Homework 3 problems (due Thursday February 14 at 9pm).

<u>12.4</u> 22, 29, 32

<u>12.5</u> 2, 4, 6, 7, 13, 16, 28, 33, 55

<u>12.6</u> 1, 3, 8, 10, 11, 15, 17, 18, 23, 25, 32, 33, 37, 42

α) There is a way to find out how far away a plane in $\mathbb{R}^3$ is from the origin by first finding a normal vector $\vec{n}$ to the plane and projecting *any* point of the specified plane onto $\vec{n}$. Show that the plane determined by $(3,1,4),(2,1,7)$ and $(1,4,1)$ is about 3.67 units away from the origin.

β) An object is moving in 3-space according to the parametric equations $x = t$, $y = \frac{1}{2}t^2$, $z = \sin t$. Find as functions of time t
a) the position vector $\vec{r}$
b) the velocity vector $\vec{v}$
c) the acceleration vector $\vec{a}$
d) the speed $\frac{ds}{dt}$
e) the tangential component of acceleration a_T
f) the curvature κ at $t = \frac{\pi}{2}$
g) the normal component of acceleration a_N at $t = \frac{\pi}{2}$

γ) An object is moving in the plane along the curve $y = 2\ln x$, $x > 0$, from left to right. It is moving at a constant speed of 5 ft/sec.
a) Find a_T and a_N when the object is at the point $(x, 2\ln x)$.
b) Find the velocity vector and the acceleration vector when the object is at the point $(1,0)$.

δ) An object is moving in 3-space in such a way that its acceleration vector as a function of time t is $\vec{a} = (\cos t)\vec{i} + (\sin t)\vec{j} + \vec{k}$. At time $t = 0$ its velocity vector is $\vec{v}(0) = -\vec{j}$. Find the tangential component of acceleration a_T, the curvature κ, and the normal component of acceleration a_N as functions of t.