Lesson 18 - Vector Functions I

Objectives

- Understand a curve in space and its relation to parametric equations.
- Find the domain of a vector function.
- Find indefinite and definite integrals of vector valued functions.

READ

- Stewart, Chapter 13.1, pages 817-820.
- (Review) Stewart, Chapter 13.2, pages 824-827.
- Stewart, Chapter 13.2, pages 827-828.

THINK ABOUT

- For a given value of t what does a position vector $\vec{r}(t)$ represent?
- What does $\vec{r}\,'(t)$ represent?
- What does $\vec{r}\,''(t)$ represent?
- How do you move back and forth from acceleration to position and from position to acceleration?
- What are the differences between taking the derivative of $f(t)$ with respect to t and taking the derivative of $\vec{r}(t) = f(t)\hat{i} + g(t)\hat{j} + h(t)\hat{z}$ with respect to t?
- What are the differences between integrating $\int f(t)dt$ and integrating $\int \vec{r}(t)dt$?

  For the rest of this block, we will use space curves to help us describe and model motion in 3-D space. If we twice differentiate a vector function describing position of an object in space, the result will describe the object's acceleration. Integration of a vector function will provide a means to go backwards from acceleration. In other words, use an acceleration vector to find a position vector. We will use this method to derive the equations for projectile motion.

MATHEMATICA COMMANDS AND TASKS YOU NEED TO KNOW

We can input a vector function into Mathematica using the brackets and . For example, the vector $r(\vec{t}) = t^2\vec{i} + \cos t\vec{j} + e^t\vec{k}$, can be defined as the vector function

$$\{\texttt{x[t]},\texttt{y[t]},\texttt{z[t]}\}$$

with the following input:

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In[1]:= r[t_] = {t^2, Cos[t], ⅇ^t}
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