ROSE-HULMAN INSTITUTE OF TECHNOLOGY

Department of Mechanical Engineering

ES 204 Mechanical Systems

Quiz - Le 23

Name: _____

1. The equation relating the acceleration of two points on the same rigid body undergoing plane motion is (circle all the correct answers):

$$a_{B} = a_{A} + \alpha \times r_{B/A} + \omega \times (\omega \times r_{B/A})$$

$$\vec{a}_{B} = \vec{a}_{A} + \vec{\alpha} \times \vec{r}_{B/A} + \omega^{2} \vec{r}_{B/A}$$

$$\vec{a}_{B} = \vec{a}_{A} + \vec{\alpha} \times \vec{r}_{B/A} - \omega^{2} \vec{r}_{B/A}$$

$$a_{\rm B} = a_{\rm A} + \alpha r + \omega^2 r$$

$$\vec{a}_{\scriptscriptstyle B} = \vec{a}_{\scriptscriptstyle A} + \vec{\alpha} \times \vec{r}_{\scriptscriptstyle B/A} + \vec{\omega} \times (\vec{\omega} \times \vec{r}_{\scriptscriptstyle B/A})$$

$$\vec{a}_{B} = \vec{a}_{A} + \vec{\alpha} \times \vec{r}_{B/A} + \vec{\omega} \times \vec{v}_{B/A}$$

$$\vec{a}_{\scriptscriptstyle B} = \vec{a}_{\scriptscriptstyle A} + \vec{\alpha} \times \vec{r}_{\scriptscriptstyle A/B} + \vec{\omega} \times \left(\vec{\omega} \times \vec{r}_{\scriptscriptstyle A/B}\right)$$

2. If
$$\vec{\alpha} = \alpha \hat{k}$$
 and $\vec{r} = 4\hat{i} + 3\hat{j}$ determine $\vec{\alpha} \times \vec{r}$

3. After substituting into the acceleration equation relating two points on the same rigid body and taking the appropriate cross products the following result is obtained:

$$a_c \hat{j} = 60\hat{i} - 0.2\alpha\hat{j} + 0.2\alpha\hat{i} - 85\hat{i} - 85\hat{j}$$

Solve for a_c and α .