Read each problem **very carefully** before starting to solve it. Each problem is worth 5 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Suppose that the motion of a particle is described by the vector function $\boldsymbol{r} = \langle t^2, \frac{1}{t}, t \rangle$. Find an equation for the normal plane to the motion at $t = 2$.

2. Let $\boldsymbol{r}(t) = \langle t, \cos t, \sin t \rangle$. Find the tangential and normal component of the acceleration at time t.

3. (a) Compute the integral

$$\int te^{3t}\,dt.$$

(b) Suppose that a moving object has acceleration function $a(t) = \langle 3te^{3t} + e^{3t}, 2t, 6 \rangle$. If the object at time $t = 0$ has velocity $v(0) = \langle 0, 0, 1 \rangle$ and is at position $r(0) = \langle -\frac{1}{9}, 1, 5 \rangle$, find the position $r(t)$ of the object at time t.