

TOPIC: PRODUCT & QUOTIENT RULES

The Product Rule

♦ The derivative of $f(x) \cdot g(x)$ is *NOT* equal to $f'(x) \cdot g'(x)$. Instead, use the product rule!

RULES OF DIFFERENTIATION		
Name	Rule	Example
Product	$\frac{d}{dx}[f(x) \cdot g(x)] = \text{ } \cdot \text{ } + \text{ } \cdot \text{ }$  $d(\text{ }) + d(\text{ })$	$h(x) = (x - 5)(2x + 9)$ $h'(x) = (\text{ }) \cdot \text{ } + (\text{ }) \cdot \text{ }$

EXAMPLE Find the derivative using the product rule.

$y = (2x^2 - 1)(3 + x^3)$

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EXAMPLE

Find the derivative of y by **(A)** using the product rule and **(B)** multiplying out the expression & using the power rule.

$$y = 4x^2(8 - x^3)$$

PRACTICE

Find the derivative of each function.

(A)

$$y = (3x + 5)^2$$

(B)

$$f(t) = 2t(t^{-3} + t^{2/3})$$

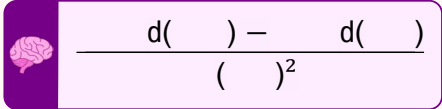
EXAMPLE

Find the slope of the tangent line to the curve $y = (x^2 - 5)(6x + 1)$ at $x = 2$.

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The Quotient Rule

◆ The derivative of $\frac{f(x)}{g(x)}$ is *NOT* equal to $\frac{f'(x)}{g'(x)}$. Instead, use the quotient rule!

RULES OF DIFFERENTIATION		
Name	Rule	Example
Quotient	$\frac{d}{dx} \left[\frac{f(x)}{g(x)} \right] = \frac{d(x) - d(x)}{(x)^2}$ 	$h(x) = \frac{x}{3x - 4}$ $h'(x) = \underline{\hspace{2cm}}$

EXAMPLE

Find the derivative using the quotient rule.

$$y = \frac{2x^2 - 1}{3 - x^3}$$

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PRACTICE

Find the derivative of the function.

(A)

$$y = \frac{2 - 3t}{4t^2 + 7}$$

(B)

$$f(x) = \frac{2x - 1}{x^3 + 2}$$

(C)

$$g(y) = \frac{5y^2 + 2y - 1}{y^2 - 2}$$

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EXAMPLE

Find the derivative.

$$y = \frac{(x+1)(x^2-3x)}{x^3}$$

EXAMPLE

Given that $f(2) = 4$, $f'(2) = -1$ and $g(2) = 3$, $g'(2) = 0$, find $h'(2)$ if **(A)** $h(x) = f(x)g(x)$ and **(B)** $h(x) = \frac{f(x)}{g(x)}$.

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EXAMPLE

The population of a species of bird is given by the function $P(t) = \frac{6t+5}{0.3t^2+2}$, where t is the time in years. Find $P'(t)$ and interpret its meaning.