Research object: a system consists of:

A - plane motion

B - rot motion

C - trans. motion

1 dof

Force analysis: mg_1, mg_2, R_x, R_y, R_B

Generalized coords:

x - ~~status~~ translat motion of body A (center of mass)

$V_A = \dot{x}$ $\quad \omega_B = \frac{V_A}{R} = \frac{\dot{x}}{R}$

~~$\omega_A = V_A \times R =$~~

$V_A = \omega_A \times R = \frac{\dot{x}}{R}$ $\quad V_C = V_A = \dot{x}$

Kinetic energy: $T = T_A + T_B + T_C$

$T_A = \frac{1}{2} m_1 V_A^2 + \frac{1}{2} J_A \omega_A^2$ → plane motion is rot + trans

$T_B = \frac{1}{2} J_0 \omega_B^2$ → rot

$T_C = \frac{1}{2} m_2 V_C^2$ → trans

$J_A = J_0 = \frac{m_1 R^2}{2}$ → from the task

$T = \frac{1}{2}(2m_1 + m_2)\dot{x}^2$

Partial derivatives:

$\frac{\partial T}{\partial \dot{x}} = (2m_1 + m_2)\dot{x}$ $\quad \frac{\partial T}{\partial x} = 0$

$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot{x}}\right) = (2m_1 + m_2)\ddot{x}$

Generalized forces

$\delta A = m_1 g \sin\alpha \, \delta x - m_2 g \, \delta s_C = g(m_1 \sin\alpha - m_2)\delta x$

($s_C = x$)

$Q_1 = \frac{\delta A_1}{\delta x} = g(m_1 \sin\alpha - m_2)$

Solution

$(2m_1 + m_2)\ddot{x} = g(m_1 \sin\alpha - m_2)$