1-(a) $w_0, w_1, \cdots, w_d$

$\therefore$ size of vector w is $(d+1)$

$y_1, y_2, \cdots, y_n$

$\therefore$ size of vector w is n

1-(b)
$$A = \begin{bmatrix} 1 & x_1 & x_1^2 & \cdots & x_1^d \\ 1 & x_2 & x_2^2 & \cdots & x_2^d \\ & & \vdots & & \\ 1 & x_n & x_n^2 & \cdots & x_n^d \end{bmatrix}$$

$\therefore$ size of matrix A is $n \times (d+1)$

1-(c)
$$\det A = \begin{vmatrix} 1 & x_1 & x_1^2 & \cdots & x_1^d \\ 1 & x_2 & x_2^2 & \cdots & x_2^d \\ & & \vdots & & \\ 1 & x_n & x_n^2 & \cdots & x_n^d \end{vmatrix}$$

$$= \begin{vmatrix} 1 & x_1 & x_1^2 & \cdots & x_1^d \\ 0 & x_2 - x_1 & x_2^2 - x_1^2 & \cdots & x_2^d - x_1^d \\ & & \vdots & & \\ 0 & x_n - x_1 & x_n^2 - x_1^2 & \cdots & x_n^d - x_1^d \end{vmatrix}$$

$$= \begin{vmatrix} 1 & 0 & 0 & \cdots & 0 \\ 0 & x_2 - x_1 & x_2(x_2 - x_1) & \cdots & x_2^{d-1}(x_2 - x_1) \\ & & \vdots & & \\ 0 & x_n - x_1 & x_n(x_n - x_1) & \cdots & x_n^{d-1}(x_n - x_1) \end{vmatrix}$$

$$= \prod_{i=2}^{n}(x_i - x_1) \begin{vmatrix} 1 & x_1 & \cdots & x_1^{d-1} \\ 1 & x_2 & \cdots & x_2^{d-1} \\ & & \vdots & \\ 1 & x_n & \cdots & x_n^{d-1} \end{vmatrix}$$

$$= \prod_{k=1}^{n-1}\left(\prod_{i=k+1}^{n}(x_i - x_k)\right) = \prod_{1 \le j < i \le n}(x_i - x_j)$$

1-(d). $\det A = \prod_{1 \le j < i \le n} (\alpha_i - \alpha_j)$

$\alpha_i \ne \alpha_j$ (단, $i \ne j$) 이어야 non-zero 된다.

1-(e). $Aw = y$

$A^{-1}Aw = A^{-1}y$

$w = A^{-1}y$

2 $Aw = y$

$(A^TA)^{-1}A^TAw = (A^TA)^{-1}A^Ty$

$w = (A^TA)^{-1}A^Ty$

$w = A^+y$