ANSWERS TO END-OF-CHAPTER PROBLEMS

CHAPTER – 3

Q 3.1) $x_{CM} = \frac{3l}{4}$

Q 3.2) $x_{CM} = 0, \quad Y_{cm} = \frac{a}{2\sqrt{3}}$

Q 3.4) $D = \frac{8}{3}L$

Q 3.5) $H = h + \frac{M^2\left(v_0^{\,2} - 2gh\right)}{2g(M+m)^2}$

Q 3.6) $s = 1277\ ft$

Q 3.7) $x(t) = \frac{m_2 l(2-\cos\varpi t)}{2(m_1+m_2)}\ for\ 0 \le t \le T/4$

$= \frac{m_2 l}{2(m_1+m_2)}\left(2+\varpi t - \pi/2\right)\ for\ t > T/4$

Q 3.8) *200 kg-m/s*

Q 3.9) $v_f = \frac{F}{b}\ln\left(\frac{M+m}{M}\right),\ b = \frac{dm}{dt}$

Q 3.10) $v = \frac{Ft}{M+m}$ where $t = \frac{m}{b}$, where $b = \frac{dm}{dt}$

Q 3.11) $\frac{dv}{dt} = \frac{b}{M}(u-v)$

Q 3.12) $v = 5\ln\left[\frac{3}{2}\right] = 2.02\ m/s$

Q 3.13) $F = 3133.38\ N$

Q 3.14)

a) $v = \frac{Nmu}{M+Nm}$

b) $v = mu\sum_{i=1}^{N}\frac{1}{M+(N+1-i)m}$

c) *(b) > (a)*

Q 3.15) **b)** $A = B = l_0 / 2$

Q 3.16) $F = \dfrac{\rho \pi D^2 v_0^2}{4}$

Q 3.17) $h = \dfrac{\left(v_0^2 - \dfrac{w^2}{4b^2} \right)}{2g}$ for given data $\mathrm{h_{max}} = 15\,\mathrm{m}$

Q 3.18) $v = \sqrt{\frac{g}{k}} \left(\frac{e^{t\sqrt{gk}} - e^{t\sqrt{gk}}}{e^{t\sqrt{gk}} + e^{t\sqrt{gk}}} \right) \Rightarrow \lim_{t \to \infty} v = \sqrt{\frac{g}{k}}$

Q 3.19) **a)** *F=2.5 x 10^{-3} N,* *b) F'= (7/5)^2 F = 4.9 x 10^{-3} N*

Q 3.20) $v = \frac{1}{b}(\gamma u - g)\left(1 - e^{-bt}\right)$