## **Math 202**

## **Differentiation Rules**

Function	Differentiation	Function	Differentiation
$\frac{d}{dx}(x^n),  n \neq -1$	$nx^{n-1}$	$\frac{d}{dx}(e^u),  u=u(x)$	$e^u$ . $u'$
$\frac{d}{dx}(f.g)$	f'.g+f.g'	$\frac{\frac{d}{dx}(a^u)}{\frac{d}{dx}(\log_a u)}$	$a^u$ . $u'$ . ln $a$
$\frac{d}{dx}\left(\frac{f}{g}\right)$	$\frac{f' \cdot g - f \cdot g'}{g^2}$ $n[f(x)]^{n-1} \cdot f'(x)$	$\frac{d}{dx}(\log_a u)$	$\frac{u'}{u \cdot \ln a}$
$\frac{d}{dx}[f(x)]^n, n$	$n[f(x)]^{n-1}.f'(x)$	$\frac{d}{dx}(\ln u)$	$\frac{u'}{u}$
$\frac{d}{dx}\left(\sqrt{f(x)}\right)$	$\frac{f'(x)}{2\sqrt{f(x)}}$		
$\frac{d}{dx}(\sin u)$	$\cos u \cdot u'$	$\frac{d}{dx}(\sin^{-1}u)$ $\frac{d}{dx}(\cos^{-1}u)$ $\frac{d}{dx}(\tan^{-1}u)$ $\frac{d}{dx}(\cot^{-1}u)$ $\frac{d}{dx}(\sec^{-1}u)$ $\frac{d}{dx}(\csc^{-1}u)$	$\frac{u'}{\sqrt{1-u^2}}$
$\frac{\frac{d}{dx}(\sin u)}{\frac{d}{dx}(\cos u)}$ $\frac{\frac{d}{dx}(\tan u)}{\frac{d}{dx}(\cot u)}$ $\frac{\frac{d}{dx}(\sec u)}{\frac{d}{dx}(\csc u)}$	- sin <i>u</i> . <i>u'</i>	$\frac{d}{dx}(\cos^{-1}u)$	$-\frac{u'}{\sqrt{1-u^2}}$
$\frac{d}{dx}(\tan u)$	sec <sup>2</sup> u.u'	$\frac{d}{dx}(\tan^{-1}u)$	$\frac{u'}{1+u^2}$ $u'$
$\frac{d}{dx}(\cot u)$	$-\csc^2 u \cdot u'$	$\frac{d}{dx}(\cot^{-1}u)$	$-\frac{u'}{1+u^2}$ $u'$
$\frac{d}{dx}(\sec u)$	sec u . tan u . u'	$\frac{d}{dx}(\sec^{-1}u)$	$\overline{u\sqrt{u^2-1}}$
$\frac{d}{dx}(\csc u)$	$-\csc u \cdot \cot u \cdot u'$	$\frac{d}{dx}(\csc^{-1}u)$	$-\frac{u'}{u\sqrt{u^2-1}}$
$\frac{d}{dx}(\sinh u)$	cosh u . u'	$\frac{d}{dx}(\sinh^{-1}u)$	$\frac{u'}{\sqrt{u^2+1}}$
$\frac{\frac{d}{dx}(\cosh u)}{\frac{d}{dx}(\tanh u)}$	$\sinh u \cdot u'$	$\frac{d}{dx}(\cosh^{-1}u)$	$rac{u'}{\sqrt{u^2-1}}$
$\frac{d}{dx}$ (tanh u)	sech <sup>2</sup> u.u'		$\frac{u'}{1-u^2}$ $u'$
$\frac{d}{dx}(\coth u)$	- csch <sup>2</sup> u . u'	$\frac{d}{dx}(\coth^{-1}u)$	$\frac{u'}{1-u^2}$ $u'$
$\frac{\frac{d}{dx}(\tanh u)}{\frac{d}{dx}(\coth u)}$ $\frac{\frac{d}{dx}(\operatorname{sech} u)}{\frac{d}{dx}(\operatorname{sech} u)}$	- sech u . tanh u . u'	$\frac{d}{dx}(\operatorname{sech}^{-1}u)$	$-\frac{u'}{u\sqrt{1-u^2}}$
$\frac{d}{dx}(\operatorname{csch} u)$	$-\operatorname{csch} u \cdot \operatorname{coth} u \cdot u'$	$\frac{\frac{d}{dx}(\tanh^{-1}u)}{\frac{d}{dx}(\coth^{-1}u)}$ $\frac{\frac{d}{dx}(\operatorname{sech}^{-1}u)}{\frac{d}{dx}(\operatorname{csch}^{-1}u)}$	$-\frac{u'}{ u \sqrt{1+u^2}}$