1. Let $\mathbf{a} = (2, 1, -1)$, $\mathbf{b} = (5, 0, 1)$, $\mathbf{c} = (10, 1, 1)$.
   (a) Find parametric equations for the line $L$ containing $\mathbf{a}$ and $\mathbf{b}$.
   (b) Find symmetric equations for the line through $\mathbf{c}$ parallel to $L$.
   (c) Find an equation of the plane $P$ containing $\mathbf{c}$ and perpendicular to $L$.
   (d) Find the point of intersection of the line $L$ and the plane $P$.
   (e) Find the distance from the point $\mathbf{a}$ to the plane $P$.

2. The position vector of a particle at any time $t$ is given by
   $$\mathbf{r}(t) = \frac{4}{5} \cos t \mathbf{i} + (1 - \sin t) \mathbf{j} - \frac{3}{5} \cos t \mathbf{k}.$$  
   (a) Find the velocity, acceleration, and speed of the particle at any time $t$.
   (b) Find the tangential and normal components of the acceleration vector at any time $t$.
   (c) Find the curvature of the trajectory at any time $t$.

3. Let $\mathbf{a}$, $\mathbf{b}$, $\mathbf{c}$ be as in problem 1. Find the area $A$ of the triangle whose vertices are $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$.

4. A ball rolls off a horizontal roof of a building 144 feet tall with a speed of 24 feet per second. How far away from the building is it when it hits the ground? Take $g = 32$ feet per second per second.

5. Mark each statement as true (T) or false (F) (no reasons needed).
   (a) If $\mathbf{u}$ and $\mathbf{v}$ are orthogonal unit vectors, $\mathbf{u} \times \mathbf{v}$ is a unit vector.
   (b) If $\mathbf{u}$, $\mathbf{v}$ and $\mathbf{w}$ are vectors then $(\mathbf{u} \cdot \mathbf{v}) \times \mathbf{w} = \mathbf{u} \cdot (\mathbf{v} \times \mathbf{w})$.
   (c) A vector-valued function $\mathbf{r}$ defined on an interval $I$ is smooth if $\mathbf{r}$ has a continuous derivative on $I$.
   (d) If a smooth space curve $C$ has its curvature $\kappa(t)$ identically zero then $C$ is a line (or a line segment).
   (e) If a particle moves with constant speed, its velocity and acceleration vectors are orthogonal.