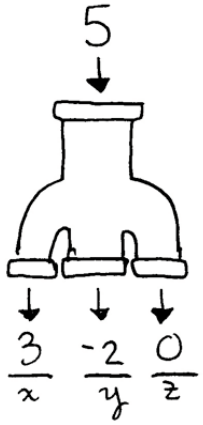
Name: _____
February 27, 2008
MATH 205 – 03
SI Session #4: Sections 14.1-14.4




# Vector Functions

## ❇ Definition

**Vector function** –

| Vector Functions | Regular functions |
|---|---|
| | |

## ❇ Visualizing Vector Functions

### 1. The "Table of Values" Method

Example: Graph $\mathbf{r}(t) = \langle t^2, t^3, t \rangle$ for all $t>0$.

**2. Understanding Them**

**Case Study**: $\mathbf{r}(t) = \langle \cos t, \sin t, t \rangle$

1. By inspection, what is this curve?

2. What axis does the curve lie on?

3. What does the *xy*-plane look like?

4. What do the *xz*- and *yz*-planes look like?

5. Sketch a graph of this curve.

6. What changes in each of the following equations?

   A. $\mathbf{r}(t) = \langle \cos 2t, \sin 2t, t \rangle$

   B. $\mathbf{r}(t) = \langle t, \cos t, \sin t \rangle$

   C. $\mathbf{r}(t) = \langle \sin t, \cos t, t \rangle$

   D. $\mathbf{r}(t) = \langle \cos t, \sin t, t+5 \rangle$

## ❇ Computational Problems

Important computations you should be replicate on the exam:

**1. Find the line or line segment between two points.**

Example: Parameterize the line segment between the points (5,-1,2) and (6,1,7).

**2. Find the tangent line passing through a specific point.**

Example: Give an equation for the tangent line of $\mathbf{r}(t) = \langle \cos 4t, -\sin 2t, 3t \rangle$ at $t = \pi/4$.

**3. Evaluate the integral, derivative, or limit of a vector equation.**

Example: $\int_0^1 (t^2\mathbf{i} + t\cos(t^2)\mathbf{j} + e^{-t}\mathbf{k})\,dt$

**4. Prove cute facts about derivatives.**

Example: If $\mathbf{u}(t) = \mathbf{r}(t) \bullet [\mathbf{r}'(t) \times \mathbf{r}''(t)]$, show that $\mathbf{u}'(t) = \mathbf{r}(t) \bullet [\mathbf{r}'(t) \times \mathbf{r}'''(t)]$.

**5. Calculate the arclength of a vector equation between certain values of *t*.**

Example: Find the arclength of $\mathbf{r}(t)=\mathbf{i}+t^2\mathbf{j}+t^3\mathbf{k}$ from $0 \le t \le 1$.

**6. Relate equations involving position, velocity, and acceleration. Calculate the speed of a particular vector.**

Example: Find the position vector of a particle that has acceleration $\mathbf{a}(t) = 2t\mathbf{i} + \sin t\mathbf{j} + \cos 2t\mathbf{k}$, $\mathbf{v}(0) = \mathbf{i}$, and $\mathbf{r}(0) = \mathbf{j}$.