

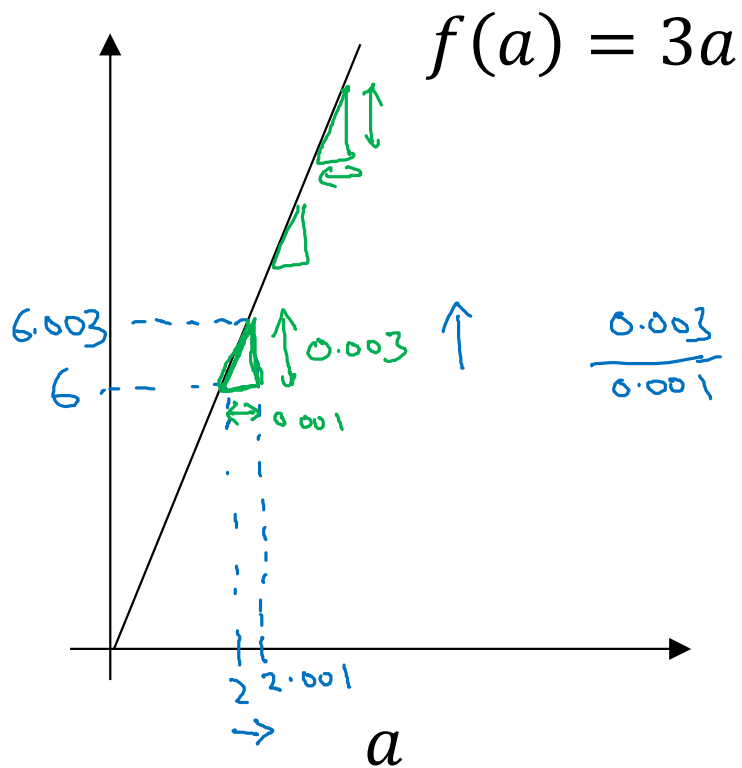


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Basics of Neural Network Programming

Derivatives

Intuition about derivatives



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

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

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

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

$0.001 \leftarrow$
 0.000000001
 0.0000000001

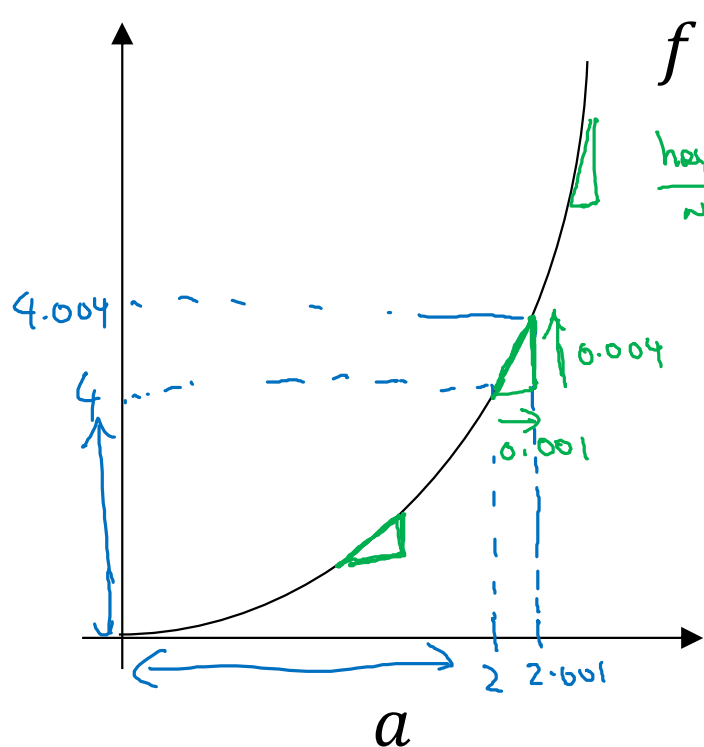


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Basics of Neural Network Programming

More derivatives examples

Intuition about derivatives



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

height
width

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

$$0.001 \times (2a) = 0.004$$

0.001 ←
0.000000...01 ←

$$a=2$$

$$f(a)=4$$

$$a=2.001$$

$$f(a) \approx 4.004$$

$$(4.004004)$$

slope (derivative) of $f(a)$ at $a=2$ is 4.

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

$$a=5$$

$$f(a)=25$$

$$a=5.001$$

$$f(a) \approx 25.010$$

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

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

More derivative examples

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

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

$$a = 2$$

$$f(a) = 4$$

$$a = 2.001$$

$$f(a) \approx 4.004$$

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

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

$$a = 2$$

$$f(a) = 8$$

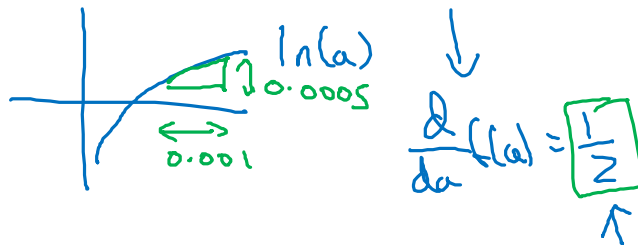
$$a = \underline{2.001}$$

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

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

$$\ln(a)$$

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



$$a = 2$$

$$f(a) \approx 0.69315$$

$$a = \underline{2.001}$$

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

$$0.0005 \leftarrow \underline{0.0005}$$

Andrew Ng