**8.5:**

The equation given in the problem should have an equals sign before exp[].

From Eq. 8.59,

$$\psi^{l+1} = A^{-1}C\psi^{l} \qquad \text{if } A^{-1} \text{ exists}$$

First we must define matrices $A$ and $C$ using Eq. 8.58 without a y dependence (i.e. $\Delta Y = \infty$).

$$A_p = a_p = \frac{2j\,n_r}{k_0\Delta z} + \frac{1}{(k_0\Delta x)^2} - 1/over2\left(n_p^2 - n_r^2\right)$$

where $n_p^{l+1} = n_p^l = n_p$ because the index profile is uniform in the z direction.

$$C_p = c_p = -a_p + \frac{4j\,n_r}{k_0\Delta z}$$

$$B = \frac{1}{2(k_0\Delta x)^2}$$

The matrices $A$ and $C$ are then defined by Eq. 8.58c. The computation can be carried out by computer using the values given in the problem by applying Eq. 8.59 (see above) to step along the z direction of the waveguide:

$k_0 = \frac{2\pi}{\lambda_0}$

$\Delta x = 1/6\mu\text{m}$

$\Delta z = 5\mu\text{m}$

$n_r = 3.1$

$n_p$ is defined at each grid point according to the figure given with the problem.

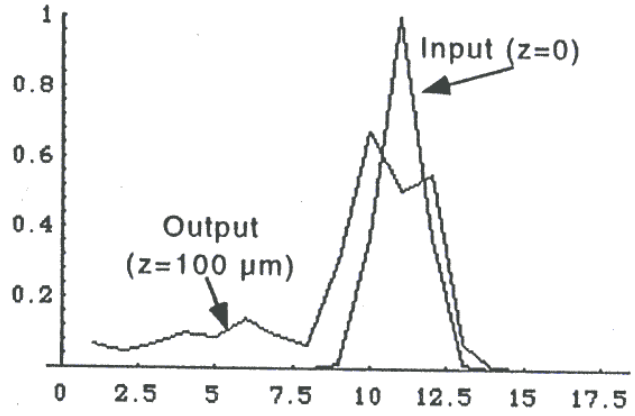


Figure 8.5. Input and output profiles for 18 grid points

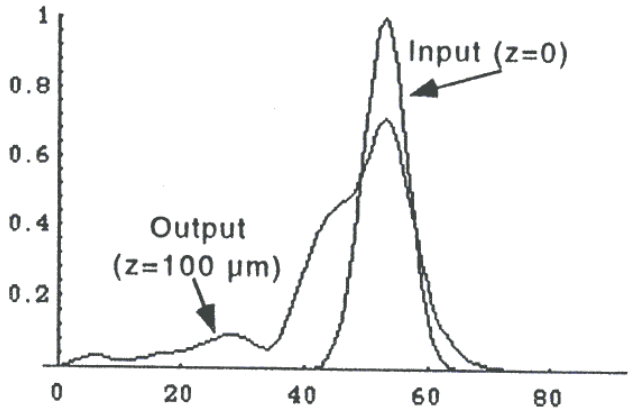


Figure 8.5. Input and output profiles for 90 grid points

Analytical result should be computed using overlap integral with guided modes