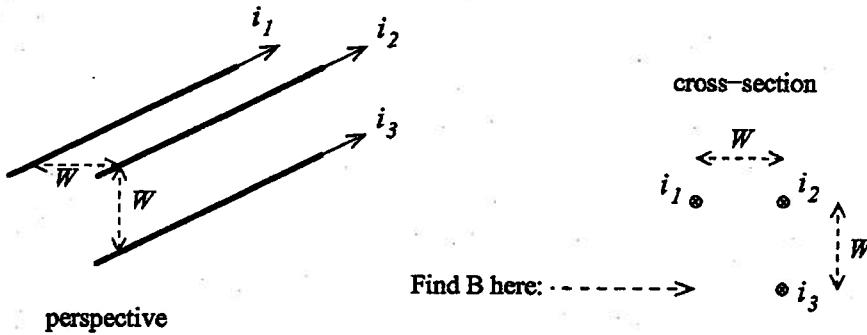Physics 208: Electricity and Magnetism, Exam 3

Problem 1. 25 points.

(a) There are three very long, extremely thin, parallel wires. One with current $i_1$ and one with $i_2$ and one with $i_3$. In cross-section, the wires are located at the corners of a square of side $W$. If all currents flow into the page, find the magnetic field vector at the fourth corner.



perspective

cross-section

Find B here: - - - - - - - >

(b) What would be the force on a length $H$ of wire if it was parallel to the other wires at the fourth corner and had a current $i_4$ coming out of the page?
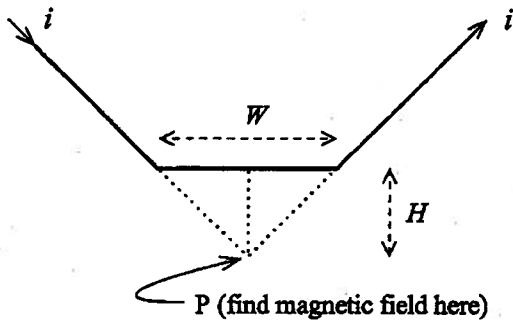
Be **neat.** Neatness helps. Work *neatly.*

Physics 208: Electricity and Magnetism, Exam 3

Problem 2. 25 points.

A very long thin wire carries a current $i$. It has the shape and dimensions shown below.



Find the magnetic field at the point $P$.

If you work **neatly** I will find more partial credit for you!

Print your name: _____

Physics 208: Electricity and Magnetism, Exam 3

Problem 3. 25 points.

A rectangular circuit containing a capacitor $C$ is located near an infinitely long narrow wire carrying a current $i_0 \cos \omega t$ where $i_0$ and $\omega$ are constants. The circuit has no resistance and its self-inductance can be ignored. Find the charge on the top capacitor plate as a function of time.
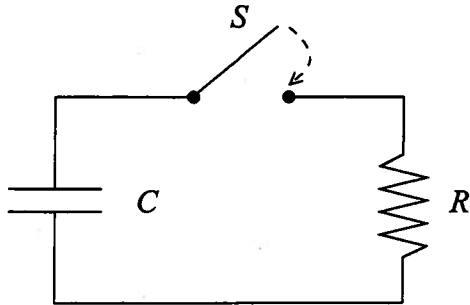
Long straight wire, current $i = i_0 \cos \omega t$

$H$

$D$

$C$

$\leftarrow \cdots W \cdots \rightarrow$
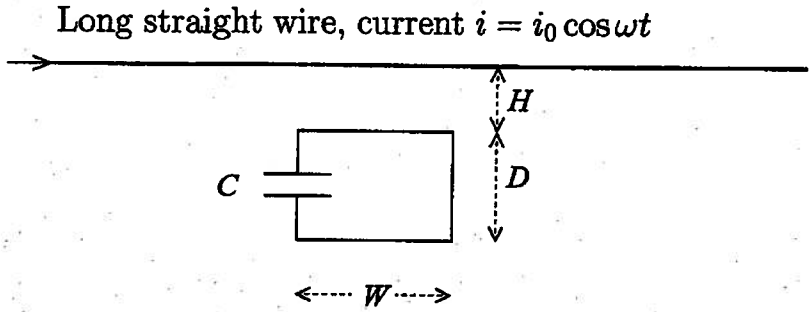
Make sure you are being neat. Working neatly will help you get it right.

Physics 208: Electricity and Magnetism, Exam 3

## Problem 4. (25 points)

(a) In the circuit below, the capacitor is originally charged with $Q_0$ on the top plate, and $-Q_0$ on the bottom. At $t = 0$ the switch $S$ is closed. Please note that all wires in this circuit have no resistance.

Derive the equation for the charge on the capacitor as a function of time assuming the self-inductance of the circuit can be ignored. Solve the equation.

(b) In the circuit below, the capacitor is originally charged with $Q_0$ on the top plate, and $-Q_0$ on the bottom. At $t = 0$ the switch $S$ is closed. Derive the equation for the charge on the plates as a function of time if the self-inductance of the circuit is $L$ and the resistance of the circuit is negligible. Solve the equation.
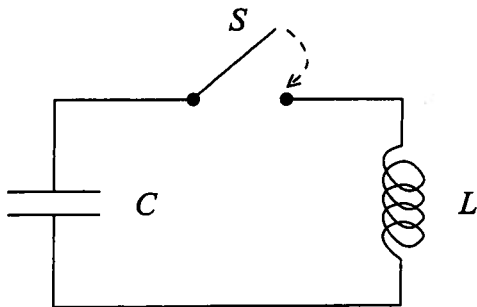
Work neatly! If you are neat, I can read what you did and maybe find more points for you.