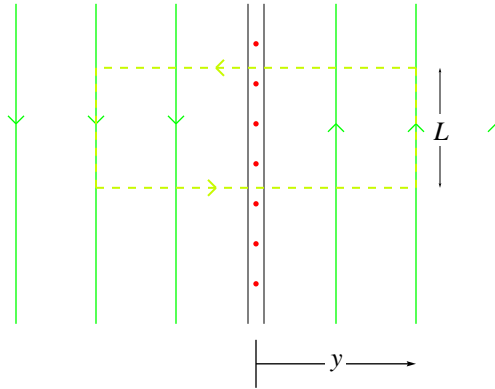


## Infinite sheet of current

(a) Simple symmetry and Biot-Savart arguments show that  $\vec{B}$  is directed as shown below, and that the magnitude  $|\vec{B}|$  is a function only of the distance  $y$  from the plane



(b) The Amperian loop shown as a dashed yellow line has

$$\oint \vec{B} \cdot d\vec{\ell} = 2B(y)L$$

and

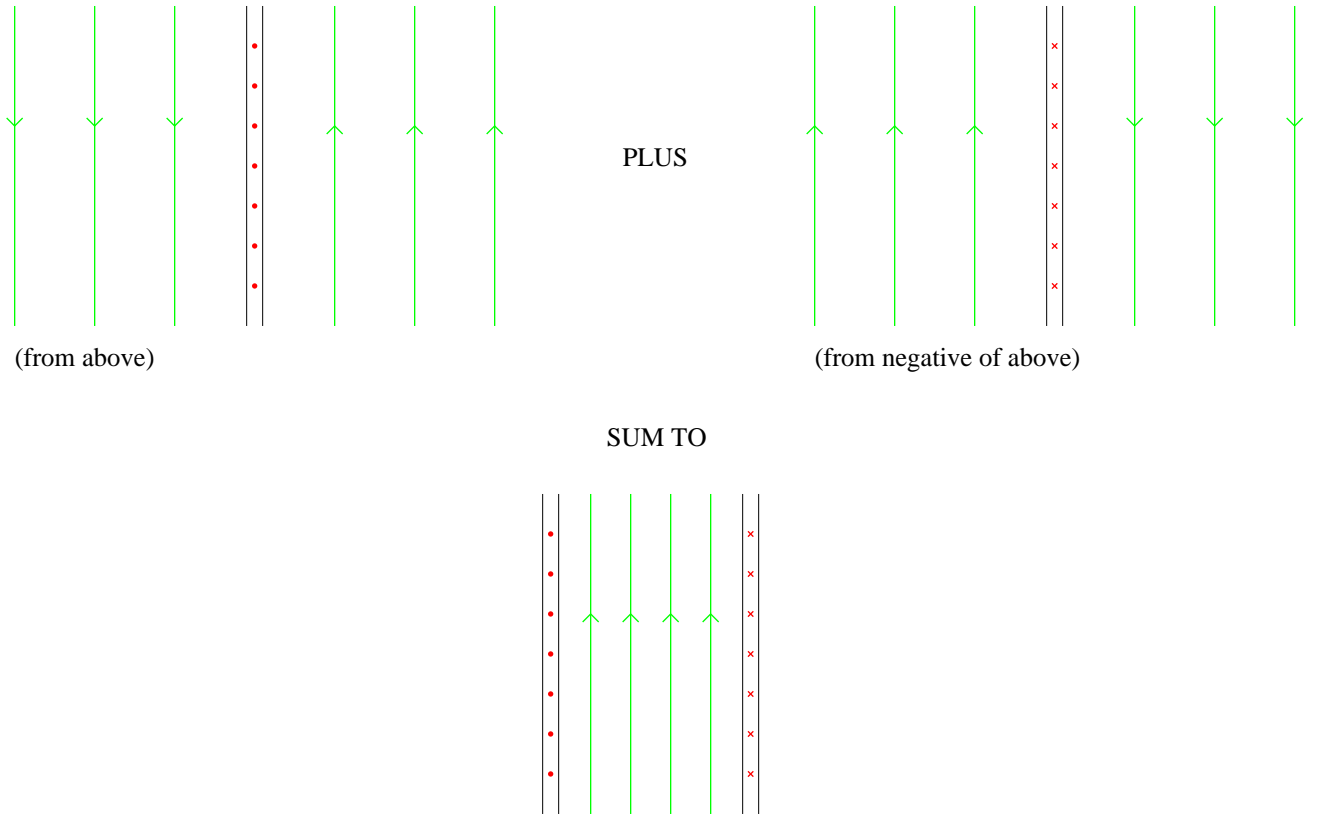
$$I_{\text{linked}} = \lambda L$$

whence

$$B(y) = \frac{1}{2}\mu_0\lambda.$$

Note that symmetry demands that  $B$  is a function of  $y$  alone, but in fact, surprisingly, it is the constant function!

(c) Use superposition:



To the left and right of the current sheets, the two contributions to  $\vec{B}$  cancel and  $\vec{B} = 0$ . Between the two current sheets, the two contributions to  $\vec{B}$  add together to make  $B = \mu_0\lambda$ .

*Grading:* 3 points for (a); 4 points for (b); 3 points for (c).