Cornell University

Department of Physics

Phys 214 August 25, 2004

Waves, Optics, and Particles, Fall 2004

Homework Assignment # 1

(Due Thursday, September 2 at 5:00pm *sharp*.)

Agenda and readings for the week of August 30:

Skills to be mastered:

- Review arithmetic of complex numbers

- Be able to go back and forth between a graph of simple harmonic motion and the values of x_{eq}, A, ω_o, f, T, ϕ_o.

Lectures and Readings:

Readings marked YF are from the text Young and Freedman, *University Physics*, 11th edition. Readings marked LN are from the course lecture notes to be found at http://people.ccmr.cornell.edu/~muchomas/P214.

- Lec 1, 08/26 (Thu): General class introduction; Introduction to simple harmonic motion (SHM).
  Readings: LN "Simple Harmonic Motion," Secs. 1–3; YF 13.1–13.3

- Lec 2, 08/31 (Tue): General and particular solutions for SHM.
  Readings: LN "Simple Harmonic Motion," Sec. 4; YF 13.3

- Lec 3, 09/02 (Thu): Complex representation for SHM.
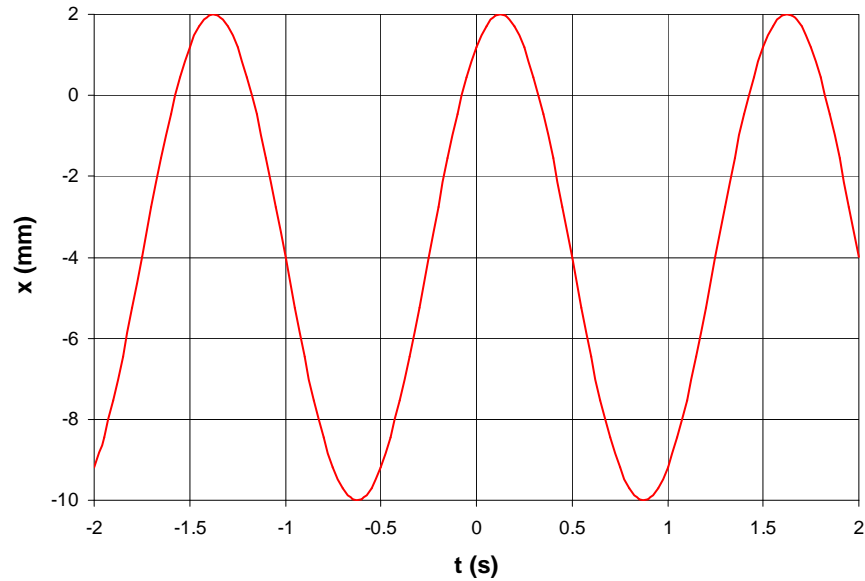 **Readings: LN "Simple Harmonic Motion," Sec. 5**

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Figure 1: Position of a mass in simple harmonic motion as a function of time.

1 Review of complex numbers

For $x = -5 + 12i$ and $y = 4 - 3i$, <u>express</u> the following *both* in Cartesian form $(a + bi)$ and polar form $(Ae^{i\phi})$:

(a) $x - y$
(b) y^2
(c) $\frac{y}{x}$
(d) e^y
(e) $|x|$
(f) yy^*, where y^* is the complex conjugate of y.

2 Basic characterization of harmonic motion

2.1

<u>Sketch</u> a graph of $x(t) = -2.0 \text{ cm} + (1.5 \text{ cm}) \cos\left((314 \frac{\text{rad}}{\text{sec}})t + (\frac{2\pi}{3} \text{ rad})\right)$. Label axes and <u>show</u> at least 2 complete cycles. What are the amplitude A, period T and frequency f (in Hz) of this motion?

2.2

(b) <u>Determine</u> values of x_{eq}, A, ω_o, f, T, ϕ_o from the graph of $x(t) = x_{\text{eq}} + A\cos(\omega_o t + \phi_o)$ in Figure 1. Approximate answers to one or two significant figures are fine. Be sure to provide units for your answers!!! (Note that, in this class, we always require this but normally won't remind you.)

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