



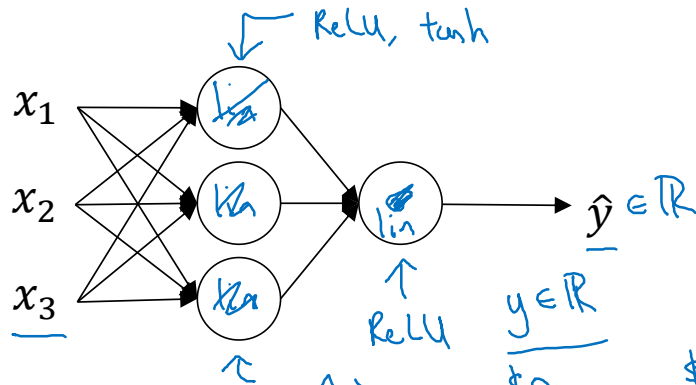
deeplearning.ai

# One hidden layer Neural Network

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Why do you  
need non-linear  
activation functions?

# Activation function



Given  $x$ :

$$\begin{aligned} \rightarrow z^{[1]} &= W^{[1]}x + b^{[1]} \\ \rightarrow a^{[1]} &= \underline{g^{[1]}(z^{[1]})} \quad z^{[1]} \\ \rightarrow z^{[2]} &= W^{[2]}a^{[1]} + b^{[2]} \\ \rightarrow a^{[2]} &= \underline{g^{[2]}(z^{[2]})} \quad z^{[2]} \end{aligned}$$

$g(z) = z$   
"linear activation function"

$$\begin{aligned} a^{[1]} = z^{[1]} &= W^{[1]}x + b^{[1]} \\ a^{[2]} = z^{[2]} &= W^{[2]}a^{[1]} + b^{[2]} \end{aligned}$$

$$\begin{aligned} a^{[2]} &= W^{[2]}(W^{[1]}x + b^{[1]}) + b^{[2]} \\ &= \underbrace{(W^{[2]}W^{[1]})}_{W'}x + \underbrace{(W^{[2]}b^{[1]} + b^{[2]})}_{b'} \\ &= W'x + b' \end{aligned}$$

$g(z) = z$