Calculus

Derivative Rules

Name of Rule	**Rule**
Constant: *The derivative of a constant is zero.	$(c)' = 0$
Constant Multiple Rule: *The derivative of a constant multiple of a function is the constant multiplied by the derivative of the function.	$(cf)' = c \cdot f'$, $(x)' = 1$, and $(cx)' = c$
Sum and Difference Rule: *The derivative of a sum or difference is the sum or difference of the derivatives.	$(f \pm g)' = f' \pm g'$
Product Rule: *The derivative of a product is the first function times the derivative of the second plus the second function times the derivative of the first.	$(f \cdot g)' = f \cdot g' + g \cdot f'$
Multi-Product Rule: *The derivative of a product is the first function times the derivative of the second plus the second function times the derivative of the first.	$(f \cdot g \cdot h)' = f' \cdot g \cdot h + f \cdot g' \cdot h + f \cdot g \cdot h'$
Quotient Rule: *The derivative of a quotient is the second function times the derivative of the first minus the first function times the derivative of the second, all over the second function squared.	$\left(\frac{f}{g}\right)' = \frac{g \cdot f' - f \cdot g'}{g^2}$
Power Rule: *The derivative of a power is the power multiplied by the original function with one subtracted from the exponent. *The **base** has the variable.	$(f^n)' = n \cdot f^{n-1} \cdot f'$ Also, $\left(\sqrt{f}\right)' = \frac{1}{2\sqrt{f}} \cdot f'$.
Exponential: *The **exponent** has the variable.	$\left(a^f\right)' = \ln a \cdot a^f \cdot f'$ Also, $(e^x)' = e^x$ and $(e^f)' = e^f \cdot f'$
Doubly-Exponential: *The base and the exponent both have variables. This combines the power and exponential rules.	$\left(f^g\right)' = \underbrace{g \cdot f^{g-1} \cdot f'}_{\text{Power}} + \underbrace{\ln f \cdot f^g \cdot g'}_{\text{Exponential}}$

Logarithm:	$\left(\log_a \lvert f \rvert\right)' = \frac{1}{\ln a} \cdot \frac{1}{f} \cdot f'$
Natural Log:	$\left(\ln f\right)' = \frac{1}{f} \cdot f'$ Also, $\left(\ln x\right)' = \frac{1}{x}$.
Sine:	$\left(\sin f\right)' = \cos f \cdot f'$
Cosine:	$\left(\cos f\right)' = -\sin f \cdot f'$
Tangent:	$\left(\tan f\right)' = \sec^2 f \cdot f'$
Cotangent:	$\left(\cot f\right)' = -\csc^2 f \cdot f'$
Secant:	$\left(\sec f\right)' = \sec f \cdot \tan f \cdot f'$
Cosecant:	$\left(\csc f\right)' = -\csc f \cdot \cot f \cdot f'$
Arcsine:	$\left(\sin^{-1} f\right)' = \frac{1}{\sqrt{1-f^2}} \cdot f'$
Arccosine:	$\left(\cos^{-1} f\right)' = \frac{-1}{\sqrt{1-f^2}} \cdot f'$
Arctangent:	$\left(\tan^{-1} f\right)' = \frac{1}{1+f^2} \cdot f'$
Arccotangent:	$\left(\cot^{-1} f\right)' = \frac{-1}{1+f^2} \cdot f'$
Arcsecant: *Mathematicians cannot agree on this.	$\left(\sec^{-1} f\right)' = \frac{1}{\lvert f \rvert} \cdot \frac{1}{\sqrt{f^2-1}} \cdot f'$
Arccosecant: *Mathematicians cannot agree on this.	$\left(\csc^{-1} f\right)' = \frac{-1}{\lvert f \rvert} \cdot \frac{1}{\sqrt{f^2-1}} \cdot f'$
Absolute Value Rule: *This rule is rarely used.	$\left(\lvert f \rvert\right)' = \frac{f}{\lvert f \rvert} \cdot f'$

Different Symbolism for "derivative": instantaneous slope or rate of change, $\left(\cos x\right)'$, $\frac{d\left(\cos x\right)}{dx}$, y', $f'(x)$, D_x