LESSON MAKER PRO

Derivative Replay

Find second and higher-order derivatives.

HIGH SCHOOL · MA.912.C.2.7

MA.912.C.2.7 "Find second derivatives and derivatives of higher order."

NAME _____ DATE _____

DIFFERENTIATE AGAIN

The second derivative is the derivative of the first derivative. To find higher-order derivatives, keep differentiating one derivative at a time, using the power rule and remembering that constants differentiate to 0.

WORKED EXAMPLE

Find f''(x) for $f(x)=19x^{20}-23x^{16}+29$.

1. $f'(x)=380x^{19}-368x^{15}$.
2. $f''(x)=7220x^{18}-5520x^{14}$.

Answer: $f''(x)=7220x^{18}-5520x^{14}$

PRACTICE 6 problems

1 Find f''(x) for $f(x)=3x^4-7x^2+1$.

ANSWER _____

2 Find f'''(x) for $f(x)=x^7-2x^5$.

ANSWER _____

3 Find f''(x) for $f(x)=7/x^3+x$.

ANSWER _____

4 Find f''(x) for $f(x)=2x^6-x^3$.

ANSWER _____

5 Find f'''(x) for $f(x)=12x^4+15x^2$.

ANSWER _____

6 Find f''''(x) for $f(x)=x^9-6x^2$.

ANSWER _____

APPLY IT Show your work

1 A skateboarder's distance, in meters, after x seconds is $s(x)=2x^3+7x^2-x$. Find the skateboarder's acceleration when x=3.

WORK SPACE

ANSWER _____

2 A coding club models a virtual race car's position, in meters, with $p(x)=x^4-7x^3+2x$, where x is time in seconds. Find the car's jerk when x=4. Jerk is $p'''(x)$.

WORK SPACE

ANSWER _____

CHALLENGE One step up

For $q(x)=3x^7-2x^4+x$, find $q''''(x)$. Then explain why the x term does not appear in your result.

WORK SPACE AND ANSWER

ANSWER KEY # Derivative Replay

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find f''(x) for $f(x)=3x^4-7x^2+1$.	**$f''(x)=36x^2-14$**
2	Find f'''(x) for $f(x)=x^7-2x^5$.	**$f'''(x)=210x^4-120x^2$**
3	Find f''(x) for $f(x)=7/x^3+x$.	**$f''(x)=84/x^5$**
4	Find f''(x) for $f(x)=2x^6-x^3$.	**$f''(x)=60x^4-6x$**
5	Find f'''(x) for $f(x)=12x^4+15x^2$.	**$f'''(x)=288x$**
6	Find f''''(x) for $f(x)=x^9-6x^2$.	**$f''''(x)=3024x^5$**

PART 2 · APPLY IT

1. **50 m/s^2** Differentiate twice to get $s''(x)=12x+14$. Substitute $x=3$ to get 50.
2. **54 m/s^3** Differentiate three times to get $p'''(x)=24x-42$. Substitute $x=4$ to get 54.

CHALLENGE

$q''''(x)=2520x^3-48$. The x term becomes 0 after its second derivative.

Accept equivalent forms, including $84x^{-5}$ for $84/x^5$. For the word problems, accept correctly stated equivalent acceleration and jerk units.