UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN  
Department of Electrical and Computer Engineering  
ECE 498MH SIGNAL AND IMAGE ANALYSIS  

Homework 1  
Fall 2013  

Assigned: Friday, September 6, 2013  Due: Friday, September 13, 2013  

Reading: McClellan & Schafer 2.1-2.5  

Problem 1.1  

(a) \(236 \cos \left( \frac{\pi n}{2} + \frac{\pi}{2} \right)\)  
(b) \(\cos \left( \frac{\pi n}{16} - \frac{\pi}{2} \right) = -\cos \left( \frac{\pi n}{16} + \frac{\pi}{2} \right) = \sin \left( \frac{\pi n}{16} \right)\)  

Problem 1.2  

(a) \(\Re \left\{ 544 \exp \left( j \frac{\pi n}{3} \right) \right\}\)  
(b) \(\Re \left\{ 26e^{j\pi} e^{j\frac{\pi n}{10}} \right\}\)  
(c) \(\Re \left\{ 5e^{j\frac{\pi n}{10}} e^{-j \tan^{-1}(3/4)} \right\}\)  

Problem 1.3  

(a) Diagram should show addition of the phasors 1 and -j.  
(b) Diagram should show addition of the phasors 1 and -j.  
(c) Diagram should show addition of the phasors 1 and \((3 - 3j)\).  

Problem 1.4  

(a) \(y[n] = \cos \left( 2\pi \frac{3}{4} n \right) = \cos \left( \frac{2\pi n}{4} \right)\) aliased, so \(z(t) = \cos (2\pi 1500t)\)  
(b) \(y[n] = \cos \left( 2\pi \frac{3}{8} n \right)\) with no aliasing, so \(z(t) = \cos (2\pi 4500t)\)
Matlab Exercises

Problem 1.5

(a)

(b)
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(c) 

(d)
Problem 1.6

(a) 

(b) Same as part (a).

Problem 1.7

(a) Changing the frequency of a tone changes its perceived pitch.

(b) Changing the amplitude of a tone changes its perceived loudness.

(c) Changing the phase of a tone changes nothing perceptible.

Problem 1.8

(a) 

(b) 

(c) 

(d)