

Notecards Derivatives

1	What is the formal definition of a derivative?	$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$
2	What is a derivative?	A derivative is a slope at a point.
3	Power Rule $\frac{d}{dx}[x^n]$	$\frac{d}{dx}[x^n] = nx^{n-1}$
4	Constant Rule $\frac{d}{dx}[Constant]$	$\frac{d}{dx}[Constant] = 0$
5	$\frac{d}{dx}[e^x]$	$\frac{d}{dx}[e^x] = e^x$
6	Product Rule	$first \cdot \frac{d}{dx}[second] + second \cdot \frac{d}{dx}[first]$
7	Quotient Rule	$\frac{lo \cdot d[hi] - hi \cdot d[lo]}{[lo]^2}$
8	Average Rate of Change	Slope over an interval $[x_1, x_2]$ Slope = $\frac{\Delta y}{\Delta x} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$
9	Instantaneous Rate of Change	Slope at a point. A derivative
11	Position Velocity Acceleration How are they related?	Let <i>position</i> = $p(t)$ Then <i>velocity</i> = $v(t) = \frac{d}{dt}[position]$ And <i>acceleration</i> = $a(t) = \frac{d}{dt}[velocity] = \frac{d^2}{dt^2}[position]$
12	$\frac{d}{dx}[\sin x]$	$\frac{d}{dx}[\sin x] = \cos x$
13	$\frac{d}{dx}[\cos x]$	$\frac{d}{dx}[\cos x] = -\sin x$

14	$\frac{d}{dx}[\tan x]$	$\frac{d}{dx}[\tan x] = \sec^2 x$
15	$\frac{d}{dx}[\csc x]$	$\frac{d}{dx}[\csc x] = -\csc x \cot x$
16	$\frac{d}{dx}[\sec x]$	$\frac{d}{dx}[\sec x] = \sec x \tan x$
17	$\frac{d}{dx}[\cot x]$	$\frac{d}{dx}[\cot x] = -\csc^2 x$
18	Chain Rule $\frac{d}{dx}[f(g(x))]$	$\frac{d}{dx}[f(g(x))] = f'(g(x)) \cdot g'(x)$ = derivative of outside · derivative of inside
19	$\frac{d}{dx}[e^{\text{anything}}]$	$\frac{d}{dx}[e^{\text{anything}}] = e^{\text{anything}} \cdot \frac{d}{dx}[\text{anything}]$
20	Implicit Differentiation $\frac{d}{dx}[x^2 + y^2 = 1]$	When you take a derivative of a variable with respect to a different variable. $\frac{d}{dx}[x^2 + y^2 = 1] = 2x + 2y \frac{dy}{dx} = 0$
22	$\frac{d}{dx}[\sin^{-1} x]$	$\frac{d}{dx}[\sin^{-1} x] = \frac{1}{\sqrt{1-x^2}}$
23	$\frac{d}{dx}[\cos^{-1} x]$	$\frac{d}{dx}[\cos^{-1} x] = -\frac{1}{\sqrt{1-x^2}}$
24	$\frac{d}{dx}[\tan^{-1} x]$	$\frac{d}{dx}[\tan^{-1} x] = \frac{1}{x^2 + 1}$
28	$\frac{d}{dx}[b^x]$	$\frac{d}{dx}[b^x] = \ln b \cdot b^x$
29	$\frac{d}{dx}[b^{f(x)}]$	$\frac{d}{dx}[b^{f(x)}] = \ln b \cdot b^x \cdot f'(x)$
30	$\frac{d}{dx}[\ln(x)]$	$\frac{d}{dx}[\ln(x)] = \frac{1}{x}$

31	$\frac{d}{dx} [\ln (f(x))]$	$\frac{d}{dx} [\ln (x)] = \frac{1}{f(x)} \cdot f'(x)$