

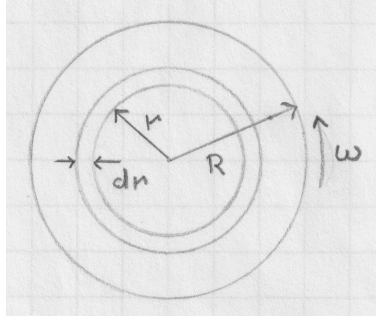
[lex63] Magnetic moment of rotating charged disk

A disk of radius R is uniformly charged with charge density $\sigma > 0$ and rotates with angular velocity ω about its axis as shown. The rotating charge represents a current and thus produces a magnetic dipole moment \mathbf{m} directed out of the plane.

(a) Express its magnitude m as a function of ω , R , and Q (the total charge on the disk).

(b) If the disk has uniform mass density and total mass M , find the ratio m/L of the magnetic moment and the angular momentum, also known as gyromagnetic ratio.

Hint: For part (a) split the disk into concentric rings. The current in each ring is the charge divided by the period of rotation.



Solution: