PHYSICS 262 FALL 2010 EXAM 1
Numbers will be changed on the real exam.
Closed book, closed notes calculators OK.
If you need to use an answer from a previous question, use the exact number, **not** the rounded number.

An electromagnetic plane wave wave traveling in a medium is described by

$\bar{E} = 4\cos(3x - 300t)\hat{j}$ in (V/m) where x is in meters and t is in microseconds.

1,2] What is the speed of the wave, in m/s?

3,4] What is the index of refraction of the medium?

5,6] What is the frequency, in Hz?

7] What part of the electromagnetic spectrum is this?
a) gamma ray
b) x-ray
c) ultraviolet
d) visible
e) infrared
f) terahertz
g) microwave
h) radiowave

8] What is the direction in which the wave is traveling?
a) +x
b) –x
c) +y
d) –y
e) +z
f) –z
g) 45° between x and y
h) 45° between –x and –y

9,10] A small minnow is swimming in water (n=1.33) 20 cm below the surface. What is the apparent depth of the minnow to a bird which sees the minnow at an angle of 45° below horizontal?

11,12] The minnow wishes to hide 20 cm underneath the center of a circular lilly pad. What must the radius of the lilly pad be in order that the minnow cannot be seen, no matter where (in the air) the bird is? (OR enter 0,0 if the minnow can *always* be seen from some position, for any finite lilly pad.)

13,14.] If the minnow is swimming 20 cm underneath the center of the circular lilly pad, but in a pool with a flat mirrored bottom that is 43 cm below the minnow, how big must the lilly pad radius be, if the minnow wishes not to be seen even in reflection off the bottom? (OR enter 0,0 if the minnow can *always* be seen from some position, for any finite lilly pad.)