Math 120a — Exam 2

1. Find the absolute maximum and absolute minimum of $f(x, y) = x^2 - 2y^2 - 3x$ on the disk $x^2 + y^2 \leq 1$.

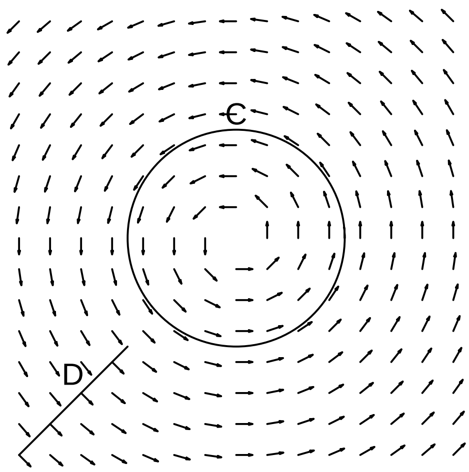
2. Circle all the line integrals that are 0. Give a reason to justify each integral you circle.

(a) $\displaystyle\int_A e^{xy} dx$ where A is the line segment from $(1, 1)$ to $(1, 2)$.

(b) $\displaystyle\int_B \cos(xy) dy$ where B is the line segment from $(1, 1)$ to $(2, 1)$.

(c) $\displaystyle\int_C \mathbf{F} \cdot d\mathbf{r}$ where $\mathbf{F}$ is the vector field and C the curve pictured below, oriented counterclockwise.

(d) $\displaystyle\int_D \mathbf{F} \cdot d\mathbf{r}$ where $\mathbf{F}$ is the vector field and D the curve pictured below, oriented from its right endpoint to its left endpoint.



3. Integrate $\mathbf{F}(x, y, z) = \cos(x)\mathbf{i} + \sin(xy)z\mathbf{j} + z\mathbf{k}$ along the line segment from $(0, 0, 0)$ to $(1, 2, 2)$.

4. (a) Evaluate the integral $\displaystyle\int_0^1 \int_{3y}^3 e^{x^2} dx dy$

(b) Set up, but DO NOT EVALUATE, the integral of $f(x, y) = x + y$ over the region inside $x^2 + y^2 = 4$ and outside $(x - 1)^2 + y^2 = 1$. Use polar coordinates. Specify the limits of integration.

5. (a) Evaluate the integral $\displaystyle\int_C \mathbf{F} \cdot d\mathbf{r}$ where $\mathbf{F}(x, y) = e^x \sin(y)\mathbf{i} + e^x \cos(y)\mathbf{j}$ and $\mathbf{r}(t) = \sin(t^2)\mathbf{i} + t\mathbf{j}$ for $0 \leq t \leq 2$.

(b) Suppose $f(x, y) = g(y)$. Evaluate $\displaystyle\int_C \nabla f \cdot d\mathbf{r}$ where C is the part of the parabola $y = 2 - x^2$ from $(-1, 1)$ to $(1, 1)$.

6. Evaluate the integral $\displaystyle\int_C \mathbf{F} \cdot d\mathbf{r}$ where $\mathbf{F}(x, y) = x^2 y\mathbf{i} + yx\mathbf{j}$ and C is the boundary of the part of the annulus $1 \leq x^2 + y^2 \leq 4$ satisfying $0 \leq y \leq x$, oriented counterclockwise.