Common Calculus Mistakes
Product Rule: Constants

Some problems provide the opportunity for more than one mistake.

The Goal

Find

$$\frac{d}{dx}\left(x\left(\frac{400-2x}{\pi}\right)\right)$$

The Mistakes

Find the mistakes:

1.

$$\frac{d}{dx}\left(x\left(\frac{400-2x}{\pi}\right)\right) = 1\left(\frac{400-2x}{\pi}\right) - 2x$$

Need a hint? Look carefully at the red part:

$$\frac{d}{dx}\left(x\left(\frac{400-2x}{\pi}\right)\right) = 1\left(\frac{400-2x}{\pi}\right) - 2x$$

2.

$$\frac{d}{dx}\left(x\left(\frac{400-2x}{\pi}\right)\right) = \left(\frac{400-2x}{\pi}\right) + x\left(\frac{\pi-2-0}{\pi^2}\right)$$

Need a hint? Look carefully at the red part:

$$\frac{d}{dx}\left(x\left(\frac{400-2x}{\pi}\right)\right) = \left(\frac{400-2x}{\pi}\right) + x\left(\frac{\pi-2-0}{\pi^2}\right)$$

A Correct Solution

$$\frac{d}{dx}\left(x\left(\frac{400-2x}{\pi}\right)\right) = \left(\frac{400-2x}{\pi}\right) + x\left(\frac{-2}{\pi}\right) = \frac{400-4x}{\pi}$$

Explanations

Differentiating the second factor has caused problems here. In the first mistake for some reason the derivative of the second factor was computed to be -2, with the π in the denominator completely ignored. In the second mistake the quotient rule was applied incorrectly (and without need - if the denominator is a *constant*, pull it out using the constant mutiple rule and differentiate the numerator); *parentheses* should have been used around the -2 in the numerator, which should therefore have been π(-2) - 0.

The derivative in this example might be more easily handled by using the constant multiple rule to pull the 1/π out in front and multiplying out x(400 - 2x) *before* differentiating, as follows:

$$\frac{d}{dx}\left(x\left(\frac{400-2x}{\pi}\right)\right) = \frac{1}{\pi}\frac{d}{dx}(400x - 2x^2) = \frac{1}{\pi}(400 - 4x)$$