Mammoth Q's

① $m = 300t^2 + 30000$ N-m $t = 2$ s

$r_B = 2$ m $r_A = 0.5$ m

$m = F r_B$

$F_y = 150t^2 + 15000 - mg$

$ma = 150t^2 + 15000$ N-m

$a = \frac{150}{5440}t^2 + \frac{15000}{5440}$

$\int_{t_1}^{t_2} a = \frac{150}{16320}t^3 + \frac{15000}{5440}t \Big|_0^2 = 5.588 \frac{m}{s} = v_f$

$F_y = 150t^2 + 15000 - mg$

$(5440)\, a = 150t^2 - 38366.4$

$a = \frac{150t^2}{5440} - 7.0526$

$\int_{t_1}^{t_2} a = \frac{150}{16320}t^3 - 7.0526t \Big|_0^2$

$\Delta v = -13.36 \frac{m}{s^2} = v_f$

★ $r_B = 0.5$ m ★

$F_y = 600t^2 + 60000 - mg$

$a = \frac{600t^2}{5440} + \frac{60000 - mg}{5440}$

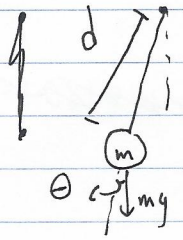
$\int_{t_1}^{t_2} a = \frac{600}{16320}t^3 + \frac{60000 - mg}{5440}t \Big|_0^2$

$\Delta v = 2.733 \frac{m}{s} = v_f$

Assuming that the mammoth swings about A?

② $I = mk^2$ $I_A = mk^2 + m(d^2)$ $d = 2m$

$k = 3.2m$



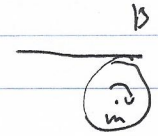
$\Sigma M_A : -dmg\sin\theta = (mk^2 + md^2)\ddot{\theta}$

assume small θ so $\sin\theta = \theta$

$dmg\theta + (mk^2 + md^2)\ddot{\theta} = 0$

$$\omega_n = \sqrt{\frac{mgd}{(mk^2 + md^2)}} = \sqrt{\frac{gd}{(k^2 + d^2)}} = 1.778 \text{ rad/s}$$

③ Does the mammoth not fall down?



$m = 40000\ Nm$

$F_r = m$ $F = 20000N$

F_y: $20000 - mg = ma$ $a = -6.1335\ m/s^2$

~~$r_b = 0.5m$~~

$r_b = 0.5m$

$m = 40000\ Nm$

$F_r = m$ $F = 80000N$

F_y: $F - mg = ma$ $a = 4.896\ m/s^2$

$d = v_i t + \frac{1}{2} a t^2$ $t = \sqrt{\frac{2d}{a}} = 1.278$

$v_f = v_i + at$ $v_f = 6.258\ m/s$

$M_A = -2000\,Nm$

$M = Fr$

impulse $= F\Delta t = m\Delta V$

$\frac{2000}{r}$ ← $\quad\quad$ $\frac{M}{r}$ →

$$\left(\frac{M}{r_B} - \frac{2000}{r_A}\right) = \frac{m\Delta V}{\Delta t}$$

$V_A = s\sin\theta$

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