

### Supplementary Problem 3

A rubber band is wrapped around a cylinder of radius  $R$  as shown below. The band can be made to oscillate by plucking it in the  $z$ -direction. The band satisfies the wave equation

$$\partial^2 z / \partial t^2 = (c/R)^2 \partial^2 z / \partial \phi^2$$

where  $c$  and  $R$  are given and  $z = z(\phi, t)$ . At  $t=0$ , a snapshot of the band shows that  $z(\phi, 0) = z_0 \cos(2\phi)$  and  $[\partial z / \partial t](\phi, 0) = 2c(z_0/R) \sin(2\phi)$ . Find  $z(\phi, t)$  for all subsequent times.

## Supplementary Problem 2

A guitar string is anchored at  $x=0$  and  $x=L$ . The string satisfies the wave equation  $\partial^2 y / \partial t^2 = c^2 \partial^2 y / \partial x^2$ , where  $y(x,t)$  is the displacement and  $c$  is a constant with dimensions of speed. At  $t=0$ , a snapshot of the string reveals that the string is not displaced but that it has a velocity, ie,  $y(x,0) = 0$  and  $[\partial y / \partial t](x,0) = v_0 \sin(2\pi x/L)$ , where  $v_0$  has dimensions of speed. Find  $y(x,t)$ , the subsequent motion of the string. What is the maximum amplitude displacement of the string (in terms of the given quantities  $c$ ,  $v_0$ ,  $L$ ) during its motion?