

# argmax Algebra

Daniel Frederico Lins Leite

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## 1 argmax plus constant

$$\begin{aligned}\arg \max [f(x) + 1] &= \arg \max [f(x)] \\ &= [x \in D | g(x) > g(y) \forall y \in D]\end{aligned}$$

given

$$g(x) = f(x) + 1$$

so

$$\begin{aligned}&= [x \in D | [f(x) + 1 > f(y) + 1] \forall y \in D] \\ &= [x \in D | [f(x) + 1 - 1 > f(y) + 1 - 1] \forall y \in D] \\ &= [x \in D | [f(x) > f(y)] \forall y \in D] \\ &= \arg \max [f(x)]\end{aligned}$$

## 2 argmax times constant

$$\begin{aligned}\arg \max [2 * f(x)] &= \arg \max [f(x)] \\ &= [x \in D | g(x) > g(y) \forall y \in D]\end{aligned}$$

given

$$g(x) = 2 * f(x)$$

so

$$\begin{aligned}&= [x \in D | 2 * f(x) > 2 * f(y) \forall y \in D] \\ &= [x \in D | \frac{2 * f(x)}{2} > \frac{2 * f(y)}{2} \forall y \in D] \\ &= [x \in D | f(x) > f(y) \forall y \in D] \\ &= \arg \max [f(x)]\end{aligned}$$