STUDENT SUCCESS CENTER
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Calculus I 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	• $(c \cdot f(x))' = c \cdot f'(x)$ • $(f(x) \pm g(x))' = f'(x) \pm g'(x)$ • $\frac{d}{dx}(c) = 0$
Product Rule	$(f(x)g(x))' = f'(x)g(x) + f(x)g'(x)$
Quotient Rule	$(\frac{f(x)}{g(x)})' = \frac{f'(x)g(x)-f(x)g'(x)}{(g(x))^2}$
Power Rule	$\frac{d}{dx}(x^n) = n \cdot x^{n-1}$
Chain Rule	$\frac{d}{dx}(f(g(x)) = f'(g(x)) \cdot g'(x)$
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	• $\lim_{x\to a} [c \cdot f(x)] = c \cdot \lim_{x\to a} f(x)$ • $\lim_{x\to a} [f(x) \pm g(x)] = \lim_{x\to a} f(x) \pm \lim_{x\to a} g(x)$ • $\lim_{x\to a} [f(x) \cdot g(x)] = \lim_{x\to a} f(x) \cdot \lim_{x\to a} g(x)$ • $\lim_{x\to a} [\frac{f(x)}{g(x)}] = \frac{\lim_{x\to a} f(x)}{\lim_{x\to a} g(x)}$ if $\lim_{x\to a} g(x) \neq 0$ • $\lim_{x\to a} [f(x)]^n = [\lim_{x\to a} f(x)]^n$
Common Derivative Formulas	• $\frac{d}{dx}(x) = 1$ • $\frac{d}{dx}(e^x) = e^x$

	• $\frac{d}{dx}(a^x) = a^x \cdot ln(a)$ • $\frac{d}{dx}[ln(x)] = \frac{1}{x}$ • $\frac{d}{dx}[log_a(x)] = \frac{1}{x \cdot ln(a)}$ • $\frac{d}{dx}[sin(x)] = cos(x)$ • $\frac{d}{dx}[cos(x)] =- sin(x)$ • $\frac{d}{dx}[tan(x)] = sec^2(x)$ • $\frac{d}{dx}[cot(x)] =- csc^2(x)$ • $\frac{d}{dx}[sec(x)] = sec(x) \cdot tan(x)$ • $\frac{d}{dx}[csc(x)] =- csc(x) \cdot cot(x)$ • $\frac{d}{dx}[sin^{-1}(x)] = \frac{1}{\sqrt{1-x^2}}$ • $\frac{d}{dx}[cos^{-1}(x)] =- \frac{1}{\sqrt{1-x^2}}$ • $\frac{d}{dx}[tan^{-1}(x)] = \frac{1}{x^2+1}$ • $\frac{d}{dx}[cot^{-1}(x)] =- \frac{1}{x^2+1}$ • $\frac{d}{dx}[sec^{-1}(x)] = \frac{1}{\lvert x \rvert \sqrt{x^2-1}}$ • $\frac{d}{dx}[csc^{-1}(x)] =- \frac{1}{\lvert x \rvert \sqrt{x^2-1}}$
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 $x_k = a + k \cdot \Delta x$
Fundamental Theorem Part One	Let f be continuous on [a,b] and F is defined for all x in [a,b] by $F(x) = \int_a^x f(t)dt$. Then F is continuous on [a,b] and differentiable over (a,b) where $F'(x) = f(x)$.
Fundamental Theorem Part Two	$\int_a^b f(x)dx = F(b) - F(a)$ where $f(x)$ is continuous on $[a, b]$ and $F'(x) = f(x)$
Integral Properties	• $\int_a^b c \cdot f(x)dx = c \cdot \int_a^b f(x)dx$ • $\int_a^b [f(x) \pm g(x)]dx = \int_a^b f(x) \pm \int_a^b g(x)$

	• $\int_a^b f(x)dx + \int_b^c f(x)dx = \int_a^c f(x)dx$
Integration by Parts	$\int udv = uv - \int vdu$ where $v = \int dv$ OR $\int f(x)g'(x)dx = f(x)g(x) - \int f'(x)g(x)dx$
Integration by Substitution	$\int_a^b f(g(x))\cdot g'(x)dx = \int_{g(a)}^{g(b)} f(u)du$ where $u = g(x)$ and $du = g'(x)dx$
Common Integrals	• $\int x^n dx = \frac{1}{n+1}\cdot x^{n+1} + c,\ n \neq -1$ • $\int \frac{1}{x}dx = \int x^{-1}dx = ln\lvert x\rvert + c$ • $\int kdx = kx + c$ • $\int \frac{1}{ax+b}dx = \frac{1}{a}ln\lvert ax + b\rvert + c\ s.t.\ a\neq 0$ • $\int e^x dx = e^x + c$ • $\int ln(x)dx = xln(x) - x + c$ • $\int sin(x)dx = -cos(x) + c$ • $\int cos(x)dx = sin(x) + c$ • $\int sec^2(x)dx = tan(x) + c$ • $\int sec(x)\cdot tan(x)dx = sec(x) + c$ • $\int csc^2(x)dx = -cot(x) + c$ • $\int csc(x)\cdot cot(x)dx = -csc(x) + c$