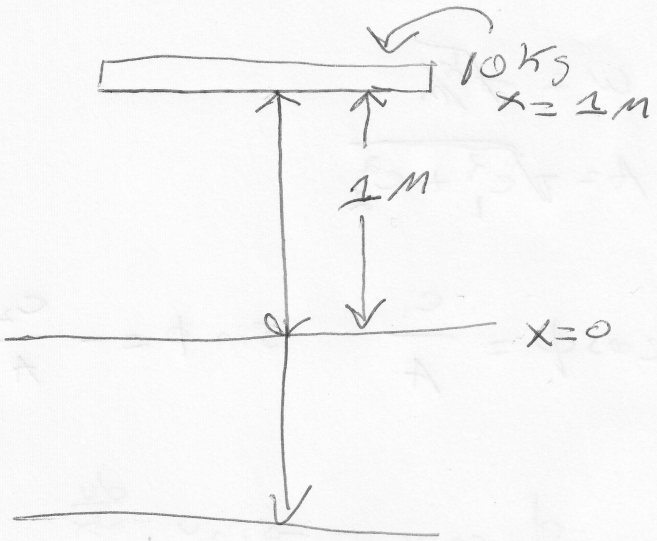

$F_0 = 100{,}000\ N$ - initial force

use: $m\frac{d^2x}{dt} + kx = 0$

$m = 10\,kg$

Find k: $x = Kx$

$100{,}000\,N = k(1\,m)$

$\boxed{k = 100{,}000}$

Sol. to DE is:

$x(t) = c_1 \cos \omega t + c_2 \sin \omega t$

$\omega = \sqrt{k/m} = \sqrt{\frac{100{,}000}{10}}$

$\omega = \sqrt{10{,}000}$

$\boxed{\omega = 100}$

$x(t) = c_1 \cos(100t) + c_2 \sin(100t)$

Initial conditions:

$x(0) = 1\,m$ → start 1m above Equilibrium

$x'(0) = 0$ + initial velocity = 0.

∴ $x(t) = \cos(100t)$ → now solve for t when position is zero or when the plate is @ equilibrium

$0 = \cos(100t)$

$\cos^{-1}(0) = 100t$

$1.57\,rad = 100t$

$\frac{2\pi}{1.57} = 100t \rightarrow t = 0.04\,s$

$4 = 100t$

$x'(t) = -100 \sin(100t)$ plug in $t = 0.04$

$x'(0.04) = -100(\sin(4))$

$\boxed{x' = -6.976\,m/s}$