1.

The primal form of the problem is:

$$L_p = \frac{1}{2}\|\theta\|^2 - \sum_{i=1}^{N} \alpha^i \left[y^i (\theta^T x^i + \theta_0) - 1 \right]$$

for $\alpha_i \geq 0$

Applying the differentiation on the Lagrangian, we get

$$\frac{\partial L_p}{\partial \theta} = \theta - \sum_{i=1}^{N} \alpha^i y^i x^i = 0 \Rightarrow$$

and $$\frac{\partial L_p}{\partial \theta_0} \Rightarrow \sum \alpha^i y^i = 0$$

L_d Substituting we get:-

$$L_d = \frac{1}{2}\|\theta\|^2 - \sum_{i=1}^{N} \alpha^i \left[y^i (\theta^T x^i + \theta_0) - 1 \right]$$

$$= \frac{1}{2}\|\theta\|^2 - \theta^T \sum_{i=1}^{N} \alpha^i y^i x^i - \theta_0 \sum_{i=1}^{N} \alpha^i y^i + \sum_{i=1}^{N} \alpha^i$$

$$= \frac{1}{2}\|\theta\|^2 - \theta^T \sum_{i=1}^{N} \alpha^i y^i x^i + \sum_{i=1}^{N} \alpha^i \quad \left(\sum \alpha^i y^i = 0 \right)$$

$$= \frac{1}{2}\|\theta\|^2 - \theta^T \theta + \sum_{i=1}^{N} \alpha^i \quad \left(\theta = \sum_{i=1}^{N} \alpha^i y^i x^i \right)$$

$$= -\frac{1}{2}\|\theta\|^2 + \sum_{i=1}^{N} \alpha^i$$