LESSON MAKER PRO

Derivative Rule Quest

Use derivative rules to analyze changing quantities.

HIGH SCHOOL · MA.912.C.2.3

MA.912.C.2.3 "Prove the rules for finding derivatives of constants, sums, products, quotients and the Chain Rule."

NAME _____ DATE _____

DERIVATIVE RULES

Constants differentiate to 0, and you can differentiate each term in a sum or difference separately. For a product use $u'v+uv'$, for a quotient use $(u'v-uv')/v^2$, and for a composite function multiply by the derivative of the inside.

WORKED EXAMPLE

Find d/dx of $y=(13x+17)(x+5)$.

1. Let $u=13x+17$ and $v=x+5$.
2. Apply the product rule: $y'=13(x+5)+(13x+17)$.
3. Combine like terms: $y'=26x+82$.

Answer: 26x+82

PRACTICE 6 problems

1 Find d/dx of $y=8$.

ANSWER _____

2 Find d/dx of $y=6x^7-9x^4+11x$.

ANSWER _____

3 Find d/dx of $y=(6x^3-8)(x^4+12)$.

ANSWER _____

4 Find d/dx of $y=(x^7+6)/x^3$.

ANSWER _____

5 Find d/dx of $y=(4x^3-6)^8$.

ANSWER _____

6 Find d/dx of $y=9x^4+(3x^2+8)^7$.

ANSWER _____

APPLY IT Show your work

1 The esports club models the number of live viewers, in hundreds, x hours after a tournament stream begins by $V(x)=(x+6)(x^2+8)$. Find the instantaneous rate that viewers are joining at x=3. Give your answer in viewers per hour.

WORK SPACE

ANSWER _____

2 A fitness app models a challenge score by $S(x)=(x^2+7)^3$, where x is the number of workout sessions. Treat x as continuous. Find the instantaneous change in score at x=3.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Assume f and g are differentiable. Use the limit definition of a derivative and limit laws to prove that d/dx[f(x)+g(x)]=f'(x)+g'(x).

WORK SPACE AND ANSWER

ANSWER KEY # Derivative Rule Quest

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find d/dx of y=8.	**0**
2	Find d/dx of $y=6x^7-9x^4+11x$.	**$42x^6-36x^3+11$**
3	Find d/dx of $y=(6x^3-8)(x^4+12)$.	**$18x^2(x^4+12)+(6x^3-8)(4x^3)$**
4	Find d/dx of $y=(x^7+6)/x^3$.	**$[7x^6(x^3)-(x^7+6)(3x^2)]/x^6$**
5	Find d/dx of $y=(4x^3-6)^8$.	**$96x^2(4x^3-6)^7$**
6	Find d/dx of $y=9x^4+(3x^2+8)^7$.	**$36x^3+42x(3x^2+8)^6$**

PART 2 · APPLY IT

1. **7,100 viewers per hour** Use the product rule: $V'(x)=(x^2+8)+2x(x+6)$. At x=3, V'(3)=71 hundred viewers per hour, which is 7,100 viewers per hour.
2. **4,608 points per session** Use the Chain Rule: $S'(x)=6x(x^2+7)^2$. At x=3, $S'(3)=18(16)^2=4{,}608$ points per session.

CHALLENGE

lim h->0 {[f(x+h)+g(x+h)]-[f(x)+g(x)]}/h = lim h->0 {[f(x+h)-f(x)]/h + [g(x+h)-g(x)]/h} = lim h->0 [f(x+h)-f(x)]/h + lim h->0 [g(x+h)-g(x)]/h = f'(x)+g'(x).

Accept algebraically equivalent derivatives, including correct unsimplified product-rule and quotient-rule forms. For the quotient problem, the derivative is valid for x not equal to 0.