Derivative Rules MTH 232 Fall 2009

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1) Match the overall pattern of your problem to one of the rules.
2) Apply the rule.
3) Simplify if possible.
4) Return to (1) if necessary until there are no more derivatives to be taken.
5) Plug in the found values of all derivatives.
6) Simplify if possible.

Eq. #	Rule	Comments
23.8	$\frac{dc}{dx}=0$	c is a constant
23.10	$\frac{d(cu)}{dx}=c\frac{du}{dx}$	c is a constant and u is any function.
23.9	$\frac{dx^n}{dx}=nx^{n-1}$	$\frac{dx}{dx}=1$, $n=1$
23.11	$\frac{d}{dx}(u+v)=\frac{du}{dx}+\frac{dv}{dx}$	u and v are any functions. By extension $\frac{d}{dx}(u+v+w)=\frac{du}{dx}+\frac{dv}{dx}+\frac{dw}{dx}$, etc.
23.12	$\frac{d}{dx}(uv)=u\frac{dv}{dx}+v\frac{du}{dx}$	Extension of rule 23.12 to $\frac{d}{dx}(uvw)$ requires two applications of 23.13: $\frac{d}{dx}(uvw)=u\frac{d}{dx}(vw)+vw\frac{d}{dx}u=uv\frac{dw}{dx}+u\frac{dv}{dx}w+\frac{du}{dx}vw$ **Note:** these rules have derivatives on the right hand side. You will need to find those derivatives as well then plug back into the original rule.
23.13	$\frac{d}{dx}\left(\frac{u}{v}\right)=\frac{v\frac{du}{dx}-u\frac{dv}{dx}}{v^2}$	
23.14	$\frac{dy}{dx}=\frac{dy}{du}\frac{du}{dx}$	The chain rule. y is a function of u which, in turn, is a function of x.
23.15	$\frac{du^n}{dx}=nu^{n-1}\frac{du}{dx}$	An application of 23.9 written as $\frac{du^n}{dx}=nu^{n-1}$ and 23.14. Compare the form of the LHS with that of rule 23.9: $\frac{dx^n}{dx}$ vs. $\frac{du^n}{dx}$ In rule 23.15 the dependent variable, u, is different from the independent variable, x. They are the both x in rule 23.9.
23.16		This is the same as rule 23.15 with $n=\frac{p}{q}$.

Eq. #	Trig Rule	Comments
27.4	$\frac{d}{dx}\sin(u)=\cos(u)\frac{du}{dx}$	
27.5	$\frac{d}{dx}\cos(u)=-\sin(u)\frac{du}{dx}$	Note the minus sign.
27.6	$\frac{d}{dx}\tan(u)=\sec^2(u)\frac{du}{dx}$	
27.7	$\frac{d}{dx}\cot(u)=-\csc^2(u)\frac{du}{dx}$	Note the minus sign.
27.8	$\frac{d}{dx}\sec(u)=\sec(u)\tan(u)\frac{du}{dx}$	
27.9	$\frac{d}{dx}\csc(u)=-\csc(u)\cot(u)\frac{du}{dx}$	Note the minus sign.
27.10	$\frac{d}{dx}\sin^{-1}(u)=\frac{1}{\sqrt{1-u^2}}\frac{du}{dx}$	
27.11	$\frac{d}{dx}\cos^{-1}(u)=-\frac{1}{\sqrt{1-u^2}}\frac{du}{dx}$	Note the minus sign. Otherwise, it is the same as $\frac{d}{dx}\sin^{-1}(u)$.
27.12	$\frac{d}{dx}\tan^{-1}(u)=\frac{1}{1+u^2}\frac{du}{dx}$	
TI-89	$\frac{d}{dx}\cot^{-1}(u)=-\frac{1}{1+u^2}\frac{du}{dx}$	Note the minus sign. Otherwise, it is the same as $\frac{d}{dx}\tan^{-1}(u)$.
TI-89	$\frac{d}{dx}\sec^{-1}(u)=\left\lvert\frac{1}{u}\right\rvert\frac{1}{\sqrt{u^2-1}}\frac{du}{dx}$	
TI-89	$\frac{d}{dx}\csc^{-1}(u)=-\left\lvert\frac{1}{u}\right\rvert\frac{1}{\sqrt{u^2-1}}\frac{du}{dx}$	Note the minus sign. Otherwise, it is the same as $\frac{d}{dx}\sec^{-1}(u)$.

Eq. #	Log/Exp Rule	Comments
27.13	$\frac{d}{dx}\log_b(u)=\frac{1}{u}\log_b(e)\frac{du}{dx}$	Recall that on the TI-89, you can find the log to any base. $\log_b(u)$ is found from ◊7 which provides LOG(. For example, $\log_b(u)$ is LOG(*u*,*b*) on the TI-89. Otherwise, use equation 13.12. The value for *e* can be found from *e*^(1) using e^x on the TI-89.
27.14	$\frac{d}{dx}\ln(u)=\frac{1}{u}\frac{du}{dx}$	
27.16	$\frac{d}{dx}e^u=e^u\frac{du}{dx}$	
27.15	$\frac{d}{dx}b^u=b^u\ln b\frac{du}{dx}$	See the comments for 27.13, $\frac{d}{dx}\log_b(u)$, to find $\ln b$.