G C

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Abstract

This product implements three methods for solving differential equations by written and coded demonstrations

Project 3 – Green's Function and ODE with IVP

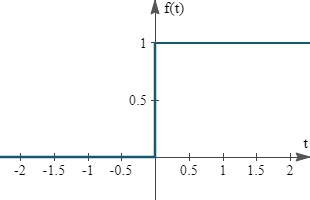
By Gaj Carson

# **Abstract**

In engineering and signal processing, the delta function (also know as the impulse symbol) may be regarded through it’s Laplace Transform coming from the boundary values of complex analytic functions of a complex variable.



The Heaviside step function H(x), θ(x), or n(x) unit step function.



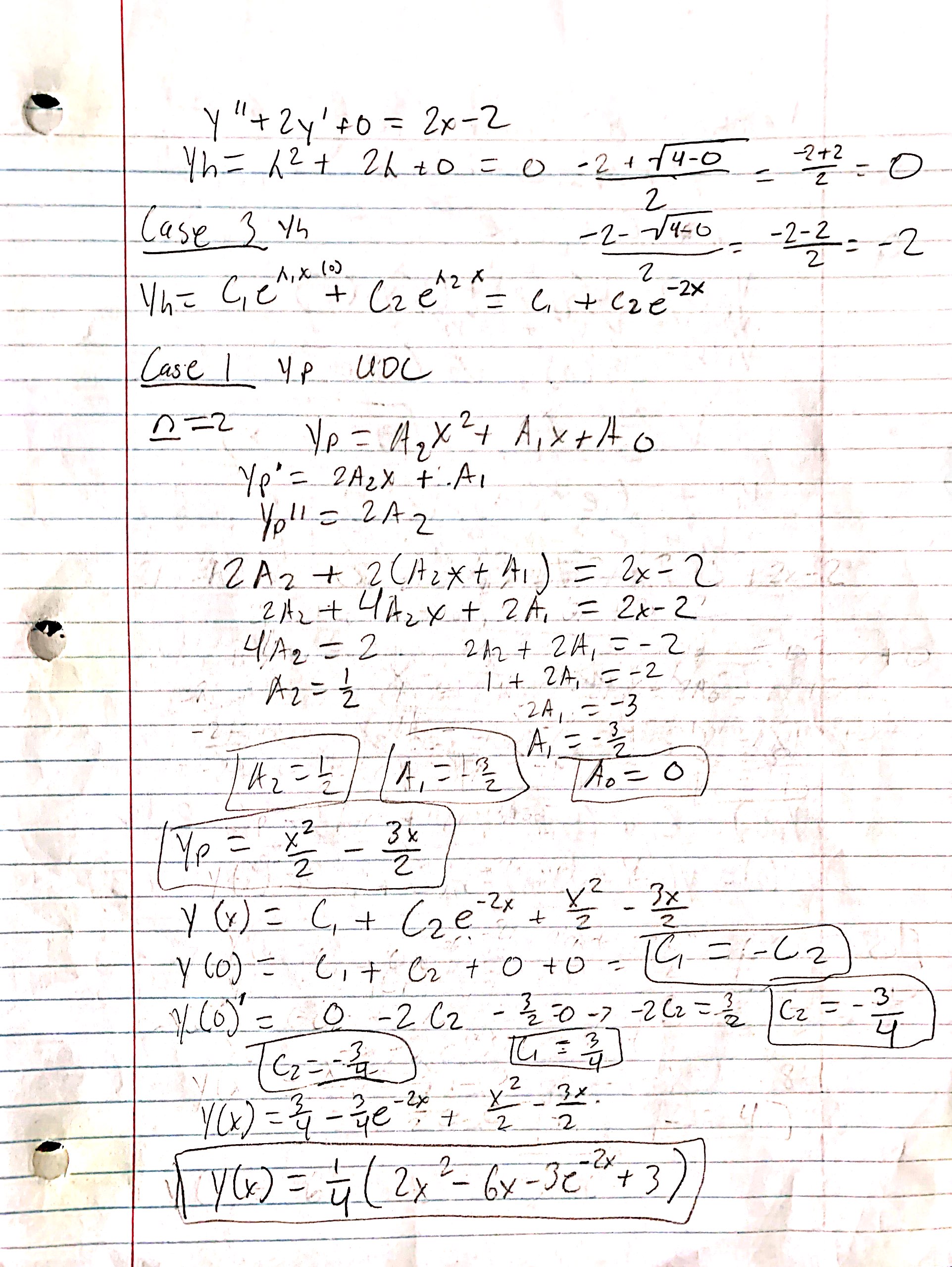
The derivative of a step function is given by .

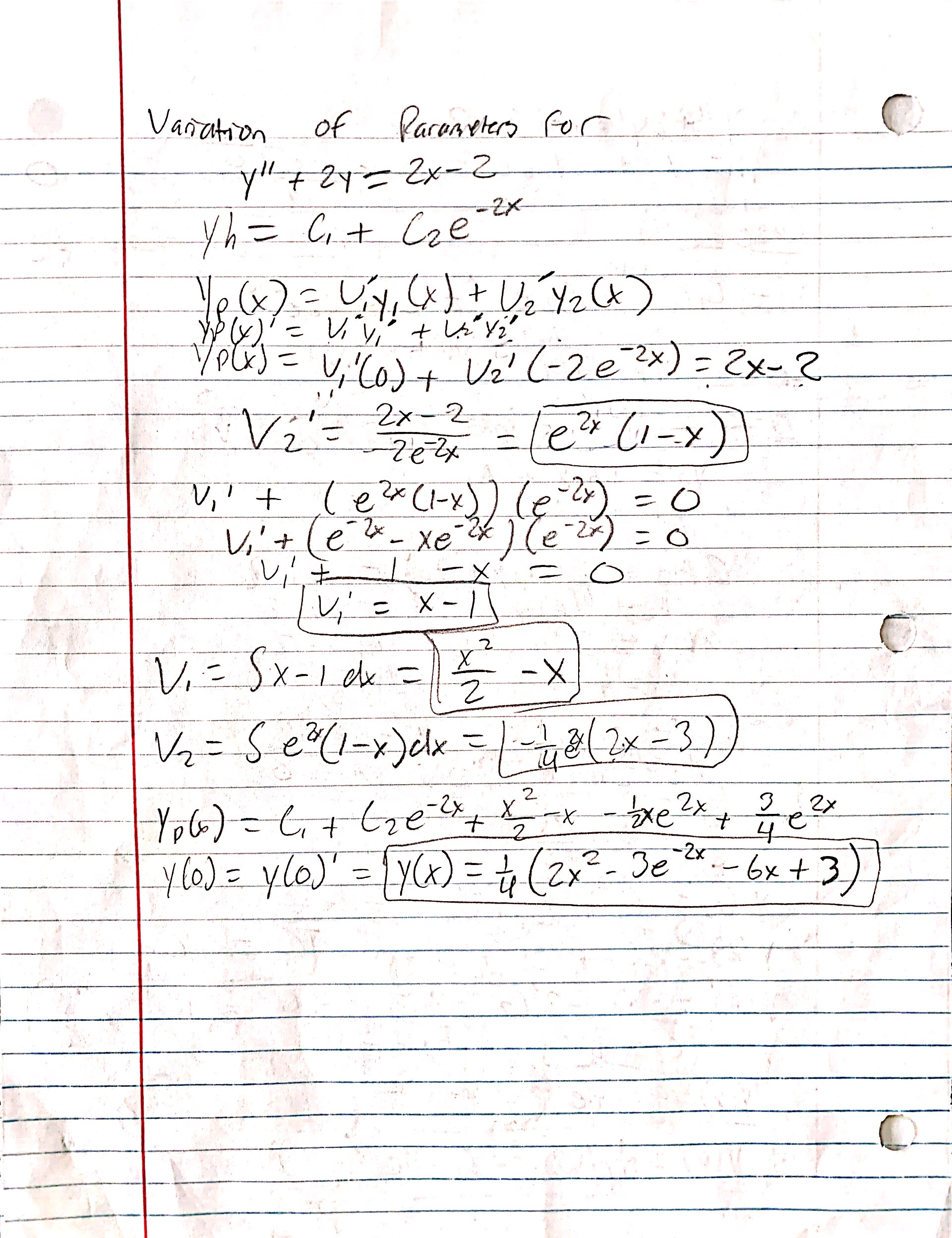
The P(t) and q(t) functions of t and this a second order ODE. And, we use to solve the ODE with the function

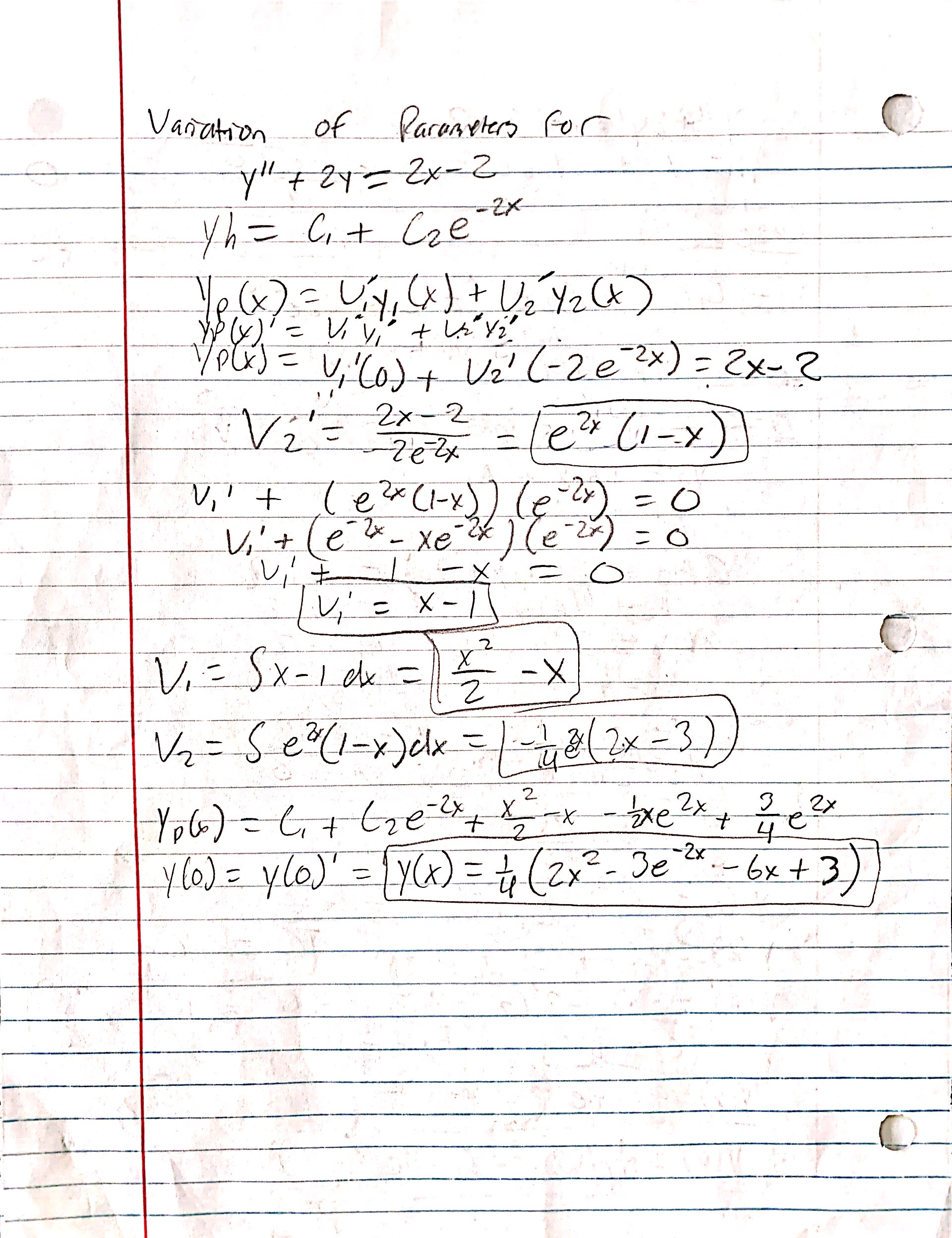
Where r(t) = 0, g(s,s) = 0, and the derivative evaluated at t = s,

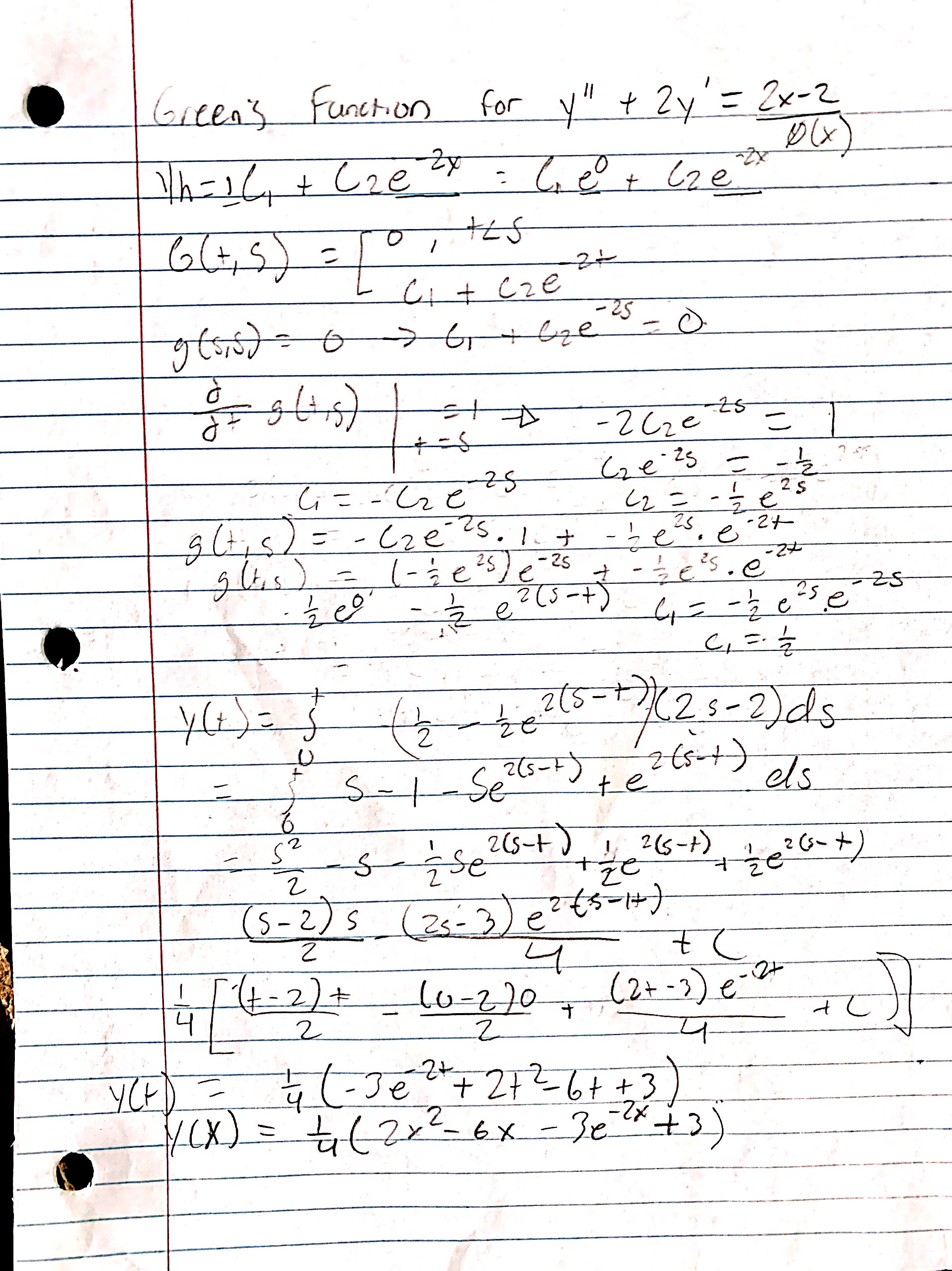
**By Hand Calculations for Equation 1**

Where , starting with the method of Undetermined Coefficients, then Variation of Parameters, and lastly the Green’s function.



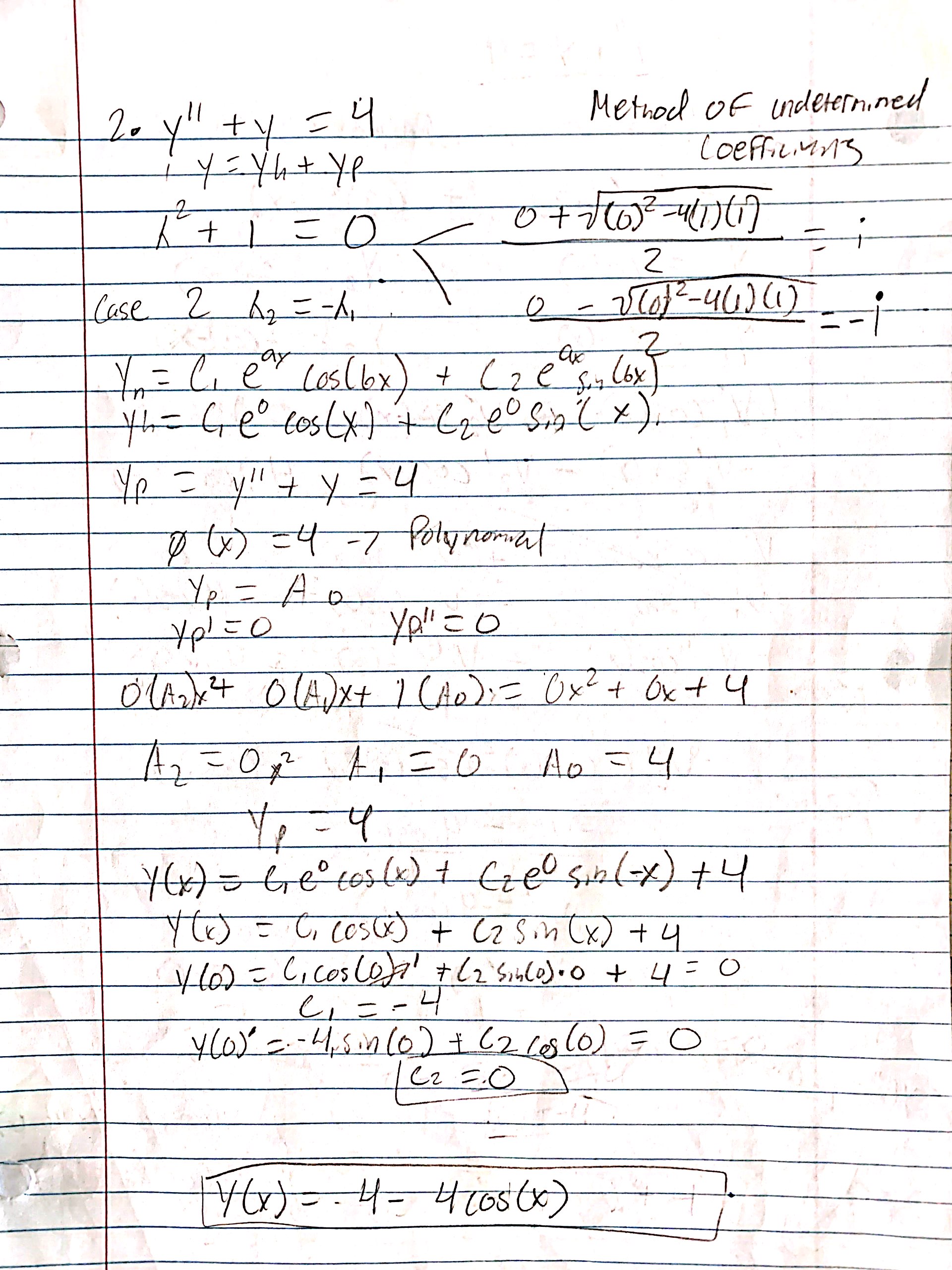


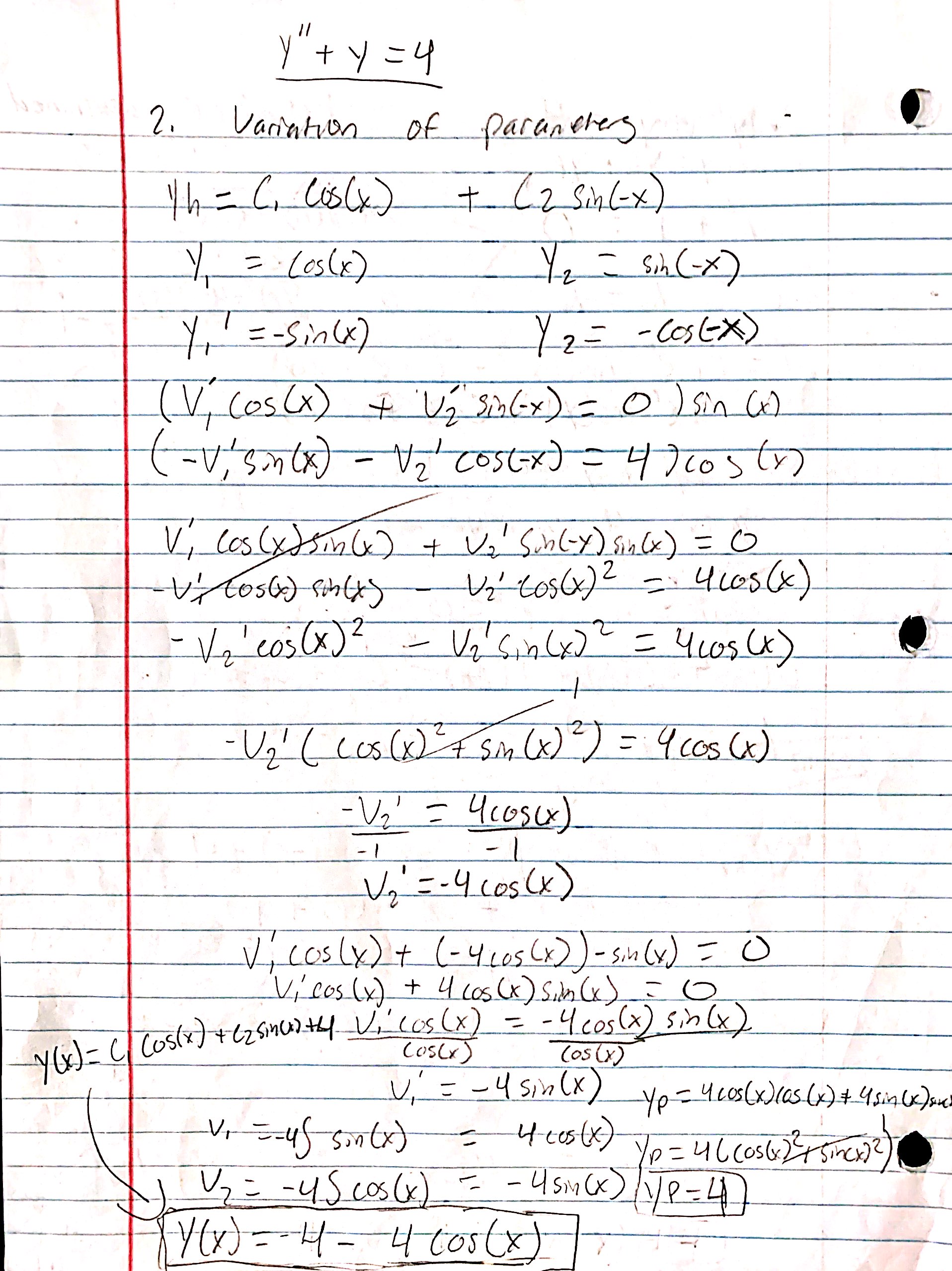


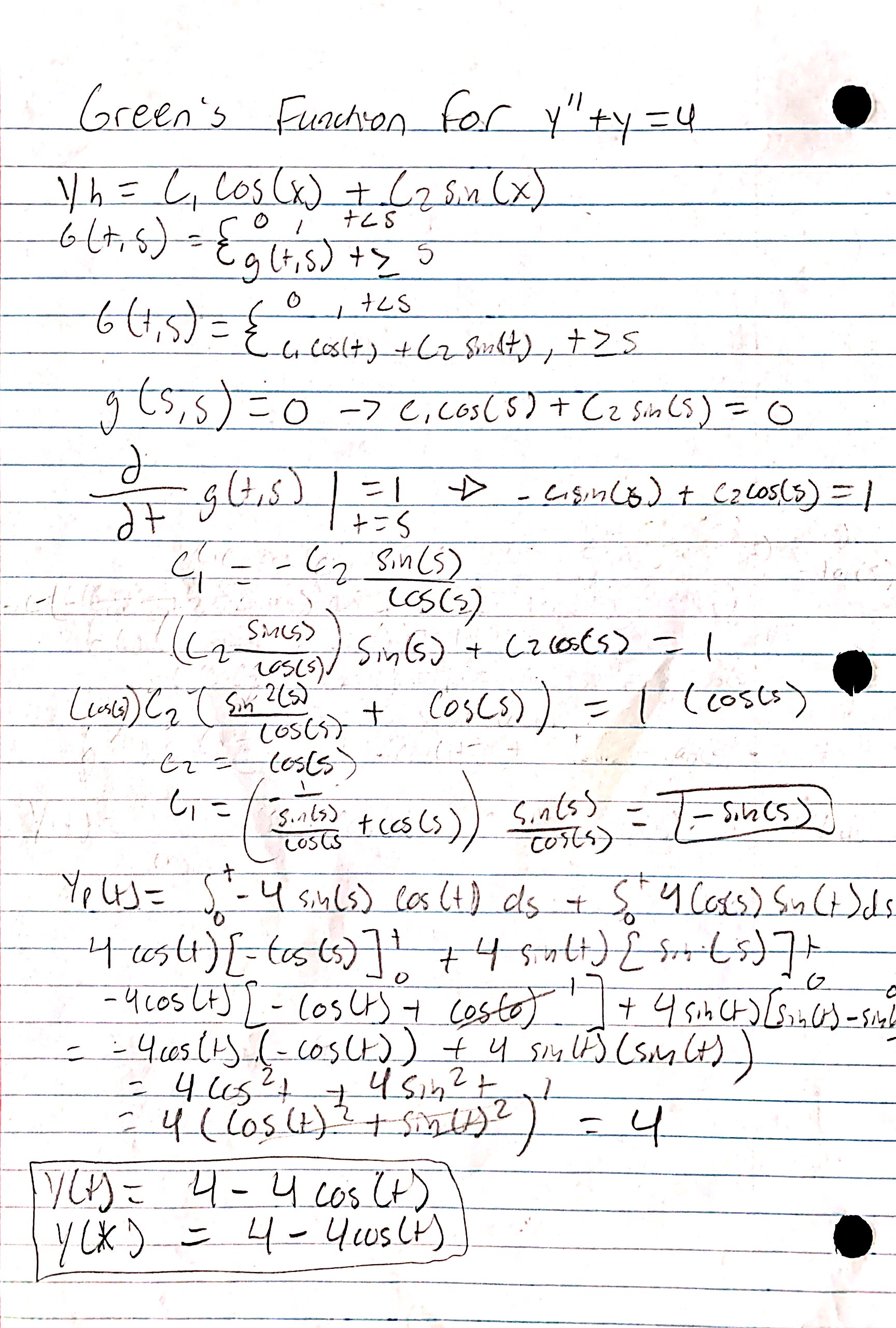


All of the methods ended with the same result, .

The next equation starts with the values of , the by hand calculations are shown by the pictures below in the same format as the question above.



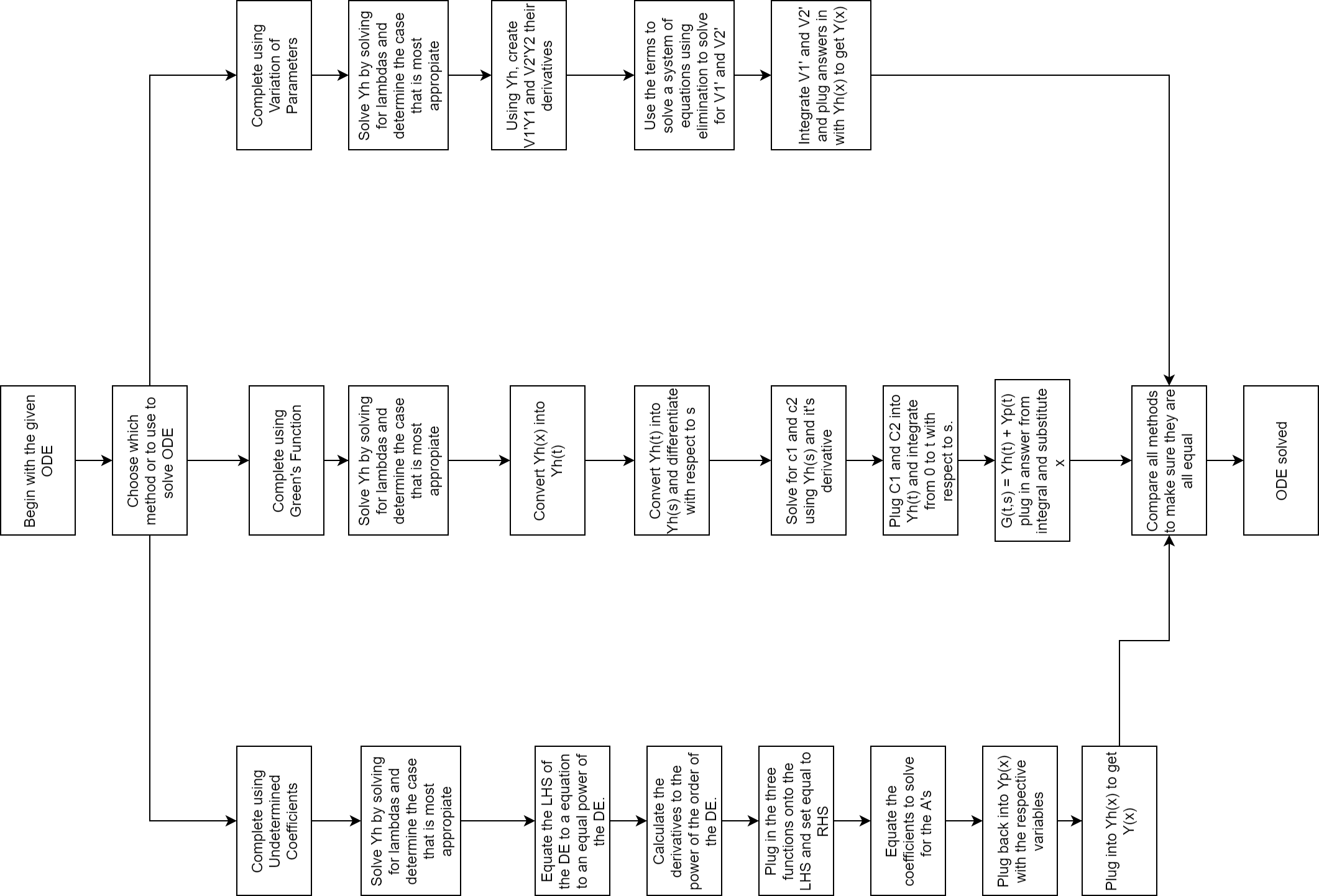




The results from the second equation were with all the methods above producing matching outputs.

Below is the flowchart which outlines the process of solving the ODE’s and generalizes what the code is doing.

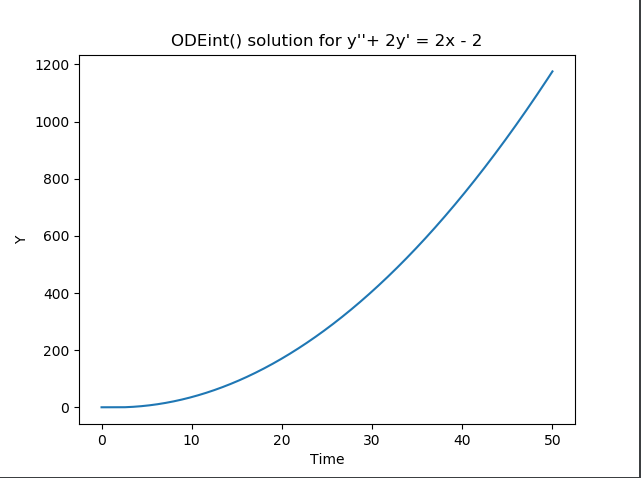
### Flowchart

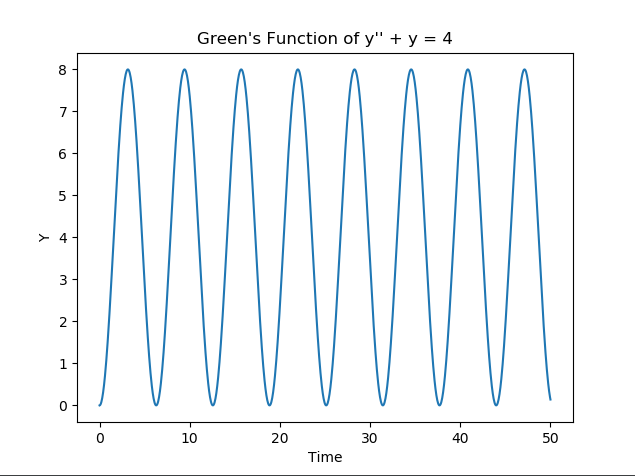


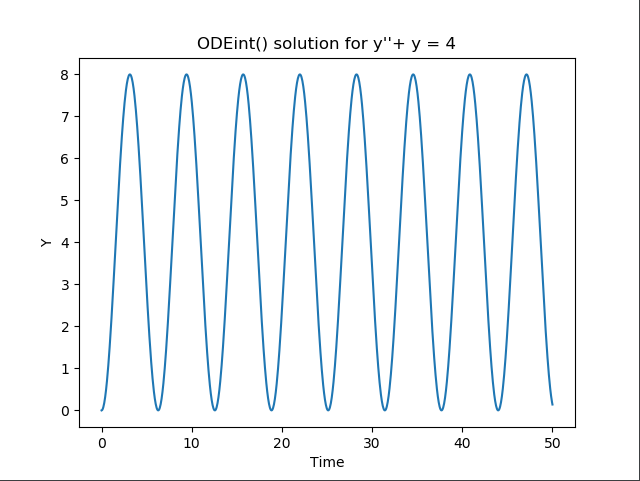
### Code Output

## Lastly, these are the code outputs for all the graphs followed by screenshots of the code. Starting with equation one and the ending with equation 2.

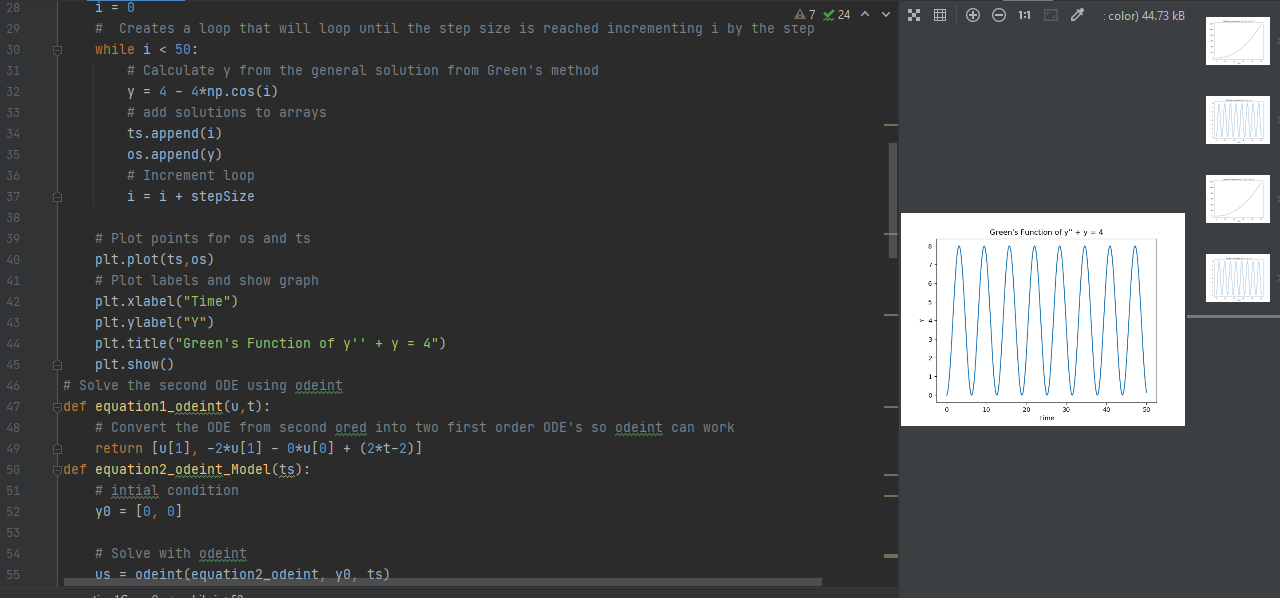
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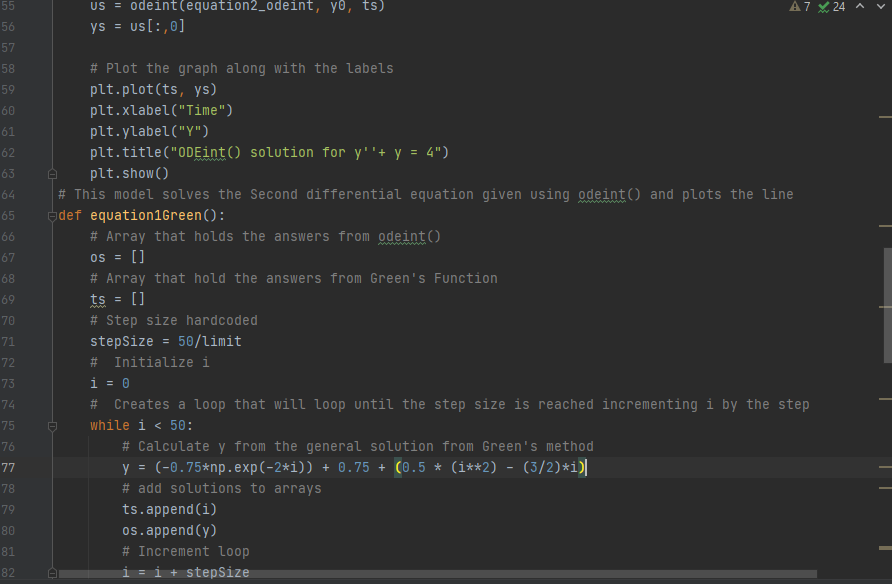


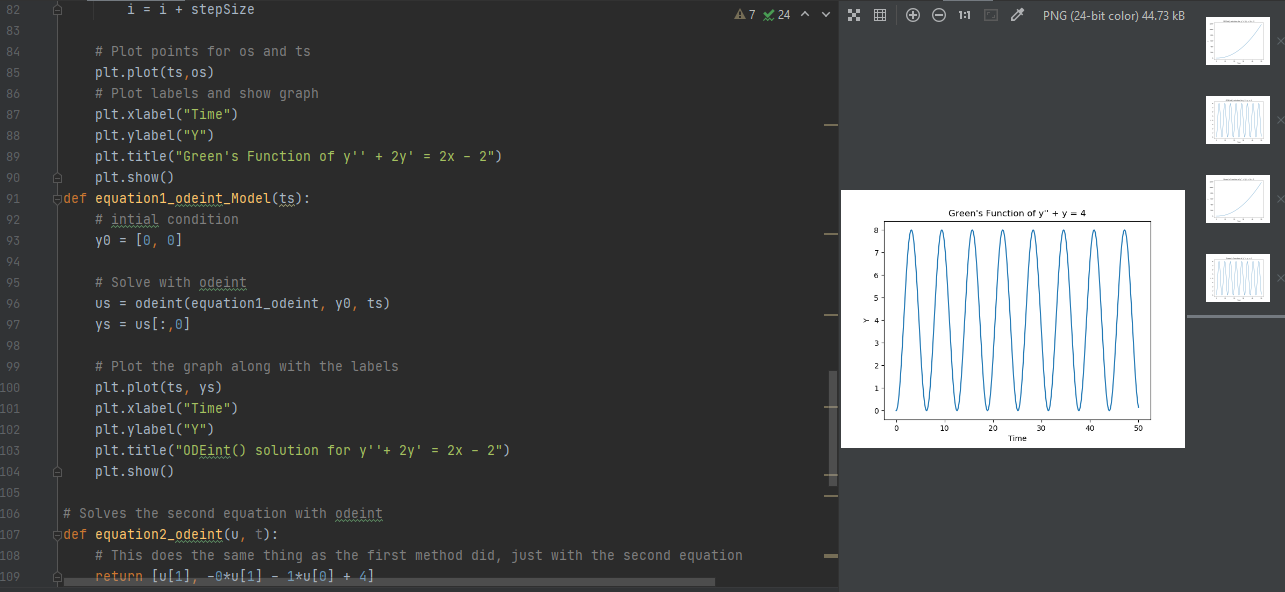


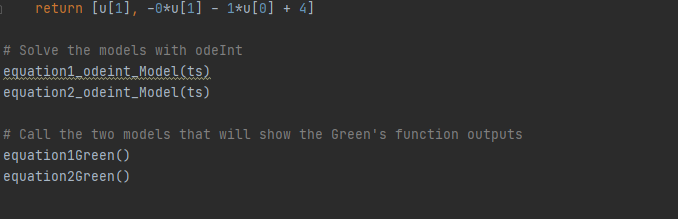


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## References

1. <https://en.wikipedia.org/wiki/Dirac_delta_function>
2. https://www.intmath.com/laplace-transformation/1a-unit-step-functions-definition.php