

Derivative Formulas for Math 150

Let f and g be functions of x and assume c is a constant.

$$\begin{aligned}(c)' &= 0 & (cf)' &= cf' & (f \pm g)' &= f' \pm g' \\(fg)' &= f'g + fg' & \left(\frac{1}{g}\right)' &= \frac{-g'}{g^2} & \left(\frac{f}{g}\right)' &= \frac{f'g - fg'}{g^2} \\(f(g(x)))' &= f'(g(x)) \cdot g'(x) & (f(cx))' &= c \cdot f'(cx) & (f^n)' &= nf^{n-1} \cdot f' \\(x^n)' &= nx^{n-1} & \left(\frac{1}{x^n}\right)' &= \frac{-n}{x^{n+1}} & (\sqrt{x})' &= \frac{1}{2\sqrt{x}}\end{aligned}$$

In the following, let u be a function of x .

$$\begin{aligned}(\sin(u))' &= \cos(u) \cdot u' & (\cos(u))' &= -\sin(u) \cdot u' & (\tan(u))' &= \sec^2(u) \cdot u' \\(\csc(u))' &= -\csc(u) \cot(u) \cdot u' & (\sec(u))' &= \sec(u) \tan(u) \cdot u' & (\cot(u))' &= -\csc^2(u) \cdot u' \\(\sinh(u))' &= \cosh(u) \cdot u' & (\cosh(u))' &= \sinh(u) \cdot u' & (\tanh(u))' &= \operatorname{sech}^2(u) \cdot u' \\(\sin^{-1}(u))' &= \frac{u'}{\sqrt{1-u^2}} & (\cos^{-1}(u))' &= \frac{-u'}{\sqrt{1-u^2}} & (\tan^{-1}(u))' &= \frac{u'}{1+u^2} \\(e^u)' &= e^u \cdot u' & (b^u)' &= b^u (\ln b) \cdot u' \\(\ln(u))' &= \frac{u'}{u} & (\log_b(u))' &= \frac{u'}{u \ln b}\end{aligned}$$

For functions of the form f^g use logarithmic differentiation.

$$\begin{aligned}y &= f^g \\ \ln y &= \ln f^g \\ \ln y &= g \ln f \\ (\ln y)' &= (g \ln f)' \\ y'/y &= g' \ln f + gf'/f \\ y' &= y(g' \ln f + gf'/f) \\ (f^g)' &= f^g(g' \ln f + gf'/f)\end{aligned}$$