Rules of Differentiation

1) **The Constant Function Rule**
Derivative of a constant is zero, $f(x) = c$
$y' = f'(x) = 0$

2) **The Power Function Rule**
Derivative of an exponent, $f(x) = x_n$, is:
$y' = f'(x) = nx^{n-1}$

3) **Constant times a Function Rule**
$f(x) = c.g(x)$
Derivative of a constant times a function is equal to the constant times the derivative of that function:
$y' = f'(x) = c.g'(x)$

4) **The Sums of Functions Rule**
Derivative of sums and differences of two functions $f(x) = g(x) \pm h(x)$, is:
$y' = f'(x) = g'(x) \pm h'(x)$

5) **Product Rule**
Derivative of product of two functions $f(x) = g(x).h(x)$, is:
$y' = f'(x) = g'(x).h(x) + g(x).h'(x)$

6) **Quotient Rule**
The derivative of the ratio of two functions, f(x)= g(x) / h(x) is:
$$y' = f'(x) = \frac{g'(x)h(x) - h'(x)g(x)}{[h(x)]^2}$$
Where g(x) is a differentiable function

7) **The Power of a Function Rule**
The derivative of a function raised into the power of n, $f(x) = [g(x)]_n$ is:
$y' = f'(x) = n[g(x)]^{n-1} g'(x)$
Where g(x) is a differentiable function

8) If, $y = f(u)$ and $u = g(x)$, where g(x) and f(x) are both differentiable functions, then the chain rule of derivatives can be applied as follows:
$$y' = \frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

The Natural Exponential Function Rule

1) $f(x)=e^{x}$ $\qquad f'(x)=e^{x}$

2) $f(x)=e^{g(x)}$ $\qquad f'(x)=g'(x)e^{g(x)}$

3) $f(x)=ke^{g(x)}$ $\qquad f'(x)=kg'(x)e^{g(x)}$

4) $f(x)=a^{g(x)}$ $\qquad f'(x)=g'(x)a^{g(x)}\cdot\ln a$

The Natural Logarithmic Function Rule

1) $f(x)=\ln x$ $\qquad f'(x)=\dfrac{1}{x}$

2) $f(x)=\ln g(x)$ $\qquad f'(x)=\dfrac{g'(x)}{g(x)}$

3) $f(x)=\log_a g(x)=\dfrac{\ln g(x)}{\ln a}$ $\qquad f'(x)=\dfrac{g'(x)}{g(x)\ln a}$

Best wishes

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