Karl Gustav Jacob Jacobi 1804-1851

$$H + \frac{\partial S}{\partial t} = 0$$

Hamilton-Jacobi equation

$$H = H\left(q_1, \dots, q_N; \frac{\partial S}{\partial q_1}, \dots, \frac{\partial S}{\partial q_N}; t\right)$$

$$S = S(q_1, q_2, \dots, q_N, t) \qquad p_k = \frac{\partial S}{\partial q_k}.$$

Formulated mechanics in a way fit for waves:
extended for quantum mechanics

Analytical properties of geometrical surfaces in space.

$$\mathbf{J} = \frac{d\mathbf{f}}{d\mathbf{x}} = \begin{bmatrix} \frac{\partial \mathbf{f}}{\partial x_1} & \cdots & \frac{\partial \mathbf{f}}{\partial x_n} \end{bmatrix} = \begin{bmatrix} \frac{\partial f_1}{\partial x_1} & \cdots & \frac{\partial f_1}{\partial x_n} \\ \vdots & \ddots & \vdots \\ \frac{\partial f_m}{\partial x_1} & \cdots & \frac{\partial f_m}{\partial x_n} \end{bmatrix}$$

Jacobian