DATE: ___________

Derivatives of Parametric Equations & Vectors Practice

1. If a particle moves in the xy-plane so that at any time $t > 0$, its position is $\langle \ln(t^2 + 5t), 3t^2 \rangle$, find the velocity vector at time $t = 2$.

2. The position of a particle moving in the xy-plane is given by the parametric equations $x = t^3 - \frac{3}{2}t^2 - 18t + 5$ and $y = t^3 - 6t^2 + 9t + 4$. For what value(s) of t is the particle at rest?

3. A particle moves in the xy-plane so that the position of the particle is given by $x(t) = 5t + 3\sin t$ and $y(t) = (8 - t)(1 - \cos t)$. Find the velocity vector at the time when the particle's horizontal position is $x = 25$.

4. Consider the curve C given by the parametric equations $x = 2 - 3\cos t$ and $y = 3 + 2\sin t$, for $-\frac{\pi}{2} \le t \le \frac{\pi}{2}$. Find the equation of the tangent line at the point where $t = \frac{\pi}{4}$.

5. An object moving along a curve in the xy-plane has position $\langle x(t), y(t) \rangle$ at time $t \ge 0$ with $\frac{dx}{dt} = 1 + \tan t^2$ and $\frac{dy}{dt} = 3e^{\sqrt{t}}$. Find the acceleration vector and the speed of the object when $t = 5$.

6. A particle moving along a curve in the xy-plane has position $\langle x(t), y(t) \rangle$ at time t with $\frac{dy}{dt} = 2 + \sin e^t$. The derivative $\frac{dx}{dt}$ is not explicitly given. At $t = 3$, the object is at the point $(4,5)$ and the value of $\frac{dy}{dx}$ is -1.8. Find the value of $\frac{dx}{dt}$ when $t = 3$.