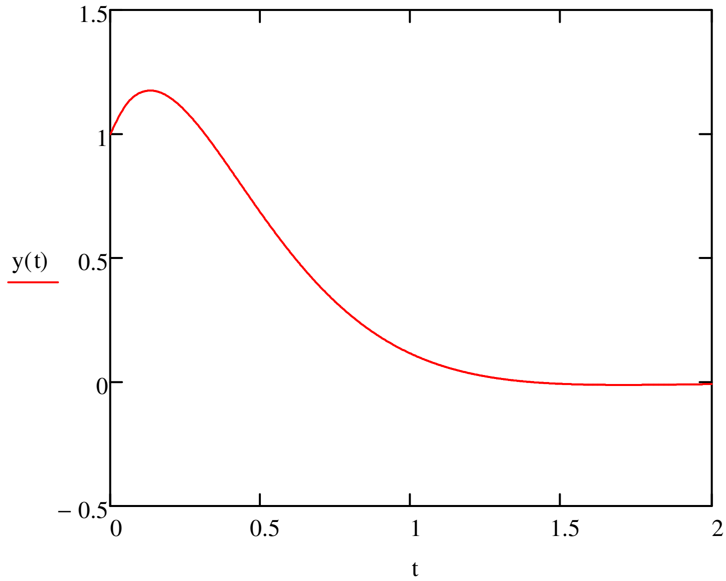
Given

$$y''(t) + 6\cdot y'(t) + 13\,y(t) = 0$$

$$y'(0) = 3 \qquad y(0) = 1$$

$$y := \mathrm{Odesolve}(t, 50)$$



You can get an analytical solution with the help of Mathcad's symbolic Laplace transform here, as follows:

Step 1

$$\frac{d^2}{dt^2}Y(t) + 6\cdot\frac{d}{dt}Y(t) + 13\cdot Y(t) \text{ laplace } \rightarrow 6\cdot s\cdot \mathrm{laplace}(Y(t), t, s) - \left|\begin{array}{l} x0 \leftarrow 0 \\ \frac{d}{dx0}Y(x0) \end{array}\right. - 6\cdot Y(0) + s^2\cdot \mathrm{lap}$$

Step 2

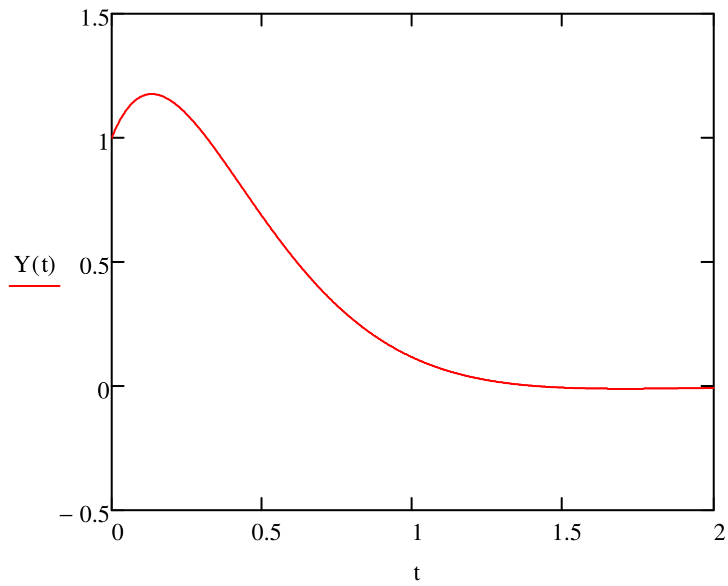
Rewrite the RHS of the above using, say L, for laplace(Y(t),t,s) and noting that $\left|\begin{array}{l} x0 \leftarrow 0 \\ \frac{d}{dx0}Y(x0) \end{array}\right.$ is just $y'(0)$ ((unfortunately this has to be done by hand (at least, I can't find a way of getting Mathcad to do it automatically), set the result equal to zero, solve using symbolic "solve", and assign the result to function L(s), say.

$$L(s) := 6\cdot s\cdot L - 3 - 6 + s^2\cdot L - s + 13\cdot L = 0 \text{ solve}, L \rightarrow \frac{s+9}{s^2 + 6\cdot s + 13}$$

Step 3 Inverse laplace L(s) using symbolic "invlaplace" and assign to Y(t)

$$Y(t) := L(s) \text{ invlaplace } \rightarrow e^{-3\cdot t}\cdot(\cos(2\cdot t) + 3\cdot\sin(2\cdot t))$$

Step 4 Plot Y(t) (compare with numerical y(t) above)
(You should also differentiate Y(t) as necessary to see that you recover your original ODE)



$\text{lace}(Y(t), t, s) - s \cdot Y(0) + 13 \cdot \text{laplace}(Y(t), t, s)$