

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 σ 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.