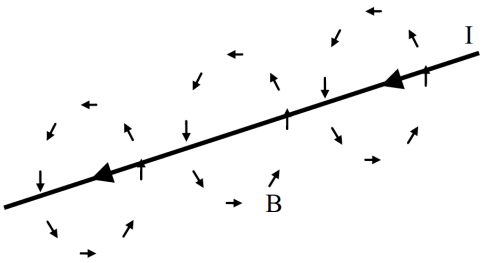
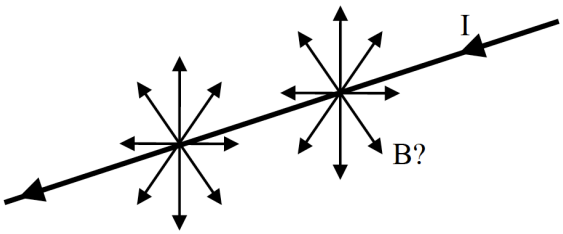
Ampere's Law

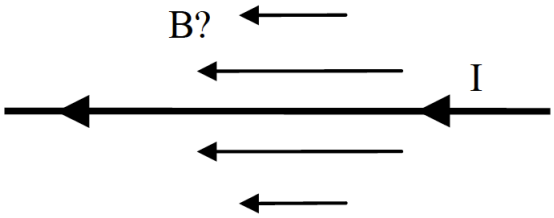
A. We will use Ampere's law in integral form to determine the magnetic field around a long straight wire, carrying a current I. Usually, we begin by assuming that the magnetic field around the current-carrying wire is entirely in the *tangential* direction.



Give a brief argument for why the magnetic field should *not* have a *radial* component (outwards from the wire).



Can you give a brief argument for why the magnetic field should *not* have a *longitudinal* component (parallel with the wire)?



B. Here is Ampere's law in *differential* form: $\vec{\nabla} \times \vec{\mathbf{B}} = \mu_0 \vec{\mathbf{J}}$

Now, write down Ampere's law in *integral* form.

C. Use Ampere's law in integral form to solve for the magnetic field around the wire. Briefly define any symbols you use.

Challenge Question: (for the really fast teams)
Can we use Ampere's Law to compute the B-field *at the center* of a circular current-carrying loop of wire? Why or why not? (If so, do it. If not, then how *could* you calculate the field there?)