Example

Find $y'(x)$ if $y(x) = (\ln x^2)^\pi$.

If we first note that $y = f(g(x))$, where $f(x) = x^\pi$ and $g(x) = \ln x^2$, then by chain rule

$$\frac{dy}{dx} = f'(g(x))g'(x).$$

For this problem, $f'(x) = \pi x^{\pi-1}$ and $g'(x) = \frac{2x}{x^2}$, thus

$$\frac{dy}{dx} = \pi (\ln x^2)^{\pi-1} \cdot \frac{2}{x}.$$