1) a) $f(w) = (w - w_{LS})^T X^T X (w - w_{LS}) + c$

If $w = w_{LS}$ is the minimum, then

for $f(w) = c$, we need

$(x - w_{LS})^T X^T X (w - w_{LS}) \geq 0$

If we assume $y = X(w - w_{LS})$

Then $y^T = (w - w_{LS})^T X^T$

since $y^T y = \|y\|_2^2$ and the two norm

squared is always ≥ 0, we have

$y^T y = (w - w_{LS})^T X^T X (w - w_{LS}) \geq 0$.

Thus at $w = w_{LS}$, we have $y^T y = 0$.

& $f(w) = c$.