c. To answer this part. I iterated over a range of values of width a and fractional aluminium content x. in Python.

Using $\lambda = 900nm = 0.9\mu m.$, I derived the following for $r^2 = k^2 a^2 (n_2^2 - n_1^2)$

$$= \left(\frac{2\pi}{\lambda}\right)^2 a^2 (3.59^2 - (3.59 - 0.71x + 0.091x^2)^2)$$

$$= \left(\frac{2\pi}{0.9}\right)^2 a^2 (3.59^2 - (3.59 - 0.71x + 0.091x^2)^2)$$

with a in μm.

The code ensures $r < \frac{\pi}{2}$ for single mode

It then finds solutions for $y = \gamma a$, $x = ha$,

and calculates the confinement.

Confinement Factor Γ: $\dfrac{1 + \gamma d / 2V^2}{1 + 2/\gamma d}$

$y = \gamma a \therefore 2y = \gamma d.$

$\therefore$ using solution for y $\quad \Gamma = \dfrac{1 + y/V^2}{1 + 1/y} = \dfrac{1 + y/r^2}{1 + 1/y}$