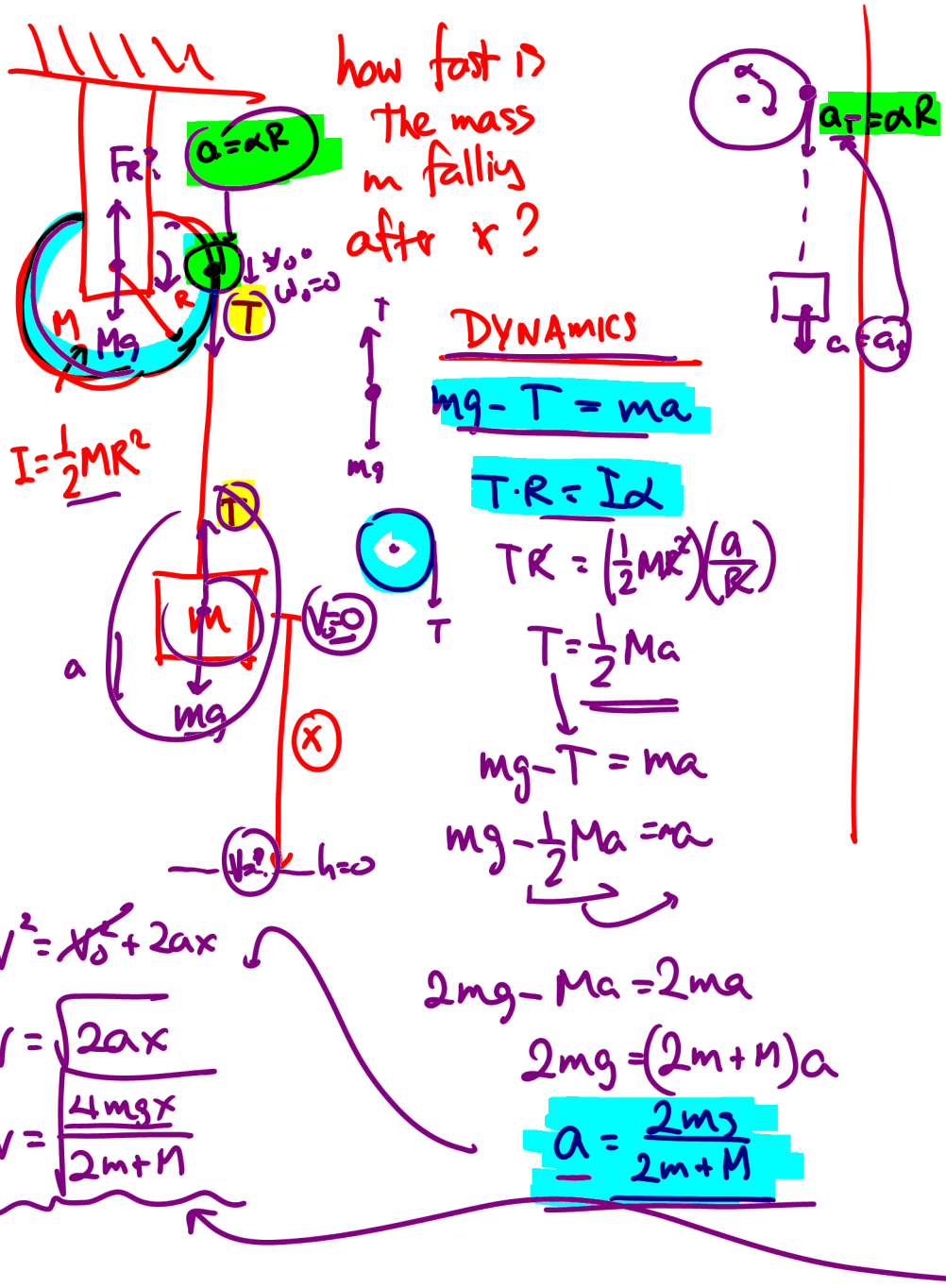
how fast is the mass m falling after x?
$a=\alpha R$
$F_R$
R
M
Mg
T
$v_0=0$
$\omega_0=0$
$I=\frac{1}{2}MR^2$
T
mg
DYNAMICS
$mg-T=ma$
$T\cdot R=I\alpha$
$TR=\left(\frac{1}{2}MR^2\right)\left(\frac{a}{R}\right)$
$T=\frac{1}{2}Ma$
$mg-T=ma$
$mg-\frac{1}{2}Ma=ma$
$2mg-Ma=2ma$
$2mg=(2m+M)a$
$a=\frac{2mg}{2m+M}$
$a_T=\alpha R$
$a=a_T$
m
a
mg
T
T
$V_0=0$
x
$V_0=?$
$h=0$
$V^2=V_0^2+2ax$
$V=\sqrt{2ax}$
$V=\sqrt{\frac{4mgx}{2m+M}}$
Conservation of energy
$U_g+\underbrace{K_T+K_R}_{v_0=0\to\omega_0=0}=U_f+K_T'+K_R'$
$mgx=\frac{1}{2}mv^2+\frac{1}{2}I\omega^2$
$=\frac{1}{2}mv^2+\frac{1}{2}\left(\frac{1}{2}MR^2\right)\left(\frac{v^2}{R^2}\right)$
$mgx=\frac{1}{2}mv^2+\frac{1}{4}Mv^2$
$4mgx=2mv^2+Mv^2$
$=(2m+M)v^2$
$v^2=\frac{4mgx}{(2m+M)}$
$v=\sqrt{\frac{4mgx}{2m+M}}$