California State University SAN MARCOS

Calculus Reference

Basic Differentiation Rules

$\frac{d}{dx}[cu] = cu'$	$\frac{d}{dx}[u \pm v] = u' \pm v'$
$\frac{d}{dx}[uv] = uv' + vu'$ (product rule)	$\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{vu' - uv'}{v^2}$ (quotient rule)
$\frac{d}{dx}[c] = 0$ (constant)	$\frac{d}{dx}[u^n] = n\,u^{n-1}\,u'$
$\frac{d}{dx}[x] = 1$	$\frac{d}{dx}[\,\lvert u\rvert\,] = \frac{u}{\lvert u\rvert}u'$ for $u \neq 0$
$\frac{d}{dx}[\ln u] = \frac{u'}{u}$ (natural log rule)	$\frac{d}{dx}[e^u] = e^u u'$
$\frac{d}{dx}[cb^x] = c\,(\ln b)\,b^x$ for $b > 0$	$\frac{d}{dx}[u^x] = u^x \ln u$

Basic Integration Formulas

$\int k\,f(u)du = k\int f(u)du$	$\int [f(u) \pm g(u)]\,du = \int f(u)du \pm \int g(u)du$
$\int du = u + C$	$\int u^n\,du = \frac{u^{n+1}}{n+1} + C,$ for $n \neq -1$
$\int \frac{du}{u} = \ln\lvert u\rvert + C$	$\int e^u\,du = e^u + C$

Properties of Exponents and Logarithms

$0 < a \neq 1, \quad 0 < b \neq 1, \quad u > 0, \quad v > 0$

Exponent		Logarithm	
Example	Rule	Rule	Example
$2^2 2^4 = 2^{2+4} = 2^6$	$b^x b^y = b^{x+y}$	$\log_b(uv) = \log_b u + \log_b v$	$\log_2(4 * 16) = \log_2 4 + \log_2 16 = 2 + 4 = 6$
$\frac{7^8}{7^6} = 7^{8-6} = 7^2 = 49$	$\frac{b^x}{b^y} = b^{x-y}$	$\log_b\left(\frac{u}{v}\right) = \log_b u - \log_b v$	$\log_2\left(\frac{8}{4}\right) = \log_2 8 - \log_2 4 = 3 - 2 = 1$
$(3^2)^3 = 3^6$	$(b^x)^y = b^{xy}$	$\log_b(u^r) = r\log_b u$	$\log_3(9^4) = 4\log_3 9 = 4 * 2 = 8$
$5^0 = 1$	$b^o = 1$	$\log_b(1) = 0$	$\log_4(1) = 0$
$8^1 = 8$	$b^1 = b$	$\log_b(b) = 1$	$\log_5(5) = 1$
$\frac{1}{4^2} = 4^{-2}$	$\frac{1}{b^x} = b^{-x}$	$\log_b\left(\frac{1}{u}\right) = -\log_b u$	$\log_2\left(\frac{1}{32}\right) = -\log_2 32 = -5$
$(20)^3 = (4 * 5)^3 = 4^3 5^3$	$(ab)^x = a^x b^x$	$\log_b(u) = \frac{\log_a u}{\log_a b}$	$\log_4 16 = \frac{\log_2 16}{\log_2 4} = \frac{4}{2} = 2$
$6 = \log_2 2^6$	$x = \log_b b^x$	$u = b^{\log_b u}$	$8 = 5^{\log_5 8}$