75. (a) The flux over the loop cross section due to the current $i$ in the wire is given by

$$\Phi = \int_a^{a+b} B_{\text{wire}} l \, dr = \int_a^{a+b} \frac{\mu_0 i l}{2\pi r} \, dr = \frac{\mu_0 i l}{2\pi} \ln\left(1 + \frac{b}{a}\right) .$$

Thus,

$$M = \frac{N\Phi}{i} = \frac{N\mu_0 l}{2\pi} \ln\left(1 + \frac{b}{a}\right) .$$

(b) From the formula for $M$ obtained above

$$M = \frac{(100)\left(4\pi \times 10^{-7}\,\text{H/m}\right)(0.30\,\text{m})}{2\pi} \ln\left(1 + \frac{8.0}{1.0}\right) = 1.3 \times 10^{-5}\ \text{H} .$$