2. Parametric Curve Derivative

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Recitation due Oct 5, 2021 20:30 IST

Parametric

1/1 point (graded)

Consider a particle with position at time t given by $\vec{r}\,(t) = \langle t^2, \sqrt{t^2+1}\rangle$.

When the particle is at position (x, y) a certain quantity w has partial derivatives

$$\frac{\partial w}{\partial x} = e^{-x^2}, \qquad \text{and} \qquad \frac{\partial w}{\partial y} = y \tag{6.229}$$

Compute $\dfrac{dw}{dt}$.

$\dfrac{dw}{dt} =$ 2*t*e^(-t^4)+t ✔ **Answer:** e^(-t^4)*2*t + t

? INPUT HELP

Solution:

By the chain rule, we have

$$\frac{dw}{dt} = \frac{\partial w}{\partial x}\frac{dx}{dt} + \frac{\partial w}{\partial y}\frac{dy}{dt} \tag{6.230}$$

We get $\dfrac{dx}{dt}$ and $\dfrac{dy}{dt}$ from $\vec{r}\,(t) = \begin{pmatrix} t^2 \\ \sqrt{t+1} \end{pmatrix}$.

$$\frac{dx}{dt} = 2t, \qquad \frac{dy}{dt} = \frac{t}{\sqrt{t^2+1}}. \tag{6.231}$$

We get $\dfrac{\partial w}{\partial x}$ and $\dfrac{\partial w}{\partial y}$ by re-writing the given values in terms of t:

$$\frac{\partial w}{\partial x} = e^{-t^4}, \qquad \frac{\partial w}{\partial y} = \sqrt{t^2+1} \tag{6.232}$$

Now, substituting everything in to the formula for $\dfrac{dw}{dt}$, we can conclude

$$\frac{dw}{dt} = e^{-t^4}\,(2t) + t. \tag{6.233}$$

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Answers are displayed within the problem

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