

Practice for Quiz 6
Math 2580
Spring 2016

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If you can answer the following problems, you should be well-prepared for Quiz 6:

1. Show that $\nabla(1/r^2) = -2\mathbf{r}/r^4$ for $r \neq 0$, where $\mathbf{r} = \langle x, y, z \rangle$ is the position vector for the point (x, y, z) , and $r = \|\mathbf{r}\| = \sqrt{x^2 + y^2 + z^2}$.
2. Verify the chain rule for the function $f(x, y, z) = e^{xyz}$ and curve $\mathbf{r}(t) = (6t, 3t^2, t^3)$.
(In this case, the chain rule can be written $\frac{d}{dt}(f(\mathbf{r}(t))) = \nabla f(\mathbf{r}(t)) \cdot \mathbf{r}'(t)$.)
3. Calculate the derivative of the function $f(x, y) = e^{x^2 \cos y}$ at the point $(1, \pi/2)$ in the direction of the vector $\mathbf{v} = \frac{1}{5}\langle 3, 4 \rangle$.
4. Determine the direction in which the function $f(x, y) = e^x \sin y$ is increasing fastest at the point $(1, 1)$.
5. Find a unit normal vector to the surface $xyz = 8$ at the point $(2, 2, 2)$.
6. Find the equation of the tangent plane to the ellipsoid $x^2 + 2y^2 + 3z^2 = 9$ at the point $(2, 1, 1)$.