1) Find the length and direction of the vector whose base is $(0, 1, -1)$ and whose terminal point is $(-2, 3, 1)$. Express this vector as $a\,\vec{i} + b\,\vec{j} + c\,\vec{k}$.

2) All our vectors will be based at origin! Two distinct vectors $\vec{v}$ and $\vec{w}$ determine a line between their terminal points. Find a vector whose terminal point is one-third of the way along the segment from $\vec{v}$ to $\vec{w}$. Hint: consider the vector $\vec{w} - \vec{v}$. How do you adjust this to point to any fraction of the way between $\vec{v}$ and $\vec{w}$?

3) Let $\vec{r}(t) = f_1(t)\vec{i} + f_2(t)\vec{j} + f_3(t)\vec{k}$ be a function $\mathbb{R} \to \mathbb{R}^3$, expressed as in terms of vectors based at the origin. We defined in class

$$\vec{r}'(t) = \lim_{h \to 0} \frac{\vec{r}(t+h) - \vec{r}(t)}{h}$$

when the limit exists. Find an expression for $\vec{r}'(t)$ in terms of $f_1(t)$, $f_2(t)$, $f_3(t)$. Use this to find $\vec{r}'(t)$ for $\vec{r}(t) = cos\,2t\,\vec{i} + sin\,t\,\vec{j} + t^2\,\vec{k}$.