8.2

1) $$\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix} = a_{11}\,\mathrm{C}_{11} + a_{21}\,\mathrm{C}_{21}$$
$$= a_{11}\,(-1)^{1+1}\,|a_{22}| + a_{21}\,(-1)^{2+1}\,|a_{12}|$$
$$= a_{11}\,a_{22} - a_{21}\,a_{12}$$

2) $$\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = a_{11}\,\mathrm{C}_{11} + a_{21}\,\mathrm{C}_{21} + a_{31}\,\mathrm{C}_{31}$$
$$= a_{11}\,(-1)^{1+1} \begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix} + a_{21}\,(-1)^{2+1} \begin{vmatrix} a_{12} & a_{13} \\ a_{32} & a_{33} \end{vmatrix}$$
$$+ a_{31}\,(-1)^{3+1} \begin{vmatrix} a_{12} & a_{13} \\ a_{22} & a_{23} \end{vmatrix}$$
$$= a_{11}\,(a_{22}\,a_{33} - a_{32}\,a_{23}) - a_{21}\,(a_{12}\,a_{33} - a_{32}\,a_{13})$$
$$+ a_{31}\,(a_{12}\,a_{23} - a_{22}\,a_{13})$$
$$= a_{11}\,a_{22}\,a_{33} - a_{11}\,a_{32}\,a_{23} - a_{21}\,a_{12}\,a_{33} + a_{21}\,a_{32}\,a_{13}$$
$$+ a_{31}\,a_{12}\,a_{23} - a_{31}\,a_{22}\,a_{13}$$
$$= a_{11}\,a_{22}\,a_{33} + a_{13}\,a_{21}\,a_{32} + a_{12}\,a_{23}\,a_{31} - a_{12}\,a_{21}\,a_{33}$$
$$- a_{11}\,a_{23}\,a_{32} - a_{13}\,a_{22}\,a_{31}$$