1. If \( V \) satisfies Laplace’s equation, show that \( V_{ave}(R) = V(0) \) for all \( R \). Where \( V_{ave}(R) \) is the average value of \( V \) on the surface of a sphere of radius \( R \), and, \( V(0) \) is the value at the origin of the sphere. (20%)

2. Find the force on the charge +q in the figure. (The xy plane is a grounded conductor, i.e. \( v=0 \)) (10%)

![Diagram]

3. What condition is made for the constitution relation \( \vec{D} = \varepsilon_0 \varepsilon \vec{E} \)? (10%)

4. When you polarize a neutral dielectric, please prove that the total bound charge vanishes. (10%)

5. Suppose you have two infinite straight line charges \( \lambda \), a distance \( d \) apart, moving along at a constant speed \( v \). How great would \( v \) have to be in order for the magnetic attraction to balance the electrical repulsion? (15%)

![Diagram]

6. A capacitor \( C \) is charged up to a voltage \( V \) and connected to an inductor \( L \), as shown in the following figure. At time \( t=0 \), the switch \( S \) is closed. Find the current in the circuit as a function of time (10%). How does your answer change if a resistor \( R \) is included in series with \( C \) and \( L \)? (10%)

![Diagram]

7. In magnetostatic, \( \vec{A}(\vec{r}) = \frac{\mu_0}{4\pi} \int \frac{\vec{I}'(\vec{r}')}{n} d\tau' \), where \( n = |\vec{r} - \vec{r}'| \). Prove that \( \nabla \cdot \vec{A} = 0 \). (15%) (Hint: \( \nabla \cdot (f\vec{A}) = f(\nabla \cdot \vec{A}) + \vec{A} \cdot \nabla f \))