How to solve $ay''+by'+cy=0$, $y(0)=y_0$, $y'(0)=V_0$.

Here $y=y(t)$ or $y(x)$, and a, b, c, y_0, V_0 are constants. (numbers)

Step 1. plug in $y=e^{rt}$ $(y'=re^{rt}, y''=r^2e^{rt})$ and get

the "characteristic equation." $\boxed{ar^2+br+c=0.}$

Step 2. Find the roots of the ch. eqn., r_1 and r_2. $r_{1,2}=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

If r_1 and r_2 are distinct, real roots then

the general solution to the ODE is $\boxed{y=C_1e^{r_1t}+C_2e^{r_2t}}$

Step 3. Solve $y(0)=\boxed{C_1+C_2=y_0}$ for C_1 and C_2. $(y'=C_1r_1e^{r_1t}+C_2r_2e^{r_2t})$

$y'(0)=\boxed{r_1C_1+r_2C_2=V_0}$

Plug these into the general solution to solve the IVP.