Electronics and Electrical Engineering 3 : Electromagnetics Tutorial

3. Biot-Savart and Ampere

3.1. Biot-Savart - this would be a relatively hard exam question. Easier if the loop were rectangular!

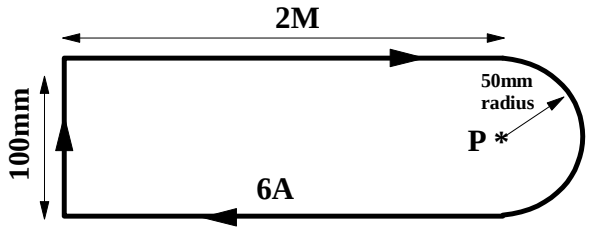

Fig 3.1 The circuit carries 6A in a clockwise direction. P is at the centre of the semicircular part of the circuit.

Find the contribution to the magnetic field at the point P in Fig. 3.1 caused by the following sections of the circuit:
(a) The semicircular section at the right of the circuit.
(b) The two long horizontal conductors.
(c) The short vertical section at the left.

[30, 19.09, 0.01194 Am^{-1}]

3.2. Ampere - easy but a bit of an oddity to make you think. Too quirky for an exam question.

A thin wire carrying current I in the $-\mathbf{k}$ direction lies along the entire positive z-axis. At the origin it connects to a large flat conducting sheet forming the z = 0 plane. The current spreads out into the sheet and the circuit is completed by a tubular outer conductor of large radius coaxial with the wire on the z-axis.
(a) Find an expression for the sheet current density in the conductor sheet in terms of I and the distance from the origin.
(b) Use Amperes law to find an expression for **H** at all points between the wire and the outer conductor.
(c) Find an expression for **H** for z < 0.

[$I\,\frac{\mathbf{a}_r}{2\pi r}, -I\,\frac{\mathbf{a}_\phi}{2\pi r}, 0$]