Name: Solutions

Math 208H, Section 1

Quiz number 8

Find the derivative of the vector-valued function

$$\vec{v}(t) = (t\sin t, e^t - t, t^2 - 3t + 4)\ .$$

Does a particle whose position is parametrized by this function ever come to rest (i.e., have velocity equal to $(0,0,0)$?

$\vec{v}'(t) = ((t)(\cos t)+(1)(\sin t),\ e^t-1,\ 2t-3)$

$= (t\cos t + \sin t,\ e^t-1,\ 2t-3)$

Is there a t with

$\vec{v}'(t) = (t\cos t + \sin t,\ e^t-1,\ 2t-3) = (0,0,0)$

ie.,

$t\cos t + \sin t = 0$

$e^t - 1 = 0$

and $2t-3 = 0$?

$e^t - 1 = 0 \longrightarrow e^t = 1 \longrightarrow t = 0$ only

$2t-3 = 0 \longrightarrow 2t = 3 \longrightarrow t = 3/2$ only

So, no, the last two coordinates are never 0 at the same time.

$t\cos t + \sin t = 0$?

that does happen: $t=0$! and other (ugly) times...

$t\cos t = -\sin t$

$t = -\dfrac{\sin t}{\cos t}$

$t\tan t = -t$