



$M_{cyl} = \text{Mass of cylinder}$
 $M_{Ta} = \text{Mass of trailing apparatus}$
 $M_{cyl,ext} = \text{Mass of extra rod}$
 $R = \text{Radius of cylinder}$
 $d = \text{Distance to center of extra rod}$
 $r = \text{Radius of extra rod}$
 $\beta = \text{slope of ramp}$

CASE 1: ROLLING CYLINDER (NO EXTRA MASS - OR - FUDGE FACTOR)
 - $M\theta = 0$
 - $M_{cyl,ext} = 0$

CASE 2: ROLLING CYLINDER (NO EXTRA MASS)
 - $M_{cyl,ext} = 0$

CASE 3: ROLLING CYLINDER (EXTRA MASS, POINT MASS)
 - $r = 0$

CASE 4: ROLLING CYLINDER (EXTRA MASS)