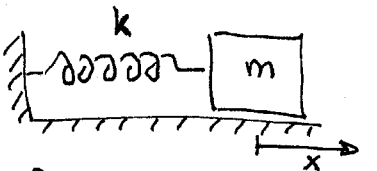
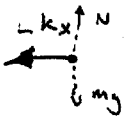
(7.) (a) THE SKETCH



THE FBD (DISPLACE WHALE TO THE RIGHT BY x)



THE EOM: $F = ma = m\frac{d^2x}{dt^2}$

$\Rightarrow -kx = m\frac{d^2x}{dt^2}$ OR, IN STANDARD FORM,

$$\boxed{\frac{d^2x}{dt^2} + \frac{k}{m}x = 0}$$

(b.) ~~THE~~ A GENERAL SOLN IS $x(t) = X_m \sin(\omega_0 t + \varphi)$

WITH $\omega_0 = \sqrt{\frac{k}{m}}$. THE INITIAL CONDITIONS ARE

$$\begin{cases} x(0) = 2m \\ \frac{dx}{dt} > 0 \end{cases} \Rightarrow \quad X_m \sin(\varphi) = 2m \Rightarrow \sin(\varphi) = \frac{2}{3}$$

SO

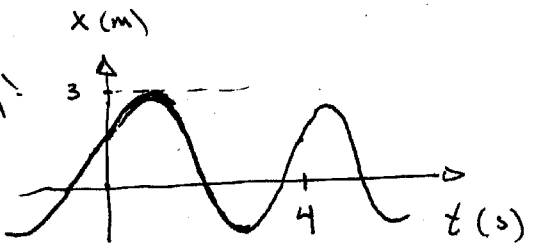
$\varphi \simeq 0.7297 \simeq$ **0.730** rad.

CHECKING THE VELOCITY GIVES

$$\left.\frac{dx}{dt}\right|_{t=0} = X_m \omega \cos(\varphi) = (3)\left(\sqrt{\tfrac{k}{m}}\right)\cos(.73) > 0 \quad \checkmark$$

$$\Rightarrow x(t) = 3.00\sin(1.57t + 0.730)$$

(c) ROUGHLY!



THE AMPLITUDE IS 3 m AND THE PERIOD IS 4 s.