(1) For a particle moving along the space curve given by \( \vec{r} = (2t)\hat{i} + (1/t)\hat{j} + (t - 1)^3\hat{k} \)
(a) Evaluate \( \vec{r}'' \) at \( t = 1 \).
(b) Determine the curvature at \( t = 1 \).

(2) If \( \vec{a} \) and \( \vec{b} \) are constant vectors, calculate
\[
\frac{d}{dt} \left[ (\vec{a} + t\vec{b}) \times (\vec{b} - t\vec{a}) \right].
\]

(3) Compute
\[
\int_0^\pi \left[ (e^{-t})\hat{i} - (\sqrt{t})\hat{j} + (\cos t)\hat{k} \right] dt.
\]

(4) Find a vector and a parametric equation of the line passing through points \( P(1, 2, 3) \) and \( Q(2, 1, 5) \).

(5) For the curve described by the parametric equations \( x = 1 + 2 \sin 4t, \ y = 2 + 2 \cos 4t \).
(a) Sketch the curve in the domain \( 0 \leq t \leq \pi/8 \).
(b) Determine the equation of the line tangent to the curve at \( t = \pi/16 \).

(6) What is the area between the curve and the \( x \)-axis for the curve described by the parametric equations \( x = t^3 + t^2, \ y = 1/t, \ 1 \leq t \leq 2 \)?

(7) For the points \( P(-1, 0, 2), Q(0, 1, 0), \) and \( R(1, 2, 3) \), determine
(a) The cosine of the angle between the vectors \( \vec{RQ} \) and \( \vec{PQ} \), and
(b) The area of the triangle formed by these points.

(8) Consider the plane \( x - 2y + z = 2 \).
(a) The parametric equations of the line perpendicular to the given plane through the point \( (2, 1, 2) \).
(b) The equation of the line of intersection of the given plane and the \( xy \)-plane.
(c) The cosine of the angle between the given plane and the \( xy \)-plane.

(9) Consider the velocity vector \( \vec{v} = (3t^2 + 1)\hat{i} + (e^t)\hat{j} \)
(a) The position vector at \( t = 1 \) if \( \vec{r}(0) = \hat{i} + \hat{j} \).
(b) The acceleration vector at \( t = 1 \).

(10) For the vector \( \vec{r} = (t^2)\hat{i} + (t^3)\hat{j} + (\cos(t - 1))\hat{k} \)
(a) Find the unit tangent vector at \( t = 1 \).
(b) Compute the curvature of the curve at \( t = 1 \).