- Definitions:

$$\left.\frac{df}{dx}\right|_a = \frac{df}{dx}(a) = f'(a) = \lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$$
$$\frac{d}{dx}f(x) = f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$

- General Rules:

$\frac{d}{dx}\left[af(x) \pm bg(x)\right] = af'(x) \pm bg'(x)$ $\qquad$ $a$ and $b$ fixed constants

Product rule:
$\frac{d}{dx}\left[f(x)g(x)\right] = f'(x)g(x) + f(x)g'(x)$ $\qquad$ $(fg)' = f'g + fg'$

Quotient rule:
$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x)-f(x)g'(x)}{g^2(x)}$ $\qquad$ $\left(\frac{f}{g}\right)' = \frac{f'g-fg'}{g^2}$

Chain rule:
$\frac{d}{dx}\left[f(g(x))\right] = f'(g(x))g'(x)$ $\qquad$ $\frac{d}{dx}f(u) = f'(u)u'$
$\frac{d}{dx}f(u) = \left.\frac{df}{du}\right|_{u(x)}\frac{du}{dx}$ $\qquad$ $\frac{d}{dx}f(u) = \frac{df}{du}\frac{du}{dx}$

- Specific functions:

$\frac{d}{dx}x^p = px^{p-1}$ $\qquad$ $\frac{d}{dx}x = 1$ $\qquad$ $\frac{d}{dx}c = 0$

$\frac{d}{dx}\sin(x) = \cos(x)$ $\qquad$ $\frac{d}{dx}\cos(x) = -\sin(x)$

$\frac{d}{dx}\tan(x) = \sec^2(x)$ $\qquad$ $\frac{d}{dx}\cot(x) = -\csc^2(x)$

$\frac{d}{dx}\sec(x) = \sec(x)\tan(x)$ $\qquad$ $\frac{d}{dx}\csc(x) = -\csc(x)\cot(x)$

$\frac{d}{dx}e^x = e^x$ $\qquad$ $\frac{d}{dx}a^x = a^x\ln(a)$

$\frac{d}{dx}\ln(x) = \frac{1}{x}$ $\qquad$ $\frac{d}{dx}\log_b(x) = \frac{1}{x\ln(b)}$

$\frac{d}{dx}\sin^{-1}(x) = \frac{1}{\sqrt{1-x^2}}$ $\qquad$ $\frac{d}{dx}\cos^{-1}(x) = \frac{-1}{\sqrt{1-x^2}}$

$\frac{d}{dx}\tan^{-1}(x) = \frac{1}{1+x^2}$ $\qquad$ $\frac{d}{dx}\cot^{-1}(x) = \frac{-1}{1+x^2}$

$\frac{d}{dx}\sec^{-1}(x) = \frac{1}{x\sqrt{x^2-1}}$ $\qquad$ $\frac{d}{dx}\csc^{-1}(x) = \frac{-1}{x\sqrt{x^2-1}}$

- Generalizations (assume $u = u(x)$ ):

$\frac{d}{dx}u^p = pu^{p-1}\frac{du}{dx}$

$\frac{d}{dx}\sqrt{u} = \frac{1}{2\sqrt{u}}\frac{du}{dx} = \frac{u'}{2\sqrt{u}}$

$\frac{d}{dx}\sin(u) = \cos(u)\frac{du}{dx}$

$\frac{d}{dx}\cos(u) = -\sin(u)\frac{du}{dx}$

$\frac{d}{dx}\tan(u) = \sec^2(u)\frac{du}{dx}$

$\frac{d}{dx}\cot(u) = -\csc^2(u)\frac{du}{dx}$

$\frac{d}{dx}\sec(u) = \sec(u)\tan(u)\frac{du}{dx}$

$\frac{d}{dx}\csc(u) = -\csc(u)\cot(u)\frac{du}{dx}$

$\frac{d}{dx}e^u = e^u\frac{du}{dx} = u'e^u$

$\frac{d}{dx}e^{cx} = ce^{cx}$

$\frac{d}{dx}\ln(u) = \frac{1}{u}\frac{du}{dx} = \frac{u'}{u}$

$\frac{d}{dx}\ln(cx) = \frac{1}{x}$

$\frac{d}{dx}a^u = a^u\ln(a)\frac{du}{dx}$

$\frac{d}{dx}\log_b(u) = \frac{1}{u\ln(b)}\frac{du}{dx}$

$\frac{d}{dx}\sin^{-1}(u) = \frac{1}{\sqrt{1-u^2}}\frac{du}{dx}$

$\frac{d}{dx}\cos^{-1}(u) = \frac{-1}{\sqrt{1-u^2}}\frac{du}{dx}$

$\frac{d}{dx}\tan^{-1}(u) = \frac{1}{1+u^2}\frac{du}{dx}$

$\frac{d}{dx}\cot^{-1}(u) = \frac{-1}{1+u^2}\frac{du}{dx}$

$\frac{d}{dx}\sec^{-1}(u) = \frac{1}{u\sqrt{u^2-1}}\frac{du}{dx}$

$\frac{d}{dx}\csc^{-1}(u) = \frac{-1}{u\sqrt{u^2-1}}\frac{du}{dx}$

It's implied that we are working within the domain of the original function. For example, $u > 0$ for $\ln(u)$, $|u| \le 1$ for $\sin^{-1}(u)$, $|u| \ge 1$ for $\sec^{-1}(u)$, etc.