

Practicing the product rule

Practice Quiz, 6 questions

6/6 points (100%)

✓ **Congratulations! You passed!**

Next Item



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point

1.

In this quiz you'll have some practice using the product rule alongside the rules you've already learned.

In the previous video we considered the product of two functions, $A(x) = f(x)g(x)$, and saw that its derivative is given by $A'(x) = f'(x)g(x) + f(x)g'(x)$.

Which of the following is the product rule in $\frac{d}{dx}$ notation?



$$\frac{dA(x)}{dx} = \frac{df(x)}{dx} g(x) - f(x) \frac{dg(x)}{dx}$$



$$\frac{dA(x)}{dx} = \frac{df(x)}{dx} g(x) + f(x) \frac{dg(x)}{dx}$$

Correct

It's useful to be able to translate between these different notations as you will see both in the real world.



$$\frac{dA(x)}{dx} = \frac{df(x)}{dx} \frac{dg(x)}{dx} + f(x)g(x)$$



$$\frac{dA(x)}{dx} = \frac{df(x)}{dx} \frac{dg(x)}{dx}$$



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2.

When using the product rule it may help to consider how the function can be broken up into two parts, which can then be labelled $f(x)$ and $g(x)$. Use this method to differentiate the function $A(x) = (x + 2)(3x - 3)$ with respect to x .



$$A'(x) = 3$$



$$A'(x) = 3x + 6$$

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Correct

You can see that this gives the same result as expanding the brackets for $(x + 2)(3x - 3)$ and then differentiating the quadratic.

☐ $A'(x) = 3x + 3$



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3.

Remember that how we choose to label the function, $A(x)$ or $u(x)$ or $f(x)$, is not important. The key is to see if the function can be written as a product of two functions, and if so, use the product rule.

Differentiate the function $f(x) = x^3 \sin(x)$ with respect to x .

☐ $f'(x) = x^3 \sin(x) - 3x^2 \cos(x)$

☒ $f'(x) = 3x^2 \sin(x) + x^3 \cos(x)$

Correct

You identified the two functions as x^3 and $\sin(x)$ and applied the product rule correctly.

☐ $f'(x) = 3x^2 \sin(x) - x^3 \cos(x)$

☐ $f'(x) = x^3 \sin(x) + 3x^2 \cos(x)$



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4.

Using the same approach, differentiate the function $f(x) = \frac{e^x}{x}$ with respect to x .

☐ $f'(x) = \frac{e^x}{x}$

☐ $f'(x) = -\frac{e^x}{x^2}$

☒ $f'(x) = e^x \left(\frac{1}{x} - \frac{1}{x^2} \right)$

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Correct
You identified the two functions, e^x and $\frac{1}{x}$, and applied the product rule correctly.

6/6 points (100%)

☐ $f'(x) = e^x \left(\frac{1}{x} + \frac{1}{x^2} \right)$



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5.

We can extend the product rule to products of more than two functions.

Consider the function $u(x) = f(x)g(x)h(x)$. Substitute $A(x) = f(x)g(x)$ and then use the product rule *twice* to find the expression for $u'(x)$. This is the product rule for a product of three functions!

☒ $u'(x) = f'(x)g(x)h(x) + f(x)g'(x)h(x) + f(x)g(x)h'(x)$



Correct

You might be able to see from this how the product rule can be extended to as many functions as necessary.

☐ $u'(x) = f'(x)g'(x)h'(x)$

☐ $u'(x) = f(x)g(x)h'(x) + f'(x)g'(x)h(x)$

☐ $u'(x) = [f'(x)g(x) + f(x)g'(x)] h'(x)$



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6.

Using your answer to the previous question, differentiate the function $f(x) = xe^x \cos(x)$ with respect to x .

☐ $f'(x) = e^x(x \cos(x) - \sin(x))$

☒ $f'(x) = e^x[(x + 1) \cos(x) - x \sin(x)]$



Correct

You spotted that the functions are x , e^x and $\cos(x)$, then applied the product rule correctly.

☐ $f'(x) = -(1 + x)e^x \sin(x)$

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$$f'(x) = -e^x \sin(x)$$

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6/6 points (100%)

