MA3160  
Quiz 7 – Summer 2007  
31st July 2007  
Closed Book/Notes  

1.) Two particles move as described below.

Particle 1: Starts at (0,1,0) and moves along $\vec{v}_1 = \hat{i} + \hat{j} + 0\hat{k}$

Particle 2: Starts at (4,0,0) and moves along $\vec{v}_2 = -3\hat{i} + 2\hat{j} + 0\hat{k}$

a.) Find $\vec{r}_1(t)$ and $\vec{r}_2(t)$, that is, the position vectors in parametric form $\vec{r} = \vec{r}_0 + \vec{v}t$.

$\vec{r}_1 = \vec{r}_0 + t(\hat{i} + \hat{j}) = t\hat{i} + (1+t)\hat{j}$

$\vec{r}_2 = 4\hat{i} + t(-3\hat{i} + 2\hat{j}) = (4 - 3t)\hat{i} + 2t\hat{j}$

b.) Determine if the particles collide, cross paths or neither. Show all work.

To check if particles collide, they would need to occupy same $x$, $y$ at same $t$.

\begin{align*}
\text{equate } x & \quad 4 - 3t = t \quad t = 1 \\
\text{equate } y & \quad 1 + 2t = 2t \quad t = 1 \\
\end{align*}

Collide at $t = 1$

$\vec{r}_1(1) = \vec{r}_2(1) = \hat{i} + 2\hat{j}$
2.) Match the vector field plots with the corresponding formula.

\[ a.) \vec{F} = -yi - xj \quad b.) \vec{F} = xi - yj \quad c.) \vec{F} = -xi - yj \quad d.) \vec{F} = yi + xj \]

\[ e.) \vec{F} = -yi + xj \quad f.) \vec{F} = yi - xj \quad g.) \vec{F} = xi + yj \quad h.) \vec{F} = \text{none of the above} \]
3.) Find the acceleration vector for a particle moving at an angular velocity of 8 radians/second counterclockwise around a circle (R = 2) in the xy plane centered at the origin. 

\[ \omega = 8 \]

\[ \mathbf{r}(t) = 2 \cos(8t) \mathbf{i} + 2 \sin(8t) \mathbf{j} \]

\[ \mathbf{r}'(t) = 8 \cdot 2 \left[ -\sin(8t) \mathbf{i} + \cos(8t) \mathbf{j} \right] \]

\[ \mathbf{r}'' = 64 \cdot 2 \left[ -\cos(8t) \mathbf{i} - \sin(8t) \mathbf{j} \right] \]