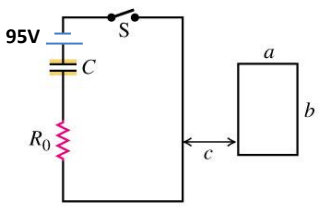
Fields 29.1

<u>Demonstration of knowledge on this problem will add 10pts. to your Exam 3 grade.</u>

The current in a long (take it to be infinite) straight wire of radius R running along the x- axis, has a current density of $\vec{J} = \left(1\frac{A}{m^4}\right) r^2 \hat{i}$ **. Calculate and plot the magnetic field strength and direction as a function of the distance r from the axis of the wire, below the x-axis.**

Fields 29.2

In the circuit shown in the figure below, the capacitor has capacitance 19 μF and is initially uncharged. The resistor has resistance 12 Ω. An emf of 95.0V is added in series with the capacitor and the resistor. The emf is placed between the capacitor and the switch, with the positive terminal of the emf adjacent to the capacitor. The small circuit is not connected in any way to the large one. The wire of the small circuit has a resistance of 1.3 Ω/m and contains 24 loops. The large circuit is a rectangle 2.0 m by 4.0 m, while the small one has dimensions a = 11.0 cm and b = 18.0 cm. The distance c is 4.0 cm. (The figure is not drawn to scale.) Both circuits are held stationary. Assume that only the wire nearest the small circuit produces an appreciable magnetic field through it. The switch is closed at t = 0 s. When the current in the large circuit is 3.10 A, what is the magnitude and direction of the induced current in the small circuit?



Fields 29.3

A bar of length L = 0.36 m is free to slide without friction on horizontal rails, as shown in the figure below. There is a uniform magnetic field B = 1.5 T, directed into the plane of the figure. At one end of the rails there is a battery with emf 12 V and a switch. The bar has mass 0.90 kg and resistance 5.0 Ω, and all other resistance in the circuit can be ignored. The switch is closed at time t = 0 s. Just after the switch is closed, what is the acceleration of the bar? What is the acceleration of the bar when its speed is 2.0 m/s? What is the terminal speed of the bar?