HW 4
Math 261

Please see the course syllabus for details on how to turn in your homework assignments.

1. (5 pts.) True or False
   (a) Let $x = 3, y = 4, z = 5t$, and $f(x, y, z)$ be a function from $\mathbb{R}^3$ to $\mathbb{R}$. Then $\frac{\partial f}{\partial t} = \frac{\partial f}{\partial z}$.
   (b) Let$x = 3, y = 4, z = 5t$, and $f(x, y, z)$ be a function from $\mathbb{R}^3$ to $\mathbb{R}$. Then $\frac{\partial f}{\partial t} = 5\frac{\partial f}{\partial z}$.
   (c) Let$x = 3, y = 4, z = 5t$, and $f(x, y, z)$ be a function from $\mathbb{R}^3$ to $\mathbb{R}$. Then $\frac{\partial f}{\partial t} = 1/5\frac{\partial f}{\partial z}$.
   (d) Let $h(x, y)$ be a function from $\mathbb{R}^2$ to $\mathbb{R}$ and P a point in the domain of h. It is possible that the directional derivative of h at P is equal to 1 for every direction vector.
   (e) Let $h(x, y)$ be a function from $\mathbb{R}^2$ to $\mathbb{R}$ and P a point in the domain of h. It is possible that the directional derivative of h at P is equal to 0 for every direction vector.
2. (3 pts.) Suppose function $f(x, y)$ depends on variables x and y, which are themselves functions of variables α, β, and γ (i.e., $x = x(\alpha, \beta, \gamma)$ and $y = y(\alpha, \beta, \gamma)$). Fill in the blanks for the chain rule to compute $\frac{\partial f}{\partial \beta}$:

$$\frac{\partial f}{\partial \beta} = \frac{\partial \square}{\partial \square}\frac{\partial \square}{\partial \square} + \frac{\partial \square}{\partial \square}\frac{\partial \square}{\partial \square}$$

3. (3 pts.) Let

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

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

4. (3 pts.) Suppose z is a function of x and y and that $x^2z^2 + y\sin(z) = 1$. Find $\frac{\partial z}{\partial x}$.

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

6. (3 pts.) Find a direction vector $\mathbf{v}$ such that the derivative of $f(x, y) = xy - y^2$ at point $(1, 2)$ in the direction of $\mathbf{v}$ is equal to 0.