No. 1. (20 points) The points \( P(2, 1, 5) \), \( Q(-1, 3, 4) \) and \( R(3, 0, 6) \) are the vertices of a triangle in 3-space.

a) Find the angle of the triangle which is at the vertex \( P \), in degrees.

b) Find the area of the triangle.

c) Find the equation of the plane which contains the triangle.
No. 2. (15 points) a) Find the parametric equations for the line which passes through the point $P(1,0,6)$ and is perpendicular to the plane $x + 3y + z = 5$.

b) Find the equation for the plane which contains the point $P(-2,8,10)$ and is perpendicular to the line that has parametric equations

$$x = 1 + t, \quad y = 2t, \quad z = 4 - 3t.$$
No. 3. (12 points) Find the unit tangential and unit normal vectors $T(t)$ and $N(t)$ for the vector function

$$
\mathbf{r}(t) = < t^2, \sin t - t \cos t, \cos t + t \sin t >, \quad t > 0.
$$
No. 4. (33 points) An object is moving in 3-space according to the parametric equations

\[ x = 2 \cos t, \quad y = 3t, \quad z = 2 \sin t, \]

where \( t \) is the time. Find, as functions of \( t \),

a) position vector \( \mathbf{r} = \)

b) velocity vector \( \mathbf{v} = \)

c) acceleration vector \( \mathbf{a} = \)

d) speed \( \frac{ds}{dt} = \)

When \( t = \frac{\pi}{2} \) find

e) tangential component of acceleration \( a_T = \)

f) curvature =

g) normal component of acceleration \( a_N = \)
No. 5. **(20 points)** An object is moving in 3-space in such a way that its acceleration vector as a function of time is

\[ \mathbf{a}(t) = t \mathbf{i} + t^2 \mathbf{j} + \cos 2t \mathbf{k}. \]

At time \( t = 0 \) its velocity vector is \( \mathbf{v}(0) = \mathbf{i} + \mathbf{k} \) and its position vector is \( \mathbf{r}(0) = \mathbf{j} \).

Find the velocity vector and the position vector as functions of \( t \) and then give the parametric equations for the motion.