

### Sample Problems for 10A Midterm

- The exam is on Tuesday, 11/18, 9:40 am – 11:00 am.
- In each problem, you have to show every step of your calculation.

1. Find the first and the second order partial derivatives:

- (1)  $f(x) = 3 \tan(2x)$ .
- (2)  $f(x, y) = y + \cos^2 x$ .
- (3)  $f(x, y, z) = x^2 + y^3 - e^{3z}$ .

2. Are following functions continuous at  $(0, 0)$ ?

- (1)  $f(x, y) = xy^{10} + y - 2014x$ .
- (2)  $f(x, y) = \frac{xy^{10} + yx^{10}}{x^2 + 2014y^2}$  and  $f(0, 0) = 0$ .
- (3)  $f(x, y) = \frac{xy}{x^2 + 2014y^2}$ ,  $f(0, 0) = \frac{1}{2015}$ .

3. Find the derivative matrix  $Df(x, y)$ :

- (1)  $f(x, y) = (x + 10xy, x)$ .
- (2)  $f(u, v) = (u^2 + v, v - u^3)$ ,  $u = 2yx$ ,  $v = y^2 \sin x + y^3$ .

4. Find the normal vector and the plane passing through the line  $x = 2t - 1$ ,  $y = 2 + t$ ,  $z = 2$  and the point  $(1, 0, 1)$ .

5. Let  $\mathbf{u} = (1, 3, 2)$  and  $\mathbf{v} = (-1, 3, 5)$ .

- (1) Find the dot and cross product of  $\mathbf{u}$  and  $\mathbf{v}$
- (2) Find the length of  $\mathbf{u}$  and  $\mathbf{v}$ ;
- (3) Find the distance between  $\mathbf{u}$  and  $\mathbf{v}$ ;
- (4) Find the angle between  $\mathbf{u}$  and  $\mathbf{v}$ .

6. Let  $f(x, y) = x^2 + y^2$ , find the graph and the level curves of this function.