NAME (print): _____

No credit for unsupported answers will be given. Clearly indicate your final answer.

1. *[3 pts.]* Sketch the solid whose volume is given by the integral $\int\limits_{0}^{2\pi} \int\limits_{0}^{2} \int\limits_{0}^{4-r^2} r\, dz\, dr\, d\theta$

2. *[2 pts.]* Find the gradient vector field for the function

$$f(x, y, z) = \sqrt{x}\sin(y^2 + z^2)$$

[more problems on back]

3. *[5 pts.]* Use spherical coordinates to find the volume of the solid that lies above the cone $z = \sqrt{x^2 + y^2}$ and below the sphere $x^2 + y^2 + z^2 = 2z$.