1. The lines given by $L_1 : x = t, y = t - 7, z = t - 13$, and $L_2 : x = 1 + 2t, y = -3 + t, z = -2t$, intersect at the point $(7,0,-6)$. Find the acute angle $\theta$ ($0 \leq \theta \leq \pi/2$) between $L_1$ and $L_2$.

2. Find the value of $a$ that makes the vector $n = i + aj + k$ perpendicular to the plane containing the points $P(1,2,2)$, $Q(-a,3,3)$, and $R(1,1,0)$.

3. At what point does the line through the points $(1,0,0)$ and $(2,3,1)$ intersect the plane $x + y - 3z = 3$?

4. A particle starts at the origin with initial velocity $<1, -1, 2>$. The acceleration is given by $a(t) = <6t, 12t^2, -6t>$. Find the position of the particle at $t = 1$.

5. Find the length of the curve $r(t) = <\frac{2}{3}t^{3/2}, \cos t, \sin t>$, $0 \leq t \leq 3$.

6. Find the unit tangent vector at $t = \pi/2$ for the curve $r(t) = <2 \sin t, 2 \cos t, \tan t>$.

7. (a) Sketch the level curves of the function $z = f(x, y) = \sqrt{x^2 + 4y^2}$.
(b) What type of quadric surface is the graph of $z = f(x, y)$?

8. Find $f_x$ and $f_y$ for the function $f(x, y) = (xy - 1)^2$. 