Hamiltonian systems: A two-dimensional system of differential equations is *Hamiltonian* if there is a function $H(x, y)$ such that

$$\frac{dx}{dt} = \frac{\partial H}{\partial y}$$
$$\frac{dy}{dt} = -\frac{\partial H}{\partial x}.$$

The function $H(x, y)$ is called the *Hamiltonian (function)* of the system.

Laplace transforms:

$$\mathcal{L}[y] = \int_0^\infty y(t)e^{-st}\, dt$$

$$\mathcal{L}[y'] = s\mathcal{L}[y] - y(0)$$

$$\mathcal{L}[y''] = s^2\mathcal{L}[y] - sy(0) - y'(0)$$

$y(t)$	$Y(s) = \mathcal{L}[y]$
1	$\frac{1}{s}$
e^{at}	$\frac{1}{s-a}$
$\sin \omega t$	$\frac{\omega}{s^2+\omega^2}$
$\cos \omega t$	$\frac{s}{s^2+\omega^2}$
$u_a(t)$	$\frac{e^{-sa}}{s}$
δ_a	e^{-as}
$u_a(t)f(t-a)$	$e^{-as}F(s)$
$e^{at}f(t)$	$F(s-a)$
$tf(t)$	$-\frac{dY}{ds}$