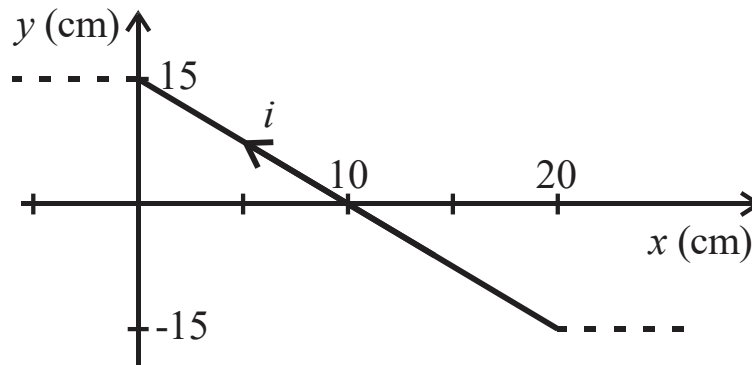


The wire section shown (solid line) is exposed to a magnetic field of $19.1 \hat{a}_x$ (kA/m) in air. If the wire carries a current of 12 A, find: a) the magnetic flux density vector, b) length vector of the wire section, and c) the vector magnetic force on the wire.



a) Per (1-21), the magnetic flux density is

$$\bar{B} = \mu \bar{H} = 4\pi \cdot 10^{-7} (19.1 \cdot 10^3 \hat{a}_x) \Rightarrow \underline{\bar{B} = 0.024 \hat{a}_x \text{ (T)} = 24 \hat{a}_x \text{ (mT)}}.$$

b) From the figure, the length vector is $\Rightarrow \underline{\bar{\ell} = -20\hat{a}_x + 30\hat{a}_y \text{ (cm)} = -0.2\hat{a}_x + 0.3\hat{a}_y \text{ (m)}}.$

c) Per (1-21), the magnetic force is

$$\begin{aligned} \bar{F} &= i(\bar{\ell} \times \bar{B}) = 12 [(-0.2\hat{a}_x + 0.3\hat{a}_y) \times 0.024 \hat{a}_x] = 12 [0 - \hat{a}_z 0.3(0.024)] \\ &\Rightarrow \underline{\bar{F} = -0.086406 \hat{a}_z \text{ (N)} = -86.4 \hat{a}_z \text{ (mN)}}. \end{aligned}$$