

There are many operations in mathematics, including differentiation, that require multiple steps in order to reach a final form. One of the options in the Simplify menu of Derive is “Display Step,” which will show the derivative theorems as they are applied to a particular function. The purpose of this document is to explain how you can use Derive to help you as you practice the art of computing derivatives.

Show Steps in Derive:

In order for the “Display Step” command to work, you must author an expression, and tell Derive that you want to differentiate it. *It is crucial that you click “OK” and not “Simplify” in the “Differentiate” dialog box.* Once you’ve highlighted the derivative expression, choose “Display Step” from the Simplify menu. After you analyze the results, choose “Display Step” again to see the next step in the differentiation process. Continue revealing one step at a time until the derivative appears in its final form.

Try This:

Author the expression $2x^3 + 5x + 6$. Choose “Differentiate” from the Calculus menu, make sure the variable is x and the order is 1, and click “OK.” The expression $\frac{d}{dx}(2x^3 + 5x + 6)$ should be highlighted.

- Select “Display Step” from the Simplify menu. On the left side of the algebra window, you should see the statement $\frac{d}{dx}(F(x) + y) \Rightarrow \frac{d}{dx}F(x)$. This theorem says that the derivative of the sum of a function $F(x)$ and a constant y is the same as the derivative of just $F(x)$. (Because the derivative of a constant alone is zero.) In the middle of the algebra window, you should see the highlighted result of applying this theorem:

$$\frac{d}{dx}(2x^3 + 5x).$$
- Select “Display Step” again. Now the theorem that you see at the left side of the window is the Sum Rule for derivatives: $\frac{d}{dx}(F(x) + G(x)) = \frac{d}{dx}F(x) + \frac{d}{dx}G(x)$. Derive uses an implication arrow (\Rightarrow) instead of the more appropriate equal sign, but you should ignore that. The highlighted result is $\frac{d}{dx}(2x^3) + \frac{d}{dx}(5x)$.
- Select “Display Step” again. The theorem that is displayed is the Constant Multiple Rule: $\frac{d}{dx}(a \cdot F(x)) = a \cdot \frac{d}{dx}F(x)$. In the highlighted result, $2 \frac{d}{dx}x^3 + \frac{d}{dx}(5x)$, you see

that this rule has been applied to only the first term. It will be applied to the second term in a later step.

- Select “Display Step.” The theorem Derive is applying now is the Power Rule: $\frac{d}{dx} x^n = n \cdot x^{n-1}$. Again, this theorem has only been applied to the first term, to get the highlighted result, $6x^2 + \frac{d}{dx}(5x)$. Notice that Derive has performed an extra simplification without telling you about it. The missing step is $2 \cdot 3x^2 = 6x^2$.
- Continue to select “Display Step” and analyze the results until you get $6x^2 + 5$, the final form of the derivative.

Copying Results from Derive onto Your Homework Paper:

First of all, you shouldn't be using Derive to do the textbook homework problems that you'll be turning in. Remember that you won't have access to Derive during exams, so you need to be able to compute derivatives quickly and confidently, without help. You should use Derive to help you when you're practicing – try differentiating a function yourself, and then check your work with Derive.

What you do write on your paper should flow well, with appropriate notation and equal signs. Write the example above like this:

$$\begin{aligned}\frac{d}{dx}(2x^3 + 5x + 6) &= \frac{d}{dx}(2x^3 + 5x) \\ &= \frac{d}{dx}(2x^3) + \frac{d}{dx}(5x) \\ &= 2 \frac{d}{dx}(x^3) + \frac{d}{dx}(5x) \\ &= 6x^2 + \frac{d}{dx}(5x) \\ &= \dots\end{aligned}$$

Of course, after you've practiced for a while, you'll start doing most of these steps in your head, and what you'll write on your paper is simply the final result: $\frac{d}{dx}(2x^3 + 5x + 9) = 6x^2 + 5$.