Physics 3323, Electromagnetism 1

PROBLEM SET #1
Due Wednesday, September 9

1. Find the gradients of the following functions:
   (a) \( f(x, y, z) = x^4 y^3 z^2 \)
   (b) \( f(x, y, z) = x^4 + y^3 + z^2 \)
   (c) \( f(x, y, z) = e^x \sin(y) \ln(z) \)

2. Calculate the divergence of the following functions:
   (a) \( \vec{V}_a = x^3 \hat{x} + 3x^2 z^2 \hat{y} - 3x^2 z \hat{z} \)
   (b) \( \vec{V}_b = xy^2 \hat{x} + 2yz^3 \hat{y} + 3x^4 \hat{z} \)
   (c) \( \vec{V}_a = y^2 \hat{x} + (2xy + z^2) \hat{y} + 2yz \hat{z} \)

3. Sketch the vector function
   \( \vec{V} = \frac{1}{r^2} \hat{r} \)
   and compute its divergence.

4. Calculate \( \vec{\nabla} \cdot (\vec{\nabla} \times \vec{V}) \) for the function \( \vec{V} = V_x \hat{x} + V_y \hat{y} + V_z \hat{z} \).
5. Calculate the volume integral of the function $T = x^2$ over the tetrahedron with corners at (0,0,0), (1,0,0), (0,1,0) and (0,0,1).