Example For $f(x) = \sqrt[3]{x^4} = x^{4/3}$, find $f'(x)$.
$f'(x) = \frac{4}{3}x^{\frac{4}{3}-1} = \frac{4}{3}x^{1/3}$

Example For $g(x) = x^{\pi} \Rightarrow g'(x) = \pi x^{\pi - 1}$

Theorem (General Derivative Rules) If $f(x)$ and $g(x)$ are differentiable at x, and c is any constant then,

1) $\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}[f(x)] + \frac{d}{dx}[g(x)]$

2) $\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)]$

Proof 1) Let $y = f(x) + g(x)$

$$\begin{aligned} y' &= \lim_{h\to 0} \frac{[f(x+h) + g(x+h)] - [f(x) + g(x)]}{h} \\ &= \lim_{h\to 0} \frac{[f(x+h) - f(x)] + [g(x+h) - g(x)]}{h} \\ &= \lim_{h\to 0} \frac{[f(x+h) - f(x)]}{h} + \lim_{h\to 0} \frac{[g(x+h) - g(x)]}{h} \\ &= \frac{d}{dx}[f(x)] + \frac{d}{dx}[g(x)] \end{aligned}$$

The last equality above is due the fact that both individual limits exists because we assumed f and g to be differentiable.
You can prove the $y = f(x) - g(x)$ case the same way I did above.

2) Let $y = cf(x)$.

$$\begin{aligned} y' &= \lim_{h\to 0} \frac{cf(x+h) - cf(x)}{h} \\ &= \lim_{h\to 0} c\left[\frac{f(x+h) - f(x)}{h}\right] \\ &= c\lim_{h\to 0} \left[\frac{f(x+h) - f(x)}{h}\right] \quad \text{by Limit Law 2} \\ &= c\frac{d}{dx}[f(x)] \end{aligned}$$