An oscillator is released from rest at x=+.1 m, and undergoes ideal SHM.
If a small damping term is added, how does $|F_{net}|$ *differ* from the ideal situation while the mass is on its way from +.1 m to the origin?

A) Slightly *larger* than the undamped case.
B) Slightly *smaller* than the undamped case
C) The *same* as the undamped case
D) It varies (and thus none of the above is correct)
E) The answer depends on how big the damping is.

Hint: **Draw a free body diagram**!

A mass on a spring has a small damping term added. What happens to the period of oscillation?

A) Slightly *larger* than the undamped case.
B) Slightly *smaller* than the undamped case
C) The *same* as the undamped case

A particle oscillates in a one-dimensional potential.
How many (which?) of the following properties guarantee simple harmonic motion?

i) The period T is independent of the amplitude A
ii) The potential $U(x) \sim x^2$
iii) The force $F=-kx$ (Hooke's law)
iv) The position is sinusoidal in time: $x=A\cos(wt-\delta)$

A) only 1 of these properties guarantees simple harmonic motion
B) exactly 2 properties guarantee simple harmonic motion
C) exactly 3 properties guarantee simple harmonic motion
D) all (any one of these guarantees simple harmonic motion)

2- 4

A mass on a spring has a small damping term added. When it passes through x=0, which is correct?

A) The mass is instantaneously speeding up
B) The mass is instantaneously slowing down
C) The mass is at a maximum speed (and is thus neither speeding up nor slowing down
D) The answer depends on which WAY it is passing through the origin.

2- 5

An oscillator has a small damping term added. We release it from rest.
Where do you think v_{max} first occurs?

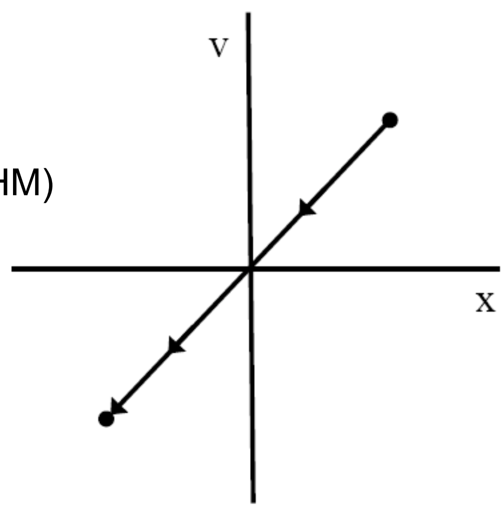
A) Just BEFORE reaching x=0
B) Just AFTER reaching x=0
C) Precisely when x=0
D) ???

HINT: At the instant it passes through x=0, is it speeding up, slowing down, or at a max speed? Does this help?

2- 6

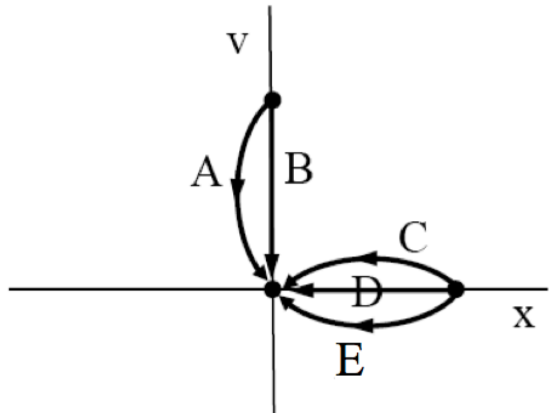
What kind of motion does this phase path describe?

A) overdamped
B) underdamped
C) critically damped
D) undamped (ideal SHM)
E) ??? (not possible?)

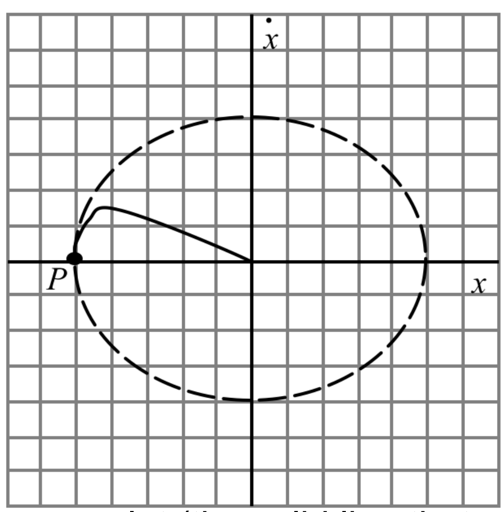


2- 8

Which phase path below best describes overdamped motion for a harmonic oscillator released from rest?

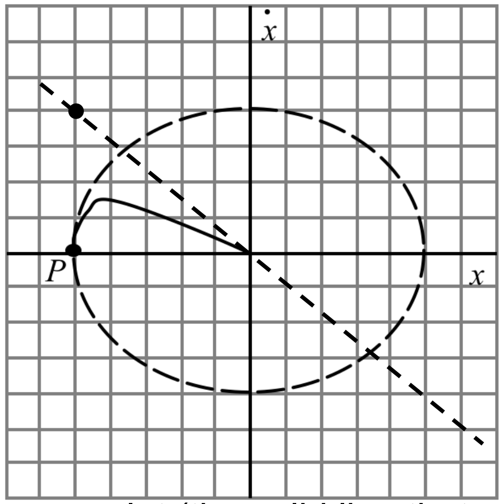


Challenge question:xxx



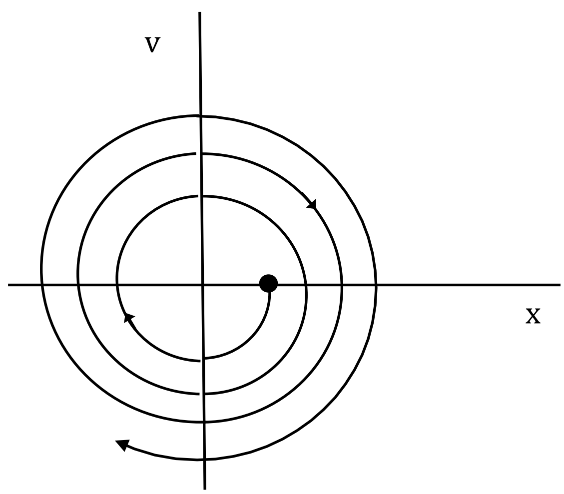
This phase space plot (the solid line that starts at P and ends at the origin) represents what system?

A) undamped B) under-damped C) critically damped D) over-damped E) Not enough info to decide!!



This phase space plot (the solid line that starts at P and ends at the origin) represents what system?
A) undamped B) under-damped C) critically damped
D) over-damped E) Not enough info to decide!! 2- 11

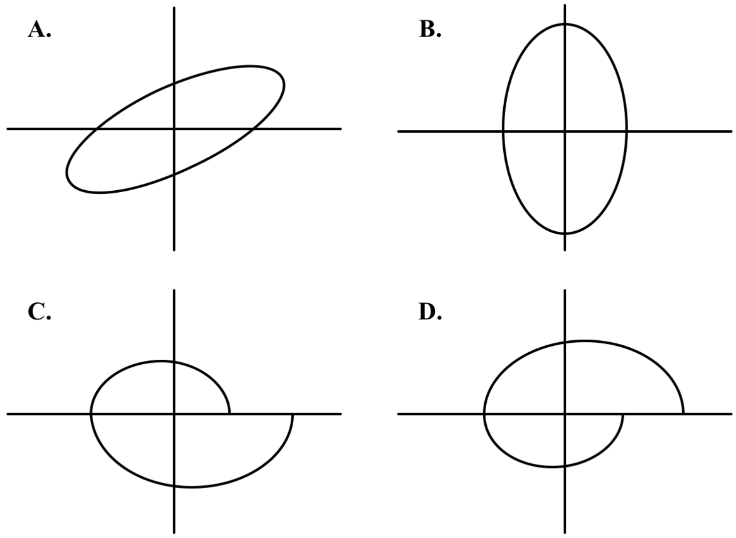
What kind of motion does this phase path describe?



A) overdamped
B) underdamped
C) critically damped
D) impossible to tell
E) This motion is impossible

2- 12

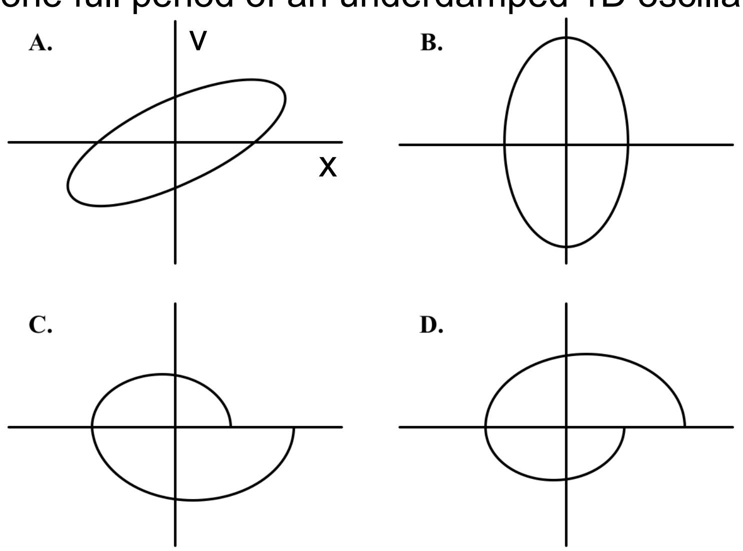
Which could be the phase space diagram for
one full period of an undamped (ideal) 1D oscillator?



E) None of these, or MORE than 1!!

2- 13

Which could be the phase space diagram for
one full period of an underdamped 1D oscillator?



E) None of these, or MORE than 1!!

2- 14

What kind of damping behavior should the shock absorbers in your car have, for the most comfortable ride?

A) No damping is best
B) under-damping
C) critical damping
D) over-damping

2- 15

What is the solution to the equation
$u''-u=e^t$?

A) $u=e^t t+Ce^t$
B) $u=e^{-t} t+Ce^{-t}$
C) $u=(1/2)e^t+Ce^{-t}$
D) $u=e^{-t}+Ce^t$
E) $u=e^t+Ce^t$

2- 16

Consider the general solution for an underdamped, driven oscillator:

$$x(t) = C_1 e^{-\beta t} e^{+\sqrt{\beta^2-\omega_0^2}\, t} + C_1 e^{-\beta t} e^{-\sqrt{\beta^2-\omega_0^2}\, t} + A\cos(\omega t - \delta)$$

term A term B term C

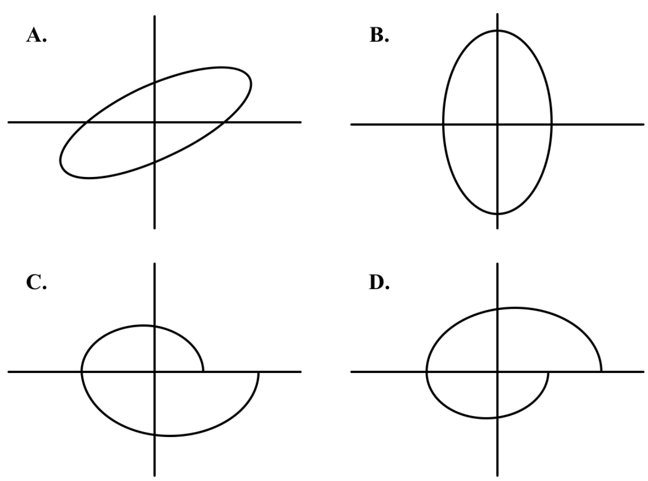
Which term dominates for large t?

D) Depends on the particular values of the constants

Challenge questions: Which term(s) matters most at small t? Which term "goes away" first?

2- 17

Which could be the phase space diagram for one full period of the steady state motion of a driven, damped 1D oscillator?



E) None of these, or MORE than 1!!

2- 19