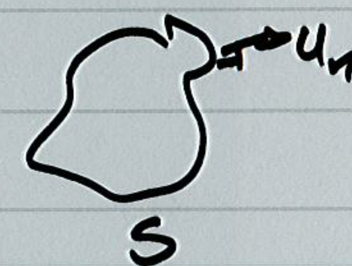
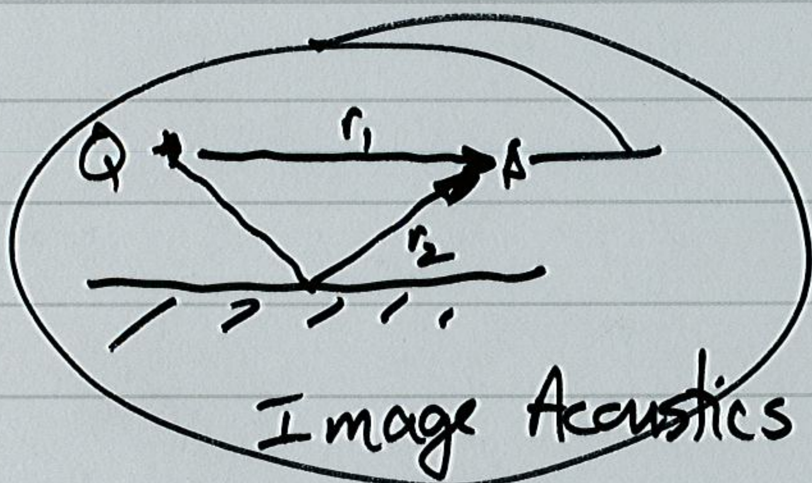
point monopole

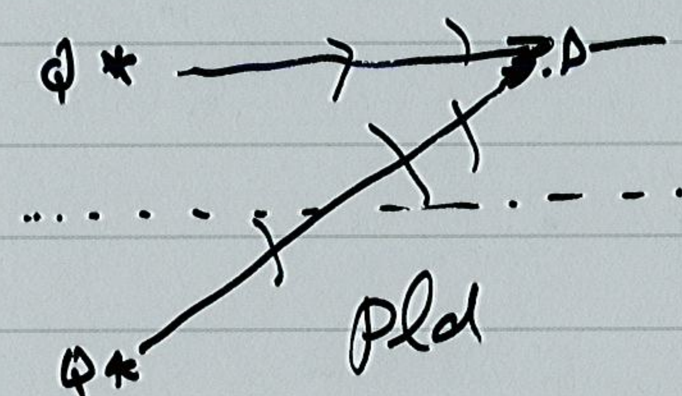
$$\tilde{p}(r) = j\rho c k \frac{Q}{4\pi r} e^{-jkr}$$

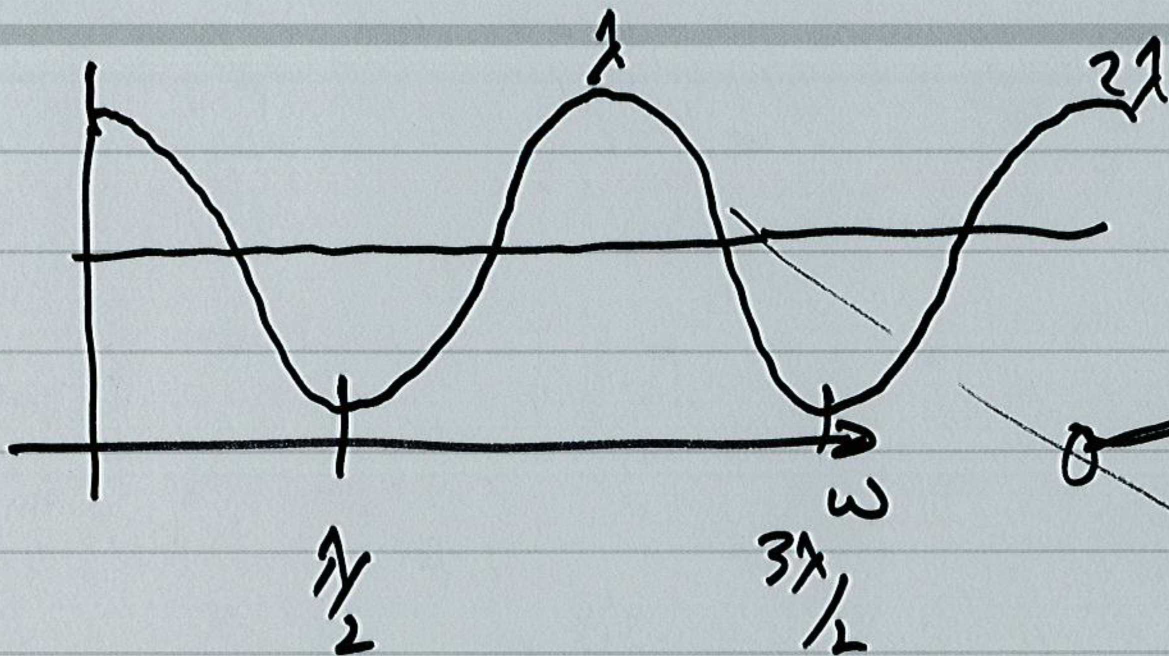
Q volume source

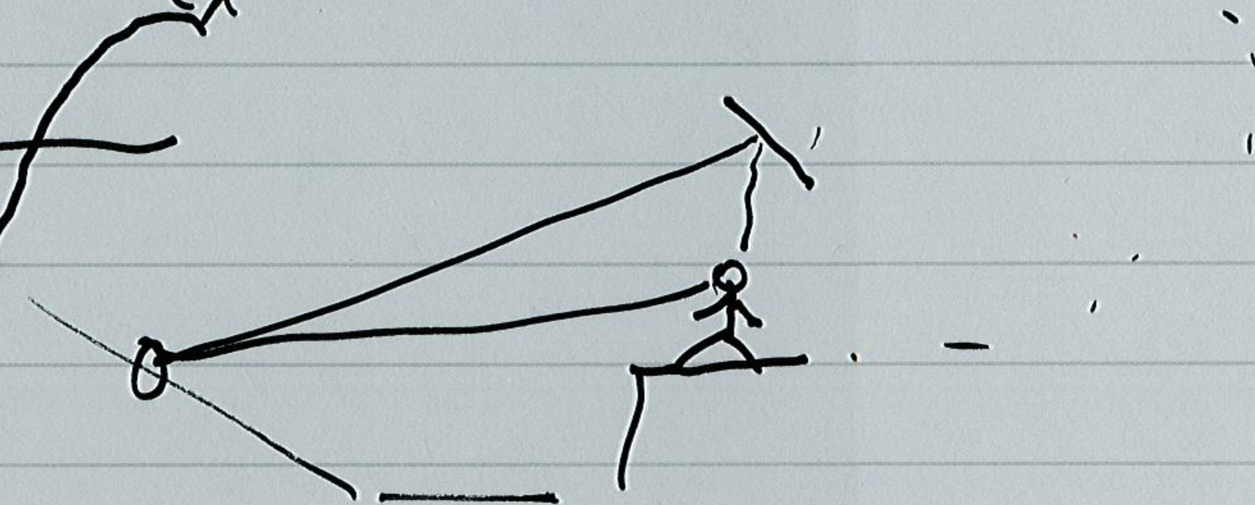
$$Q = \int_S u_n \, dS$$

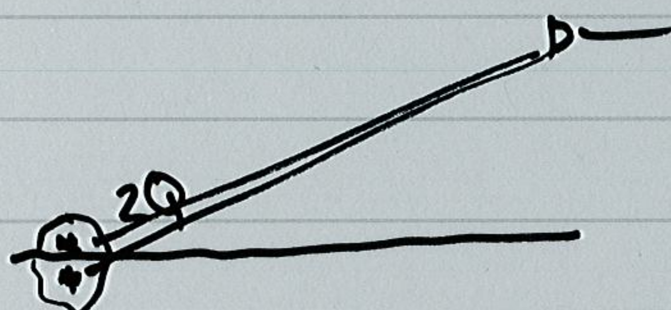


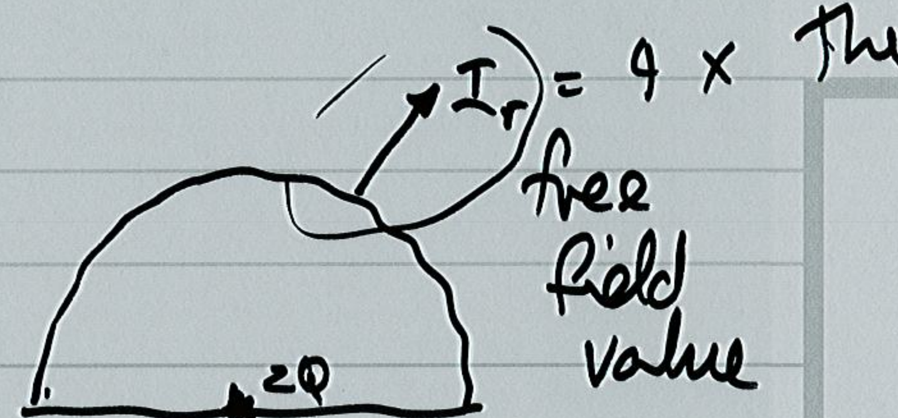








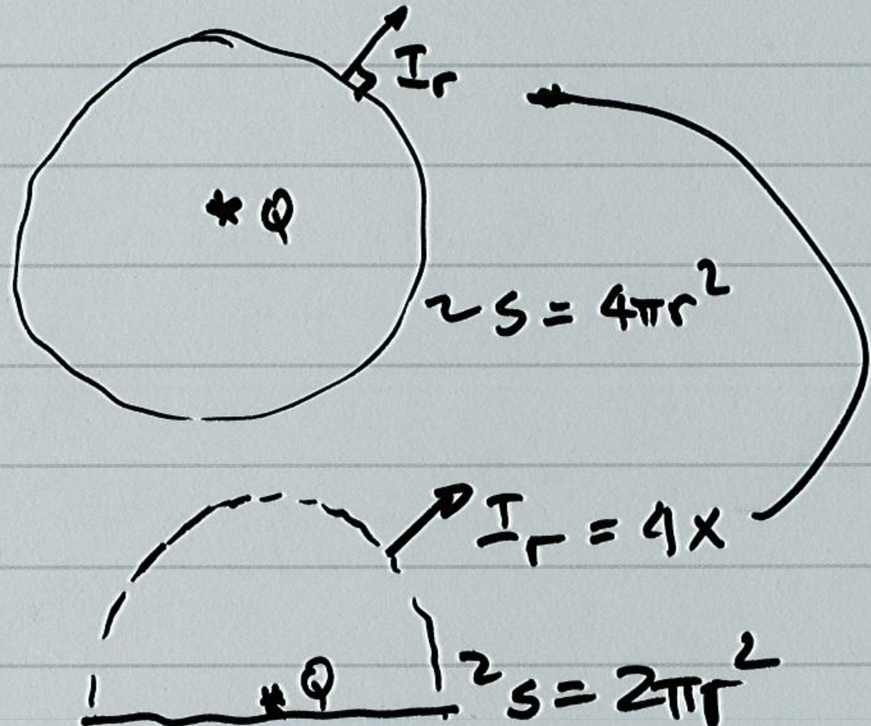




$$\hat{p}(r) = j\rho_0 c k \frac{(2Q)}{4\pi r} e^{-jkr}$$

sound power is doubled

hard surface has increased the intensity (on a surface of radius r centered on the source) by a factor of 4 compared to the same source in a free field



$$W = \int I_r \, dS = \frac{\rho_0 c k^2 Q^2}{8\pi}$$

$$W = \frac{\rho_0 c k^2 Q^2}{4\pi}$$

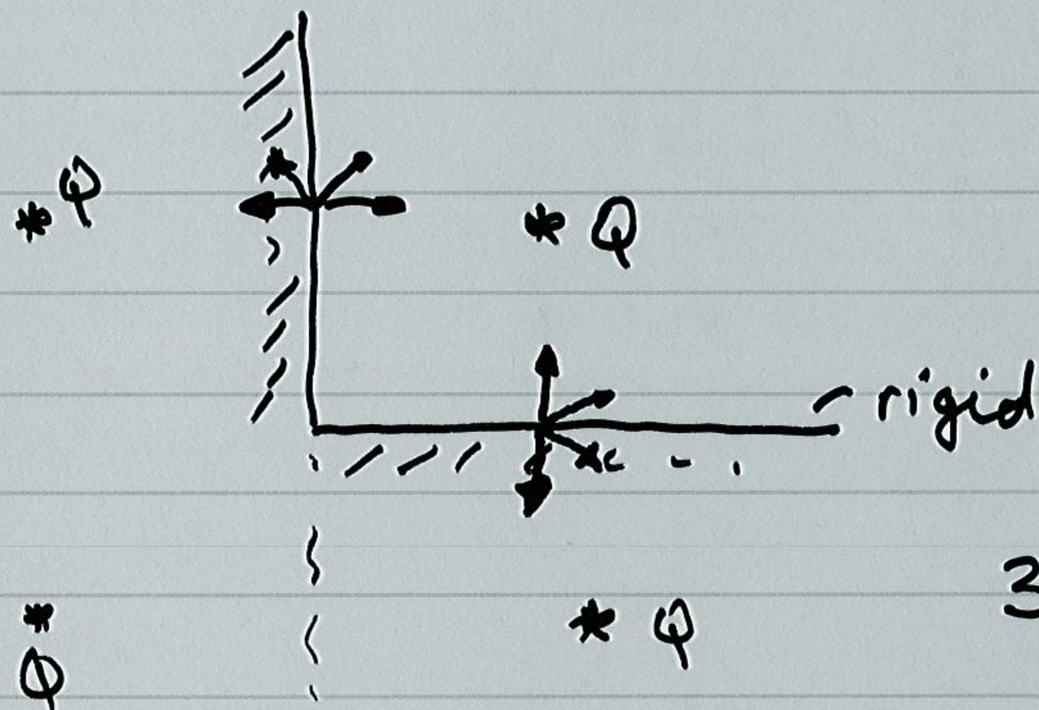
2x

simply by putting a monopole on a hard surface - radiated sound power doubles - assuming that Q is independent of load.

If a source is mounted in an "infinite rigid baffle, then a <u>high impedance</u> acoustic source radiates twice the sound power that it would in free space

(because the loading (radiation resistance) is increased)

5.3.3.2 Multiple Reflections



place a source close to the junction of two infinite planes

$\bar{u} \cdot \bar{n} = 0$

3 image sources are required (in a free field) to satisfy the hard walled b.c.'s

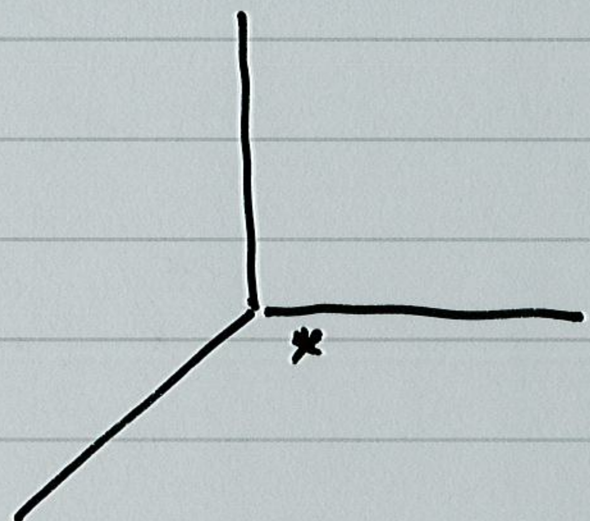
if the source is moved into the corner

$Q = 4Q$

Intensity increases by a factor of 16

sound is radiating into a 1/4 sphere

hence W increases by a factor of 4



3 walls

7 images required to satisfy The b.c.'s

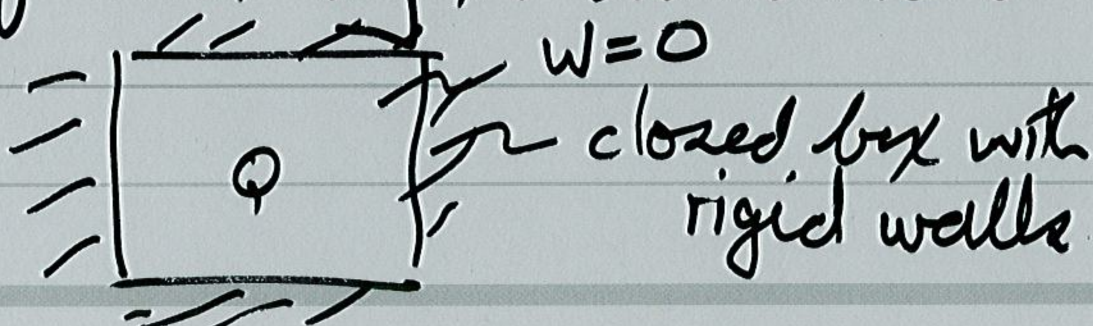
Source → corner $Q_e \to 8Q$

Intensity increases by a factor of 64

Radiation is Through 1/8Th of a sphere

Sound power increases by factor of 8

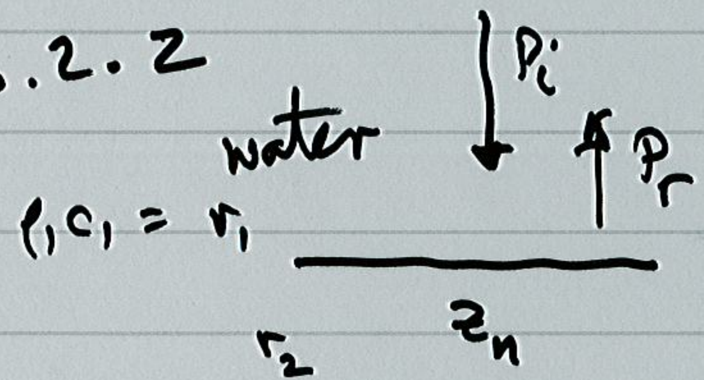
- monopoles – represent "small" sources (compact)
  ka<<1 (source is small compared to a wavelength)
  - that exhibit oscillating volume changes.
- assumed that Q is independent of acoustic loading
- sound power of a source is affected by the environment



Homework # 4

r_1 + r_2 are real

6.2.2



$$20 \log \left(\frac{|p_r|}{|p_i|} \right) = -20$$

$$|R| = x$$

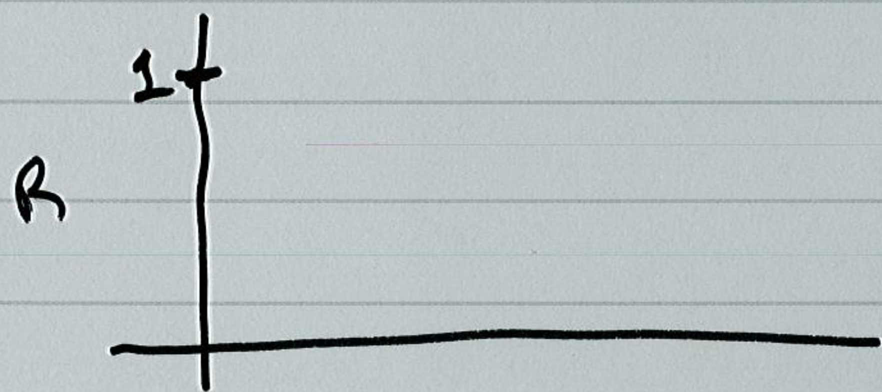
$$R = +x$$
$$\quad -x$$

6.2.6C

Equ 6.2.8

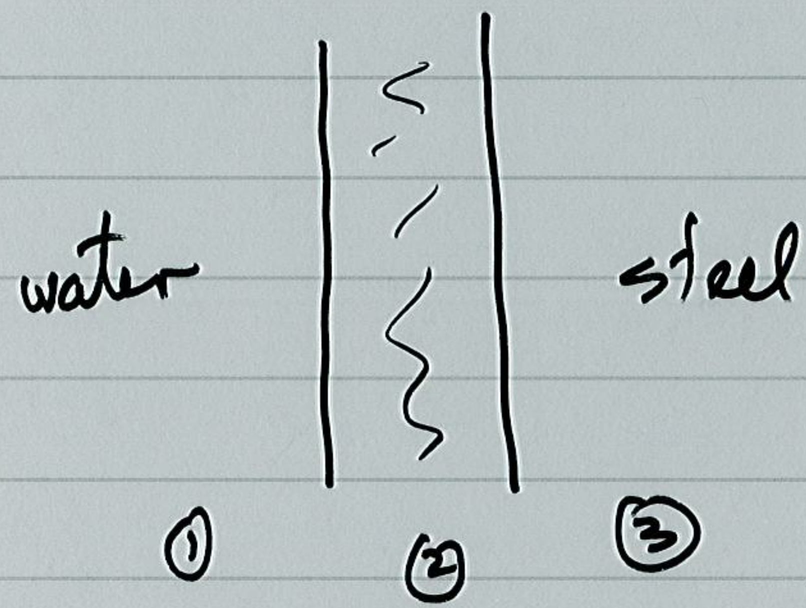
$$R = \frac{r_2 - r_1}{r_2 + r_1} = \frac{1 - \frac{r_1}{r_2}}{1 + \frac{r_1}{r_2}}$$

$$= \frac{1 - x}{1 + x}$$



$$\left(\frac{r_1}{r_2}\right) = x$$

6.3.4



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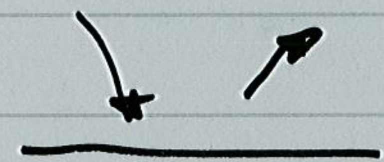
6.4.1 Eqn 6.4.10

$$R = \frac{\frac{r_2}{r_1} - \frac{\cos\theta_t}{\cos\theta_i}}{\frac{r_2}{r_1} + \frac{\cos\theta_t}{\cos\theta_i}}$$

$$\frac{c_2 = c_1}{\rho_2 > \rho_1}$$

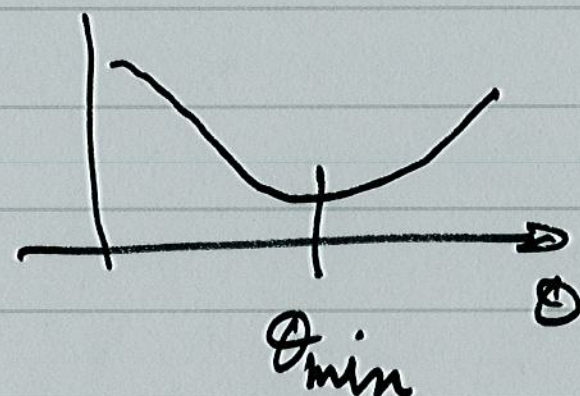
$c_2 > c_1 \qquad \rho_2 = \rho_1$

6.6.1



$Z_n = 900 - j1200$ Rayls

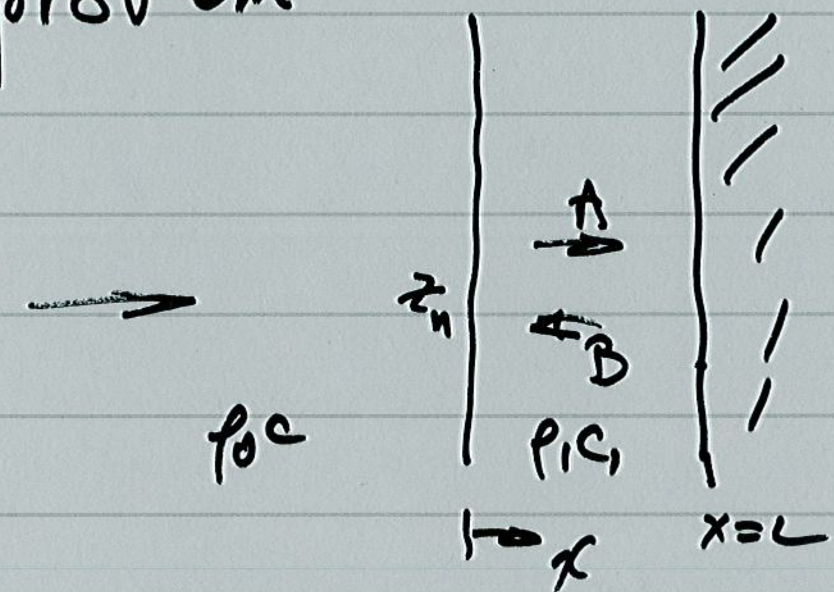
Eqn 6.6.5 $\qquad |R|^2$ vs Θ



$|R|^2 = RR^*$

$$\frac{d|R|^2}{d\Theta} = 0$$

Additional problem



$$z_n = \left.\frac{p_1}{u_1}\right|_{x=0} \frac{\cancel{A}}{\cancel{A}}$$

$$p_1 = A e^{-jk_1 x} + B e^{+jk_1 x} \quad {}^{x=0}$$

$$u_1 \Big|_{x=L} = 0$$