

Problem set 2

1. Verify the null identities in Cartesian coordinates:
 - a. $\nabla \times (\nabla V) = 0$
 - b. $\nabla \cdot (\nabla \times A) = 0$
2. Two point charges, Q_1 and Q_2 , are located at $(1,2,0)$ and $(2,0,0)$, respectively. Find the relation between Q_1 and Q_2 such that the total force on a test charge at the point $(-1,1,0)$ will have:
 - a. No x component; and
 - b. No y component.
3. A current I flows around a square $w \times w$ loop of wire. Find the total magnetic flux density $\int_S \vec{B} \cdot d\vec{S}$, where S is the surface enclosed by the loop.
4. The circuit in the figure below is situated in a magnetic field

$$\vec{B} = \hat{z} 3 \cos \left(5\pi 10^7 t - \frac{2}{3} \pi x \right).$$

Assuming $R = 15\Omega$, find the current i .

