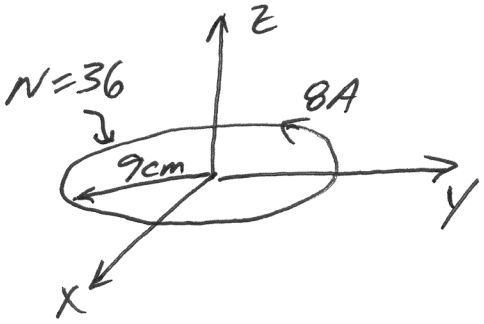
A tightly-wound, 36-turn, circular, thin wire coil with a 9 cm radius is centered on the origin on the *x*-*y* plane in free space. If the loop carries a current of 8 A in the $\hat{a}_\phi$ direction, find the magnetic moment. Also, find the vector torque on the coil if an external $\bar{H} = 7957.75\hat{a}_x + 3987.87\hat{a}_z$ (A/m) is applied.



Per (8.18) $\bar{m} = NIS\hat{a}_n$ & notes

By RHR, $\hat{a}_n = \hat{a}_z$

$S = \pi a^2 = \pi 0.09^2$

$\bar{m} = 36(8)\pi 0.09^2 \hat{a}_z$

$\bar{m} = 7.32871\,\hat{a}_z \ (A \cdot m^2)$

(8.19) $\bar{T} = \bar{m} \times \bar{B}$

$= 7.32871\,\hat{a}_z \times \mu_0 (7957.75\,\hat{a}_x + 3987.87\,\hat{a}_z)$

$= 7.32871\,\mu_0\, 7957.75\,\hat{a}_y + 0$

$\bar{T} = 0.073287\,\hat{a}_y\,(N \cdot m) = 73.287\,\hat{a}_y\,(mN \cdot m)$