Answers Exam 2 2009

1. a) $U = c_1 \frac{x^3}{3} - c_2 \frac{x^2}{2} + c$

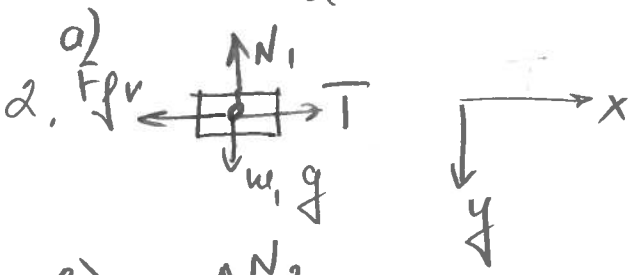
$$F_x = -\frac{\partial U}{\partial x} = -(c_1 x^2 - c_2 x)$$

$$F_y = -\frac{\partial U}{\partial y} = 0$$

b) $c_1 \frac{A^3}{3} - c_2 \frac{A^2}{2} + \frac{m v_1^2}{2} = c_1 \frac{x_s^3}{3} - c_2 \frac{x_s^2}{2}$

c) $\frac{m v^2}{2} = \frac{c_1 A^3}{3} - \frac{c_2 A^2}{2} + \frac{m v_1^2}{2} - c_1 \frac{x^3}{3} + c_2 \frac{x^2}{2}$

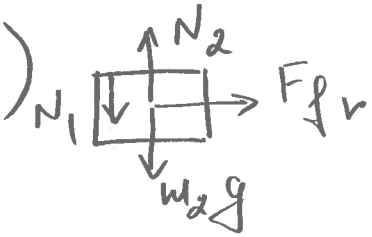
2. a)



$$T - F_{fr} = m_1 a_{1x}$$

$$-N_1 + m_1 g = 0$$

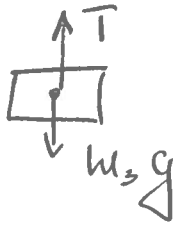
b)



$$F_{fr} = m_2 a_{2x}$$

$$-N_2 + N_1 + m_2 g = 0$$

c)



$$m_3 g - T = m_3 a_{3y} \qquad a_{1x} = a_{2x} = a_{3y} = a$$

d) $a = \frac{m_3}{m_1 + m_2 + m_3} g$

e) $a = \mu g \frac{m_1}{m_2}$

Answers Exam 2 2009 (cont)

3. a) $F_x = -2\beta x$

$F_y = -2\beta y$

b) $v = \sqrt{\frac{2}{m}\left(mgL\sin\theta - \beta L^2\right)}$

c) $v = \sqrt{\frac{2}{m}\left(mgL\sin\theta - \mu mgL\cos\theta - \beta L^2\right)}$

4. a) $y_{eq} = \frac{mg - b}{k}$

b) $U = \frac{ky^2}{2} + by + C$

$y_s = \frac{2}{k}(mg - b) = 2y_{eq}$

c) U_{min}, $\frac{m v_{max}^2}{2}$ at y_{eq}.

$U_{eq} = \frac{k y_{eq}^2}{2} + b y_{eq} - mg y_{eq}$

$KE_{max} = -U_{eq}$