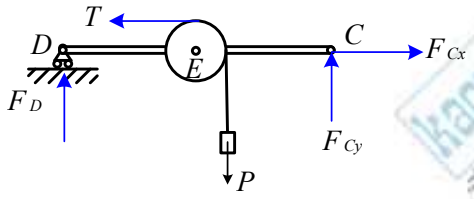
一、1 对　2 对　3 不对　4 不对　5 不对

二 1 考虑 DEC　$\sum m_c = 0,$

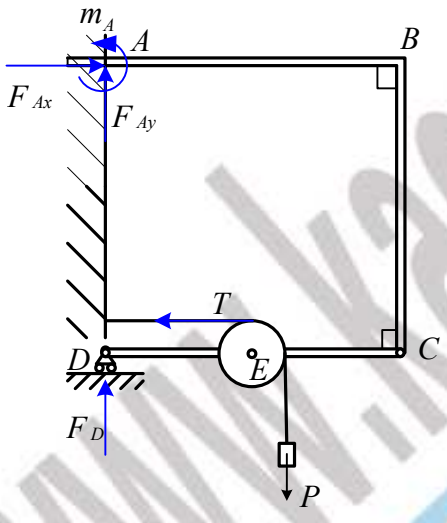
$F_D \times 200 - T \times 20 - P \times 80 = 0$

$P = T = 10kN$

$F_D = 5kN$



2 整体

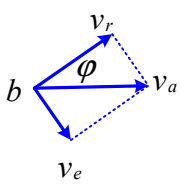


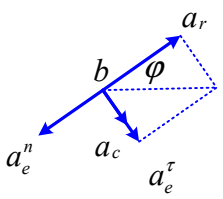
$\sum F_{ix} = 0, F_{Ax} - T = 0 \therefore F_{Ax} = T = 10kN$

$\sum F_{iy} = 0, F_{Ay} + P + F_D = 0 \therefore F_{Ay} = 5kN$

$\sum m_A = 0, m_A - P \times 120 - T \times 55 = 0 \therefore m_A = 17.5kNm$

三　b 为动点，哦 0A 为动系，则速度图及加速度图如下





$$v_a = v_0, v_e = v_0 \sin\varphi, v_r = v_0 \cos\varphi$$

$$v_e = \omega \times \frac{h}{\sin\varphi}, \therefore \omega = \frac{v_0 \sin^2\varphi}{h}$$

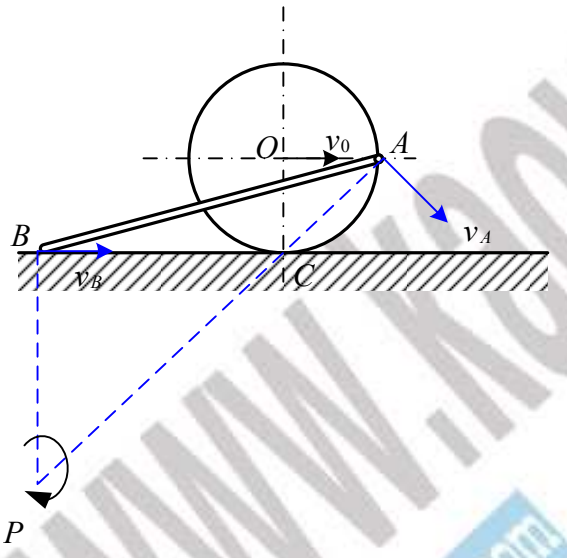
$$\vec{a}_a = \vec{a}_e^{\tau} + \vec{a}_e^{n} + \vec{a}_r + \vec{a}_c = 0$$

$$a_c = 2\omega v_r = 2\frac{v_0^2 \sin^2\varphi \cos\varphi}{h}$$

$$a_e^{\tau} = \alpha \frac{h}{\sin\varphi} = -a_c = -2\frac{v_0^2 \sin^2\varphi \cos\varphi}{h}$$

$$\alpha = -\frac{v_0^2 \sin^3\varphi \cos\varphi}{h^2}$$

四、



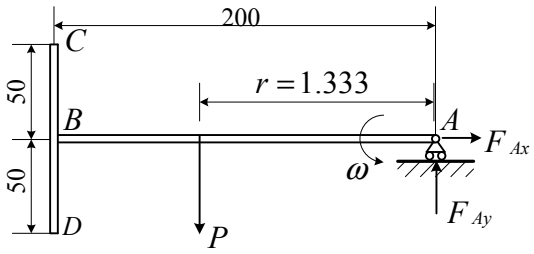
$$v_0 = \omega_o r \therefore \omega_0 = \frac{v_0}{r} = 40 rad/s$$

$$v_A = \sqrt{2} r\omega_o = 28,3 m/s = 4 r\omega_{AB}$$

$$\omega_{AB} = \frac{\sqrt{2}}{4}\omega_o = 14.14 rad/s$$

$$\therefore v_B = (2\sqrt{2}-1) r\omega_{AB} = 12.9 m/s$$

五、



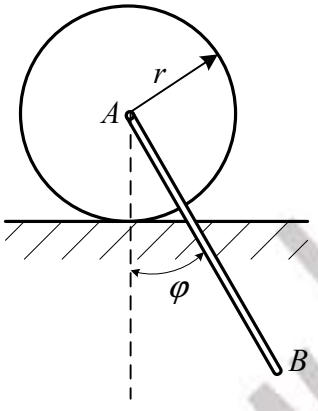
重力$P=100\times0.3=030N$, 质量$m=\frac{P}{g}\approx3kg$

质心$r=1.3333m$

$F_n=mr\omega^2=3\times0.1333\times0.36=0.144N$

$\therefore F_\tau=0$

六、



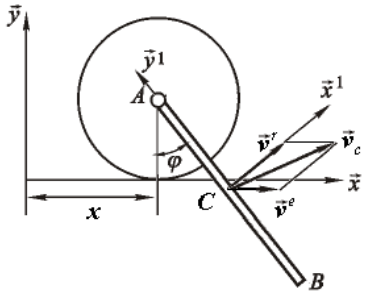
解）如图建立惯性基$\vec{e}^I$与均质杆 AB 的连体基$\vec{e}^1$。系统有两个自由度，取圆柱的质心在 x 轴上坐标 x 和连体基$\vec{e}^1$的姿态角为广义坐标$q=(x\quad \phi)^T$

系统动能为：

$$T=\frac{1}{2}m\dot{x}^2+\frac{1}{2}\frac{1}{2}mr^2(\frac{\dot{x}}{r})^2+\frac{1}{2}m[\dot{x}^2+(\frac{3}{2}r\dot{\phi})^2+2\dot{x}\frac{3}{2}r\dot{\phi}\cos\phi]+\frac{1}{2}\frac{1}{12}m(3r)^2\dot{\phi}^2$$

$$=\frac{5}{4}m\dot{x}^2+\frac{3}{2}mr^2\dot{\phi}^2+\frac{3m}{2}r\dot{x}\dot{\phi}\cos\phi$$

$$V=-mg\frac{3}{2}r\cos\phi$$



系统的拉格朗日函数为：

$$L = T - V = \frac{5}{4}m\dot{x}^2 + \frac{3}{2}mr^2\dot{\phi}^2 + \frac{3m}{2}r\dot{x}\dot{\phi}\cos\phi + mg\frac{3}{2}r\cos\phi$$

$$\frac{d}{dt}(\frac{\partial L}{\partial \dot{x}}) = \frac{5}{2}m\ddot{x} + \frac{3}{2}mr\ddot{\phi}\cos\phi - \frac{3}{2}mr\dot{\phi}^2\sin\phi$$

$$\frac{\partial L}{\partial x} = 0$$

$$\frac{d}{dt}(\frac{\partial L}{\partial \dot{\phi}}) = 3mr^2\ddot{\phi} + \frac{3}{2}mr\ddot{x}\cos\phi - \frac{3}{2}mr\dot{x}^2\sin\phi$$

$$\frac{\partial L}{\partial \phi} = -\frac{3}{2}mgr\sin\phi$$

代入拉氏方程得

$$5\ddot{x} + 3r\cos\phi\ddot{\phi} - 3r\sin\phi\dot{\phi}^2 = 0 \qquad (1)$$

$$\cos\phi\ddot{x} + 2r\ddot{\phi} - \sin\phi\dot{x}\dot{\phi} + g\sin\phi = 0 \qquad (2)$$