For a positive charge q, the force on the particle is:

\[ F = qE \]

For a negative charge, the force is:

\[ F = -qE \]

The magnetic force on a charged particle is:

\[ F = qvB \]

The net force on the charged particle is:

\[ F = qE + qvB \]

The electric field is:

\[ E = \frac{kq}{r^2} \]

The magnetic field is:

\[ B = \frac{v}{c} \]

The Lorentz force equation relates the electric and magnetic forces:

\[ F = q(E + v \times B) \]

For circular motion, the centripetal force is equal to the magnetic force:

\[ F_c = \frac{mv^2}{r} = qvB \]

The radius of the circular path is:

\[ r = \frac{mv}{qB} \]

The angular momentum is:

\[ L = mr^2 \]

The angular velocity is:

\[ \omega = \frac{v}{r} \]

The period of circular motion is:

\[ T = \frac{2\pi}{\omega} = 2\pi \sqrt{\frac{m}{qB^2}} \]
\[
\begin{align*}
\vec{F} &= e \left( \vec{E} + \vec{v} \times \vec{B} \right) \\
&= (1.6 \times 10^{-19} \text{ C}) \cdot \left( (3.0 \hat{i} - 4.2 \hat{j}) \times 10^5 \frac{\text{V}}{\text{m}} \right) \\
&\quad + (6.0 \hat{i} + 3.0 \hat{j} - 5.0 \hat{k}) \times (0.45 \hat{i} + 0.20 \hat{j}) \cdot \left( 10^8 \frac{\text{m}}{\text{C}} \right) \\
\text{use: } &\hat{i} \times \hat{i} = 0, \hat{j} \times \hat{j} = 0, \hat{k} \times \hat{k} = 0, \hat{k} \times \hat{i} = \hat{j}, \hat{i} \times \hat{j} = -\hat{k}, \hat{j} \times \hat{k} = \hat{i} \\
\text{and both } &\frac{\vec{E}}{\text{m}} \text{ and } \frac{\vec{B}}{\text{m}} \text{ are } \vec{N} \\
\vec{F} &= (1.6 \times 10^{-10}) \cdot 10^9 \cdot \\
&\hat{i} \cdot \left( 3.0 \hat{i} - 1.0 \hat{j} \right) + \hat{j} \cdot (-4.2 - 0.25) \\
&+ \hat{k} \cdot (1.2 - 1.35) \cdot \vec{N} \\
&= (6.4 \hat{i} - 10.3 \hat{j} - 0.24) \times 10^{-10} \text{ N}
\end{align*}
\]