

## General Stuff

- Office Hours  
T: 12:30 - 1:30, Th: 10 - 11
- Lab 3 due tonight  
Exercises 1,2,5
- Midterm Thursday 2/18  
2 problems  
30 minutes to take exam  
5-10 minutes to upload to gradescope  
11:15 - 11:25 questions before quiz  
11:25 - 11:55 midterm  
11:55 - 12:05 uploading
- Lab after midterm from 12:20 - 1:10

1. Let  $f(x, y) = x^2 + y^2$  and  $p(t) = (3 \cos(t) - 1, 3 \sin(t) + 2)$ . Find  $\frac{d}{dt}(f \circ p)$ .

2. Let  $F(x, y) = (x^2, y^2, x + y, xy + e^x)$  and  $G(s, t, u, v) = (st, uv, 3t^2)$ . Find  $D(G \circ F)(0, 2)$ .

Let  $f(x, y, z) = xyz + xy + xz + yz + 2$ . Find the directional derivative of  $f$  in the direction  $w = (2, -1, 1)$  at  $x_0 = (0, 3, 1)$ .

- 4. Let  $p(t) = (3t + e^t, -t^2)$  and  $F(x, y) = (x^2, xy)$ . Find  $D(F \circ p)(0)$  using the chain rule.
- 5. Suppose the temperature at a point  $(x, y, z)$  in a room the shape of  $\mathbb{R}^3$  is given by  $T(x, y, z) = e^{-(x^2+y^2+z^2)}$ . Furthermore, you are standing at the point  $(x_0, y_0, z_0) = (1, -1, 0)$ . What direction do you walk in order to have the maximum increase in temperature?

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