Chapter 4   Linear Second-Order Equations

4.1 Intro: mass-spring oscillator

equilibrium
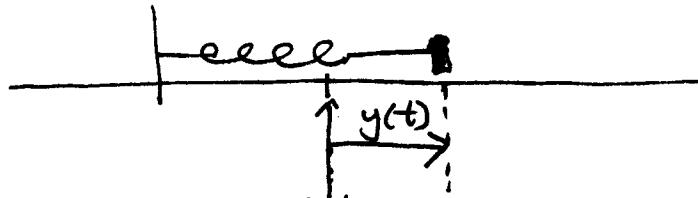
Then $\quad my'' + by' + ky = F_{ext}(t)$

4.2 Homogeneous Linear Equations: The general solution
Suggested homework: odds 1-19, odds 27-33, 34, 35

A linear 2nd order DE has the form
$$a(t)y'' + b(t)y' + c(t)y = f(t).$$
In this chapter we will consider the case when $a(t), b(t), c(t)$ are constant functions, ie DE of the form
$$a y'' + by' + cy = f(t)$$
where a, b, c are constants & $a \neq 0$.
A 2nd order linear DE (with constant coefficients) is **homogeneous** if it has the form
$$(*) \quad a y'' + by' + cy = 0.$$

We try $y = e^{rt}$. Then $y' = re^{rt}, y'' = r^2 e^{rt}$,
$$ay'' + by' + cy = ar^2 e^{rt} + bre^{rt} + ce^{rt}$$
$$= e^{rt}(ar^2 + br + c).$$
So $y = e^{rt}$ is a solution of $(*)$ iff
$$\boxed{ar^2 + br + c = 0}$$
(Auxiliary or Characteristic Eqn).