1. (*Note: This problem may also serve as a post-test for* Damped harmonic motion: Energy loss and the quality factor.)  
  
Consider two linear, underdamped oscillators (#1 and #2) that are identical in *every* way except for the magnitudes of their damping constants *(1* ≠ *2).* The following information is known:

• Oscillator #1 (whose undamped frequency *o* is equal to that of oscillator #2) has a damped frequency **d1 = 0.995 *o*.

• Oscillator #2 has a quality factor *Q2* = 8.0

A. On the basis of the information above:

• Which oscillator (#1 or #2) has the larger *damping constant?*

• Which oscillator has the larger (damped) *frequency?*

• Which oscillator has the larger *quality factor?*

Justify your answers with appropriate calculations and explanations.

B. If the undamped frequency of oscillator #1 is *o* = 1.6 s-1 (and **d1 = 0.995 *o*), determine the ratio of the amplitudes of two successive maxima of that oscillator. Show all work.

2. (*Note: This problem may also serve as a post-test for* Damped harmonic motion: Energy loss and the quality factor.)  
  
Two damped oscillators (#1 and #2) are released from rest from different locations at *t* = 0, as shown below right. Oscillator #1 is released from *x* = 0.75 m; oscillator #2, from *x* = 1.00 m. Note that at *t* = 1.5 s both oscillators experience maximum displacement at the same location, *x* = 0.25 m.

(*Note:* Do **not** assume that the natural frequencies of the oscillators are the same.)

A. Is the damping constant *()* of oscillator #1 *greater than, less than,* or *equal to* that of oscillator #2? Explain how you can tell.

B. Is the quality factor of oscillator #1 *greater than, less than,* or *equal to* that of oscillator #2? Explain how you can tell.

C. Use the information provided in the graph for oscillator #1 to evaluate the constants *a* and *b* in its differential equation of motion (see below). Clearly show all work.

