

Physics 451: Homework #12

Due Thursday, Oct 23, 5:00PM, 2008

3.17

3.18 Worth double – this is a long problem that is a bit messy and will involve a lot of review. Much of the work is in obtaining $\sigma_x^2 = \frac{a^2}{4} \left[\frac{1}{3} - \frac{5}{4\pi^2} - \left(\frac{32}{9\pi^2} \right)^2 \cos^2(3\omega t) \right]$. You will want to look back at problem 2.4 as well as 2.5.

In addition to the integrals on Homework #5, you might use

$$\int_0^a x^2 \sin\left(\frac{n\pi x}{a}\right) \sin\left(\frac{m\pi x}{a}\right) dx = \frac{a^3}{2\pi^3} \left[\frac{2\pi}{(n-m)^2} \cos[(n-m)\pi] - \frac{2\pi}{(n+m)^2} \cos[(n+m)\pi] \right] \quad (n \neq m),$$

which for $n=1$ and $m=2$ becomes $\int_0^a x^2 \sin\left(\frac{\pi x}{a}\right) \sin\left(\frac{2\pi x}{a}\right) dx = -\frac{a^3}{\pi^2} \left[1 - \frac{1}{3^2} \right]$.