Name:

1. The integral version of the Gauss law says

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q}{\epsilon_0}$$

What is the differential form of this law? Using this law, find the electric field for a uniformly charged cylinder of radius R. The cylinder carries a charge density λ per unit length.

2. In electrostatics we have

$$\vec{\nabla} \times \vec{E} = 0$$

Why does this equation imply that we can introduce a potential in electrostatics? How are the electric field and electric potential related?

4. The magnetic field satisfies

$$\vec{\nabla} \cdot \vec{B} = 0$$

Explain how this motivates us to introduce a vector potential.

5. The differential form of Amperes Law is

$$\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$$

Using Stokes theorem, obtain the integral form of this law. Determine the magnetic field $\vec{B}$ due to a constant current I flowing through an infinite cylindrical conductor of radius R.