Homework #10 (100 points) - Show all work on the following problems:
(Grading rubric: Solid attempt = 50% credit, Correct approach but errors = 75% credit, Correct original solution = 100% credit, Copy of online solutions = 0% credit)

Problem 1 (30 points): An infinite thick slab lies in the x-y plane, extending from z = \(-a/2\) to z = \(+a/2\). The slab carries a uniform volume current \(J\) pointing in the +x-direction. Find the magnitude and direction of the magnetic field, as function of \(z\), inside and outside the slab.

Problem 2 (20 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 (10 point): Find the magnetic field between the plates and above and below them.

2b (10 point): Find the magnitude and direction of the magnetic force per unit area on the upper plate (caused by the bottom plate).

Problem 3 (30 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 (15 points): Find the magnetic vector potential at a radial distance \(s\) from the origin.

3b (15 points): Show that the curl of this magnetic vector potential gives the same magnetic field as derived in Ex. 5.5.

Problem 4 (20 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.