56. The unit vector associated with the current element (of magnitude $d\ell$) is $-\hat{\mathrm{j}}$. The (infinitesimal) force on this element is

$$d\vec{F} = i\, d\ell(-\hat{\mathrm{j}}) \times (0.3y\hat{\mathrm{i}} + 0.4y\hat{\mathrm{j}})$$

with SI units (and 3 significant figures) understood.

(a) Since $\hat{\mathrm{j}} \times \hat{\mathrm{i}} = -\hat{\mathrm{k}}$ and $\hat{\mathrm{j}} \times \hat{\mathrm{j}} = 0$, we obtain

$$d\vec{F} = 0.3iy\, d\ell\, \hat{\mathrm{k}} = \left(6.00 \times 10^{-4}\,\mathrm{N/m^2}\right) y\, d\ell\, \hat{\mathrm{k}}\ .$$

(b) We integrate the force element found in part (a), using the symbol ξ to stand for the coefficient $6.00 \times 10^{-4}\,\mathrm{N/m^2}$, and obtain

$$\vec{F} = \int d\vec{F} = \xi\hat{\mathrm{k}} \int_0^{0.25} y\, dy = \xi\hat{\mathrm{k}} \left(\frac{0.25^2}{2}\right) = 1.88 \times 10^{-5}\,\mathrm{N}\,\hat{\mathrm{k}}\ .$$