1. (a) Find the line of intersection of the planes given by equations $2x - 3y + 4z + 5 = 0$ and $y - z = 7$.
   (b) Where does the line from part (a) intersect the plane $x + y + z = 0$?

2. (a) Given the points $A = (1, 0, 0), B = (0, 1, 0)$ and $C = (0, 0, 1)$, find the point $P$ on the line segment $\overrightarrow{AB}$ that is closest to $C$.
   (b) Find the area of the triangle with vertices $A$, $B$, and $C$.
   (c) Find the plane that contains the points $A$, $B$, and $C$.

3. Consider the line $L_1$ given by $x = 4 + t, y = 3 + t, z = 1 + 2t$ and the line $L_2$ given by $x = 1 - t, y = 2t, z = 1 + t$, and also the point $P = (3, 2, -1)$.
   (a) Find a parametric equation of a line $L$ that passes through $P$ and is perpendicular to both $L_1$ and $L_2$.
   (b) Show that $P$ lies on $L_1$ and find the point $Q$ at which $L$ and $L_2$ meet.
   (c) What is the distance between lines $L_1$ and $L_2$? Why?

4. The acceleration vector of a particle moving in space at a time $t$ is $\mathbf{a}(t) = -2t\mathbf{i} + 4\mathbf{j}$.
   (a) Find the position $\mathbf{r}(t)$ of the particle as a function of $t$, if at the time $t = 0$ the velocity vector is $\mathbf{v}(0) = (3, 0, 4)$ and at time $t = 3$ the particle is at the point $(0, 1, 0)$.
   (b) Find an equation of the tangent line to the curve at the point $(0, 1, 0)$.
   (c) Find the length of the trajectory traveled from time $t = 0$ to time $t = 2$.

5. Calculate the first and second partial derivatives of the function $f(x, y) = e^x \cos(xy) + xy^2$. 