Lesson #6: Gauss's Law & The Divergence Theorem **Name: ______________________________**

Study Example 1.10 (page 32) in Griffiths, then answer the following questions.

1. Work out (show your work) the divergence of the given vector function $\vec{v}$ and confirm that it equals $2(x + y)$. What does it mean that the divergence is not constant but depends on position?

2. What, then, does the integral $\int \left(\vec{\nabla} \cdot \vec{v}\right) d\tau$ represent?

3. Work out (show your work) the surface integral for the left side (labeled *iv*) of the cube (see page 33). In particular, work through:

$$d\vec{a} =$$

$$\vec{v} \cdot d\vec{a} =$$

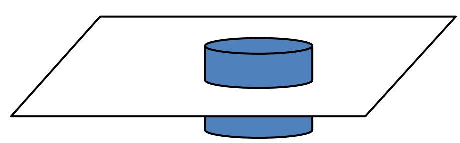
$$\iint_{side\ iv} \vec{v} \cdot d\vec{a} =$$

4. What does the integral $\oint \vec{v} \cdot d\vec{a}$ represent?

5. What does it mean that $\int \left(\vec{\nabla} \cdot \vec{v}\right) d\tau = \oint \vec{v} \cdot d\vec{a}$? (That is, interpret the divergence theorem.)

Study Example 2.4 (page 73) in Griffiths and answer the following questions:

6. Could we solve this problem using a cylindrical Gaussian surface (see Figure) rather than a square one? Explain.



7. Explain the statement at the top of page 74, "…whereas the sides contribute nothing." Why is this statement true?