LESSON MAKER PRO

Derivative Tool Kit

Use derivative rules to analyze functions and rates of change.

HIGH SCHOOL · MA.912.C.2.4

MA.912.C.2.4 "Apply the rules for finding derivatives of constants, sums, products, quotients and the Chain Rule to solve problems with functions limited to algebraic, trigonometric, inverse trigonometric, logarithmic and exponential."

NAME _____ DATE _____

CHOOSE THE RULE

The derivative of a constant is 0, and for a sum you differentiate each term. For products use (fg)'=f'g+fg', and for quotients use (f/g)'=(f'g-fg')/g^2. When one function is inside another, multiply by the derivative of the inside function, this is the Chain Rule.

WORKED EXAMPLE

Find d/dx of $y=(x^5-7)\ln x$.

1. Let $u=x^5-7$ and $v=\ln x$.
2. Use the product rule: $y'=u'v+uv'$.
3. Substitute $u'=5x^4$ and $v'=1/x$.

Answer: $y'=5x^4\ln x+(x^5-7)/x$

PRACTICE 6 problems

1 Find d/dx of $y=12$.

ANSWER _____

2 Find d/dx of $y=x^4-9x+1$.

ANSWER _____

3 Find d/dx of $y=(x^2+3)(x-4)$.

ANSWER _____

4 Find d/dx of $y=(x^3+2)/(x-1)$.

ANSWER _____

5 Find d/dx of $y=\sin(4x^2)$.

ANSWER _____

6 Find d/dx of $y=\ln(\cos x)+e^{2x}+\arctan x$.

ANSWER _____

APPLY IT Show your work

1 A student models the number of points earned in a game by $P(x)=x^3+2x^2+6x$, where x is the number of minutes played. Find P'(x), then find the rate at which points are being earned when x=2.

WORK SPACE

ANSWER _____

2 A music app models its rate of new playlist saves by $R(x)=(x^2+1)/(x+2)$, where x is the number of hours after a playlist is shared. Find R'(x), then find R'(1).

WORK SPACE

ANSWER _____

CHALLENGE One step up

For $x>0$, find d/dx of $h(x)=x^2 \ln x/e^{3x}$. Write your answer as one fraction.

WORK SPACE AND ANSWER

ANSWER KEY

Derivative Tool Kit

HIGH SCHOOL · MA.912.C.2.4

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find d/dx of y=12.	**0**
2	Find d/dx of $y=x^4-9x+1$.	**$4x^3-9$**
3	Find d/dx of $y=(x^2+3)(x-4)$.	**$2x(x-4)+x^2+3$**
4	Find d/dx of $y=(x^3+2)/(x-1)$.	**$(2x^3-3x^2-2)/(x-1)^2$**
5	Find d/dx of $y=\sin(4x^2)$.	**$8x\cos(4x^2)$**
6	Find d/dx of $y=\ln(\cos x)+e^{2x}+\arctan x$.	**$-\tan x+2e^{2x}+1/(1+x^2)$**

PART 2 · APPLY IT

1. **$P'(x)=3x^2+4x+6$; $P'(2)=26$ points per minute.** Differentiate each term of P(x). Substitute 2 into the derivative to find the instantaneous scoring rate.
2. **$R'(x)=(x^2+4x-1)/(x+2)^2$; $R'(1)=4/9$.** Use the quotient rule, then simplify the numerator. Substitute 1 into the derivative.

CHALLENGE

$h'(x)=x(2\ln x+1-3x\ln x)/e^{3x}$

Accept algebraically equivalent forms, including unsimplified product-rule or quotient-rule expressions. For the challenge, accept $e^{-3x}(2x\ln x+x-3x^2\ln x)$ as equivalent.