LESSON 3-2 PRODUCT AND QUOTIENT RULES, CALCULATOR DIFFERENTIATION

Product Rule: $\frac{d}{dx}\left(f(x)\cdot g(x)\right)=f(x)g'(x)+g(x)f'(x)$ or $\boxed{\frac{d}{dx}(f\cdot s)=fs'+sf'}$

Quotient Rule: $\frac{d}{dx}\frac{f(x)}{g(x)}=\frac{g(x)f'(x)-f(x)g'(x)}{\left(g(x)\right)^2}$ or $\boxed{\frac{d}{dx}\frac{t}{b}=\frac{bt'-tb'}{b^2}}$

Examples: Differentiate.

1. $f(x)=\left(3x^2-2\right)\left(2x+3\right)$

$P.R:\ f'(x)=(3x^2-2)(2)+(2x+3)(6x)$
$=6x^2-4+12x^2+18x$
$=18x^2+18x-4$

or $f(x)=6x^3+9x^2-4x-6$
$f'(x)=18x^2+18x-4$

2. $y=\frac{2x^2-4x+3}{2-3x}$

$Q.R:\ y'=\frac{(2-3x)(4x-4)-(2x^2-4x+3)(-3)}{(2-3x)^2}$

3. $y=\frac{-9}{5x^2}=-\frac{9}{5}x^{-2}$

$y'=\frac{18}{5}x^{-3}=\frac{18}{5x^3}$

or

$Q.R:\ y'=\frac{(5x^2)(0)-(-9)(10x)}{(5x^2)^2}=\frac{90x}{25x^4}=\frac{18}{5x^3}$

Calculator Differentiation

A TI-83 calculator can be used to find the value of a derivative at a specific point using $\frac{dy}{dx}$ in the calculate menu or nDeriv in the math menu. It can also graph the derivative of a given function using nDeriv in the math menu. Since nDeriv works for both of these situations, and in some situations is more accurate, it is the recommended method.

4. If $f(x)=x^3+3^x$, find $f'(2)$. Calculator $\frac{dy}{dx}=21.887$ or 21.888

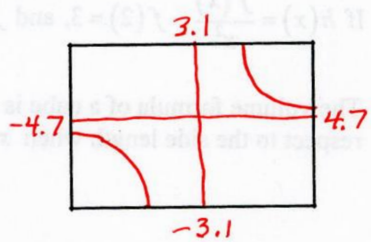
$f'(2)=$ nDeriv $\left(x^3+3^x,x,2\right)=$ 21.887 or 21.888

5. If $g(x)=\ln\left(x^2-3\right)$, find $g'(2)$, $g'(4)$, and sketch a graph of $g'(x)$.

Hint: To save time and avoid confusing parentheses, let $y_1=\ln\left(x^2-3\right)$.

$g'(2)=$ nDeriv $(y_1,x,2)=$ 4.000 $\qquad g'(4)=$ .615

To graph $g'(x)$, let $y_2=$ nDeriv(y_1,x,x).
zoom decimal



6. If $f(x)=|x|$, find $f'(0)$.

f′(0) does not exist in spite of what the calculator suggests (sharp turn)