Here is one arch of the cycloid

\[ \vec{r}(t) = (t - \sin t)i + (1 - \cos t)j \]

It is called a cycloid because it is the path traced out by a point on the rim of a wheel rolling *without slipping*. Imagine that a wheel of radius 1 starts resting with the marked point P on the origin of the x-axis, and then rolls by rotating t radians clockwise. Show that the coordinates of P are now given by \( x = t - \sin t \) and \( y = 1 - \cos t \).