

Limits, Derivatives & Integrals – Advanced Techniques

Limits:

		A	B
1	LCD	$\lim_{x \rightarrow 0} \frac{\frac{1}{x+3} - \frac{1}{3}}{x}$	$\lim_{x \rightarrow 4} \frac{\frac{1}{x-2} - \frac{1}{2}}{x-4}$
2	Rationalizing	$\lim_{x \rightarrow 0} \frac{\sqrt{x+4} - 2}{x}$	$\lim_{x \rightarrow 3} \frac{\sqrt{x+6} - 3}{x-3}$
3	Split Functions	$f(x) = \begin{cases} x^2 + 1, & x \leq 0 \\ 2x - 3, & x > 0 \end{cases}$ Find: $f(0)$ $\lim_{x \rightarrow 0} f(x)$ $f(4)$ $\lim_{x \rightarrow 4} f(x)$	$f(x) = \begin{cases} 3x + 2, & x < 1 \\ 2x^2 - 3x + 6 & x \geq 1 \end{cases}$ Find: $f(1)$ $\lim_{x \rightarrow 1} f(x)$ $f(-2)$ $\lim_{x \rightarrow -2} f(x)$

Derivatives:

4	Chain & Product	$f(x) = (x^2 - 1) \sqrt{x^3 - 2}$	$f(x) = \cos(x^2) \sin(\pi x)$
5	Chain & Quotient	$f(x) = \left(\frac{3x}{x^2 + 1} \right)^4$	$f(x) = \frac{\tan 3x^2}{4x^3}$
6	Chain & Chain	$f(x) = \sin^2 3x$	$f(x) = 4 \cot(3x^2)^7$
7	Implicit	Find dy/dx $x + 2xy + y = 1$	Find d ² y/dx ² $y^2 = 4x$

Integrals:

8	U-Substitution	$\int x^2 (5x^3 + 9)^4 dx$	$\int \sec^3(3x) \tan(3x) dx$
9		$\int_0^6 \frac{1}{\sqrt{2x+1}} dx$	$\int_0^\pi x \cos \pi x^2 dx$
10	Direct Substitution	$\int x \sqrt{x+1} dx$	$\int_0^3 x(x+1)^{12} dx$

Mixed:

		A	B
11	Mixed	$\frac{d}{dx} \left[\frac{4}{x^2} - 3x \sin(2x) \right]$	$\int \frac{(x^3 + 8)}{(x + 2)} dx$
12		Find dy/dx $y = \cos(x - y)$	$\lim_{x \rightarrow 25} \frac{\sqrt{x} - 5}{25 - x}$
13		$\int x \sqrt{(3x^2 - 7)} dx$	$\frac{d}{dx} \left[(3x^3 - 7x)^3 \right]$