

13.1, number 5: The position vector of an object at time t is $\vec{r}(t) = (t + 1)\vec{i} + (t^2 - 1)\vec{j}$. Eliminate t and find an equation involving only x and y which gives the path of the object. Find the object's velocity and acceleration vectors at time $t = 1$.

Answer: We are given $x = t + 1$, $y = t^2 - 1$. We solve the first equation for t : $x - 1 = t$ and drop this into the second equation: $y = (x - 1)^2 - 1$. We compute $\vec{v}(t) = \vec{r}'(t) = \vec{i} + 2t\vec{j}$ and $\vec{a}(t) = \vec{v}'(t) = 2\vec{j}$. We conclude that $\vec{v}(1) = \vec{i} + 2\vec{j}$ and $\vec{a}(1) = 2\vec{j}$.