

# Congratulations! You passed!

Grade received 100%

To pass 80% or higher

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item

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

5 / 5 points

$$\begin{bmatrix} t \cos t \\ t \sin t \end{bmatrix}$$

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

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

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

☒  $\frac{dh}{dt} = \frac{df}{dg} \frac{dg}{dt}$

☒ Correct

Yes, this is exactly what the chain-rule says.

☐  $\frac{dh}{dt} = \cos t - t \sin t + 2t \sin t (\sin t + t \cos t)$

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

☒ Correct

Yes, this is a row vector.

☒  $\frac{dh}{dt} = \exp(x_1 x_2^2) [x_2^2 (\cos t - t \sin t) + 2x_1 x_2 (\sin t + t \cos t)]$  with  $x_1 = t \cos t$ ,  $x_2 = t \sin t$

☒ **Correct**

Yes, this is what we get when we apply the chain-rule. Well done!



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



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



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

☒ **Correct**

Well done

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

1 / 1 point

$$a = x^2$$

$$b = \exp(a)$$

$$c = a + b$$

$$d = \log(c)$$

$$e = \sin(c)$$

$$f = d + e$$

- ☐  $\frac{df}{dx} = \frac{(1 + \cos(x^2 + \exp(x^2))(x^2 + \exp(x^2)))(2x + 2x \exp(x^2))}{x^2}$
- ☒  $\frac{df}{dx} = \frac{(1 + \cos(x^2 + \exp(x^2))(x^2 + \exp(x^2)))(2x + 2x \exp(x^2))}{x^2 + \exp(x^2)}$
- ☐  $\frac{df}{dx} = \frac{(1 + \cos(x^2 + \exp(x^2))(x^2 + \exp(x^2)))(2x + 2x \exp(x^2))}{x^2 + \exp(x^2) + \log(x^3)}$

☒ **Correct**  
Excellent!

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

1 / 1 point

$$f = \cos(t^2)$$

$$t = x^3$$

- ☐  $-\sin(x^6)$
- ☒  $-6x^5 \sin(x^6)$
- ☐  $6x^5 \sin(x^6)$
- ☐  $-6x \sin(x^6)$

☒ **Correct**  
Well done!