

# Backpropagation Equations

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## 1 Component form

## 2 Matrix form

$$\delta^L = \nabla_a C \odot \sigma'(z^L) \tag{1}$$

$$\delta^l = ((w^{l+1})^T \delta^{l+1}) \odot \sigma'(z^l) \tag{2}$$

$$\frac{\partial C}{\partial b_j^l} = \delta_j^l \tag{3}$$

$$\frac{\partial C}{\partial w_{jk}^l} = a_k^{l-1} \delta_j^l \tag{4}$$