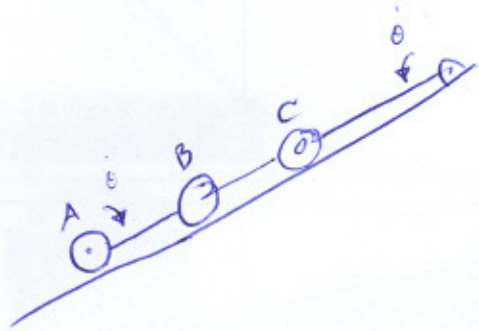
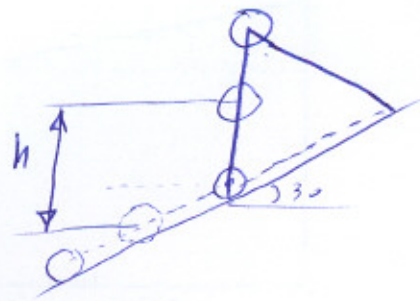
۱) $(m_{\text{دایره}} + m_{\text{گوی}})\, V_1 = (m_{\text{دایره}} + m_{\text{گوی}})\, V_2 + m_{\text{گوی}} (l\dot{\theta})$

۲)

$T_2 = U_1$





$V_{A1} = V_{B1} = V_{C1} = 0$

$V_{A2} = 0$

$V_{B2} = \frac{V_{C2}}{2}$

$T_2 = \frac{1}{2} m \left(V_{C2}^2 + \frac{V_{C2}^2}{4} \right) = \frac{3}{8} m V_{C2}^2$

$h = 0.25 + 0.25 \sin 30 = 0.375$

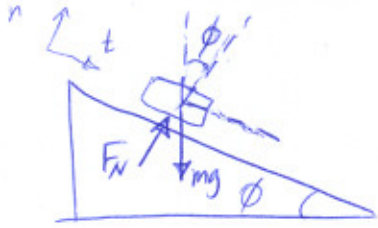
$U_1 = 3mgh = 3 m g \times 0.375$

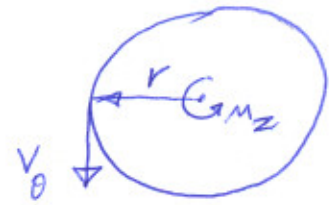
۳) $H_1 = H_2$

$m R_a V_a = m R_b V_b \rightarrow V_b = \frac{R_a}{R_b} V_a = 10$

$W = T_2 - T_1 = \frac{1}{2} m (V_b^2 - V_a^2) = \frac{1}{2} m \times 75 = 300$

4)





$$a_n = 0 \longrightarrow F_N = mg\cos\phi$$

$$\Sigma M_z = r F_N \sin\phi = r\, mg \sin\phi\cos\phi$$

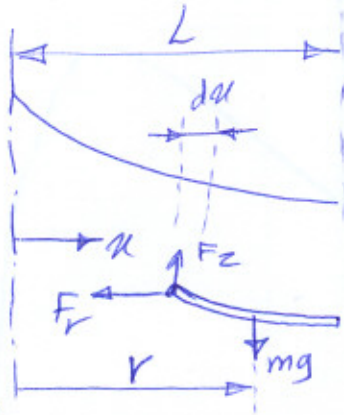
$$\dot{H}_z = r \times m a_\theta = m r^2 \ddot{\theta}$$

$$[\Sigma M_z = \dot{H}_z] \Rightarrow m r^2 \ddot{\theta} = r mg \sin\phi\cos\phi$$

$$\Rightarrow \ddot{\theta} = \frac{g}{r}\sin\phi\cos\phi \quad \Rightarrow \dot{\theta} = \frac{gt}{r}\sin\phi\cdot\cos\phi$$

$$V = \frac{V_\theta}{\cos\phi} = \frac{gt}{r}\sin\phi$$

5)



$$[F_r = m a_r]$$

$$\Rightarrow F_r = \left((L-x)\rho\right)\cdot(r\omega^2)$$

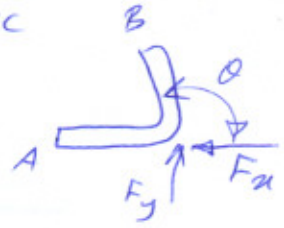
$$, r = \frac{L+x}{2}$$

$$\Rightarrow F_r = \frac{\rho\omega^2}{2}(L^2 - x^2)$$

$$[\Sigma F_z = m a_z] \Rightarrow F_z - mg = 0 \Rightarrow F_z = \rho g (L-x)$$

$$y' = \frac{F_z}{F_r} = -\frac{2g}{\omega^2(x+L)} \Rightarrow y = \frac{-2g}{\omega^2}\,Ln(x+L)$$

4- $Q = AV$ $\quad \dot{m} = \rho Q = \gamma_w Q = 1.3468 \ \frac{slug}{sec}$



$$F_x = \frac{\dot{m}}{g}(V_{Ax} - V_{Bx}) = 55.3 \ lb$$

$$F_y = \frac{\dot{m}}{g}(V_{By} - V_{Ay}) = 25.8 \ lb$$

V- $A_B = \pi \left(\frac{d_B}{2}\right)^2$ $\quad A_A = \pi \left(\frac{d_A}{2}\right)^2$

$\dot{m} = \rho_w v_B \pi \left(\frac{d_B}{2}\right)^2$

$V_A = \frac{\dot{m}}{\rho_w A_A}$

$F_x = \dot{m} v_B = 3.98 \text{ kN}$

$-F_y + 50\pi \left(\frac{d_1}{2}\right)^2 = \dot{m}(0 - v_A) \rightarrow F_y = 3.81 \text{ kN}$

$M = \dot{m} h v_B = 1.99 \text{ kN.m}$

۸- $F_s = m\dot{v} + v_i \dot{m}_i$, $m = m'y$, $\dot{m}_i = m'\dot{y} = m'v$

$v_i = v$

$m'g y = m' y \dot{v} + m' v^2$

$g y = y \dot{v} + v^2$, $v = \dot{y} \rightarrow dt = \frac{dy}{v}$

$g y = v y \frac{dv}{dy} + v^2$

$2g y^2 dy = 2v y^2 dv + 2 y v^2 dy$

$\int 2g y^2 dy = \int 1 \, d(v^2 y^2) \rightarrow \frac{2}{3} g y^3 + C = v^2 y^2$

$v = 0 \ @ \ y = h \rightarrow \frac{2}{3} g h^3 + C = 0 \rightarrow C = -\frac{2}{3} g h^3$

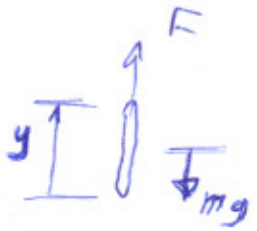
$\rightarrow v = \sqrt{\frac{2}{3} g \left(\frac{y^3 - h^3}{y^2}\right)}$

9) $\dot{v} = 0 \qquad y = vt$

$m_i = m_y = mvt$

$m_j = m_y = mvt$

$\dot{m}_j = mv$



$+\uparrow \quad \Sigma F_s = m\dot{v} + v_j \dot{m}_j$

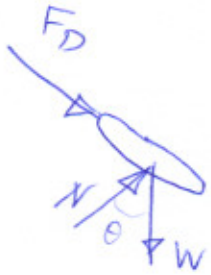
$F - mgvt = 0 + vmv \rightarrow F = mgvt + vmv$

$F = \rho g v t + v^2$

$F = 7.85\ t + 0.320$

10) $\dot{m}_i = \frac{r_2}{g_1} \qquad A_1 = r_2 \qquad \dot{m}_e = \frac{r_1 + r_2}{g_1}$

$B = r_1 + r_2 \qquad V_1 = V$



$+\nwarrow \quad \Sigma F_D = m\dot{v} - v_{De}\dot{m}_e + v_{Di}\dot{m}_i$

$-W \sin\theta - K_1 v_1^2 = W a - V_e B + v_1 A_1$

$a = \dfrac{-W \sin\theta - K_1 v_1^2 + v_e B/g - v_1 A_1/g}{W} g = 37.5 \dfrac{ft}{s^2}$

11) $\xrightarrow{+} \quad \Sigma F_s = m\dot{v} + v_j \dot{m}_j$

$m = m_0 + \dot{m}_1 t = m_0 + m' v$

$v_j = v \ , \ \dot{v} = 0$

$F = (m_0 + m'vt)(0) + v m' v = \cancel{mv^2}$

$F = m' v^2$