Achievable

AP CALCULUS AB DUMP SHEET

Derivatives

Limit definition of the derivative

- The instantaneous rate of change, the limit of the difference quotient: $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$
- At a point $(a, f(a))$, the alternate definition: $f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$

Tangent and normal lines

- **Tangent line** at $(a, f(a))$: $y = f'(a)(x - a) + f(a)$, where $f'(a)$ is the slope at $x = a$
- **Point-slope form:** $y - y_1 = m(x - x_1)$
- **Normal line** at $(a, f(a))$: perpendicular to the tangent, with slope $-\frac{1}{f'(a)}$

Basic derivative rules

Rule	Formula
Constant rule (c is a constant)	$\frac{d}{dx}[c] = 0$
Constant multiple rule	$\frac{d}{dx}[cf(x)] = cf'(x)$
Power rule	$\frac{d}{dx}[x^n] = nx^{n-1}$
Product rule	$\frac{d}{dx}[f(x)g(x)] = f(x)g'(x) + f'(x)g(x)$
Quotient rule	$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$
Chain rule	$\frac{d}{dx}[f(g(x))] = f'(g(x)) \cdot g'(x)$