# MAT 17C, Fall 2017

## Practice problems for Midterm 1

This practice sheet has more problems than the actual exam

1. Prove that the limit

$$\lim_{(x,y)\to(0,0)} \frac{x^2+y^2}{x^2+2y^2}$$

does not exist by approaching $(0,0)$ along the $x$-axis and along the $y$-axis.

2. Find the following partial derivatives:

a) $\frac{\partial}{\partial y}\left(\sin(x^2+3x-1)\right)$

b) $\frac{\partial}{\partial x}\left(xe^{x+y}\right)$

c) $\frac{\partial}{\partial x}\left(\sin(x)\cos(y)\right)$

d) $\frac{\partial}{\partial y}\left(e^{x^2-y^2}\right)$

e) $\frac{\partial^2}{\partial x \partial y}\left(\frac{x}{y}\right) = \frac{\partial}{\partial x}\left(\frac{\partial}{\partial y}\left(\frac{x}{y}\right)\right)$

3. (a) Find the equation of the tangent plane to the graph of the function $f(x,y) = \ln(x+y)$ at the point $(1,1)$ (b) Use linearization to approximate $f(1.1, 1.1)$.

5. Use implicit differentiation to find $y'(x)$ if $2x^2+3y^2=9$.

6. Compute $z'(t)$ where $z = f(x(t), y(t))$, $f(x,y) = x^2y^2$, $x(t) = t^2, y(t) = t^3$.

7. Find all critical points of the function $f(x,y) = xy + 3x + 5y + 8$.

8. Find the direction where the directional derivative of the function $f(x,y) = x^3 + 2y^3$ at the point $(2,3)$ is (a) maximal (b) zero.

9. The map on the next page forecasts atmospheric pressure on the West Coast on Tuesday, October 17.

(a) What is the pressure at Portland, OR (marked by a circle)?

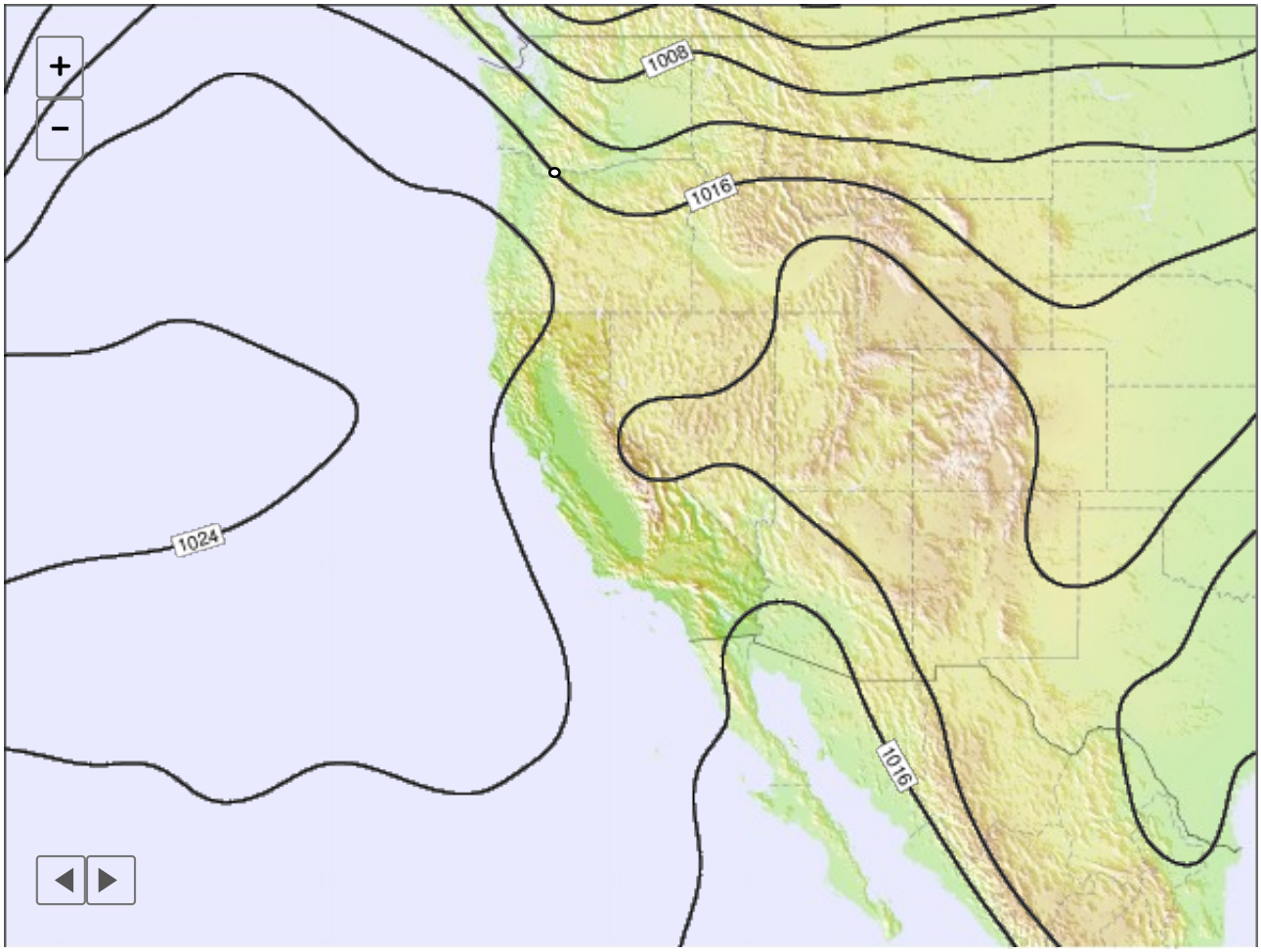
(b) What is the direction of the pressure gradient at Portland?

10*. Suppose crop yield $Y$ depends on nitrogen ($N$) and phosphorus ($P$) concentrations as

$$Y(N,P) = NPe^{-(N+P)}.$$

Find the value of $(N,P)$ that maximizes crop yield.

**Weather Forecast Tuesday 17 Oct 11am PDT**




Sea Level Pressure in Millibars Tuesday 17 Oct at 11am