Math 240: More of Divergence Theorem

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Wednesday February 8, 2012
Today’s Goals
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1. Understand how to use the Divergence Theorem.
2. Understand why the Divergence Theorem is true.
Theorem

Let $D$ be a closed and bounded region in 3-space with a piecewise smooth boundary $S$ that is oriented outward. Let $F(x, y, z) = P(x, y, z)i + Q(x, y, z)j + R(x, y, z)k$ be a vector field for which $P$, $Q$ and $R$ are continuous and have continuous first partial derivatives in a region of 3-space containing $D$. Then

$$\int \int_S (F \circ n) dS = \int \int \int_D \text{div}(F) dV$$

where $n$ is the unit normal vector to $S$. 