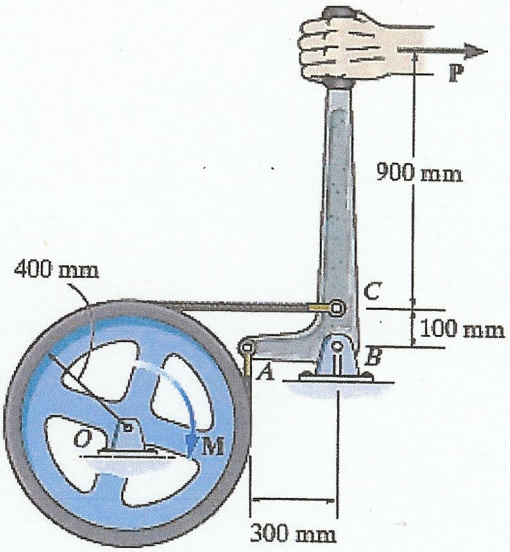
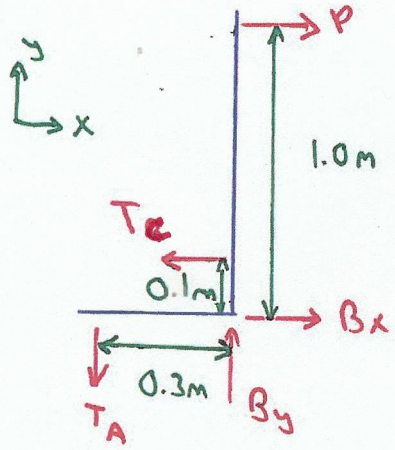
Friction III – Problem 3

If a force of $P = 200N$ is applied to the handle of the bell crank, determine the maximum torque M that can be resisted so that the flywheel does not rotate clockwise. The coefficient of static friction between the brake band and the rim of the wheel is $\mu_s = 0.3$.



FBD 1



$\curvearrowleft + \Sigma M_B = 0$ 200 N

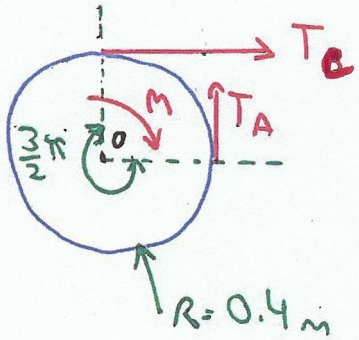
$0 = 1.0(P) - 0.3(T_A) - 0.1(T_B)$

① $0.3T_A + 0.1T_B = 200$ N·m

* Belt Friction μ_s β

$T_A = T_B e^{0.3(\pi \cdot \frac{3}{2})}$ $\therefore T_A = 4.111 T_B$ ②

FBD 2



Solve 1 & 2

$0.3(4.111)T_B + 0.1T_B = 200$

$1.333T_B = 200$

$T_B = 150$ N

$\therefore T_A = 617$ N

$\curvearrowleft \Sigma M_O = 0$

$0 = M - 617(0.4) + 150(0.4)$

$M = 0.4(617 - 150)$

$M = 186.7$ Nm