Physics 3A: Basic Physics I
Quiz #6a: Solutions

Name: XXXXXXXXXXXXXXXXXXXX_____
Student ID #:_________________________
Discussion Section:____________________
Date:________________________________
Signature:____________________________

\[ \vec{A} \cdot \vec{B} = |A||B|\cos(\theta) \]
\[ \vec{\tau} = \vec{r} \times \vec{F} \]
\[ |\vec{A} \times \vec{B}| = |A||B|\sin\phi \]
\[ \sum \tau = 0 \]
\[ \sum F_x = 0 \quad \sum F_y = 0 \]

(circle the letter of your answer)

1. (2 pts) If two or more forces are acting on a rigid body, then

a.) if the sum of the forces equals zero, then the sum of the torques must be zero.
b.) if the sum of the torques equals zero, then the sum of the forces must be zero.
c.) you can always choose a rotation axis such that all the forces don't produce torques.
d.) both a) and b)
e.) none of the above

2. (2 pts) Vector A points in the positive y direction. Vector B points in the negative x direction. What are the directions of AxB and BxA, respectively?

a.) Ax B points in negative z, and BxA points in positive z.
b.) Ax B points in positive z, and BxA points in negative z.
c.) Ax B points in negative y, and BxA points in positive x.
d.) Ax B points in negative x, and BxA points in positive y.
e.) none of the above

3. (6 pts) A rigid body with its center at the origin of an x-y-z coordinate system. A force of \[ \vec{F} = 4.5 \hat{i} - 3.7 \hat{j} \text{ N} \] is applied to the body at the point indicated by the position vector \[ \vec{r} = 7.5 \hat{i} + 4.3 \hat{j} \]. Find the direction and magnitude of the torque the force produces relative to a rotation axis which is the z axis. (use back of sheet as well, circle your final answer and show all work)

Use the unit vector notation form of the cross product:
\[ \vec{A} \times \vec{B} = (A_y B_z - A_z B_y) \hat{i} + (A_z B_x - A_x B_z) \hat{j} + (A_x B_y - A_y B_x) \hat{k} \]
where A is the position vector r, and B is the force. Since rz and Fz are zero, only non-zero term is the k term:
\[ \vec{\tau} = \vec{r} \times \vec{F} = (r_y F_x - r_x F_y) \hat{k} = (-7.5)(-3.7) - (4.3)(4.5) \hat{k} = -47.1 \hat{k} \text{ Nm} \]
so magnitude is 47.1 Nm, and direction is negative z direction.