Announcements

- Homework 5 is posted and due on Monday!
- Read all of Ch 6 (it is short) for Friday!
- I'm thinking to probably hand out the Midterm a week from Friday.
- Responses: `rembold-class.ddns.net`

Today's Objectives

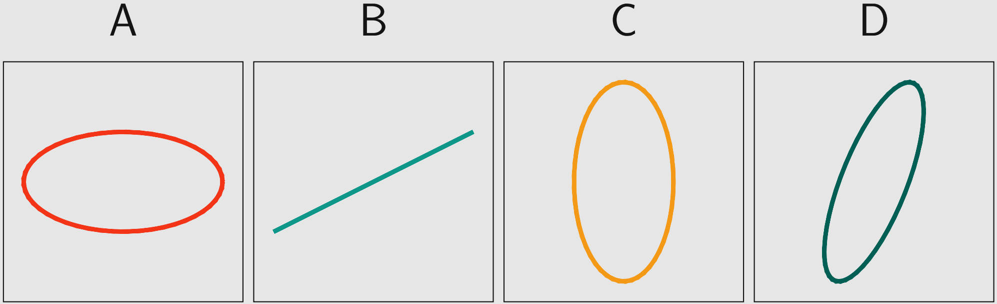
- Show an intuitive understanding of the motion of 2D oscillators
- Come to grips with different forms of damping and their effects
- Understand how to utilize the worked out solutions for driven systems
- Gain some insight into where resonance comes from

Q1

Which plot below best describes the motion of the 2D oscillator whose solutions are given by:

$$x(t) = 2\cos(2t)$$

$$y(t) = 4\cos\left(2t - \frac{\pi}{2}\right)$$



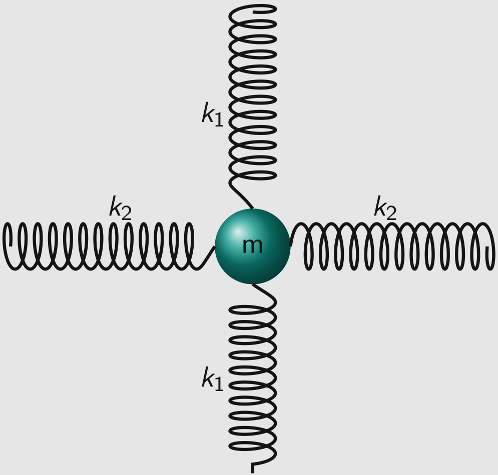
Q2

The object to the right is connected to 4 springs with spring constants of

$$k_1 = 16$$
$$k_2 = 2$$

The resulting motion of the mass could best be characterized as:

A) Periodic
B) Quasiperiodic
C) Episodic
D) None of the above



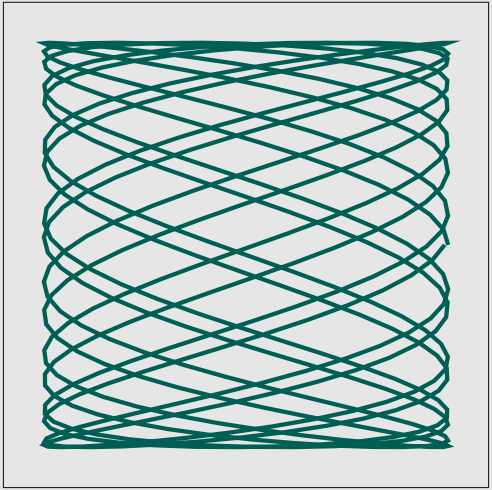
Q2

The object to the right is connected to 4 springs with spring constants of

$$k_1 = 16$$
$$k_2 = 2$$

The resulting motion of the mass could best be characterized as:

A) Periodic
B) Quasiperiodic
C) Episodic
D) None of the above



Q3

Different amount of damping give rise to different sorts of behavior. Which types of damping result in oscillations still being visible?

A) Only weak damping
B) Weak damping and critical damping
C) Weak damping and strong damping
D) Oscillations still technically exist for all 3! They are just really subtle.

Q4

Your book derives the particular solution for the case where:

$$f(t) = f_0 \cos(\omega t)$$

And finds a solution of:

$$x(t) = A\cos(\omega t - \delta)$$

With some somewhat ugly definitions of A and δ. What would change if instead your system was driving as:

$$f(t) = f_0 \sin(\omega t)$$

A) The constants would not change but the cos in the solution would become a sin
B) The A would flip its sign and the cos in the solution would become a sin
C) δ would shift by a factor of $\pi/2$ and the cos would become a sin in the solution
D) Nothing would change at all! The exact same solution holds for both

Q5

You are curious about a spring system whose equation of motion is given by:

$$\ddot{x} + 2\dot{x} + 4x = \cos(3t)$$

and starts at $x = 5\,\text{cm}$ and $v = 0\,\text{cm/s}$. A long time after you start observing the system, the system will be oscillating with what amplitude?

A) $0\,\text{m}$

B) $1.6\,\text{cm}$

C) $12.8\,\text{cm}$

D) $1\,\text{m}$

Q6

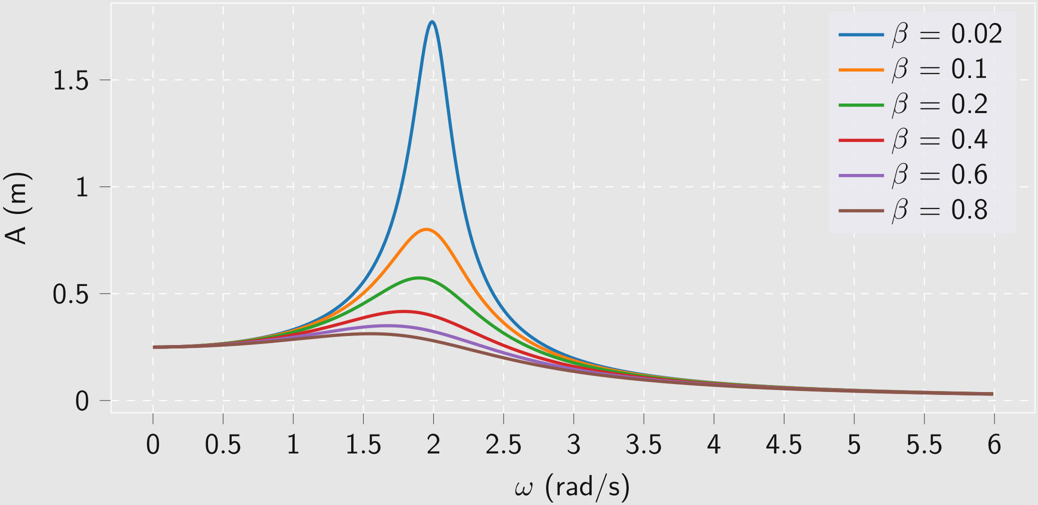
True or False? Increasing the damping on a driven system will decrease the magnitude of the resonance effect, but you would observe *some* resonance over a greater range of frequencies.

A) True

B) False

C) Impossible to tell

Q6



MECHANICS