

# Waves, Optics, and Particles, Fall 2003

## Homework Assignment # 1

(Due Thursday, September 4 at 5:00pm *sharp*.)

### Agenda and readings for the week of September 1:

#### 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  $x_{\text{eq}}$ ,  $A$ ,  $\omega_o$ ,  $f$ ,  $T$ ,  $\phi_o$ .

#### Lectures and Readings:

Readings marked YF are from the text Young and Freedman, *University Physics*, 10th edition. Readings marked LN are from the course lecture notes to be found at <http://people.ccmr.cornell.edu/~muchomas/P214>.

- Lec 1, 08/28 (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, 09/02 (Tue): General and particular solutions for SHM.  
**Readings: LN “Simple Harmonic Motion,” Sec. 4; YF 13.3**
- Lec 3, 09/04 (Thu): Complex representation for SHM.  
**Readings: LN “Simple Harmonic Motion,” Sec. 5**

## Contents

<b>1</b>	<b>Review of complex numbers</b>	<b>2</b>
<b>2</b>	<b>Basic characterization of harmonic motion</b>	<b>2</b>
2.1	.....	2
2.2	.....	2

# 1 Review of complex numbers

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

- (a)  $x - y$
- (b)  $x^2$
- (c)  $\frac{y}{x}$
- (d)  $e^x$

# 2 Basic characterization of harmonic motion

## 2.1

Sketch a graph of  $x(t) = 4.0 \text{ cm} + (3.0 \text{ cm}) \cos\left(\left(628 \frac{\text{rad}}{\text{sec}}\right)t - \left(\frac{2\pi}{3} \text{ rad}\right)\right)$ . Label axes and show at least 2 complete cycles. What are the amplitude  $A$ , period  $T$  and frequency  $f$  (in Hz) of this motion?

## 2.2

(b) Determine values of  $x_{\text{eq}}$ ,  $A$ ,  $\omega_o$ ,  $f$ ,  $T$ ,  $\phi_o$  from the graph of  $x(t) = x_{\text{eq}} + A \cos(\omega_o t + \phi_o)$  shown below. 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.)

