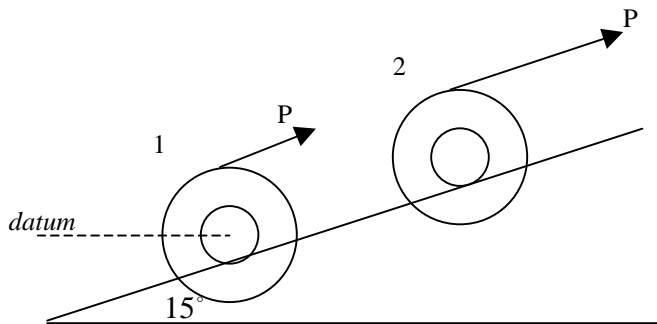
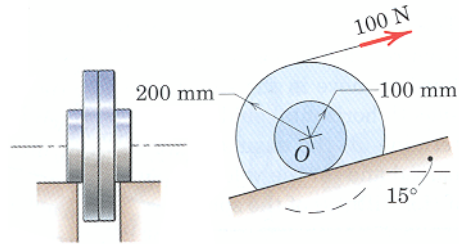


Example Problem - Le 13

**Ex.** The wheel rolls up the incline on its hubs without slipping and is pulled by the 100-N force applied to the cord wrapped around its outer rim. If the wheel start from rest, compute its angular velocity after its center has moved a distance of 3-m up the incline. The wheel has a mass of 40-kg with a center of mass at O and has a centroidal radius of gyration of 150-mm. (taken from *Engineering Mechanics, 4th Edition by Meriam & Kraige*)



unk	eqs
$\omega_2$	1
$E_{K2}$	2
$E_{G2}$	3
$E_{K1}$	4
$E_{G1}$	5
W	6
$v_{G,2}$	7
$I_G$	8
s	9
z	10
$r_{G/IC}$	11

**Known:**

$$m = 40 \text{ kg} \quad P = 100 \text{ N} \quad k_G = 0.15 \text{ m}$$

**Kinetics:**

$$\text{COE(FT)} \quad \Delta E_{sys} = W$$

$$(E_{K2} + E_{G2}) - (E_{K1} + E_{G1}) = W \quad (1)$$

$$E_{K1} = 0 \quad (2) \quad E_{K2} = \frac{1}{2}mv_{G,2}^2 + \frac{1}{2}I_G\omega_2^2 \quad (4)$$

$$E_{G1} = 0 \quad (3) \quad E_{G2} = mgz \quad (5)$$

$$W = Ps \neq P(3m) \quad (6)$$

**Kinematics:**

$$v_{G,2} = \omega_2 r_{G/IC} \quad (7)$$

$$r_{G/IC} = 0.1 \text{ m} \quad (8)$$

$$s = 9 \text{ m} \quad (9)$$

**Other:**

$$I_G = mk_G^2 = 0.9 \text{ kgm}^2 \quad (10)$$

$$z = 3\sin(15^\circ) \text{ m} \quad (11)$$

**Solving:**

$$\boxed{\omega_2 = 30.3 \text{ rad/s}}$$