5.7 5.24 is the error function in multi-class classification.

$$
\begin{aligned}
\frac{\partial E}{\partial a_k} &= \frac{\partial}{\partial a_k}\left(-\sum_{j=1}^{K}\{t_{nj}\ln y_{nj}\}\right) \\
&= -\sum_{j=1}^{K}\frac{\partial\{t_{nj}\ln y_{nj}\}}{\partial a_k} \\
&= -\sum_{j=1}^{K}t_{nj}\left(\frac{\partial\{\ln y_{nj}\}}{\partial a_k}\right) \\
&= -\sum_{j=1}^{K}t_{nj}\left(\frac{1}{y_{nj}}\right)\left(\frac{\partial y_{nj}}{\partial a_k}\right)
\end{aligned}
$$

Here, y_{nk} is given by the softmax function. We calculated it's derivative w.r.t a_k in exercise 4.17, which gave us $\frac{\partial y_j}{\partial a_k} = y_j(I_{jk} - y_k)$. Applying this result here, we get:

$$
\begin{aligned}
&= -\sum_{j=1}^{K}t_{nj}\left(\frac{1}{y_{nj}}\right)(y_{nj}(I_{jk} - y_{nk})) \\
&= -\sum_{j=1}^{K}t_{nj}(I_{jk} - y_{nk}) \\
&= -\sum_{j=1}^{K}t_{nj}I_{jk} + \sum_{j=1}^{K}t_{nj}y_{nk} \\
&= -t_{nk} + y_{nk}\sum_{j=1}^{K}t_{nj}
\end{aligned}
$$

t_{nj} will be 1 for one j, and 0 for the rest. So the expression becomes:

$$= -t_{nk} + y_{nk}$$

$$= y_{nk} - t_{nk}$$

which satisfies 5.18.