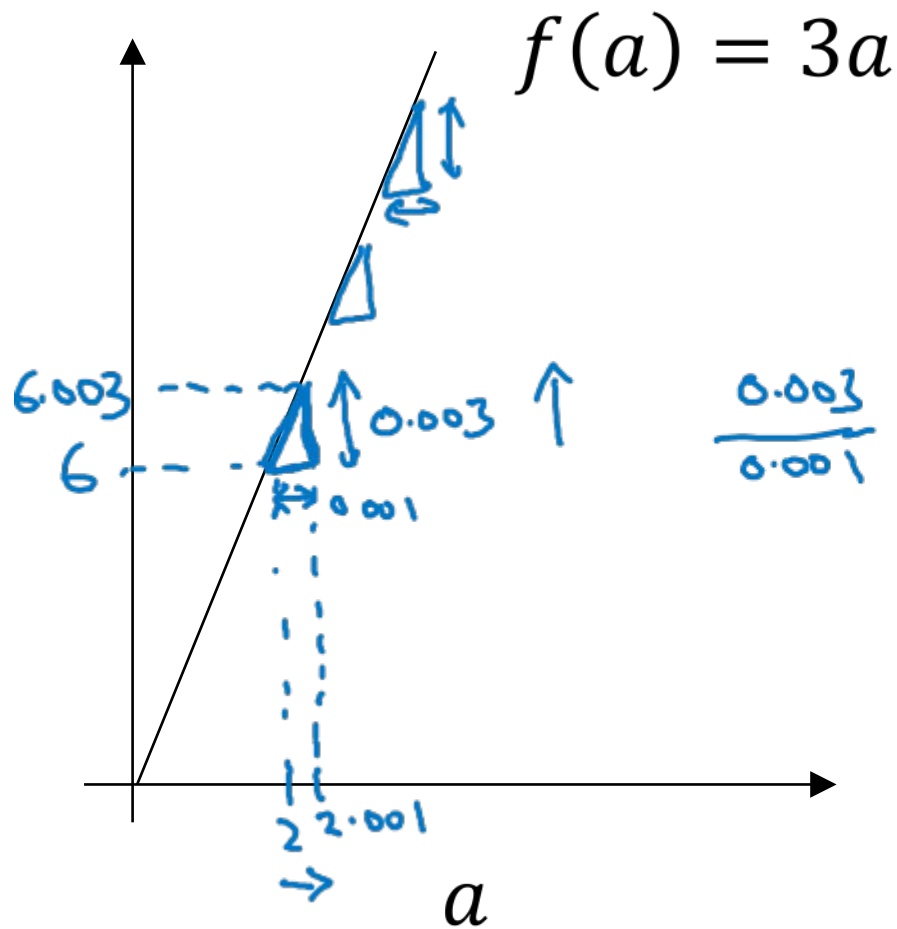




deeplearning.ai

Basics of Neural Network Programming Derivatives

Intuition about derivatives



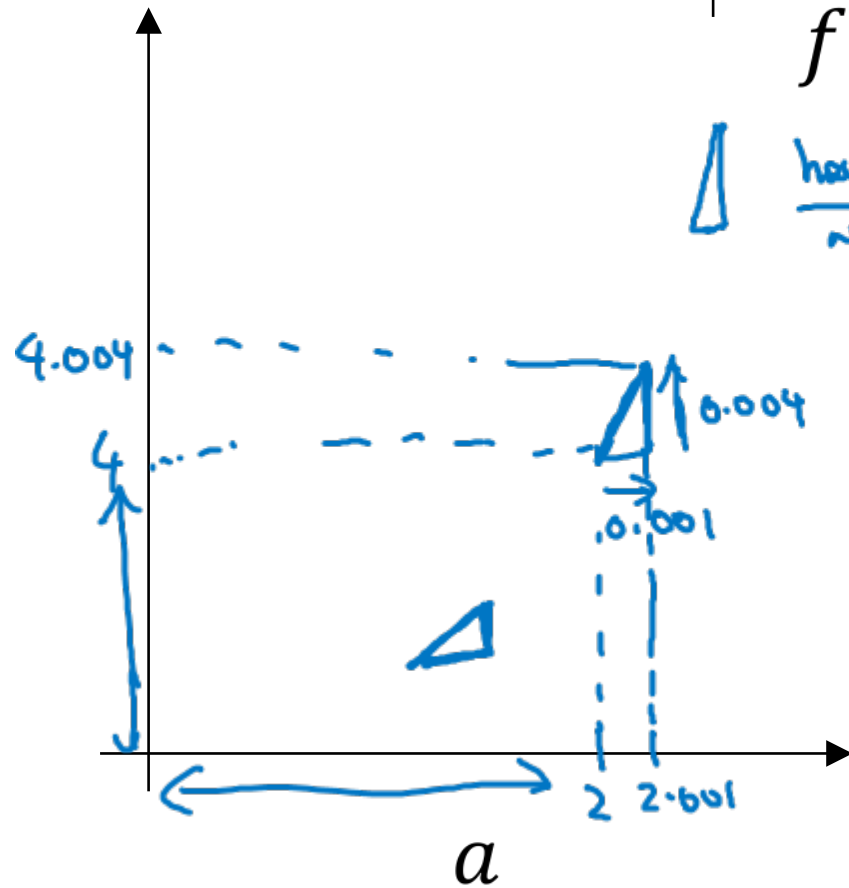
$\rightarrow a = 2 \quad f(a) = 6$
 $a = 2.001 \quad f(a) = 6.003$

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

$\frac{df(a)}{da} = 3 = \frac{d}{da} f(a)$
 $\frac{0.003}{0.001} = 3$

Intuition about derivatives



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

\triangle $\frac{\text{height}}{\text{width}}$

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

$$0.001$$

$$(2a) \times 0.001$$

0.001 \leftarrow
0.000000...01 \leftarrow

$a=2$ $f(a)=4$
 $a=2.001$ $f(a) \approx 4.004$
 $\frac{4.004 - 4}{0.001} = 4$
 slope (derivative) of $f(a)$ at $a=2$ is 4.

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

$a=5$ $f(a)=25$
 $a=5.001$ $f(a) \approx 25.010$

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

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

More derivative examples

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

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

$$a = 2$$

$$f(a) = 4$$

$$a = 2.001$$

$$f(a) \approx 4.004$$

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

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

$$a = 2$$

$$f(a) = 8$$

$$a = \underline{2.001}$$

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

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

$$\ln(a)$$

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



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

$$\downarrow a = 2$$

$$\downarrow f(a) \approx 0.69315$$

$$a = \underline{2.001}$$

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

$$\downarrow 0.0005$$

$$\swarrow \underline{0.0005}$$