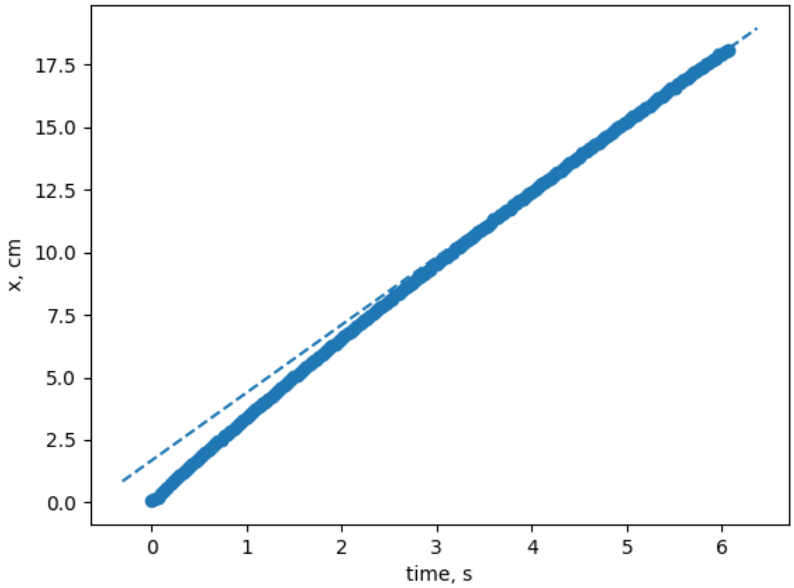
$x(t) V$



$V \eta d$

$$mg = 3\pi d\eta V + \rho g \frac{\pi d^3}{6}$$

$$\eta = \frac{mg - \rho g \frac{\pi d^3}{6}}{3\pi d V}$$

$d m \rho \eta v_x > 0$

$$m \frac{\mathrm{d}v_x}{\mathrm{d}t} = -3\pi\eta d v_x - \rho g \frac{\pi d^3}{6} + mg$$

$$\frac{\mathrm{d}v_x}{\mathrm{d}t} = -\frac{3\pi\eta d}{m} v_x - \frac{\rho g \pi d^3}{6m} + g$$

$$\frac{\mathrm{d}v_x}{\mathrm{d}t} = -\frac{3\pi\eta d}{m}\left(v_x + \frac{\frac{\rho g \pi d^3}{6} - mg}{3\pi\eta d}\right)$$

$c = \frac{mg - \frac{\rho g \pi d^3}{6}}{3\pi\eta d} v'_x = v_x - c k = \frac{3\pi\eta d}{m} c > 0 k > 0$

$$\frac{\mathrm{d}v'_x}{\mathrm{d}t} = -k v'_x \implies v'_x(t) = \left(v_{x_0} - c\right)\exp(-kt)$$

$$v_x(t) = \left(v_{x_0} - c\right)\exp(-kt) + c.$$

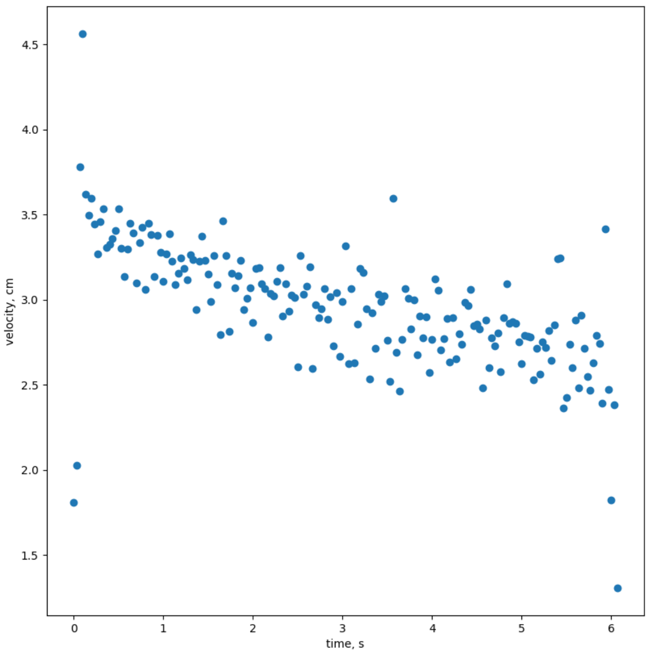
$$x(t) = \int_0^t v_x(t')\mathrm{d}t' = \int_0^t \Big((v_{x_0} - c)\exp(-kt') + c\Big)\mathrm{d}t' = \frac{(v_{x_0} - c)}{-k}\exp(-kt') + ct + x_0$$

$x(t) k k \eta x(t) v_x(t) c v_x(t) v(t)$

$$\ln(v_x(t) - c) = \ln(v_{x_0} - c) - kt.$$

$-k$

$c c \rho$



$$v_x(t) = \big(v_{x_0} - c\big) \exp(-kt) + c.$$

$\tau 0.01 v_x(\tau) = 1.01c$

$$t = \frac{1}{k} \ln\!\left(\frac{v_{x_0} - c}{v_x - c}\right).$$

$$\tau = \frac{1}{k} \ln\!\left(\frac{v_{x_0} - c}{0.01c}\right).$$

$h = 0.05 v_{x_0} = \sqrt{2gh} \approx 1$

$$m = 3.9 \cdot 10^{-4} d = 4 \cdot 10^{-3}.$$

$\rho = 1.12^3 \eta = 1.2$`calculate_when_stable.py`

$$c = 8.5 k = 116 \tau = 0.06.$$

$x(t) \eta(x) \eta(x)$