I'm curious about is there any geometric property relative to negative value for determinant of matrix.

$$\det(A) > 0, \det(A) = 0, \det(A) < 0$$

I knew about some of determinant of matrix properties as following, but it seems to me that it is nothing relative to negative value of determinant of matrix

$$\det(AB) = \det(A)det(B)(Multiplicative)$$

$$\det(A) = 0 \iff A \text{ is singular}$$

$$M_{2,2} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

$$|\det(M_{2\times 2})| = |ad - bd| = \text{volumn of parallelogram}$$

$$|\det(M_{n\times n})| = \prod_{j=1}^{n} a_{i,j}(-1)^{i+j} \det(M_{i,j}) \quad \text{expansion of determinant alone the } i^{th} \text{ row}$$