9.03.2016 – N2

Show your work for each problem using numbers, sketches, or words.

Name:_____

1) Prove the identities:

a) $\left(\left(\vec{a}\times\vec{b}\right)\cdot\left(\vec{c}\times\vec{d}\right)\right)=\left(\vec{a}\cdot\vec{c}\right)\left(\vec{b}\cdot\vec{d}\right)-\left(\vec{a}\cdot\vec{d}\right)\left(\vec{b}\cdot\vec{c}\right)$

b) $\left(\left(\vec{a}\times\vec{b}\right)\times\left(\vec{c}\times\vec{d}\right)\right)=\left(\vec{a}\cdot\left(\vec{b}\times\vec{d}\right)\right)\vec{c}-\left(\vec{a}\cdot\left(\vec{b}\times\vec{c}\right)\right)\vec{d}$

2) Find the divergence and curl of the following vectors:

$$\left(\vec{a}\cdot\vec{r}\right)\vec{b},\ \left(\vec{a}\cdot\vec{r}\right)\vec{r},\ \left(\vec{a}\times\vec{r}\right),\ \phi\left(\vec{r}\right)\left(\vec{a}\times\vec{r}\right),\ \left(r\times\left(\vec{a}\times\vec{r}\right)\right)$$

where $\vec{a}$ and $\vec{b}$ are constant vectors.

3) The plane $z=0$ is charged to a density which varies in accordance with the periodic law $\sigma=\sigma_0\sin\left(\alpha x\right)\cdot\sin\left(\beta y\right)$, where σ_0, α, β are constants. Find the potential φ due to this charge distribution.