Homework #10 (10 points) - Show all work on the following problems:

**Problem 1 (3 points):** Calculate the magnetic field at the center of a uniformly charged spherical shell of radius $R$, carrying total charge $Q$, and spinning around the $z$-axis with a uniform angular velocity $\omega$. *Hint: Start with the solution derived for the magnetic field above/below the center of a circular loop of current.*

**Problem 2 (2 points):** Consider a large parallel-plate capacitor with uniform charge density $\sigma$ on the top plate, and $-\sigma$ on the bottom plate, moving with a constant speed $v$ tangential to the surface of the plates.

2a (1 point): Find the magnetic field between the plates and above and below them.

2b (1 point): Find the magnitude and direction of the magnetic force per unit area on the upper plate (caused by the bottom plate).

**Problem 3 (3 points):** Consider a finite segment of wire aligned with the $z$-axis, extending from point $z_1$ to $z_2$, and carrying a current $I$.

3a (1.5 points): Find the magnetic vector potential at a radial distance $s$ from the origin.

3b (1.5 points): Show that the curl of this magnetic vector potential gives the same magnetic field as derived in Ex. 5.5.

**Problem 4 (2 points):** Find the magnetic vector potential above and below an infinite plane (in the x-y plane) with a surface current density $K$ flowing in the x-direction.