PHYS 102:General PhysicsII **KOÇ UNIVERSITY** **Spring Semester 2016**

College of Sciences

Section 1 **Quiz 6** **24 March 2016**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

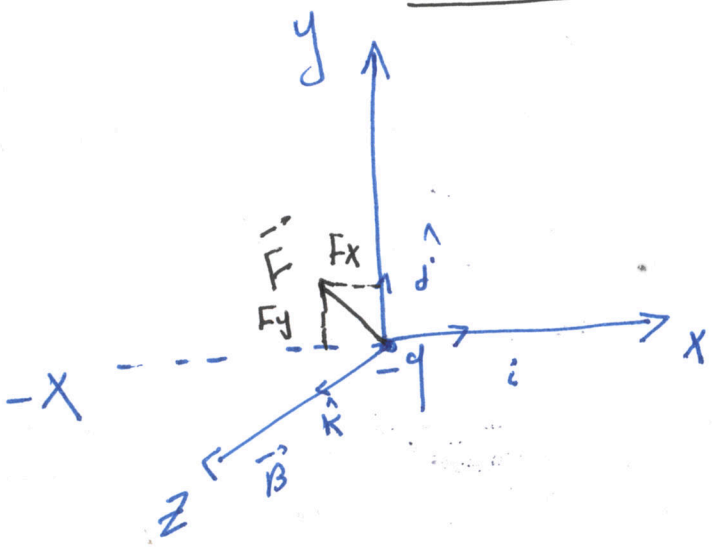
Suppose a uniform magnetic field with strength **C > 0** exists along the positive **z** direction. Find and sketch the subsequent motion of a point charge with mass **m** and charge **q < 0** after it is released from the origin with an initial velocity **V= A (i + j)**, where **A>0** is constant.

The magnetic force is given by

$$\vec{F} = q(\vec{v} \times \vec{B}) = -|q| Ac(\hat{i} \times \hat{k} + \hat{j} \times \hat{k})$$

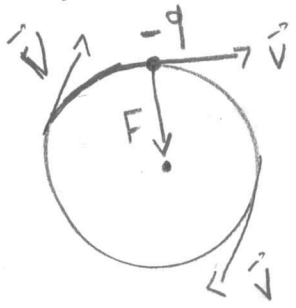
$$= -|q| Ac(-\hat{j} + \hat{i}) = |q| Ac(\hat{j} - \hat{i})$$

$$\boxed{\vec{F} = |q| Ac(\hat{j} - \hat{i})}$$



$F_x = -|q| Ac$

$F_y = |q| Ac$



Circular motion of the charged particle q<0 in the magnetic field.

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Section 2 **Quiz 6** **24 March 2016**

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Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

Suppose a uniform electric field with strength **C > 0** along the **x** direction is simultaneously present with a uniform magnetic field with strength **D > 0** along the **y** direction. Sketch and describe the subsequent motion of a point charge with mass **m** and charge **q > 0** after it is released from the origin with zero velocity.

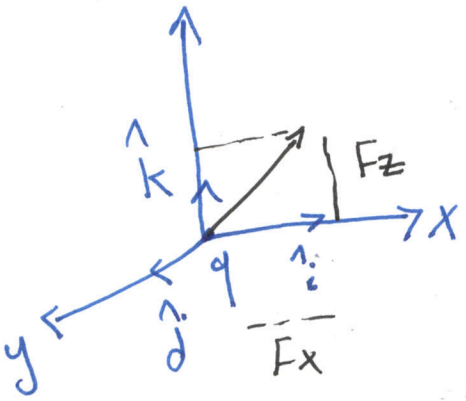
Lorentz force is given by $\vec{F} = q(\vec{E} + \vec{v} \times \vec{B})$

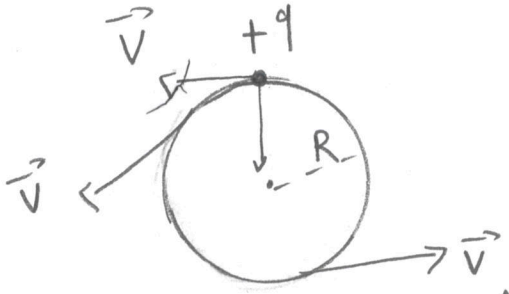
The velocity is in the direction of electric field.

$= q[C\hat{i} + vD\,\hat{i} \times \hat{k}]$

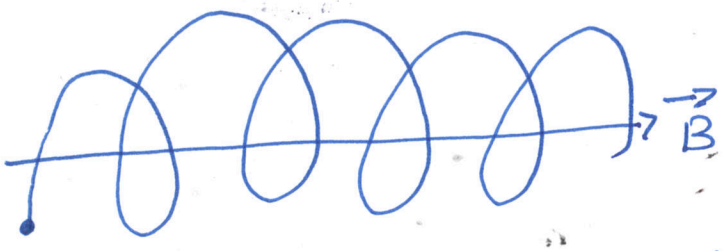
$= q[C\hat{i} + vD\,\hat{k}]$

$F_x = qC \quad ; \quad F_z = qvD$





Circular motion of charged particle



q70

The helical trajectory of positively charged particle (opposite in direction from negatively charged particle)

PHYS 102:General PhysicsII **KOÇ UNIVERSITY** **Spring Semester 2016**

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Section 3 **Quiz 6** **24 March 2016**

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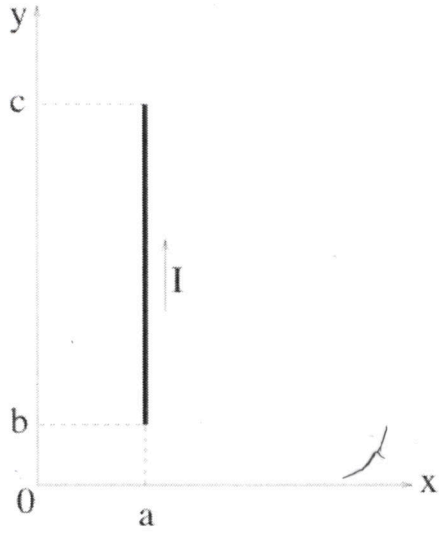
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

Consider a piece of current carrying wire that is shown in **x-y** coordinate system as shown in the figure. Let's assume a non-uniform magnetic field is pointing along the positive **k** direction (out of the page) with magnitude **Cy** where **C > 0** is constant. Find the magnetic force on the wire at this instant.



The magnetic force in a non-uniform magnetic field is given by

$$d\vec{F} = I\,(d\vec{\ell} \times \vec{B})$$

$$= I\,(dy\,\hat{j} \times Cy\,\hat{k})$$

$$\vec{F} = IC \int_b^c y\,dy\,\hat{i} = IC\,\frac{y^2}{2}\Big|_b^c\,\hat{i}$$

$$\boxed{\vec{F} = IC\left(\frac{c^2 - b^2}{2}\right)\hat{i}}$$

PHYS 102:General PhysicsII **KOÇ UNIVERSITY** **Spring Semester 2016**

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Section 4 **Quiz 6** **24 March 2016**

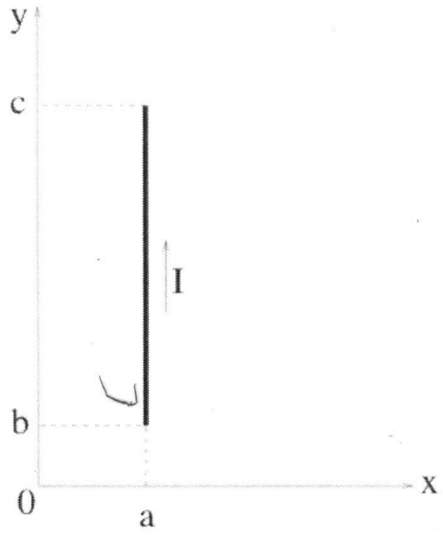
Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

Consider a piece of current carrying wire that is shown in **x-y** coordinate system as shown in the figure. Let's assume a non-uniform magnetic field is pointing along the negative **k** direction (into the page) with magnitude **Cxy** where **C > 0** is constant. Find the magnetic force on the wire at this instant.

since the magnetic field is non-uniform we will use the formula

$d\vec{F} = I(d\vec{\ell} \times \vec{B})$



$$\vec{F} = \int_b^c dy\,(I\,\hat{j} \times (C x y\,(-\hat{k})))$$

$$= -IXC \int_b^c dy\,(\hat{j} \times \hat{k})\,y = -IXC \left(\frac{y^2}{2}\Big|_b^c\right) \hat{i}$$

$$= +IXC\left(\frac{b^2 - c^2}{2}\right) = IaC\left(\frac{b^2 - c^2}{2}\right)\hat{i}$$

since $X = a$ at that instant.
The integration was performed along y-axis