PHYS 102: General Physics 2 — KOÇ UNIVERSITY — Spring Semester 2013

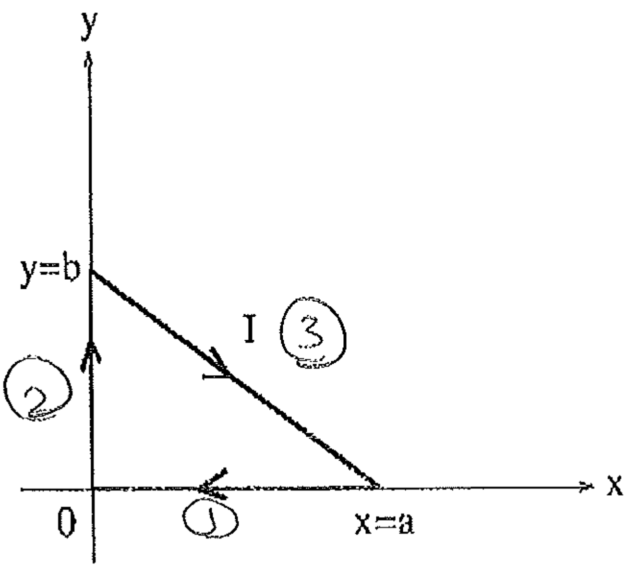
College of Arts and Sciences

Section 1 — Quiz 8 — 05 April 2013

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

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

If the current carrying loop shown in the figure is under a varying magnetic field given by $\vec{B} = B_0 xy\hat{j}$, calculate the total magnetic force on the loop.



$d\vec{F} = I\vec{dl} \times \vec{B}$

① $\Rightarrow \vec{F} = \int_{x=a,\ y=0}^{0} I\,dx\,\hat{i} \times B_0 x y\,\hat{j} = 0$

② $\Rightarrow \vec{F} = \int_{x=0,\ y=0}^{b} I\,dy\,\hat{j} \times B_0 x y\,\hat{j} = 0$

③ $\Rightarrow$ $x = t\ ,\quad y = \frac{b}{a}(a-t)$

$\int_{t=a}^{0} I\,dt\left(\hat{i} - \frac{b}{a}\hat{j}\right) \times B_0 \frac{tb}{a}(a-t)\,\hat{j}$

$= \int_{t=0}^{0} I\,dt\,B_0 \frac{tb}{a}(a-t)\,\hat{k} = \frac{B_0 b a^2}{6}\hat{k}$

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Section 2 Quiz 8 05 April 2013

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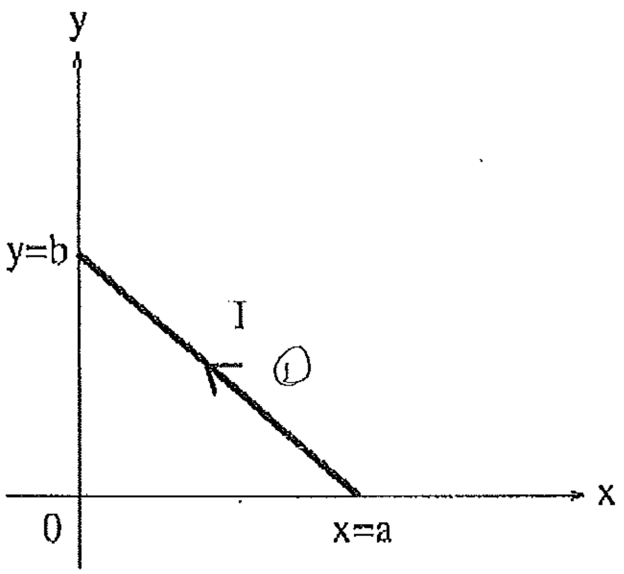
Quiz duration: 10 minutes

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

If the current carrying loop shown in the figure is under a varying magnetic field given by $\vec{B} = B_0(x\hat{i} + y\hat{j})$, calculate the total magnetic force.



$\vec{dF} = I\vec{dl} \times \vec{B}$

① $x + \frac{a}{b} y = a \Rightarrow \begin{array}{l} x = t \\ y = (a-t)\frac{b}{a} \end{array} \Rightarrow \vec{dl} = dx\,\hat{i} + dy\,\hat{j} = dt(\hat{i} - \frac{b}{a}\hat{j})$

$\int_a^0 I\,dt(\hat{i} - \frac{b}{a}\hat{j}) \times B_0\left(t\hat{i} + (a-t)\frac{b}{a}\hat{j}\right) = \int_a^0 I B_0\left((a-t)\frac{b}{a} + t\frac{b}{a}\right)\hat{k}\,dt$

$= I B_0 \left(bt - \frac{t^2 b}{2a} + t^2\frac{b}{2a}\right)\Big|_a^0 \hat{k}$

$= -I B_0\, b a\, \hat{k}$

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Section 3 Quiz 8 05 April 2013

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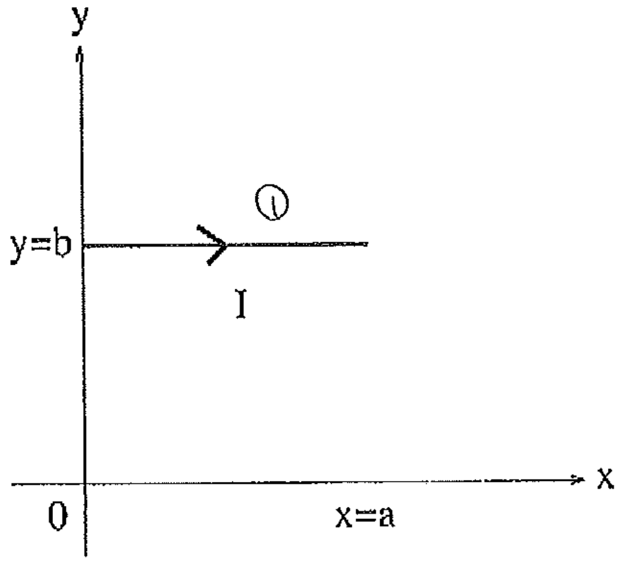
Quiz duration: 10 minutes

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

If the current carrying wire shown in the figure is under a varying magnetic field given by

$\vec{B} = B_0 xy\hat{k}$, calculate the total magnetic force.



$d\vec{F} = I d\vec{l} \times \vec{B}$

① $\vec{F} = \int_{x=0,\, y=b}^{a} I\, dx\, \hat{i} \times B_0 x y\, \hat{k} = -B_0 b I \frac{a^2}{2} \hat{j}$

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Section 4 Quiz 8 05 April 2013

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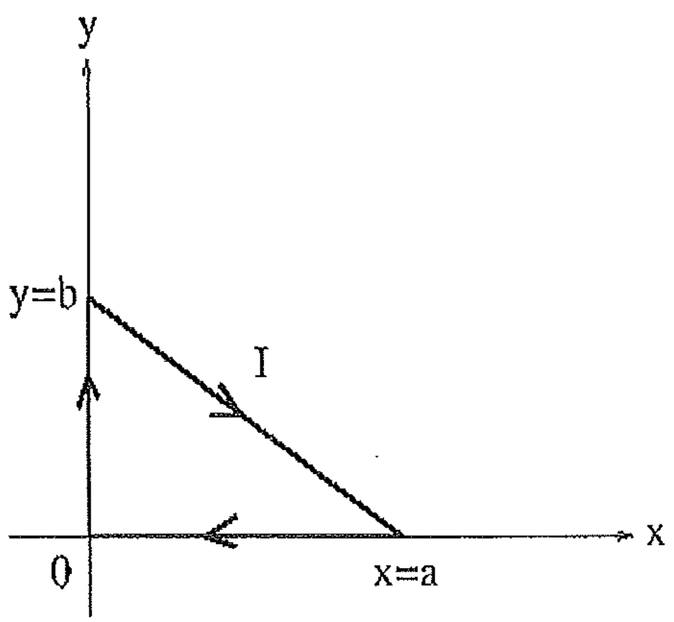
Quiz duration: 10 minutes

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

If the current carrying loop shown in the figure is under a uniform magnetic field $\vec{B} = B_0(2\hat{i} - \hat{k})$, calculate the total torque caused by the magnetic force.



The total $\vec{F}$ is equal zero because the magnetic field is homogenous.

$\vec{\tau} = \vec{\mu} \times \vec{B} = \frac{ba}{2}(-\hat{k}) \times B_0(2\hat{i} - \hat{k})$

$= -baB_0\hat{j}$

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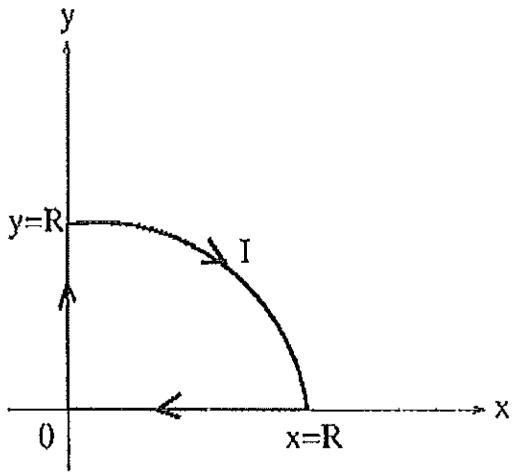
Section 5 Quiz 8 05 April 2013

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

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

If the current carrying loop shown in the figure is under a uniform magnetic field $\vec{B} = B_0(\hat{i} + \hat{j} + \hat{k})$, calculate the total torque caused by the magnetic force.



$\otimes$ $-\hat{k}$

$\odot$ $\hat{k}$

Total Force is equal to zero

$\vec{\tau} = \vec{\mu} \times \vec{B}$, $\vec{\mu} = \frac{\pi R^2}{4}(-\hat{k})$

$\vec{\tau} = \vec{\mu} \times \vec{B} = \frac{\pi R^2}{4} B_0 (-\hat{j} + \hat{i})$

$= \frac{\pi R^2}{4} B_0 (\hat{i} - \hat{j})$

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Section 6 Quiz 8 05 April 2013

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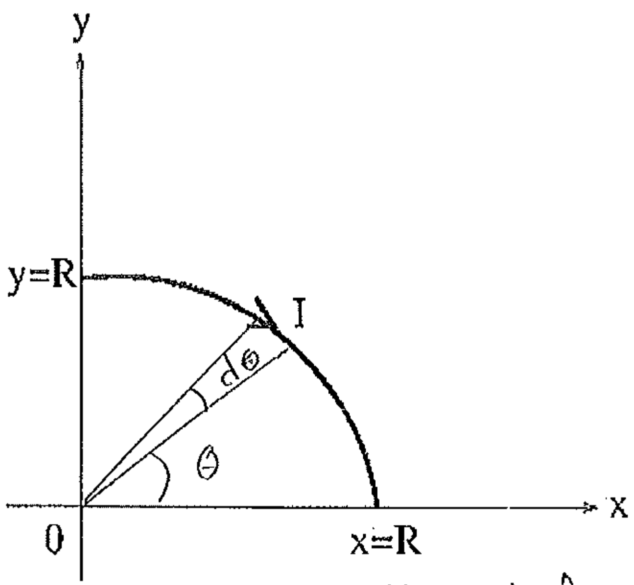
Quiz duration: 10 minutes

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

If the current carrying wire shown in the figure is under a varying magnetic field given by $\vec{B} = B_0 x\hat{j}$, calculate the total magnetic force.



$d\vec{l} = dx\hat{i} + dy\hat{j}$, $x = R\cos\theta$, $y = R\sin\theta$

$d\vec{F} = I d\vec{l} \times \vec{B}$ = $d\vec{l} = Rd\theta(-\sin\theta\,\hat{i} + \cos\theta\,\hat{j})$

$\vec{F} = \int_{\pi/2}^{0} IR^2 B_0 (-\sin\theta\,\hat{i} + \cos\theta\,\hat{j}) \times \cos\theta\,\hat{j}$

$= \int_{\pi/2}^{0} I R^2 B_0 (-\sin\theta\cos\theta\,\hat{k})\,d\theta = \frac{I R^2 B_0}{2} \cos^2\theta \Big|_{\pi/2}^{0}$

$= \frac{I R^2 B_0}{2}\hat{k}$