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	$\frac{d}{dx}[f(x) \cdot g(x)] =$ _____ $\cdot$ _____ $+$ _____ $\cdot$ _____  d( ) + d( )	$h(x) = (x-5)(2x+9)$ $h'(x) =$ (_____) $\cdot$ ___ $+$ (_____) $\cdot$ ___

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 ($\boldsymbol{A}$) using the product rule and ($\boldsymbol{B}$) multiplying out the expression & using the power rule.

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

PRACTICE Find the derivative of each function.

($\boldsymbol{A}$)

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

($\boldsymbol{B}$)

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

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

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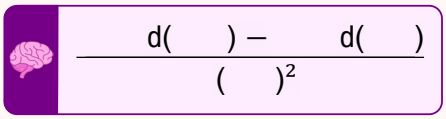
The Quotient Rule

◆ 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	$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] =$ _____ 	$h(x) = \frac{x}{3x-4}$ $h'(x) =$ _____

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.

$(\boldsymbol{A})$

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

$(\boldsymbol{B})$

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

$(\boldsymbol{C})$

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

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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 $(\boldsymbol{A})\ h(x) = f(x)g(x)$ and $(\boldsymbol{B})\ h(x) = \frac{f(x)}{g(x)}$.

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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.