

Name: ~~_____~~

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The figure shows a cross section of a long thin ribbon of width w that is carrying a uniformly distributed total current i into the page. Calculate the magnitude and direction of the magnetic field B at a point P in the plane of the ribbon, at a distance d from its edge. (Hint: Imagine the ribbon to be constructed from many long, thin, parallel wires.)



$$dB = \frac{\mu_0 i dx}{2\pi(d+x)}$$

$$di = \frac{i}{w} dx$$

$$dB = \frac{\mu_0 i dx}{2\pi w (d+x)}$$

$$B = \int_0^w \frac{\mu_0 i dx}{2\pi w (d+x)}$$

$$B = \frac{\mu_0 i}{2\pi w} \int_0^w \frac{dx}{(d+x)} = \frac{\mu_0 i}{2\pi w} \ln(d+x) \Big|_0^w$$

$$B = \frac{\mu_0 i}{2\pi w} \ln\left(\frac{d+w}{d}\right)$$

B up

Field due to a line of charge