PHYS 1210 Group Work Sheet
Vectors in 3D

With your group, discuss how to answer these questions and write your group answer in the space provided.

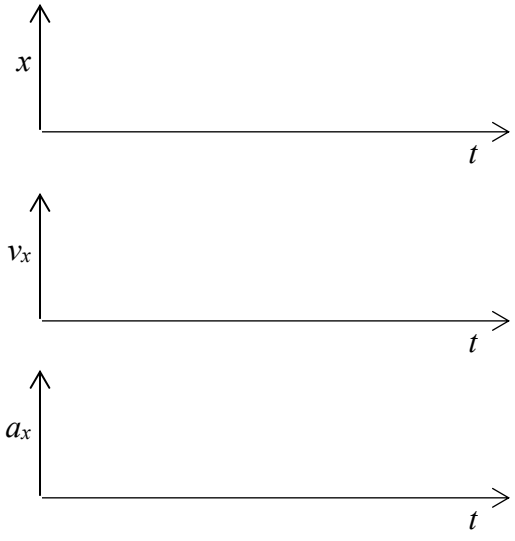
1. Define vectors $\vec{A} = (10\hat{\imath} + 30\hat{\jmath})$ N and $\vec{B} = (0.50\hat{\imath} + 0.1\hat{\jmath})$ m. What is the cross product of vectors $\vec{A}$ and $\vec{B}$?

2. A projectile's position after launch at time $t = 0$ is given by the formula

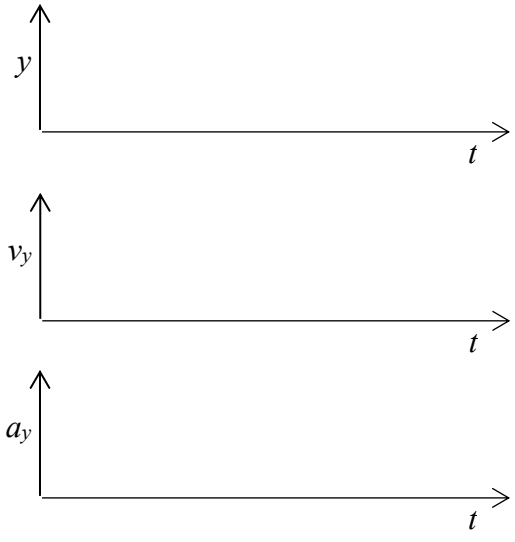
$$\vec{r} = \left(15\frac{m}{s}t\right)\hat{\imath} + \left(15\frac{m}{s}t - 5\frac{m}{s^2}t^2\right)\hat{\jmath}.$$

   a. Its velocity is $\vec{v} = d\vec{r}/dt$ and its acceleration is $\vec{a} = d\vec{v}/dt$. Find the projectile's velocity $\vec{v}$ and acceleration $\vec{a}$ as functions of time by taking the derivatives. Treat $\hat{\imath}$ and $\hat{\jmath}$ as constants, because that's what they are.

   b. Sketch plots of the horizontal components of position, velocty, and acceleration vs. time.



   c. Sketch plots of the vertical components of position, velocty, and acceleration vs. time.



d. Find the formula for speed as a function of time, $v = \sqrt{\vec{v} \cdot \vec{v}}$.

e. Find the formula for magnitude of acceleration as a function of time.

f. Find the formula for rate of change of speed as a function of time, dv/dt.

3. Find the dot products between the unit basis vectors $\hat{\imath}$, j, and $\hat{k}$.

$\hat{\imath} \cdot \hat{\imath} =$ _____	$\hat{\imath} \cdot \hat{\jmath} =$ _____	$\hat{\imath} \cdot \hat{k} =$ _____
$j \cdot \hat{\imath} =$ _____	$\hat{\jmath} \cdot \hat{\jmath} =$ _____	$\hat{\jmath} \cdot \hat{k} =$ _____
$\hat{k} \cdot \hat{\imath} =$ _____	$\hat{k} \cdot \hat{\jmath} =$ _____	$\hat{k} \cdot \hat{k} =$ _____

4. Find the cross products between the unit basis vectors $\hat{\imath}$, j, and $\hat{k}$.

$\hat{\imath} \times \hat{\imath} =$ _____	$\hat{\imath} \times \hat{\jmath} =$ _____	$\hat{\imath} \times \hat{k} =$ _____
$j \times \hat{\imath} =$ _____	$\hat{\jmath} \times \hat{\jmath} =$ _____	$\hat{\jmath} \times \hat{k} =$ _____
$\hat{k} \times \hat{\imath} =$ _____	$\hat{k} \times \hat{\jmath} =$ _____	$\hat{k} \times \hat{k} =$ _____