1. Look back to Worksheet 3, problem 1. Find a parametric equation for L. Does this parametric equation tell you the points on L, or the position vectors of points on L?

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2. Again look back to Worksheet 3, problem 2. Find a parametrization of the line passing through $(4, 1, 5)$ and normal to P.

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3. A particle moves in the xy-plane in such a way that its position at time t is

$$\vec{r}(t) = \langle t - \sin(t), 1 - \cos(t) \rangle$$

   (a) Find the domain and range of $\vec{r}(t)$.

   (b) Graph $\vec{r}(t)$.

   (c) Find $\vec{v}(t)$. Graph the velocity vector for $t = \pi$ and $t = 3\pi/2$.

   (d) Find the maximum and minimum values of $|\vec{v}(t)|$. (Hint: Maximize instead $|\vec{v}(t)|^2$.)

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4. A particle moves around the unit circle in the xy-plane. Its position at time t is $\vec{r}(t) = x(t)\vec{i} + y(t)\vec{j}$, where x and y are differentiable functions of t. Suppose $\vec{v}(t) \cdot \vec{i} = y(t)$, where $\vec{v}(t)$ is the velocity vector. Can you tell if the motion clockwise or counterclockwise? (Hint: Try to solve for dy/dt and see what you get...)

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5. Given the velocity functions below, find the particle's position subject to the given initial conditions.

   (a) $\vec{v}(t) = (180t)\vec{\mathbf{i}} + (180t - 16t^2)\vec{\mathbf{j}}$ with $\vec{r}(0) = 100\vec{\mathbf{j}}$.

   (b) $\mathbf{v}(t) = (t^3 + 4t)\vec{\mathbf{i}} + t\vec{\mathbf{j}} + 2t^2\vec{\mathbf{k}}$ with $\vec{r}(0) = \vec{\mathbf{i}} + \vec{\mathbf{j}}$.
