Answer on Question #45776, Physics, Mechanics | Kinematics | Dynamics

A spring of stiffness 2o KN/m supports a mass of 4 Kg. the mass is pulled down 8 mm and released to produce linear oscillations. calculate the frequency and periodic time. sketch the graphs of displacement, velocity and acceleration. calculate the displacement, velocity and acceleration 0.05 s after released.

note X= A sin(w t + phase angle)

X : displacement
A : amplitude
w : omega
t : periodic time
ceta : phase angle

$$\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{20 * 10^3 N/m}{4kg}} = 10\sqrt{50}\, s^{-1} \approx 70.7\, s^{-1}$$

$$A = 8mm = 8 \cdot 10^{-3} m$$

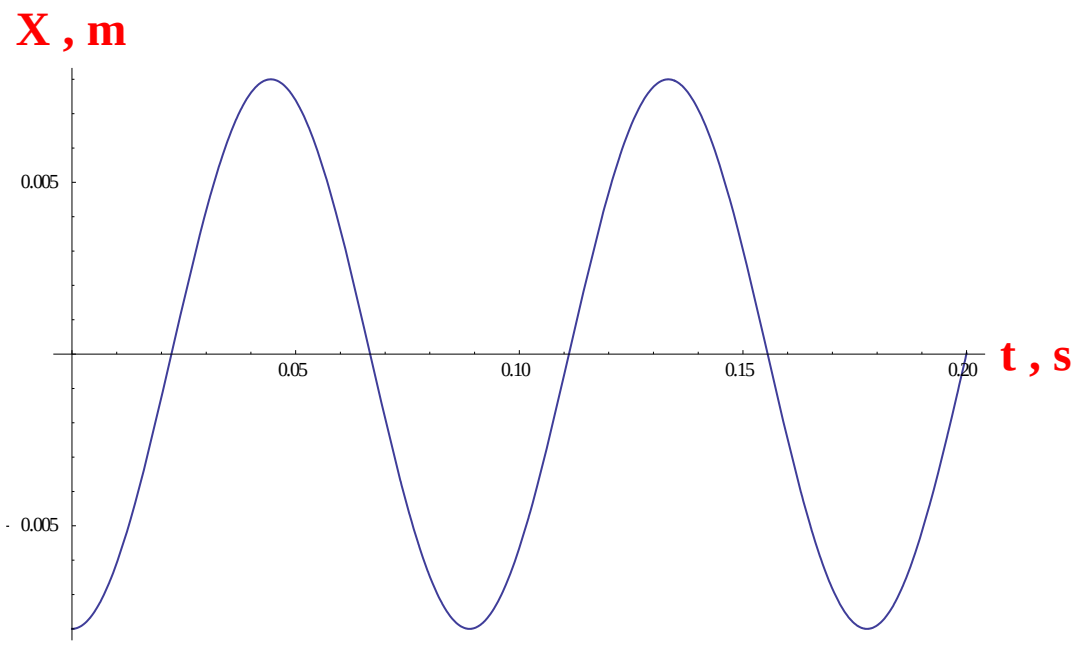
$$\varphi(phase\ angle) = -\frac{\pi}{2}$$

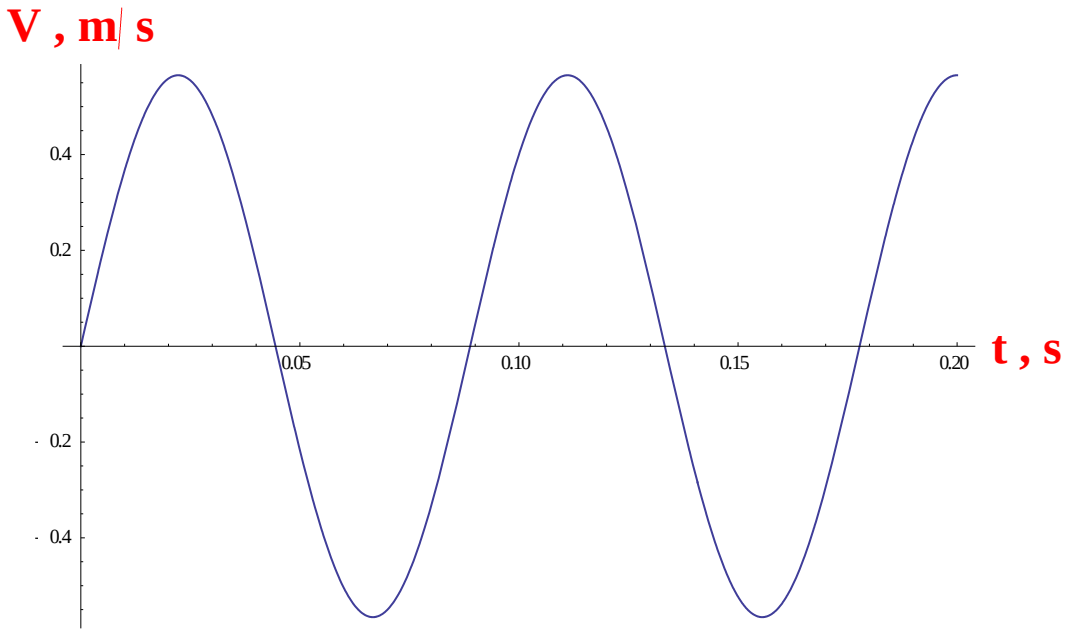
Phase angle take in such way , that at the moment (t=0) we have displacement equal to –A.

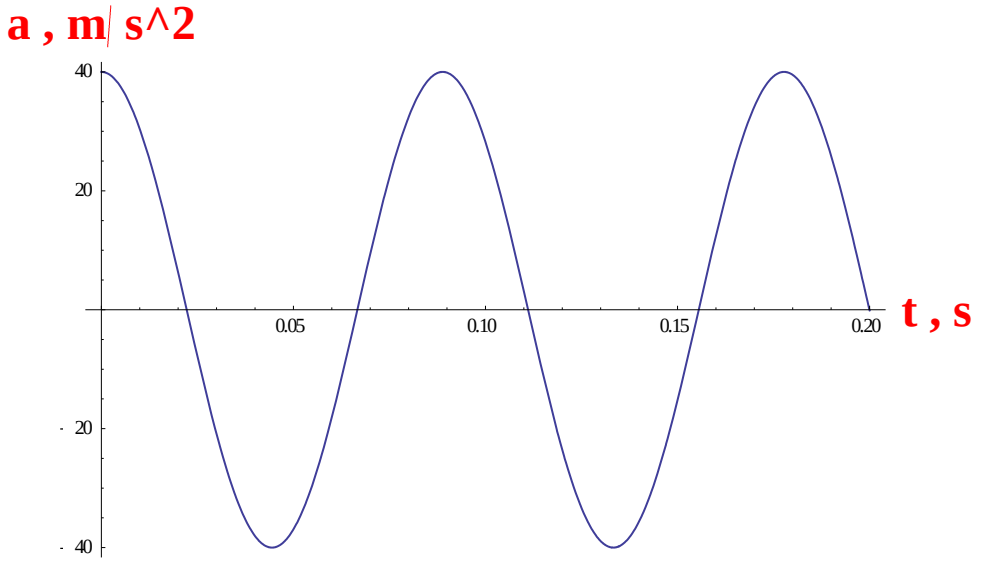
$$X = 8 \cdot 10^{-3} m \cdot Sin(70.7\, s^{-1} \cdot t - \frac{\pi}{2})$$

$$\frac{dX}{dt} = V = 70.7\, s^{-1} \cdot 8 \cdot 10^{-3} m \cdot Cos\left(70.7\, s^{-1} \cdot t - \frac{\pi}{2}\right)$$
$$= 70.7\, s^{-1} \cdot 8 \cdot 10^{-3} m \cdot Cos\left(70.7\, s^{-1} \cdot t - \frac{\pi}{2}\right)$$
$$= 0.5656 \cdot Cos\left(70.7\, s^{-1} \cdot t - \frac{\pi}{2}\right) m/s$$

$$\frac{dV}{dt} = a = -0.5656 \cdot 70.7\, s^{-1} \cdot Sin\left(70.7\, s^{-1} \cdot t - \frac{\pi}{2}\right) m/s = -40 \cdot Sin\left(70.7\, s^{-1} \cdot t - \frac{\pi}{2}\right) \frac{m}{s^2}$$


X , m
0.005
- 0.005
0.05
0.10
0.15
0.20
t , s


V , m/ s
0.4
0.2
- 0.2
- 0.4
0.05
0.10
0.15
0.20
t , s


a , m/ s^2
40
20
- 20
- 40
0.05
0.10
0.15
0.20
t , s

And

$$X(t = 0.05\ s) = 0.00738886607\ m$$