dropped from rest

$-F_g + F_d = -ma_y,$

F_g
F_d
a_y
magnitude
??
F_d
analytically

$-mg + bv_y = m(a_y),$

a_y
$-1/m$

$$g - \frac{b}{m}v_y = -a_y.$$

$a_y =$
$-\frac{dv}{dt}$

$$g - \frac{b}{m}v_y = \frac{dv_y}{dt} \quad (1)$$

dt
$g -$
$\frac{b}{m}v_y$

$$\frac{dv_y}{g - \frac{b}{m}v_y} = dt$$

$$-\frac{m}{b}\ln\left(g - \frac{b}{m}v_y\right) = t + const$$

$$v_y(t) = \frac{mg}{b}\left(1 - \frac{A}{g}e^{-\frac{b}{m}t}\right) \quad (2)$$

A
A
$v_y(0) =$
0
$A =$
g
??

$$v_y(t) = \frac{mg}{b}\left(1 - e^{-\frac{b}{m}t}\right) \quad (3)$$

v_t
??
$t \to$
∞

$$v_t = \frac{mg}{b} \quad (4)$$

$$v_y(t) = v_t\left(1 - e^{-\frac{gt}{v_t}}\right) \quad (5)$$

$\tau =$
v_t/g
$\tau =$
v_t/g

$$v_y(t) = v_t\left(1 - e^{-\frac{t}{\tau}}\right) \quad (6)$$

$t =$
τ
$v_y(t =$
$\tau) =$
$v_t\left(1 - e^{-1}\right) \approx$
$0.63v_t$
$\approx$
$0.86v_t$
??
??

$$\frac{dv_y}{dt} = g - \frac{b}{m}v_y,$$

$_{Y}.pyHereisthefileEulerFreeFall.py, whichcontainsthefunctionsthatimplementtheEulermethod:$
$[style =$
$myPythonStyle, caption =$
$Thecontentsofthefile EulerFreeFall., label =$
$code:$
$EulerFreeFall, frame =$
$single]Code/Kinematics/EulerFreeFall.py$

$\overset{\circ}{1000}$
$\vec{F}_{\mathrm{D}}$
ρ

$$\vec{F}_{\mathrm{D}} = -\frac{1}{2}\rho C_d A v^2 \, \hat{v} \tag{9}$$

C_d
$\widetilde{\approx}$
$0{,}04$
A
v

??

m_1
m_2

$$F = \mathrm{G}\frac{m_1 m_2}{r^2}$$

r

m_1
m_2
$\vec{r}_{12} =$
$\vec{r}_2 -$
$\vec{r}_1$