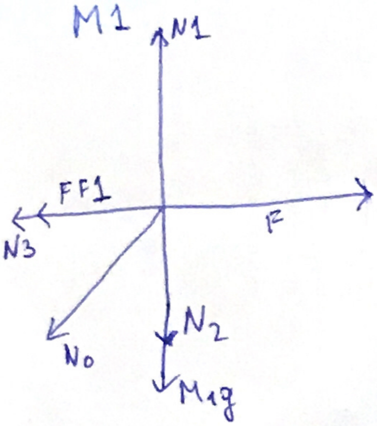
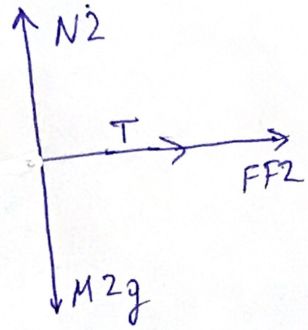
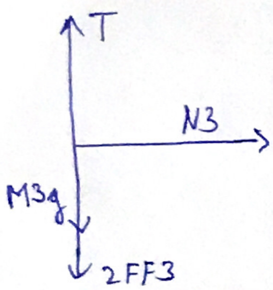
M1



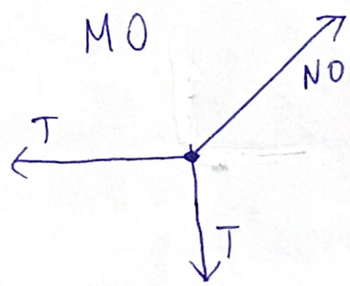
M2



M3



M0



Dartyan Edgar
ENGS 121
Project 2

The following equations are given

M_1 in x direction: $F - N_{ox} - F_{F1} - N_3 = M_1 a_1$

M_1 in y direction: $N_1 - M_1 g - N_2 - N_{oy} = 0$ (doesn't move in y direction)

M_2 in x direction: $F_{F2} + T = M_2 a_2$

M_2 in y direction: $N_2 - M_2 g = 0$

M_3 in x direction: $N_3 = M_3 a_{3x}$

M_3 in y direction: $T - M_3 g - 2F_{F3} = M_3 a_{3y}$

M_0 in x direction: $N_{ox} - T = M_0 g = 0 \Rightarrow N_{0x} = T$

M_0 in y direction: $N_{oy} - T = M_0 g = 0 \Rightarrow N_{oy} = T$

Also, the following constraints are given

The length of the rope is constant $\Rightarrow a_1 - a_2 - a_{3y} = 0 \Rightarrow a_1 = a_2 + a_{3y}$

The M_3 will not escape the hole $\Rightarrow a_1 = a_{3x}$

$\therefore$ From the system of equations we can obtain

$$a_1 = \frac{(M_3 + M_2)(F - \mu_1(M_1 + M_2)g) - M_2 M_3 g(1-\mu_2)(1-\mu_1)}{(M_1 + M_3)(M_3 + M_2) + (1-\mu_1)(2\mu_3 M_3 + M_3)M_2}$$

$$T = \frac{M_2 M_3 g + (2\mu_3 M_3 + M_3) a_1 M_2 - \mu_2 M_2 g M_3}{M_3 + M_2}$$

$$a_2 = \frac{T - M_3 g - 2\mu_3 M_3 a_1 - M_3 a_1}{-M_3}$$

$$a_{3y} = a_1 - a_2$$

$$a_{3x} = a_1$$

By having all of the above, it is possible to find the coordinates after the use of F_n forces.