$I = C\Delta V$

$I_K = g_k(t)(V - V_K)$

$I_{ext} = C_m \frac{dV_M}{dt} + g_K(t)(V_M - V_K) + g_{Na}(t)(V_M - V_{Na}) + g_L(V_M - V_L)$

$\bar{g_K}, \bar{g_{Na}}, \bar{g_L}$

V nullcline ($\dot{V} = 0$)
$W = I + V - \frac{V^3}{3}$

W nullcline ($\dot{W} = 0$)
$W = \frac{V+a}{b}$

$\frac{b}{3}(V^*)^3 + (1-b)V^* + (a - Ib) = 0$
$W^* = \frac{V^*+a}{b}$

$$\frac{d}{dt}\begin{pmatrix} x \\ y \end{pmatrix} = J_f(V^*, W^*)\begin{pmatrix} x \\ y \end{pmatrix}$$

$$J_f(V^*, W^*) = \begin{pmatrix} 1 - (V^*)^2 & -1 \\ \phi & -b\phi \end{pmatrix}$$

$det(J_f - \lambda I) = (1 - (V^*)^2 - \lambda)(-b\phi - \lambda) + \phi = 0$

$\lambda^2 + (-1 + (V^*)^2 + b\phi)\lambda + (-b\phi + b\phi(V^*)^2 + \phi)$

$$\lambda = \frac{1}{2}\left(-((V^*)^2 - 1 + b\phi) \pm \sqrt{((V^*)^2 - 1 + b\phi)^2 - 4(-b\phi + b\phi(V^*)^2 + \phi)}\right)$$

$$\lambda = \frac{1}{2}\left(-((V^*)^2 - 1 + b\phi) \pm \sqrt{((V^*)^2 - 1 - b\phi)^2 - 4\phi}\right)$$