Common Calculus Mistakes

Chain Rule: Trigonometric Functions

The Goal

Find

$$\frac{d}{dx}(2\sin(x)-\cos(2x))$$

The Mistake

Find the mistake:

$$\frac{d}{dx}(2\sin(x)-\cos(2x))=2\cos(x)+2\sin(x)$$

Need a hint? Look carefully at the red part:

$$\frac{d}{dx}(2\sin(x)-\cos(2x))=2\cos(x)+2\sin(x)$$

The Correction

$$\frac{d}{dx}(2\sin(x)-\cos(2x))=2\cos(x)+2\sin(2x)$$

An Explanation

The chain rule was used incorrectly on cos(2x). The chain rule says:

$$\frac{d}{dx}f(g(x))=f'(g(x))g'(x)$$

For cos(2x) the outside function is f(x) = cos(x) and the inside function is g(x) = 2x. The inside function g(x) is composed with (plugged into) the derivative f'(x). The g'(x) = 2 part of the chain rule was performed correctly.

(There's another possible explanation for the mistake: the student may have incorrectly reasoned that cos(2x) is equal to 2cos(x), and then taken the derivative. Cosine is *not* a linear function, so cos(2x) ≠ 2cos(x).)

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