If You See…	You Should Think…
The derivative of a power Examples: 1. $h(x) = x^3$ 2. $h(x) = 3x^{1.5}$	**Power rule: $(x^n)' = nx^{n-1}$** Example 1: $h'(x) = 3x^2$ Example 2: $h'(x) = 3*1.5\ x^{1.5-1} = 4.5\ x^{0.5}$
The derivative of a product Examples: 1. $h(x) = x^2 \sin x$ 2. $h(x) = (x^2 + x + 1)(x^2 - 3x + 1)$	**Product rule: $(uv)' = u'v + v'u$** **<u>or</u> $(f(x)g(x))' = f'(x)g(x) + f(x)g'(x)$** Example 1: $h'(x) = 2x \sin x + x^2 \cos x$ Example 2: $h'(x) = (2x + 1)(x^2 - 3x + 1) + (2x - 3)(x^2 + x + 1)$
The derivative of a quotient Examples: 1. $h(x) = \frac{2x+1}{3x-4}$ 2. $h(x) = \frac{\sin x}{\cos x}$	**Quotient rule: $(u/v)' = (u'v - v'u)/v^2$** **or $(f(x)/g(x))' = [f'(x)g(x) - f(x)g'(x)]/[g(x)]^2$** Example 1: $h'(x) = \frac{2(3x-4) - 3(2x+1)}{(3x-4)^2}$ Example 2: $h'(x) = \frac{\cos x(\cos x) - \sin x(-\sin x)}{(\cos x)^2} = \frac{1}{\cos^2 x} = \sec^2 x$
The derivative of a function of a function Examples: 1. $h(x) = \sin(x^2)$ 2. $h(x) = \sqrt{1+x^2}$	**Chain rule: $(u(v(x))' = \frac{du(v)}{dv} \bullet \frac{dv(x)}{dx}$** **or $(f(g(x))' = \frac{df(g)}{dg} \bullet \frac{dg(x)}{dx}$** Example 1: $h'(x) = \cos(x^2) \bullet (2x)$ Example 2: $h'(x) = \left(\frac{1}{2\sqrt{1+x^2}}\right)(2x)$
The derivative of an exponential Examples: 1. $h(x) = e^x$ 2. $h(x) = e^{3x}$ 3. $h(x) = 2^x$	**Exponential rule: $(e^x)' = e^x$** Example 1: $h'(x) = e^x$ Example 2: $h'(x) = 3e^{3x}$ (using the chain rule) Example 3: $h'(x) = (2^x)' = [(e^{\ln 2})^x]' = \ln 2\,(e^{\ln 2})^x = \ln 2\,(2^x)$ (using the chain rule with v(x) = x ln2)
The derivative of a logarithm Examples: 1. $h(x) = \ln x$ 2. $h(x) = x \ln x$	**Logarithm rule: $(\ln x)' = 1/x$** Example 1: $h'(x) = \frac{1}{x}$ Example 2: $h'(x) = \ln x + x\frac{1}{x} = \ln x + 1$ (using the chain rule)
The derivative of sine and cosine	**Sine/cosine rules: $(\sin x)' = \cos x$** **$(\cos x)' = -\sin x$**
The derivative of tangent and cotangent	**Tangent/cotangent rules: $(\tan x)' = (\sin x/\cos x)' = \sec^2 x$** **$(\cot x)' = (\cos x/\sin x)' = -\csc^2 x$**
The derivative of secant and cosecant	**Secant/cosecant rules: $(\sec x)' = (1/\cos x)' = \sec x \tan x$** **$(\csc x)' = (1/\sin x)' = -\csc x \cot x$**