Section 3.7: Derivatives of Vector Functions

Sketching Vector Curves: We can sketch a vector curve by finding parametric equations, then eliminating the parameter to obtain a cartesian equation. We can determine the direction of the curve by finding the direction of a tangent vector.

EXAMPLE 1: Sketch the following vector equations. Include the direction of the curve:

(i) $\mathbf{r}(t) = \langle t, t^2 \rangle$

(ii) $\mathbf{r}(t) = \langle 2\cos t, 3\sin t \rangle$

EXAMPLE 2: If $\mathbf{r}(t) = \left\langle t^2 - 4, \sqrt{9-t} \right\rangle$, find the domain of $\mathbf{r}(t)$ and $\mathbf{r}'(t)$.

EXAMPLE 3: $\mathbf{r}(t) = \langle t, 25t - 5t^2 \rangle$ is the position of a moving object at time t, where position is measured in feet and time in seconds.

(i) Find the velocity and speed at time $t = 1$.

(ii) With what speed does the object strike the ground?

EXAMPLE 4: Find a tangent vector of unit length at $t = 1$ to the curve given by $\mathbf{r}(t) = \langle t^2, 3t^3 \rangle$.

EXAMPLE 5: Find the angle of intersection of the curves $\mathbf{r}(t) = \langle 1 - t, 3 + t^2 \rangle$ and $\mathbf{s}(u) = \langle u - 2, u^2 \rangle$.