HW 4  
Math 261, S18

Please see the course syllabus for details on how to turn in your homework assignments. This one is due at the beginning of your class on Friday, February 23.

1. Suppose function $f(x, y)$ depends on variables $x$ and $y$, which are themselves functions of variables $\alpha, \beta,$ and $\gamma$ (i.e., $x = x(\alpha, \beta, \gamma)$ and $y = y(\alpha, \beta, \gamma)$. Fill in the blanks for the chain rule to compute $\frac{\partial f}{\partial \beta}$:

$$\frac{\partial f}{\partial \beta} = \frac{\partial}{\partial \beta} \frac{\partial}{\partial \gamma} + \frac{\partial}{\partial \alpha} \frac{\partial}{\partial \gamma}$$

2. Let

$$g(u, v) = u^2 - 3uv + v^3,$$
$$u(t) = \cos(t),$$
$$v(t) = e^t.$$  

Compute $\frac{dg}{dt}$. (Please use only the variable $t$ in your response, but do not bother multiplying everything out.)

3. Suppose $z$ is a function of $x$ and $y$ and that $x^2z^2 + y\sin(z) = 1$. Find $\frac{\partial z}{\partial x}$.

4. Find the derivative of $f(x, y) = 2xy - 3y^2$ at point $(1, 2)$ in the direction of $\mathbf{v} = \langle 5, 12 \rangle$. Please simplify your answer to a number. (Notice that $\mathbf{v}$ is not a unit vector!)