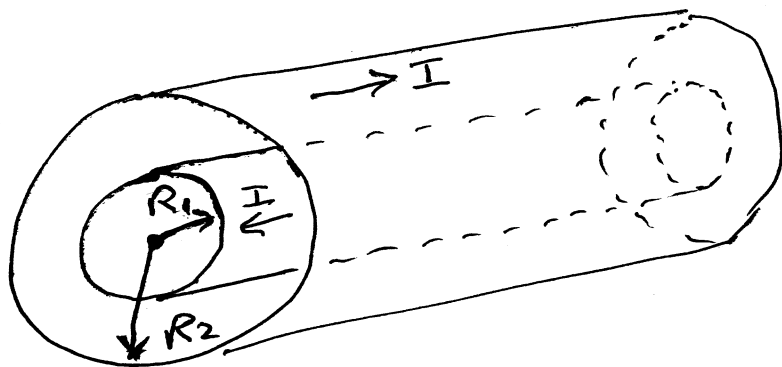


EM PROBLEM SET 6

2019

1. Consider two concentric (same axis) cylindrical conducting sheets with radii R_1 and R_2 , $R_1 < R_2$. Suppose a current I flows along each conductor, but in opposite directions for the inner and outer conductor:



Since $\vec{\nabla} \cdot \vec{B} = 0$, the magnetic field produced has no radial component (it is not diverging or converging). So it curls around the currents. Symmetry \Rightarrow the magnetic field can only depend on the radial

distance r from the axis of the cylinders.

Determine (using Ampere's law) $B(r)$

for

(i) $r < R_1$

(ii) $R_1 < r < R_2$

(iii) $r > R_2$

2. Consider a straight cylindrical wire of radius R . Suppose there is a current flowing, and the magnitude of the current density depends only on the distance r from the centre of the wire, and has the form

$$j(r) = \lambda r, \quad r \leq R$$

Determine the current I in the wire.

Hint: consider the current in

a circular strip between r and $r+dr$, and "sum" (integrate) over all strips from $r=0$ to $r=R$

