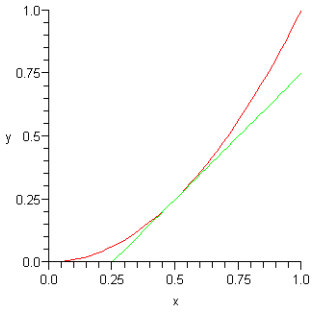
DIFFERENTIATION REVIEW

Let $y = f(x)$ be a differentiable function. Then,



$\frac{dy}{dx} = f'(x) =$ instantaneous rate of change = slope of tangent line = $\lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

Differentiation Formulas:

1. Constant Rule: If $y = c$ is a constant, then $\frac{dy}{dx} = 0$.
2. Power Rule: If $y = x^n$, then $\frac{dy}{dx} = nx^{n-1}$.
3. Constant Multiplier Rule: If $y = c \cdot f(x)$, where c is a constant, then $\frac{dy}{dx} = c \cdot f'(x)$.
4. Sum Rule: If $y = f(x) + g(x)$, then $\frac{dy}{dx} = f'(x) + g'(x)$.
5. Difference Rule: If $y = f(x) - g(x)$, then $\frac{dy}{dx} = f'(x) - g'(x)$.
6. Natural Exponential Rule: If $y = e^x$, the $\frac{dy}{dx} = e^x$.
7. Natural Log Rule: If $y = \ln x$, then $\frac{dy}{dx} = \frac{1}{x}$.
8. Exponential Rule: If $y = b^x$, then $\frac{dy}{dx} = b^x \ln b$.
9. Logarithm Rule: If $y = \log_b x$, then $\frac{dy}{dx} = \frac{1}{x \cdot \ln b}$.
10. Chain Rule: If $y = f(g(x))$, then $\frac{dy}{dx} = \frac{df}{dg} \cdot \frac{dg}{dx} = f'(g(x)) \cdot g'(x)$.
11. Product Rule: If $y = f(x) \cdot g(x)$, then
$$\frac{dy}{dx} = f(x)\frac{dg}{dx} + g(x)\frac{df}{dx} = f(x) \cdot g'(x) + g(x) \cdot f'(x)$$
12. Quotient Rule: If $y = \frac{f(x)}{g(x)}$, then $\frac{dy}{dx} = \frac{g(x)\frac{df}{dx} - f(x)\frac{dg}{dx}}{[g(x)]^2} = \frac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{[g(x)]^2}$

Numerical Derivative on TI-83/84: **nDeriv**(*expression, variable, value*)