In the situation of two vortices in a thin slab, the free energy is:

$$F = 2[F_1 + \sum_{n=-\infty}^{\infty} U(nw) + \sum_{n=-\infty}^{\infty} U(\sqrt{x^2 + (nw)^2})] \tag{1}$$

we map this to a potential function V(x) and ignore the first two terms because they do not depend on x. We then have

$$V(x) = 2 \sum_{n=-\infty}^{\infty} U(\sqrt{x^2 + (nw)^2}) \tag{2}$$

where U is defined by

$$U(r) = \frac{\phi_0^2}{8\pi^2\lambda^2} K_0(\frac{r}{\lambda}) \tag{3}$$

and K_0 is the 0^{th} order Bessel function. Use this potential in the Schrodinger equation with

$$H\psi = E\psi \tag{4}$$

$$H = -\frac{\hbar^2}{2m}\frac{d^2}{dx^2} + V(x) \tag{5}$$

We expect ψ asymptotically to be of the form:

$$\psi = \sin(k|x| - \delta(k)) \tag{6}$$

and $\delta(k)$ to be

$$\delta(k) = ak \tag{7}$$

once this is done, the goal is to determine the value of a, because a is involved in an equation for another parameter g, which is what we are really interested in:

$$g \approx 1 - 2an_0 \tag{8}$$

where n_0 is the density of vortices.