STUDENT SUCCESS CENTER
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

CALCULUS A REVIEW

Derivative Definition	$\frac{d}{dx}(f(x)) = f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$
Basic Properties of Derivatives	$(cf(x))' = c(f'(x))$ $(f(x) \pm g(x))' = f'(x) \pm g'(x)$ $\frac{d}{dx}(c) = 0$
Product Rule	$(f(x)g(x))' = f(x)'g(x) + f(x)g(x)'$
Quotient Rule	$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$
Power Rule	$\frac{d}{dx}(x^n) = nx^{n-1}$
Chain Rule	$\frac{d}{dx}\left(f(g(x))\right) = f'(g(x))g'(x)$
L'Hopital's Rule	If $\lim_{x\to a}\frac{f(x)}{g(x)} = \frac{0}{0}$ or $\frac{\pm\infty}{\pm\infty}$ then $\lim_{x\to a}\frac{f(x)}{g(x)} = \lim_{x\to a}\frac{f'(x)}{g'(x)}$
Limit Properties	$\lim_{x\to a}[cf(x)] = c\lim_{x\to a} f(x)$ $\lim_{x\to a}[f(x) \pm g(x)] = \lim_{x\to a} f(x) \pm \lim_{x\to a} g(x)$ $\lim_{x\to a}[f(x)g(x)] = \lim_{x\to a} f(x) \lim_{x\to a} g(x)$ $\lim_{x\to a}\left[\frac{f(x)}{g(x)}\right] = \frac{\lim_{x\to a} f(x)}{\lim_{x\to a} g(x)}$ if $\lim_{x\to a} g(x) \neq 0$ $\lim_{x\to a}[f(x)]^n = \left[\lim_{x\to a} f(x)\right]^n$

Common Derivative Formulas	$\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$ $\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$ $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$ $\frac{d}{dx}(a^x) = a^x \ln(a)$ $\frac{d}{dx}(e^x) = e^x$ $\frac{d}{dx}(\ln(x)) = \frac{1}{x}, x > 0$ $\frac{d}{dx}(\ln\|x\|) = \frac{1}{x}$ $\frac{d}{dx}(\log_a(x)) = \frac{1}{x\ln(a)}$ $\frac{d}{dx}(x) = 1$ $\frac{d}{dx}(\sin x) = \cos x$ $\frac{d}{dx}(\cos x) = -\sin x$ $\frac{d}{dx}(\tan x) = \sec^2 x$ $\frac{d}{dx}(\sec x) = \sec x \tan x$ $\frac{d}{dx}(\csc x) = -\csc x \cot x$ $\frac{d}{dx}(\cot x) = -\csc^2 x$
Integral Definition	$\int_a^b f(x)dx = \lim_{n\to\infty} \sum_{k=1}^{n} f(x_k)\Delta x$ where $\Delta x = \frac{b-a}{n}$ and $x_k = a + k\Delta x$
Fundamental Theorem	$\int_a^b f(x)dx = [F(x)]_a^b = F(b) - F(a)$ where f is continuous on $[a,b]$ and $F' = f$
Integral Properties	$\int_a^b cf(x)dx = c\int_a^b f(x)dx$ $\int_a^b f(x) \pm g(x)dx = \int_a^b f(x)dx \pm \int_a^b g(x)dx$ $\int_a^a f(x)dx = 0$ and $\int_a^b f(x)dx = -\int_b^a f(x)dx$ $\int_a^b f(x)dx + \int_b^c f(x)dx = \int_a^c f(x)dx$
Integration by Parts	$\int u\,dv = uv - \int v\,du$ where $v = \int dv$ or $\int f(x)g'(x)dx = f(x)g(x) - \int f'(x)g(x)dx$
Integration by Substitution	$\int_a^b f(g(x))\,g'(x)dx = \int_{g(a)}^{g(b)} f(u)du$ where $u = g(x)$ and $du = g'(x)dx$

Integration by Substitution (continued)	$\int k\,dx = kx + C$ $\int x^n\,dx = \frac{1}{n+1}x^{n+1} + C, n \neq -1$ $\int x^{-1}\,dx = \int \frac{1}{x}\,dx = \ln\lvert x\rvert + C$ $\int \frac{1}{ax+b}\,dx = \frac{1}{a}\ln\lvert ax+b\rvert + C$ $\int \ln(x)\;dx = x\ln(x) - x + C$ $\int e^x\,dx = e^x + C$ $\int \cos x\;dx = \sin x + C$ $\int \sin x\;dx = -\cos x + C$
Common Integrals	$\int \sec^2 x\;dx = \tan x + C$ $\int \sec x \tan x\;dx = \sec x + C$ $\int \csc x \cot x\;dx = -\csc x + C$ $\int \csc^2 x\;dx = -\cot x + C$ $\int \tan x\;dx = \ln\lvert\sec x\rvert + C$ $\int \sec x\;dx = \ln\lvert\sec x + \tan x\rvert + C$ $\int \frac{1}{a^2+u^2}\,dx = \frac{1}{a}\tan^{-1}\left(\frac{u}{a}\right) + C$ $\int \frac{1}{\sqrt{a^2-u^2}}\,dx = \sin^{-1}\left(\frac{u}{a}\right) + C$

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