

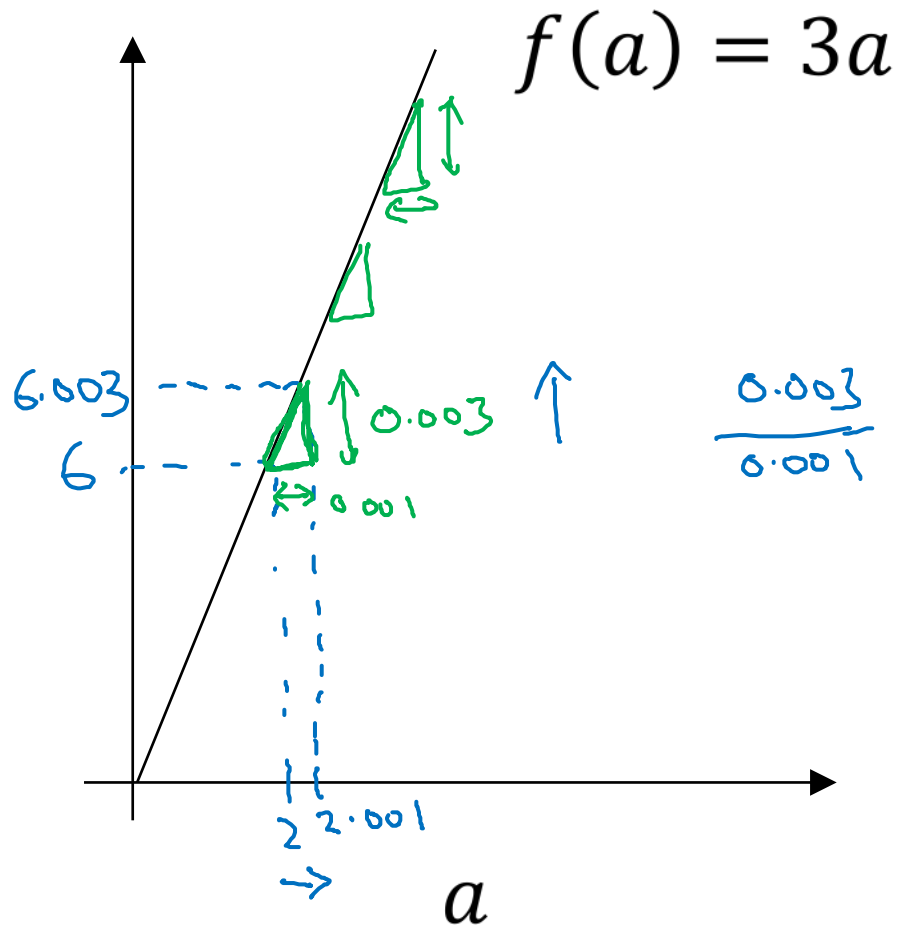


deeplearning.ai

Basics of Neural Network Programming

Derivatives

Intuition about derivatives



$$\frac{0.003}{0.001} \quad \frac{\text{height}}{\text{width}}$$

$\rightarrow a = 2 \quad f(a) = 6$
 $a = 2.001 \quad f(a) = 6.003$

\rightarrow slope (derivative) of $f(a)$
 at $a = 2$ is 3

$\rightarrow a = 5 \quad f(a) = 15$
 $a = 5.001 \quad f(a) = 15.003$
 slope at $a = 5$ is also 3

\downarrow
 $\frac{df(a)}{da} = 3 = \frac{d}{da} f(a)$
 \uparrow

$0.001 \leftarrow$
 0.000000001
 0.0000000001

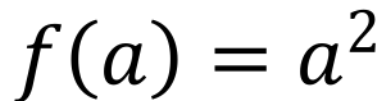


deeplearning.ai

Basics of Neural Network Programming

More derivatives
examples

0.001 ←
0.000000...01 ←



$$\frac{d}{da} a^2 = 2a$$

$$0.001$$
$$(2a) \times 0.001$$

$$\frac{d}{da} f(a) = 4 \quad \text{when} \quad a=2$$

$$\frac{d}{da} f(a) = 10 \quad \text{when} \quad a = 5$$

$$\frac{d}{da} f(a) = \frac{d}{da} a^2 = 2a$$

More derivative examples

$$f(a) = a^2$$

$$\frac{d}{da} f(a) = \frac{2a}{4}$$

$$a = 2$$

$$f(a) = 4$$

$$a = 2.001$$

$$f(a) \approx 4.004$$

$$f(a) = a^3$$

$$\frac{d}{da} f(a) = \frac{3a^2}{3 \times 2^2 = 12}$$

$$a = 2$$

$$f(a) = 8$$

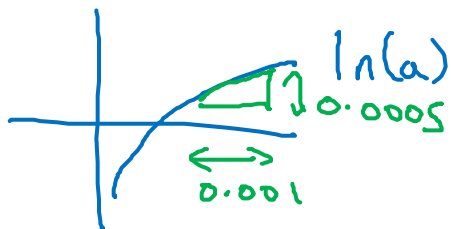
$$a = \underline{2.001}$$

$$f(a) \approx \underline{8.012}$$

$$f(a) = \log_e(a)$$

$$\ln(a)$$

$$\frac{d}{da} f(a) = \frac{1}{a}$$



$$\frac{d}{da} f(a) = \frac{1}{2}$$

$$a = 2$$

$$f(a) \approx 0.69315$$

$$\downarrow$$

$$a = \underline{2.001}$$

$$\downarrow$$

$$\underline{f(a) \approx 0.69365}$$

$$\downarrow$$

$$0.0005$$