

Section 31.10: cont'd

Tuesday, May 05, 2015
3:14 PM

Assign 2 due Tues May 19

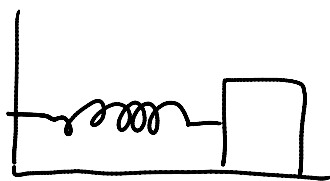
Test 2 on Thurs May 21

- covers sections 31.9 & 31.10

plus statistics chapter 1

- formula sheet posted to web site

recall:



with air resistance

$$m \frac{d^2x}{dt^2} + b \frac{dx}{dt} + kx = 0$$

linear, 2nd order, homogeneous O.E.

so aux eqn:

$$m n^2 + b n + k = 0$$

$$n = \frac{-b \pm \sqrt{b^2 - 4km}}{2m}$$

Solutions will be

- ① 2 real if $b^2 - 4km > 0$
- ② 1 repeated real $= 0$
- ③ 2 complex < 0

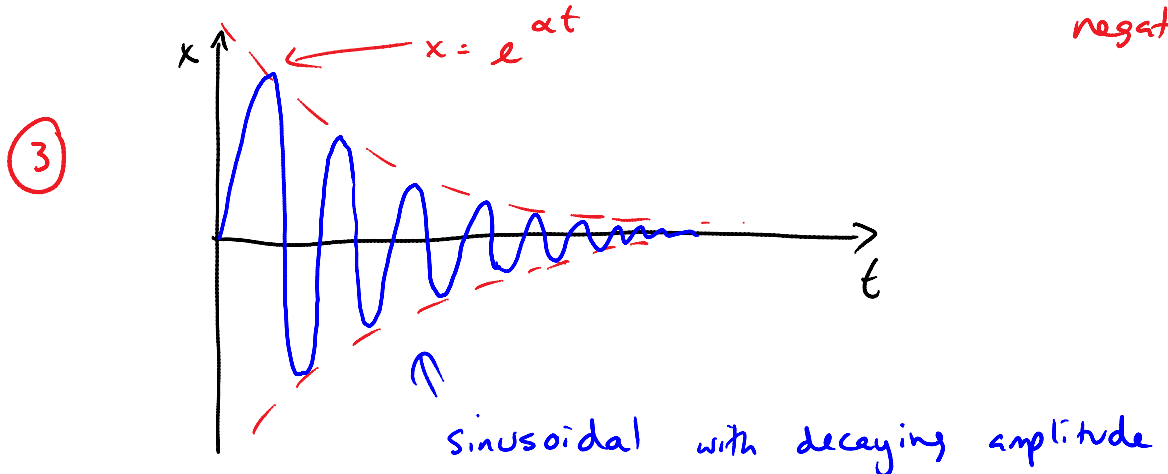
① $x = C_1 e^{n_1 t} + C_2 e^{n_2 t}$

② $x = (C_1 + C_2 t) e^{nt}$

③ $x = e^{\alpha t} (C_1 \cos \beta t + C_2 \sin \beta t)$

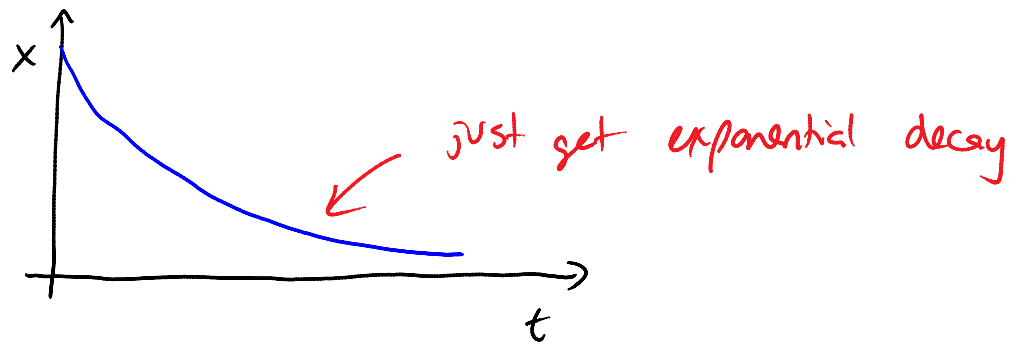
what do these solutions look like?

assume α is negative

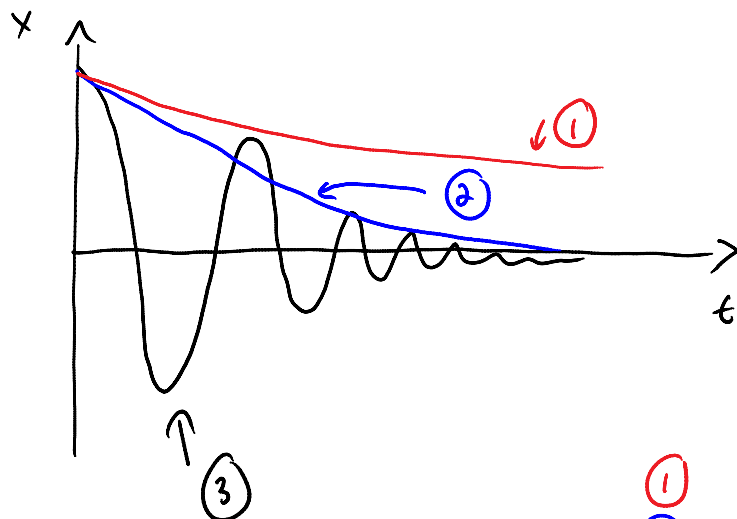


but do ① and ② look like?

if ζ 's are negative



so, putting it all together



- ① overdamped
- ② critically damped
- ③ underdamped

critically damped - just enough friction to prevent oscillation

→ object "returns to equilibrium" in minimum time