Question

Let

$q(x) = \sin(3x^2)$

$v(x) = e^{14.55 \cdot x}$

$j(x) = \ln(4x + 13)$

Select each of the true statements from the following:

Answerlist

- For $q(x)$ the outside function is $f(x) = \sin(3x)$ and the argument is $g(x) = 3x^2$
- $q^{'}(x) = -6x\cos(3x^2)$
- For $v(x)$ the outside function is $f(x) = e^x$ and the argument is $g(x) = 14.55x$
- $v^{'}(x) = e^{14.55x}$
- For $j(x)$ the outside function is $f(x) = e^{4x}$ and the argument is $g(x) = \sin(13x)$
- $j^{'}(x) = 4x + 13$
- All of the above statements are false.

Solution

Answerlist

- False. The composition of $f(x) = \sin(3x)$ and $g(x) = 3x^2$ is
$$f(g(x)) = f(3x^2) = \sin(3(3x^2)) \neq q(x)$$
- False. The chain rule states
$$\frac{d}{dx}\sin(3x^2) = q^{'}(x) = f^{'}(g(x))g^{'}(x)$$
where the outside function is $f(x) = \sin(x)$ and the argument (or inside function) is $g(x) = 3x^2$. Since $f^{'}(x) = \cos(x)$ (not $-\cos(x)$) and $g^{'}(x) = 6x$
$$q^{'}(x) = \cos(3x^2) \cdot 6x$$
- True. For $v(x) = e^{14.55 \cdot x}$ the outside function is $f(x) = e^x$ and the argument (or inside function) is $g(x) = 14.55x$. The composition of $f(x)$ and $g(x)$ is
$$f(g(x)) = f(14.55x) = e^{14.55x} = v(x)$$
- False. What function(s) could have derivative $e^{14.55x}$? Correctly using the chain rule, a little trial and error will show that $\frac{1}{14.55}e^{14.55x}$ is an answer to this question.
- False. The composition of $f(x) = e^{4x}$ and $g(x) = \sin(13x)$ is
$$f(g(x)) = f(\sin(13x)) = e^{4\sin(13x)} \neq j(x)$$
- False. What function(s) could have derivative $4x + 13$? Using the power rule you can check that the derivative of $2x^2$ is $4x$ and the derivative of $13x$ is 13. Therefore, the derivative of $2x^2 + 13x$ is $4x + 13$ which means $2x^2 + 13x$ is an answer to this question.
- False.

Meta-information

extype: mchoice exsolution: 0010000 exname: Chain Rule