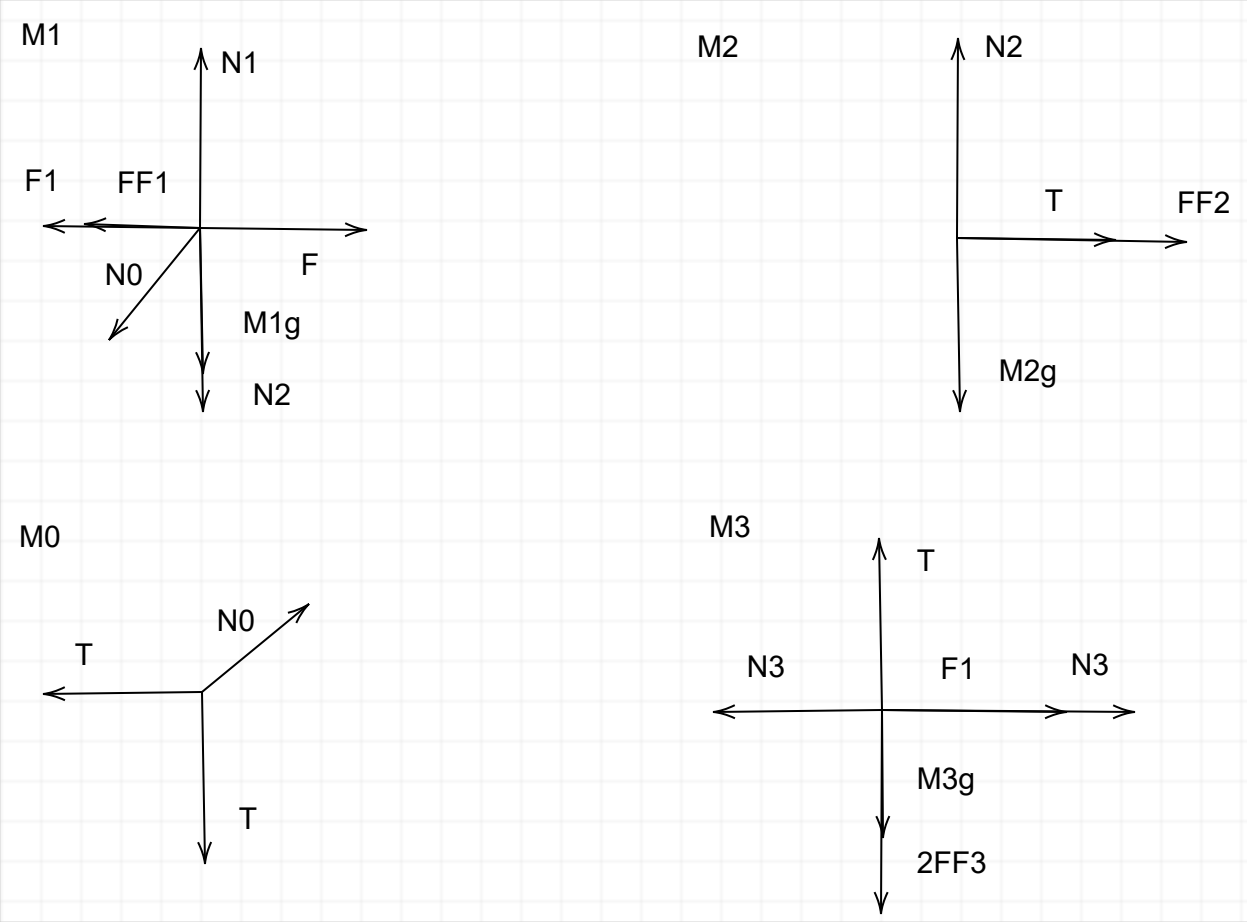
Project02



I have assumed F is positive

We have the following equations:

M_1 *in x direction*: $F - N_{0x} - F_{F1} - F_1 = M_1 a_1$

M_1 *in y direction*: $N_1 - M_1 g - N_2 - N_{0y} = 0$ (*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*: $N_3 + F_1 - N_3 = M_3 a_{3x} \implies F_1 = M_3 a_3 x$

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

M_0 *in x direction*: $N_{0x} - T = M_0 g = 0 \implies N_{0x} = T$

And the following constraints

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

M3 cannot escape the hole $\implies a_1 = a_{3x}$

$x_1 - x_2 = a_2 t^2 / 2$ (*if* M_2 *goes to the right and stops at* x_1) $\implies a_2 = 2(x_1 - x_2)/t^2$

$y_1 - y_3 = a_{3y}t^2/2\ (if\ M_3\ stops\ at\ the\ bottom) \implies a_{3y} = 2(y_1 - y_3)/t^2$

We have equal number of unknowns and equations and by solving we get:

$$t = \sqrt{\frac{2(x1 - x2)(\mu_1 M_2 - M_2) - 2(x_1 - x2 + y_1 - y_3)(M_3 + M1)}{\mu_1\mu_2 M_2 g - F - \mu_2 M_2 g + \mu_1 M_1 g + \mu_1 M_2 g}} \implies$$

We can insert t and find a_1, a_2, a_{3x} , a_{3y} . *after that we can find the cordinates at a given time* t_0 *by inserting t in the following equations*

$X_{1n} = x_1 + a_1 t_0^2/2,\ Y_{1n} = y_1$
$X_{2n} = x_2 + a_2 t_0^2/2 + a_1 t_0^2/2,\ Y_{2n} = y_2$
$X_{3n} = X_{1n}\ ,\ Y_{3n} = y_3 + a_{3y} t_0^2/2$

Code workflow:

We get the parameters M_1, M_2, M_3, F, μ_1, μ_2, μ_2, x_1, x_2, x_3, y_1, y_2, y_3, t_0 *and find t, based on that we find* a_1, a_2, a_{3x}, a_{3y} *and then find the coordinates at time* t_0 *using the equations above*