

Higher-order derivatives; notation tour

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Practice problems

1. Find the second derivative of $f(x) = 3x^3 - 7x^2 + 5$.
2. Find the second derivative of $g(x) = \cos(x)$.
3. Find the third derivative of $h(x) = e^{5x}$.

Solutions

1. Find the second derivative of $f(x) = 3x^3 - 7x^2 + 5$.

- First, find the first derivative using the power rule: $f'(x) = 9x^2 - 14x$.
- Next, differentiate the first derivative: $f''(x) = 18x - 14$.

Answer: $f''(x) = 18x - 14$

2. Find the second derivative of $g(x) = \cos(x)$.

- The first derivative of $\cos(x)$ is $-\sin(x)$.
- The derivative of $-\sin(x)$ is $-\cos(x)$.

Answer: $g''(x) = -\cos(x)$

3. Find the third derivative of $h(x) = e^{5x}$.

- The first derivative is $h'(x) = 5e^{5x}$ using the chain rule.
- The second derivative is $h''(x) = 5 \cdot 5e^{5x} = 25e^{5x}$.
- The third derivative is $h'''(x) = 25 \cdot 5e^{5x} = 125e^{5x}$.

Answer: $h'''(x) = 125e^{5x}$