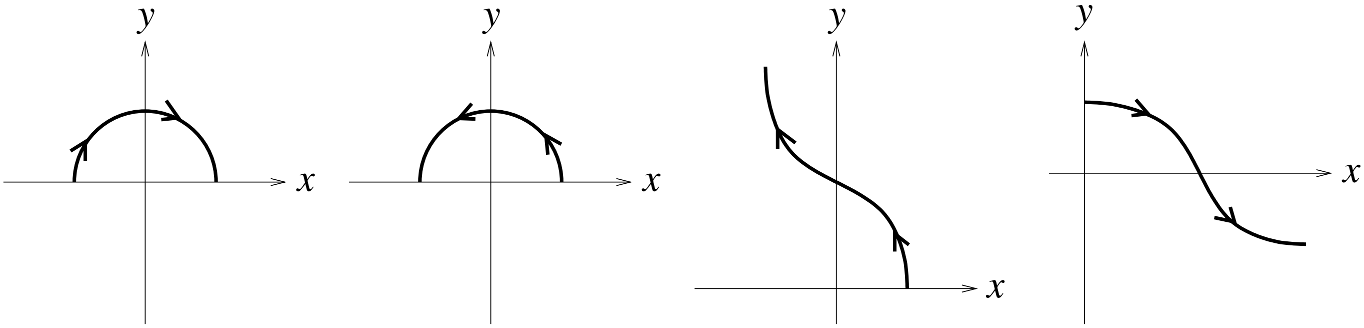
5. (6 points) Consider the vector field $\mathbf{F}(x, y) = \langle e^{(x^2)}, \sin(y) \rangle$. Is $\mathbf{F}$ conservative? Circle the correct response

Yes	No	We do not have enough information.

and justify your answer.

6. (7 points) Consider the oriented curve C parameterized by $\mathbf{r}(t) = \langle \cos(t), t \rangle$, $t \in [0, \pi]$.

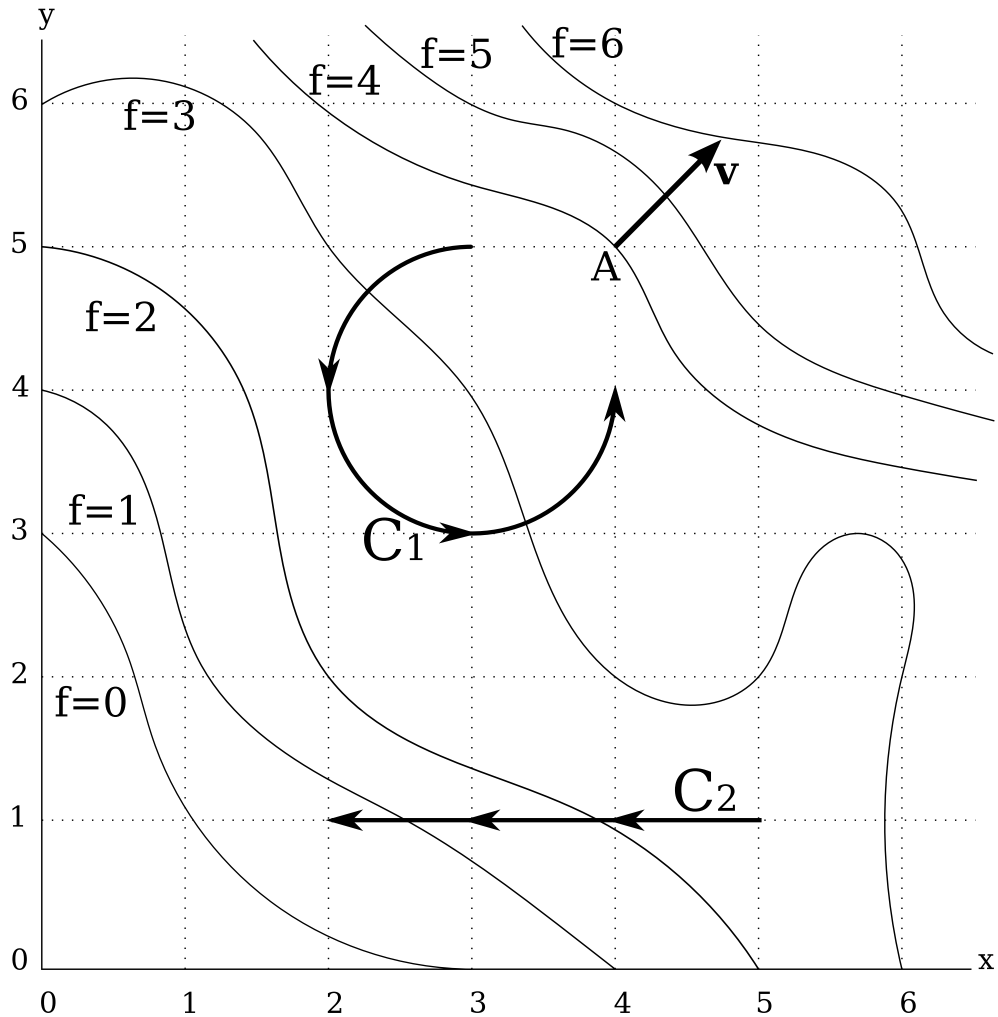
(a) Circle the picture of C.



(b) Calculate the integral $\int_C \langle 1, y^2 + x \rangle \cdot d\mathbf{r}$.

$$\int_C \langle 1, y^2 + x \rangle \cdot d\mathbf{r} = \boxed{}$$

7. (7 points) Consider the function $f : \mathbb{R}^2 \to \mathbb{R}$ whose contour diagram is shown below, as well as the curves C_1, C_2, the point A, and the unit vector $\mathbf{v}$. For each part circle the best answer



(a) The sign of $\nabla f(A) \cdot \mathbf{v}$ is

negative	zero	positive

(b) The value of $\int_{C_1} f\, ds$ is

-14	-4	4	14	24

(c) The sign of $\int_{C_2} \nabla f \cdot d\mathbf{r}$ is

negative	zero	positive