Common Calculus Mistakes

Chain Rule: Exponential

The Goal

Find

$$\frac{d}{dx}\left(xe^{\cos x}\right)$$

The Mistake

Find the mistake:

$$\frac{d}{dx}\left(xe^{\cos x}\right) = 1 \cdot e^{\cos x} + xe^{\cos x}(\sin x)$$

Need a hint? Look carefully at the red part:

$$\frac{d}{dx}\left(xe^{\cos x}\right) = 1 \cdot e^{\cos x} + xe^{\cos x}(\sin x)$$

The Correction

$$\frac{d}{dx}\left(xe^{\cos x}\right) = 1 \cdot e^{\cos x} + xe^{\cos x}(-\sin x) = (1 - x\sin x)e^{\cos x}$$

An Explanation

Although the form of the chain rule (as well as the product rule) was applied correctly, the derivative of cos(x) was incorrectly given as sin(x); the correct derivative is -sin(x).