8.

$$X = \begin{pmatrix} x_{1,1} & x_{1,2} \\ \vdots & \vdots \\ x_{N,1} & x_{N,2} \end{pmatrix}$$

$$X^T X = \begin{pmatrix} x_{1,1} & \cdots & x_{N,1} \\ x_{1,2} & \cdots & x_{N,2} \end{pmatrix} \begin{pmatrix} x_{1,1} & x_{1,2} \\ \vdots & \vdots \\ x_{N,1} & x_{N,2} \end{pmatrix}$$

$$= \begin{pmatrix} N v_1^2 & N \rho v_1 v_2 \\ N \cdot \rho v_1 v_2 & N v_2^2 \end{pmatrix}$$