

radius of the larger wheel (shown in black):

 $r_L = 1$

radius of the smaller wheel (shown in red):

 r_S

where $0 \leq r_S \leq r_L$

x and y coordinates of the curve:

$$x = (r_L - r_S)\cos(\theta) + h\cos\left(\frac{r_L - r_S}{r_S}\theta\right)$$
$$y = (r_L - r_S)\sin(\theta) - h\sin\left(\frac{r_L - r_S}{r_S}\theta\right)$$

where θ is an angle in degrees, and h is the distance between the pencil tip (shown in blue) and the center of the smaller wheel. Because the pencil tip sits inside the smaller wheel, it must be the case that $0 \le h < r_S$.