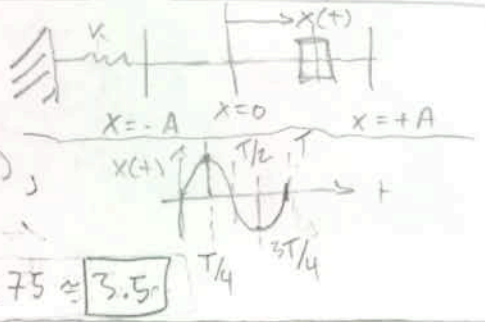
# Physics 1C Quiz #1 Ver A Solutions

**#1** $F = -kx = ma \Rightarrow a(t) = -\left(\frac{k}{m}\right)x(t) \Rightarrow |a_{max}| = \frac{k}{m}|x_{max}|$, when **x(t) is maximum.**

**#2** $v(t) = -A\omega \sin(\omega t + \phi)$; At $t=0$, $v(0) = -A\omega\sin(\phi)$ w/ $A = 7.5\,cm$, $\omega = 4$, & $\phi = \frac{\pi}{2}$. Thus, $|v(0)| = (7.5\,cm)\cdot 4/sec \cdot \sin\left(\frac{\pi}{2}\right) =$ **30 cm**

**#3** For a pendulum, Hook's law is, $\tau = -mgl\theta = ml^2\frac{d^2\theta}{dt}$ w/ $\tau$ = torque, thus, $\frac{d^2\theta}{dt^2} = -\left(g/l\right)\theta$, independent of mass, $\omega = \left(g/l\right)^{1/2} = \frac{2\pi}{T}$;

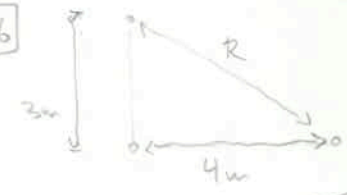
**period does not change**




**#4** $x(0) = 0$ [given in problem]. $x(t) = A\sin(\omega t)$, $f = 0.2\,Hz \Rightarrow T = 5\,sec$; $x = \pm A$ when $t = \frac{T}{4}, \frac{3T}{4}, \frac{5T}{4}, \ldots$ $t_1 = 3.75 \simeq$ **3.5**

**#5** velocity stays the same since the medium doesn't change. If $f\downarrow$, then $\lambda\uparrow$ in order the velocity to remain the same,

**wavelength increases & velocity stays the same**

**#6** 


$R = (4^2 + 3^2)^{\frac{1}{2}} = 5m$. destructive interference occurs when the path differences are $\frac{1}{2}\lambda$. Thus, $1m = \frac{\lambda}{2} \Rightarrow \lambda = 2m$.

**#7** waves oscillate perpendicular to the of the spring

**#8** $T = 2\pi\left(\ell/g\right)^{1/2}$. $T' = 2\pi\left(\frac{\ell}{g}\cdot 10\right)^{1/2} = \sqrt{10}\,T =$ **3.16 sec**

**#9** (1) $v_s \rightarrow$ police $\rightsquigarrow$ obs $\quad$ (2) obs $\rightsquigarrow$ $v_s \rightarrow$; $f^{(1)} = f_s\left(\frac{c}{c-v_s}\right)$ & $f^{(2)} = f_s\left(\frac{c}{c+v_s}\right)$; Solve for $v_s$; $f^{(1)}/f^{(2)} = \frac{c+v_s}{c-v_s} = \frac{560}{480} \Rightarrow c + v_s = (c-v_s)\frac{56}{48} \Rightarrow v_s = c\left[\left(56/48 - 1\right)/\left(56/48 + 1\right)\right] =$

$= v_s =$ **26 m/s** & where $c = 340\,m/s$.

**#10** $E = \frac{1}{2}kA^2 = \frac{1}{2}mv^2 + \frac{1}{2}k\left(\frac{A}{2}\right)^2 \Rightarrow \frac{1}{2}mv^2 = \frac{1}{2}k\frac{3}{4}A^2 = \frac{3}{4}(50\,J) =$ **37.5 J**