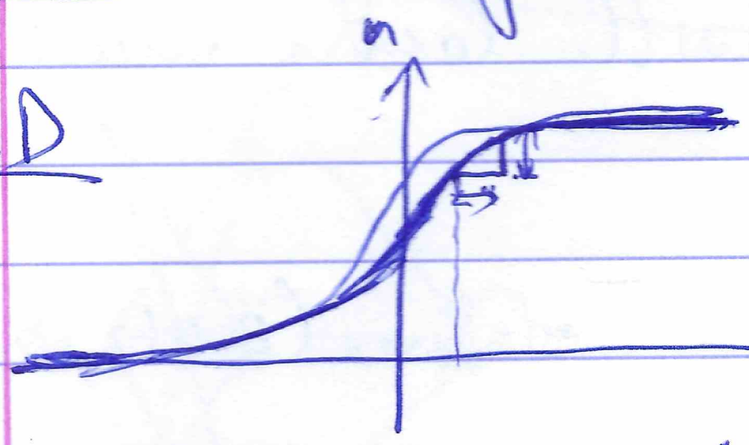
Derivatives of activation functions

SIGMOID



$$g(z) = \frac{1}{1+e^{-z}}$$

$$g'(z) = \frac{d}{dz} g(z) = \frac{1}{1+e^{-z}} \left(1 - \frac{1}{1+e^{-z}}\right)$$

$$= g(z)(1-g(z))$$

$$= a(1-a) \quad g'(z) = a(1-a)$$

if $z = 10$, $g(z) \approx 1$

$\frac{d}{dz} g(z) \approx 1(1-1) = 0$

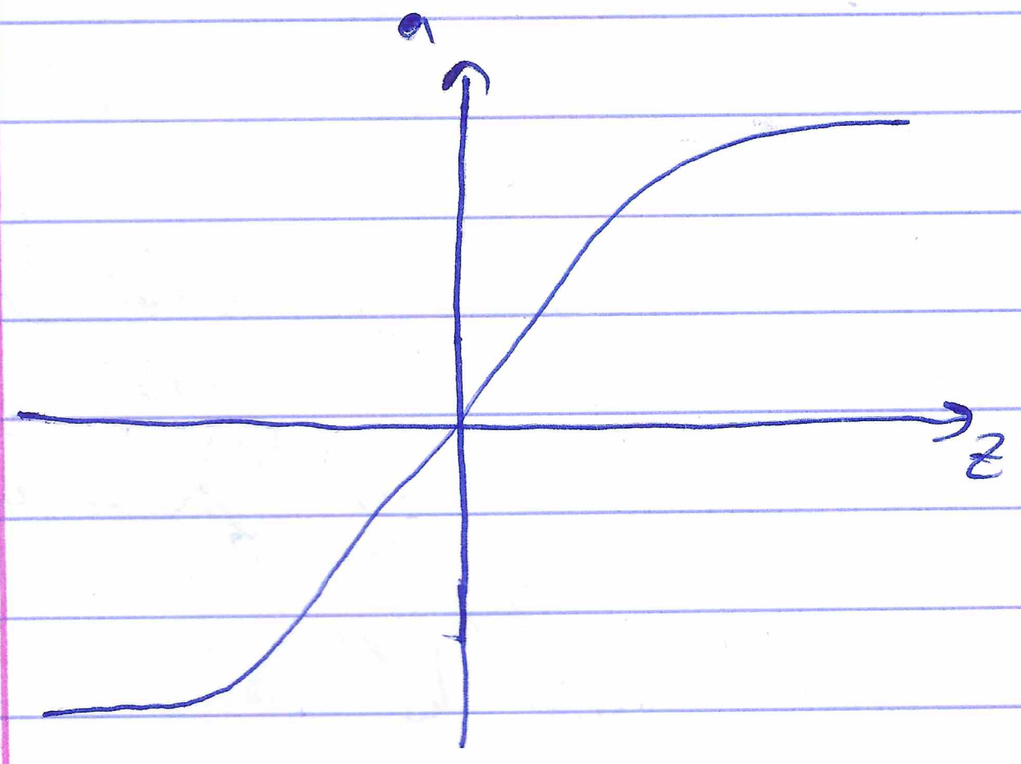
if $z = -10$, $g(z) \approx 0$

$\frac{d}{dz} g(z) \approx 0(1-0) = 0$

if $z = 0$, $g(z) = \frac{1}{2}$

$\frac{d}{dz} g(z) = \frac{1}{2}\left(1 - \frac{1}{2}\right) = \frac{1}{4}$

tanh



$$g(z) = \tanh(z)$$

$$= \frac{e^z - e^{-z}}{e^z + e^{-z}}$$

$$g'(z) = \frac{d}{dz} g(z) = 1 - (\tanh(z))^2$$

$$a = g(z), \quad g'(z) = 1 - a^2$$

if $z = 10$:
$\tanh(z) \approx 1$
$g'(z) \approx 0$

if $z = -10$:
$\tanh(z) \approx -1$
$g'(z) \approx 0$

$z = 0$:
$\tanh(z) = 0$
$g'(z) = 1$