Basics of Neural Network Programming

Derivatives

deeplearning.ai

Intuition about derivatives

$$f(a) = 3a$$
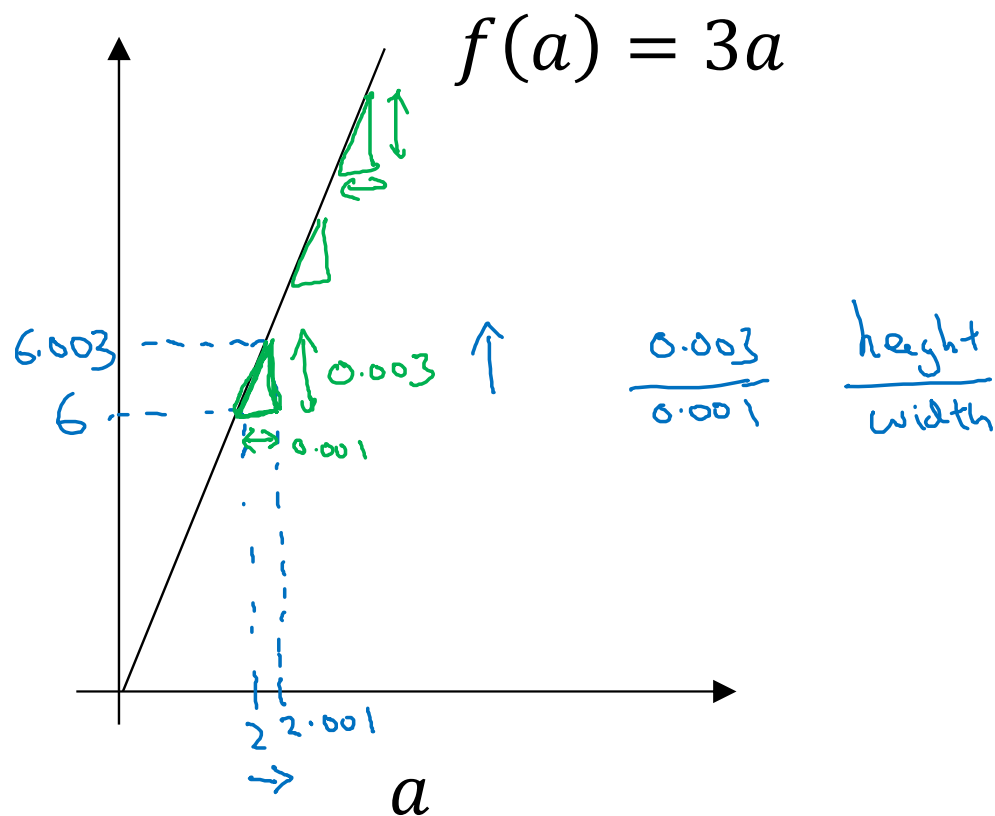
$a = 2$ $f(a) = 6$

$a = 2.001$ $f(a) = 6.003$

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

$\dfrac{0.003}{0.001}$ $\dfrac{height}{width}$

$a = 5$ $f(a) = 15$

$a = 5.001$ $f(a) = 15.003$

slope at $a = 5$ is also 3
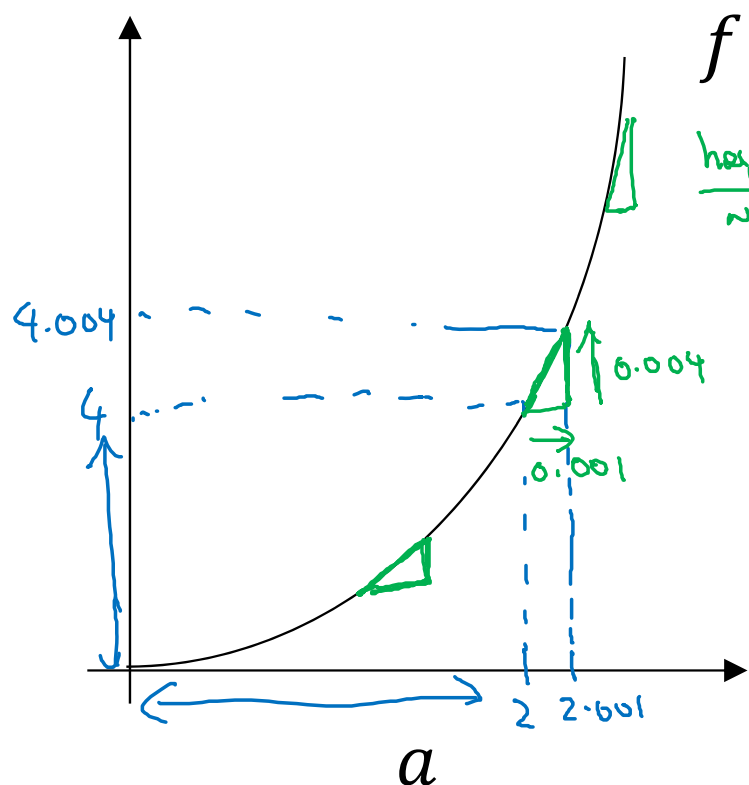
$$\dfrac{d\, f(a)}{da} = 3 = \dfrac{d}{da} f(a)$$

0.001
0.00000001
$0.00\,0000000\,1$

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Basics of Neural Network Programming

More derivatives examples

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Intuition about derivatives

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

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

$$0.001$$

$$(2a) \times 0.001$$

height / width

$a = 2$ $f(a) = 4$

$a = 2.001$ $f(a) \approx 4.004$

$(4.004\boxed{001})$

slope (derivative) of $f(a)$ at

$a = 2$ is   4.

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

$a = 5$ $f(a) = 25$

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

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

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

0.001

$0.00000....01$

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More derivative examples

$f(a) = a^2$

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

$a = 2 \qquad f(a) = 4$

$a = 2.001 \qquad f(a) \approx 4.004$

$f(a) = a^3$

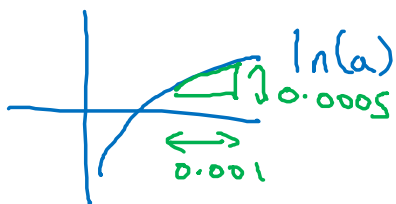$$\frac{d}{da} f(a) = \underset{3 \times 2^2 = 12}{3a^2}$$

$a = 2 \qquad f(a) = 8$

$a = 2.001 \qquad f(a) \approx 8.012$

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

$\ln(a)$

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

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

$\ln(a)$

0.0005

0.001

$a = 2 \qquad f(a) \approx 0.69315$

$a = 2.001 \qquad f(a) \approx 0.69365$

0.0005

0.0005

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