After this you can

- determine the force on a point charge moving within a uniform magnetic field
- determine the force on a line of current within a uniform magnetic field
- discuss the trajectory of a charged particle in a uniform magnetic field

Magnetic force on a moving charged particle

cross product

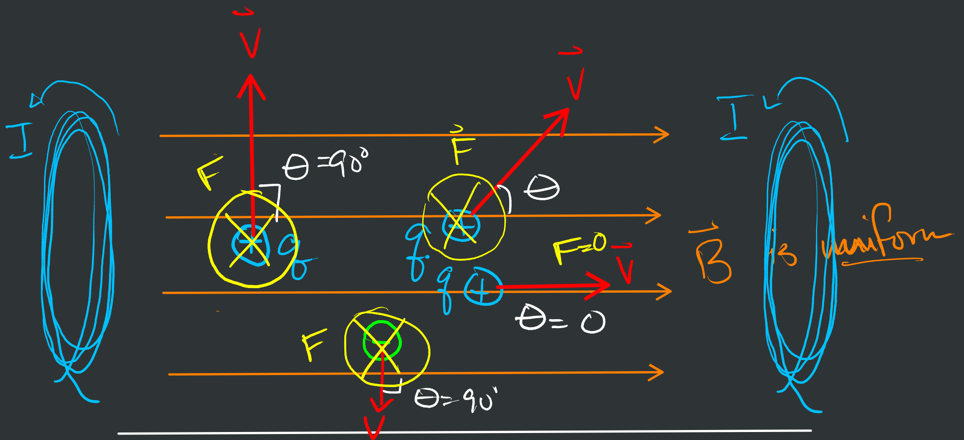
$$\vec{F}_B = q\vec{v} \times \vec{B}$$

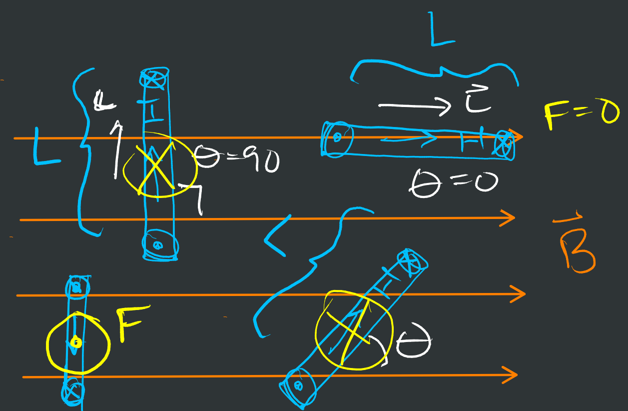
$$\boxed{|F_B| = q\,v\,B \sin\theta}$$

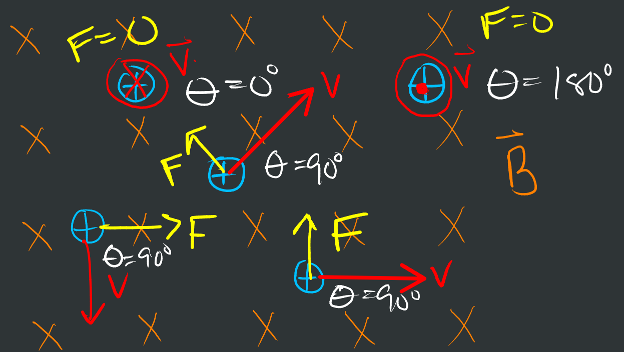
Magnetic force on a current

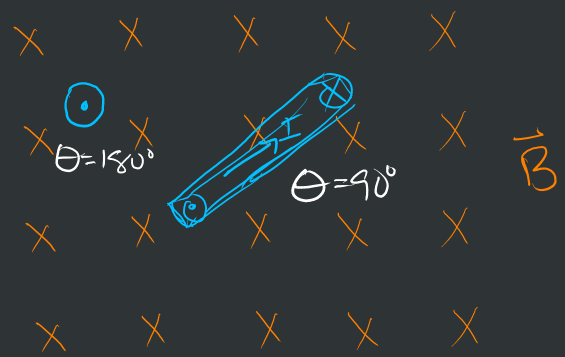
$$\vec{F}_B = I\vec{L} \times \vec{B}$$

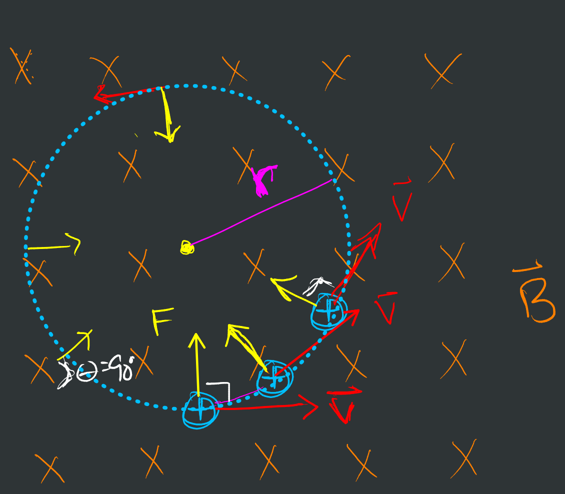
$$\boxed{|F_B| = I \cdot L \cdot B \sin\theta}$$

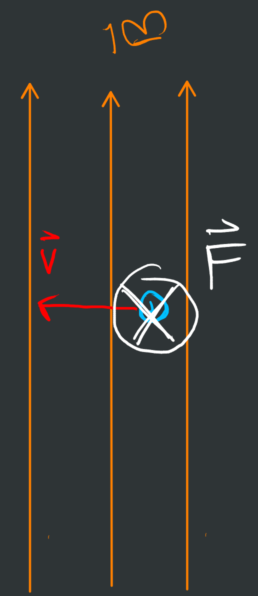


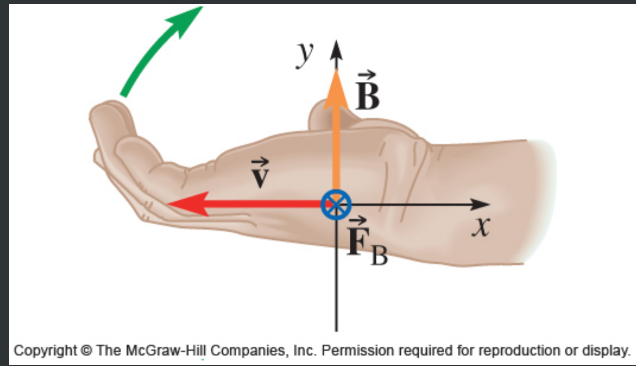












$$F_r = \frac{m v^2}{r} \rightarrow a_r$$

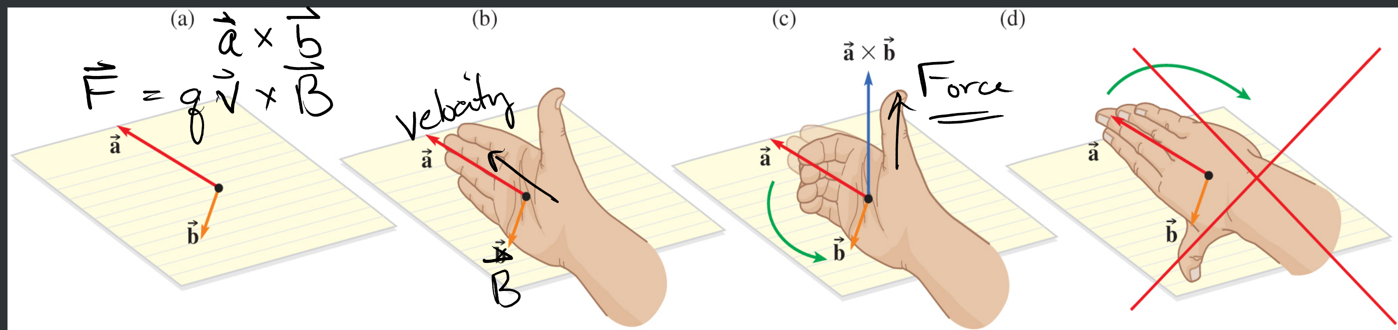
$$\underline{\underline{F_r}}$$

$$\uparrow$$

$$F_B$$

$$q \cancel{v} B = \frac{m v^{\cancel{2}}}{r}$$

$$\boxed{qB = \frac{mv}{r}}$$



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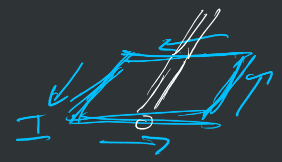
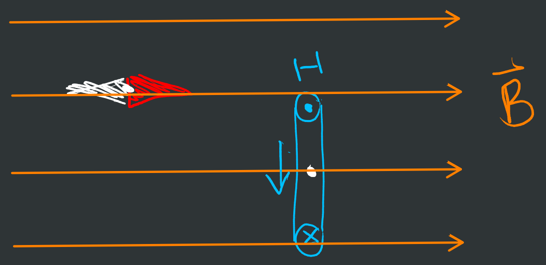
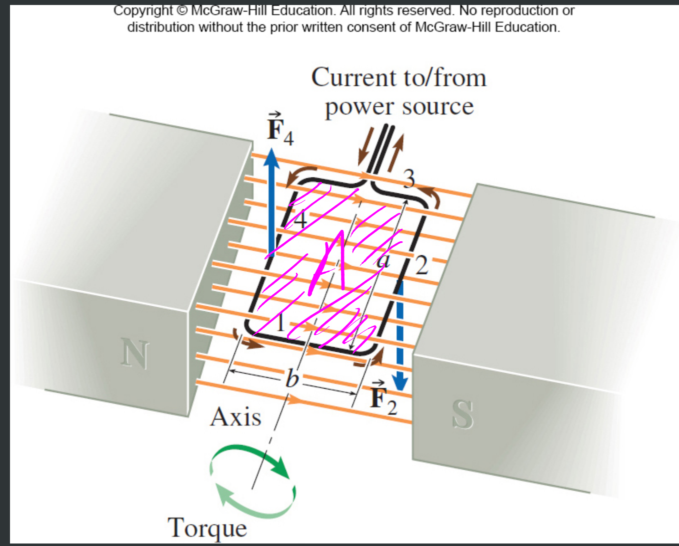
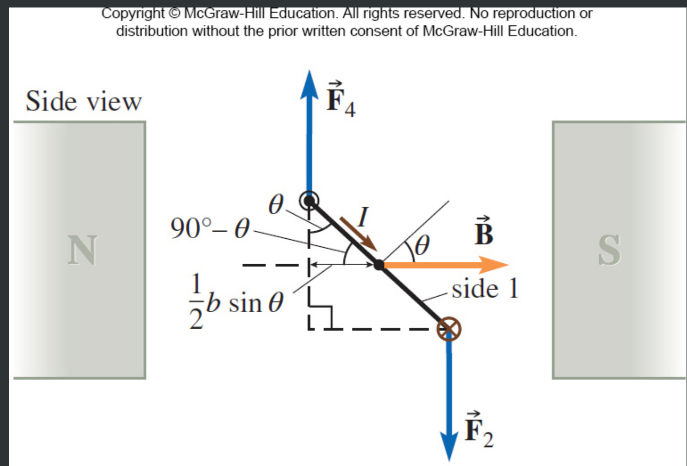
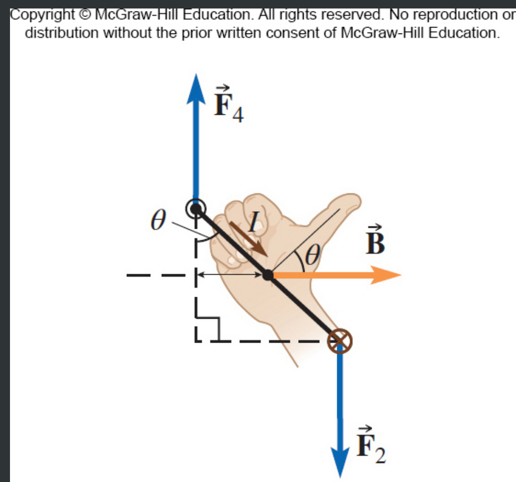
After this you can
- discuss torque on a current loop (dipole)
- discuss the functioning of an electric motor











$$\tau = F_B \cdot r \cdot \sin\theta \rightsquigarrow \tau = N I \cdot A \cdot B \sin\theta \Rightarrow \boxed{\tau_{max} = N \cdot I \cdot A \cdot B}$$

torque

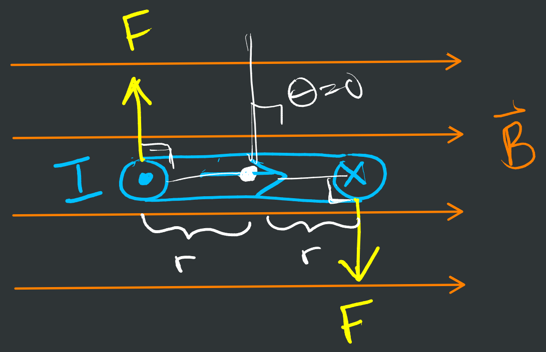
distance from axis

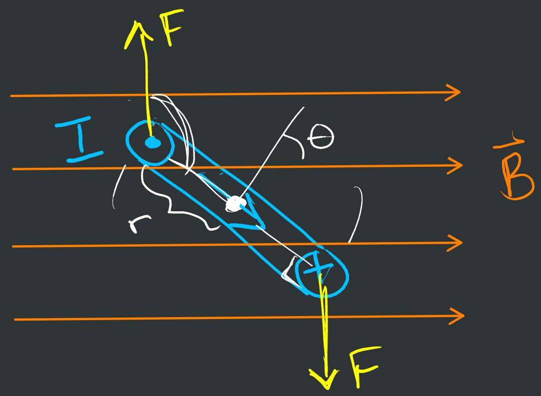
# of loops

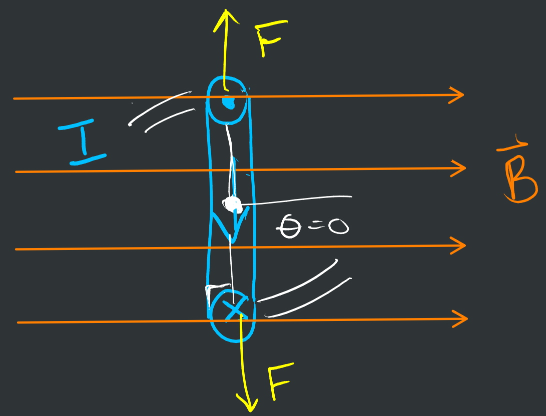
current

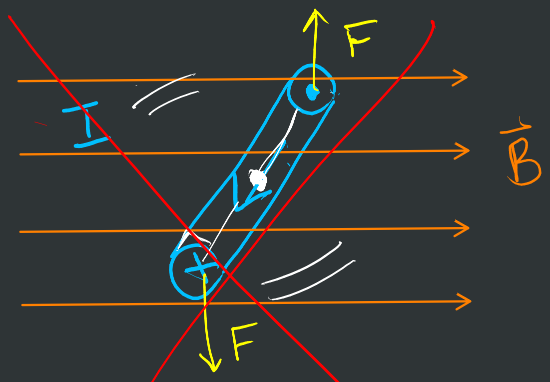
area of the loop

magnetic field

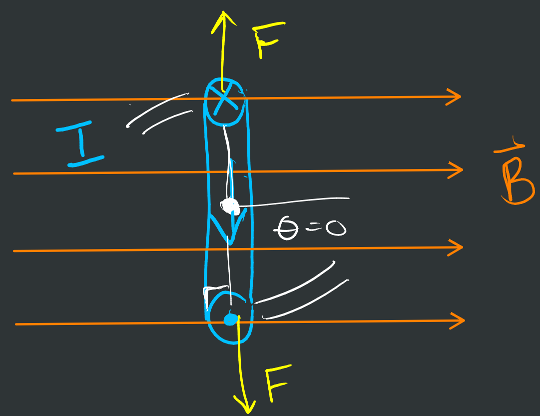








~~slow down the rotation~~



change the current direction