Problem 1 Let $\vec{a} =< -2, 0, 1 >$ and $\vec{b} =< 1, -3, 1 >$.
a) Compute $\vec{a} \cdot \vec{b}$.

b) Find the cosine of the angle between $\vec{a}$ and $\vec{b}$.

c) Find the projection vector $\vec{a}$ onto $\vec{b}$.

Problem 2 Compute $\vec{a} \times \vec{b}$ with $\vec{a} = \vec{i} - \vec{j} + \vec{k}$ and $\vec{b} = \vec{i} - 2\vec{j} - \vec{k}$.

Problem 3 Let $\vec{u}$ and $\vec{v}$ be two nonzero vectors. Find $(\vec{u} \times \vec{v}) \cdot (\vec{u} + \vec{v})$.

Problem 4 Find the parametric equation of the line which parallel to the line $\frac{x+1}{3} = y - 1 = \frac{z+1}{2}$ and passes through $(2, 3, 1)$.

Problem 5 Find the vector equation of the line which passes through $(2, -4, 6)$ and $(5, 0, 2)$.

Problem 6 Find the equation of the plane that contains $(1, 0, 2)$, $(3, 4, 5)$, and $(0, 0, 1)$.

Problem 7 Find the equation of the plane containing the line $\frac{x-1}{2} = \frac{y-2}{-3} = z+1$ and passes through $(3,0,1)$.

Problem 8 Find the equation of the plane through $(-1,6,-5)$ and parallel to the plane $2x+y+z=2$.

Problem 9 Sketch the graph of $z = x^2 - 2x + y^2 + 2y + 2$.

Problem 10 Let $\vec{r}(t) =< t, 3, t^2 >$.
a) Find the unit tangent vector at $t = 1$.

b) Find the parametric equation of the tangent line at $t = 1$.

Problem 11 A particle moves along $\vec{r}(t) =< 3\cos 2t, 3\sin 2t, 2t >$.
a) Find the speed $v(t)$. Is the speed constant?

b) Use part b) to show that $\vec{v}(t) \perp \vec{a}(t)$ for all t.

Problem 12 A particle has an acceleration $\vec{a}(t) = t\vec{i} + t^2\vec{j} + e^{-t}\vec{k}$ and its velocity vector $\vec{v}(0)$ is $\vec{i} + \vec{j}$. Find the its velocity vector.

Problem 13 Let $\vec{r}(t) = 2\cos t^3\vec{i} + 2\sin t^3\vec{j}$.

a) Reparametrize the curve with respect to the arc length from the point where $t = 0$ in the direction of increasing t.

b) Using $\vec{r}''(t) = (-12t\sin t^3 - 18t^4\cos t^3)\vec{i} + (12t\cos t^3 - 18t^4\sin t^3)\vec{j}$, find the tangential component of acceleration.

Problem 14 True of false: Explain your answer.
a) There are vectors $\vec{u}$ and $\vec{v}$ so that $\vec{u} \times \vec{v} = 5$.

b)The cross product is associative, that is, $(\vec{a} \times \vec{b}) \times \vec{c} = \vec{a} \times (\vec{b} \times \vec{c})$.

c) The binormal vector $\vec{B}(t)$ is perpendicular to the ocsulating plane.