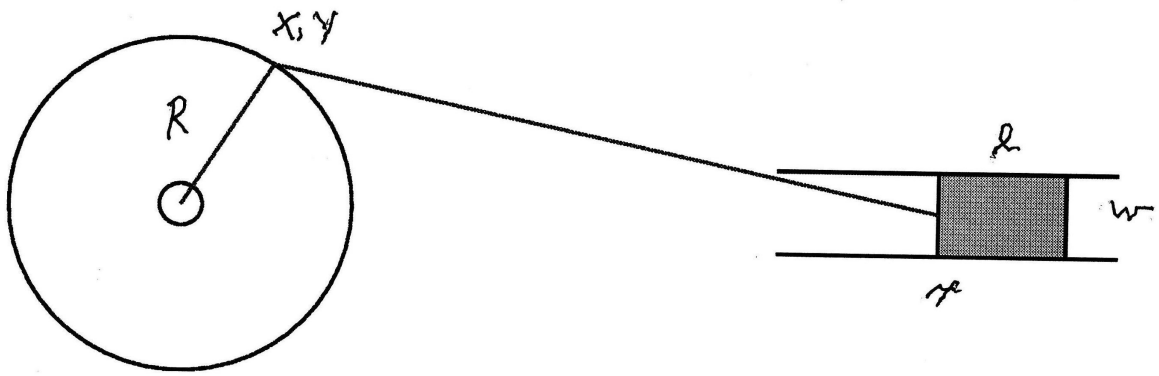
PHYS160
Introduction to Scientific Computing

Assignment # 2

You are to animate a piston-wheel assembly. Schematically, it is illustrated as follows. As the wheel turns the piston goes back and forth, or vice-versa.



Assume that the coordinate system is centered on the wheel axis and that the piston moves along the x axis. The coordinates are given by

$$X(t) = Rcos(\theta(t)) \tag{1}$$

$$Y(t) = Rsin(\theta(t)) \tag{2}$$

$$\theta(t) = \omega t \tag{3}$$

$$x(t) = X(t) + \sqrt{L^2 - Y(t)^2} \tag{4}$$

The geometry is given by the following relations: $L = 4R$, $w = R/2$, and $l = 1.5w$. Use $\omega = 2\pi/50$. This value of ω will allow to use the time in integer values, $t = [0, 50]$ in the animation below.

The radius of the wheel is arbitrary - use $R = 1.5$.

Using Maple

- Define the coordinate functions.
- Define the geometry.
- Load the plotting libraries.
- Plot and animate the piston-wheel assembly.

HINTS:

- You may remove the axes in the animation.
- Build the various plot objects - for instance the wheel is a *circle*.
- Define the diverse plots as maps, i.e., $\mathbf{t} -> \mathbf{graph}$, or functions of time.
- Plot the piston assembly for one value of the time (say t=12).
- Prepare a large number of picture frames (time should be integers between 0 – 50) and plot them in a single image using *display*.
- Use *display* to animate these images.