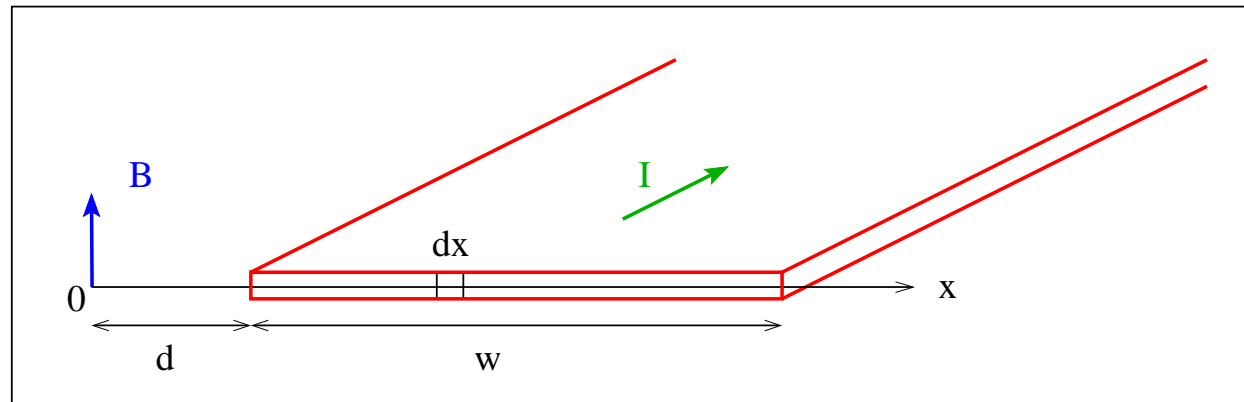


# Magnetic Field Next to Current-Carrying Ribbon



Consider a very long ribbon of width  $w$  carrying a current  $I$  in the direction shown. The current density is assumed to be uniform. Find the magnetic field  $B$  generated a distance  $d$  from the ribbon as shown.



Divide the ribbon into thin strips of width  $dx$ .  
Treat each strip as a wire with current  $dI = I dx/w$ .  
Sum up the field contributions from parallel wires.

$$dB = \frac{\mu_0}{2\pi} \frac{dI}{x} = \frac{\mu_0 I}{2\pi w} \frac{dx}{x}$$
$$B = \frac{\mu_0 I}{2\pi w} \int_d^{d+w} \frac{dx}{x} = \frac{\mu_0 I}{2\pi w} \ln \left( 1 + \frac{w}{d} \right)$$