

Vector derivatives

1. Let $\mathbf{r}(t)$ be a vector function. Prove by using components that

$$\frac{d\mathbf{r}}{dt} = \mathbf{0} \Rightarrow \mathbf{r}(t) = \mathbf{K}, \text{ where } \mathbf{K} \text{ is a constant vector.}$$

Answer: In two dimensions $\mathbf{r}(t) = \langle x(t), y(t) \rangle$, $\mathbf{r}'(t) = \langle x'(t), y'(t) \rangle$.

Therefore,

$$\begin{aligned} \mathbf{r}'(t) = \mathbf{0} &\Rightarrow x'(t) = 0 \text{ and } y'(t) = 0 \\ &\Rightarrow x(t) = k_1 \text{ and } y(t) = k_2 \\ &\Rightarrow \mathbf{r}(t) = \langle k_1, k_2 \rangle, \text{ where } k_1 \text{ and } k_2 \text{ are constants.} \end{aligned}$$

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