Congratulations! You passed!

Grade received 100% **To pass** 80% or higher

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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**

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

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

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

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

- ☐ $\frac{df}{d\mathbf{x}} = \begin{bmatrix} x_1 x_2^2 & 2x_2 x_1 x_2^2 \end{bmatrix}$
- ☐ $\frac{dh}{dt} = \cos t - t\sin t + 2t\sin t(\sin t + t\cos t)$
- ☑ $\frac{dg}{dt} = \begin{bmatrix} \cos t - t\sin t \\ \sin t + t\cos t \end{bmatrix}$

  Correct
  Well done

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

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

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

  Correct
  Yes, this is a row vector.

2. **Compute $\frac{df}{dx}$ of the following function using the chain rule.** **1 / 1 point**

$$a = x^2$$
$$b = \exp(a)$$
$$c = a + b$$
$$d = \log(c)$$
$$e = \sin(c)$$
$$f = d + e$$

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

  Correct
  Excellent!

3. What is $\frac{df}{dx}$ where **1 / 1 point**

$$f = \cos(t^2)$$
$$t = x^3$$

- ◉ $-6x^5\sin(x^6)$
- ○ $6x^5\sin(x^6)$
- ○ $-6x\sin(x^6)$
- ○ $-\sin(x^6)$

  Correct
  Well done!