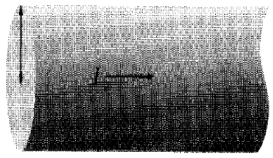
Department of Physics, Shiv Nadar Institution of Eminence
Spring 2025
PHY102: Introduction to Physics-II
Tutorial – 10



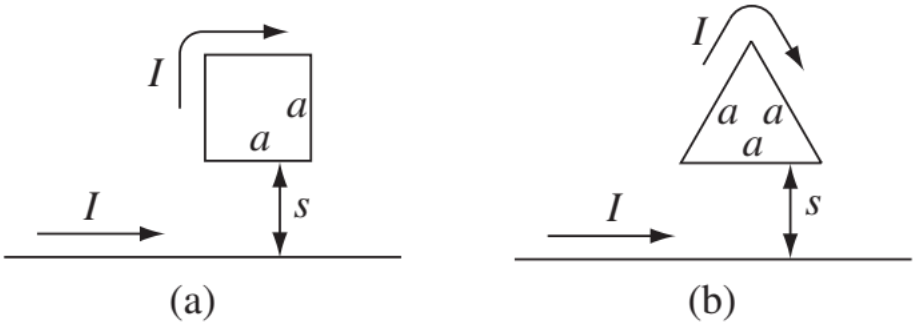
(a) A current of magnitude I is uniformly distributed over a wire of circular cross section, with radius a. Find the magnitude, J, of the volume current density.
b) Suppose the magnitude of current density in the wire is proportional to the distance s from the axis, i.e.,

$$J = k\,s\,,$$

where k is a constant. Find the magnitude, I, of the total current in the wire.

2. Suppose a thin metallic ribbon carrying a steady current I is bent into the form of a circular ring of inner and outer radii r_1 and r_2, respectively. Find the magnetic field **B** at the centre of the ring.

3. Find the force on a square loop and the triangular loop as shown in the figure below, placed near an infinite straight wire. Both the loop and the wire carry a steady current I.



4. Suppose you have two infinite straight-line charges λ, a distance *d* apart, moving along at a constant speed *v* (see figure below). How great would *v* have to be for the magnetic attraction to balance the electrical repulsion? Work out the actual number. Is this a reasonable sort of speed?