MATH 32A Midterm 2 Study Guide

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1 14.5 Motion in 3-Space

the velocity is $\mathbf{v}(t) = \mathbf{r}'(t)$ and the acceleration is $\mathbf{a}(t) = \mathbf{v}'(t)$
Likewise, we can also easily extrapolate that $\int \mathbf{a}(t)dt = \mathbf{v}(t)$ and $\int \mathbf{v}(t)dt = \mathbf{r}(t)$

Additionally, we can decompose $\mathbf{a}(t)$ into the sum of tangential and normal components. Remember that

$$\mathbf{T}(t) = \frac{\mathbf{v}(t)}{\|\mathbf{v}(t)\|}, \qquad \mathbf{N}(t) = \frac{\mathbf{T}(t)}{\|\mathbf{T}(t)\|}$$

Additionally, we know that $\mathbf{a} = a_{\mathbf{T}}\mathbf{T} + a_{\mathbf{N}}\mathbf{N}$, where the coffeficient $a_{\mathbf{T}}$is called the tangential component and $a_{\mathbf{N}}$ is the normal component of acceleration.
To find the value of the tangential component and the normal component, we can use the following equations:

$$a_{\mathbf{T}} = \mathbf{a} \cdot \mathbf{T} = \frac{\mathbf{a} \cdot \mathbf{v}}{\|\mathbf{v}\|}, \qquad a_{\mathbf{N}} = \mathbf{a} \cdot \mathbf{N} = \sqrt{\|\mathbf{a}\|^2 - \|a_{\mathbf{T}}\|^2}$$

where $\|\mathbf{v}\|$ is the magnitude of the velocity vector

$\lim_{(x,y)\to(0,0)} \frac{x^2y}{x^4+y^2}$
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