Quiz #1  
January 12, 2007

[1] Calculate the divergence and curl of the following function:
\[ \mathbf{v} = xy\mathbf{\hat{x}} + 2yz\mathbf{\hat{y}} + 3xz\mathbf{\hat{z}} \]

[2] Evaluate the following integral:
\[ \int_{-1}^{1} 4x^2 \delta(2x + 1) \, dx \]

[3] Evaluate the integral
\[ \int_{\vec{a}}^{\vec{b}} \nabla T \cdot d\vec{l} \text{ with } T = x^2 + 2xy + 2yz, \quad \vec{a} = (0,0,0), \text{ and } \vec{b} = (1,1,1) \]
by explicitly doing the line integral along the parabolic path \( z = x^2; \ y = x \). Check that your result agrees with the “fundamental theorem of calculus” for gradients:
\[ T(\vec{b}) - T(\vec{a}) \]