Chain rule practice

TOTAL POINTS 7

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1. Consider the function $h : \mathbb{R} \to \mathbb{R}$, where $h(t) = (f \circ g)(t) = f(g(t))$ with

    5 / 5 points

$$g(t) = \mathbf{x} = \begin{bmatrix} t\cos t \\ t\sin t \end{bmatrix}, \quad t \in \mathbb{R}$$

$$f(\mathbf{x}) = \exp(x_1 x_2^2), \quad \mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \in \mathbb{R}^2$$

☑ $\dfrac{df}{d\mathbf{x}} = \begin{bmatrix} x_2^2 \exp(x_1 x_2^2) & 2x_1 x_2 \exp(x_1 x_2^2) \end{bmatrix}$

> ✓ **Correct**
>
> Yes, this is a row vector.

☐ $\dfrac{df}{d\mathbf{x}} = \begin{bmatrix} x_1 x_2^2 & 2x_2 x_1 x_2^2 \end{bmatrix}$

☑ $\dfrac{dh}{dt} = \exp(x_1 x_2^2)\left[x_2^2(\cos t - t\sin t) + 2x_1 x_2(\sin t + t\cos t)\right]$ with $x_1 = t\cos t,\ x_2 = t\sin t$

> ✓ **Correct**
>
> Yes, this is exactly what the chain-rule says.

☑ $\dfrac{dg}{dt} = \begin{bmatrix} \cos t - t\sin t \\ \sin t + t\cos t \end{bmatrix}$

> ✓ **Correct**
>
> Well done

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2. Compute $\frac{df}{dx}$ of the following function using the chain rule.

    1 / 1 point

$a = x^2$

$b = \exp(a)$

$c = a + b \quad \dfrac{dc}{dx}$ $x^2 + \exp(x^2) + \log(x^3)$

> ✓ **Correct**
>
> Excellent!

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3. What is $\dfrac{df}{dx}$ where

    1 / 1 point

$f = \cos(t^2)$

$t = x^3$

○ $-6x\sin(x^6)$

○ $6x^5\sin(x^6)$

◉ $-6x^5\sin(x^6)$

○ $-\sin(x^6)$

> ✓ **Correct**
>
> Well done!