## Reading

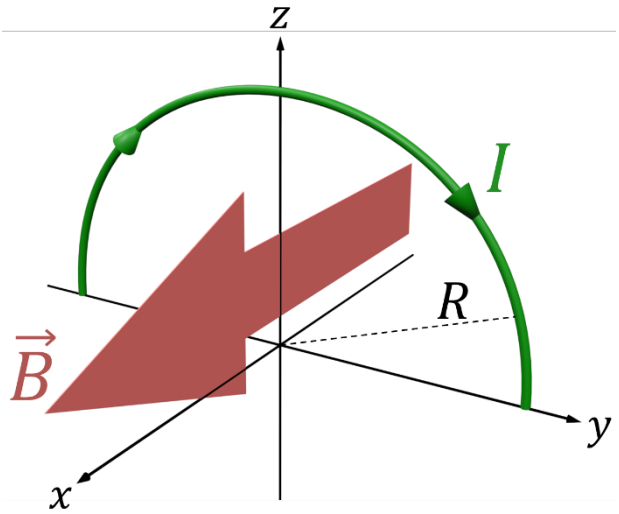
Chapter 8, pp. 348-368

## Problem 1 – Lorentz Force Law

A point charge $Q$ is moving with velocity $\vec{u} = (\hat{a}_x + \hat{a}_y)$ m/s in the presence of both an electric field $\vec{E}$ and a magnetic field $\vec{B}$. If the electric field intensity is $\vec{E} = (2\hat{a}_x - 2\hat{a}_y + \hat{a}_z)$ V/m, calculate the simplest possible magnetic field $\vec{B}$ necessary so that no net force $\vec{F}$ is applied to the charge.

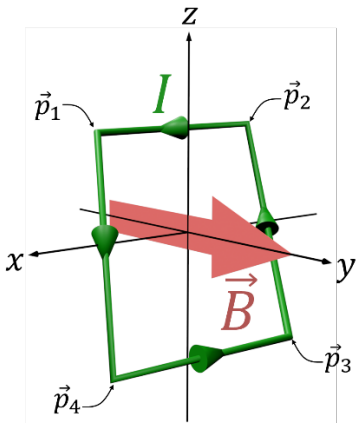
## Problem 2 – Force on a Current Element

A wire forming a half circle of radius $R = 1$ inch carries a current of $I = 2.7$ A. There exists a uniform magnetic flux $\vec{B} = (17\text{ mT})\hat{a}_x$ perpendicular to the plane of the loop. Calculate the total force on the semicircular loop of wire.




## Problem 3 – Magnetic Dipole Moment and Torque

A planar current loop in the shape of a parallelogram is depicted in the figure below. The loop carries a current of $I = 6.5$ A and is placed in a uniform magnetic field of $\vec{B} = (5.0\text{ mT})\hat{a}_y$.




$\vec{p}_1 = (6.5787\text{ mm}, -49.151\text{ mm}, 49.842\text{ mm})$
$\vec{p}_2 = (-116.58\text{ mm}, -49.151\text{ mm}, 49.842\text{ mm})$
$\vec{p}_3 = (-55.000\text{ mm}, 49.151\text{ mm}, -49.842\text{ mm})$
$\vec{p}_4 = (55.000\text{ mm}, 49.151\text{ mm}, -49.842\text{ mm})$

(a) Calculate the magnetic dipole moment of the current loop.

(b) Calculate the torque on the loop due to the magnetic field.