Problem 2

$$C = \frac{1}{2N} \sum_n \| w^T \phi^{(n)} - y^{(n)} \|^2$$

$$\Rightarrow \frac{\partial}{\partial w_j} = \frac{1}{2N} 2 \sum_n \| w^T \phi^{(n)} - y^{(n)} \| \frac{\partial}{\partial_j} (w^T \phi^{(n)}) = 0$$

[for minimization condition]

Now,

$$w^T \phi^{(n)} = \sum_k w_k^T \phi_k^{(n)}$$

$$\Rightarrow \frac{\partial}{\partial w_j} (w^T \phi^{(n)}) = \sum_k \frac{\partial w_k^T}{\partial w_j} \phi_k^{(n)}$$

$$= \phi_j^{(n)}$$

Now, since $\phi_j^{(n)}$ are linearly independent, if their linear combination is 0, each coefficient must be 0.

$\therefore$ this relation must hold true for all n.

$$\therefore \quad w^T \phi = y$$

I cannot figure how to get the correct form beyond this point.