

$$\textcircled{1} \quad y'' + 4y' - 5y = 0 \quad y = y(t)$$

$$r^2 + 4r - 5 = 0$$

$$(r + 5)(r - 1) = 0$$

$$r = -5, 1$$

$$y = C_1 e^{-5t} + C_2 e^t$$

guess  $y = e^{rt}$

$$y' = r e^{rt}$$

$$y'' = r^2 e^{rt}$$

$$r^2 e^{rt} + 4r e^{rt} - 5e^{rt} = 0$$

$$e^{rt}(r^2 + 4r - 5) = 0$$

$$\textcircled{2} \quad x'' + 9x = 0 \quad x(0) = 2, x'(0) = -1$$

$$r^2 + 9 = 0$$

$$r^2 = -9$$

$$r = \sqrt{-9}$$

$$r = \pm 3i$$

$$y = C_1 \sin 3t + C_2 \cos 3t$$

$$y' = 3C_1 \cos 3t - 3C_2 \sin 3t$$

$$-1 = 3C_1$$

$$\therefore C_1 = -\frac{1}{3}$$

$$2 = C_2 \cos 3t$$

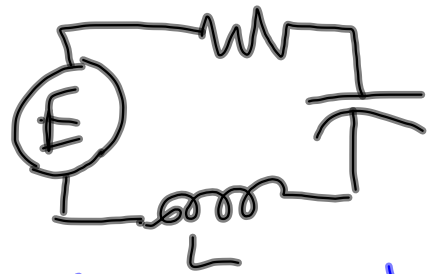
$$2 = C_2$$

$$x = -\frac{1}{3} \sin 3t + 2 \cos 3t$$

$$\textcircled{3} \quad y'' + 6y' + 13y = 0$$

$$L \frac{dq}{dt} + R \frac{dq}{dt} + \frac{1}{C} q = 0$$

$$r^2 + 6r + 13 = 0$$



(char poly)

$$r_{1,2} = -3 \pm 2i \quad \text{(quadratic form.)}$$

$$y(t) = e^{-3t} (c_1 \cos 2t + c_2 \sin 2t)$$

