

T3: Crossed wires (10 pts)

- a) (1 pt) Current flows through an infinite, straight, thin wire. There is an externally imposed, uniform magnetic field directed parallel to the wire. Qualitatively sketch one of the magnetic field lines.
- b) (5 pts) Now consider two infinite, straight, thin wires (wires X and Y), each carrying a current I as shown in the figure. The x -axis coincides with wire X , while wire Y is parallel to the y -axis and passes through the point $(0,0,-a)$. Let P be the point $(3a,0,r)$. Assuming $r \ll a$, calculate d , the distance of closest approach of the magnetic field line that passes through P to the wire X .
- c) (4 pts) Let L be the length of this field line between P and its point of closest approach to wire X . Using values $a = 10$ cm and $r = 1.0$ mm, calculate L to within 20% relative error.

