Symbolic Calculator – Diff. Eq.


For $2. you can purchase Symbolic Calculator for iPhone/iPod Touch or for iPad in the iTunes Store. I, of course, bought both. The support by the author is fabulous. I recommend this product for those wishing to do computer algebra system (CAS) calculations on their mobile devices. The interface is reminiscent of a hardware calculator.

Here are the links for the app.

iPhone/iPod Touch:

iPad:

The problem I needed to solve was to solve a differential equation with initial conditions. i.e. solve

\[ y'' + 3y' + 2y = 0 \]
with initial conditions \( y(0) = 1 \) and \( y'(0) = 2 \)

The steps to solution follow:

1) Enter the DE into the editor line of SymCalc

\[
\text{odesolve}\left(\text{diff}(y,x,2)+3\cdot\text{diff}(y,x)+2\cdot y=0,y,x\right)
\]

2) Press enter

\[
\text{odesolve}\left(\frac{d^2}{dx^2}(y)+3\cdot\frac{d}{dx}(y)+2\cdot y=0,y,x\right)
\]

3) The editor form of the solution is

\[
\left( e^{x}\cdot\text{arbconst}(4)+\text{arbconst}(3) \right) / e^{(2\cdot x)}
\]

4) Define \( yy(x) \) with the constants renamed for subsequent use. Note that I started by copying the above solution to the editor after typing “\( yy(x)=\)” then I edited the previous results. I never type if I can go up and get an expression.

\[
yy(x)=\left( e^{x}\cdot k3+k4 \right) / e^{(2\cdot x)}
\]

5) Find the derivative

\[
\text{diff}(yy(x),x)
\]
6) Press enter
\[ \frac{d}{dx}(yy(x)) = \frac{-(e^{x} \cdot k_{3}) - 2 \cdot k_{4}}{e^{2 \cdot x}} \]

7) Define the first derivative function.
\[ yy2(x) = \frac{-(e^{x} \cdot k_{3}) - 2 \cdot k_{4}}{e^{2 \cdot x}} \]

8) Press enter
\[ yy2(x) = \frac{-(e^{x} \cdot k_{3}) - 2 \cdot k_{4}}{e^{2 \cdot x}} \]

9) Now apply initial conditions by typing yy(0) then yy2(0).
\[ yy(0) = k_{3} + k_{4} \]
\[ yy2(0) = -k_{3} - 2 \cdot k_{4} \]

10) Solve for k3 and k4 using the initial conditions \( y(0) = 1 \) and \( y'(0) = 2 \).
\[ \text{solve}(1 = k_{3} + k_{4}, 2 = -k_{3} - 2 \cdot k_{4}, k_{3}, k_{4}) \]

Note that if you leave the constants as \( \text{arbconst}(n) \), this step will not work. You get the error message

Therefore, I renamed them to \( k_{3} \) and \( k_{4} \) above in my function definition for \( yy(x) \).

11) Press enter
\[ \text{solve}(1 = k_{3} + k_{4}, 2 = -k_{3} - 2 \cdot k_{4}, k_{3}, k_{4}) \]
\[ k_{3} = 4 \]
\[ k_{4} = -3 \]

12) Substitute the values back into \( yy(x) \).
\[ \text{sub}(k_{3} = 4, k_{4} = -3, (e^{x} \cdot k_{3} + k_{4})/e^{(2 \cdot x)}) \]
13) Press Enter

The final form of the solution with initial conditions applied is

\[ y(x) = \frac{4 \cdot e^x - 3}{e^{2x}} \]

Now select the final result and choose plot. Adjust the plot window to your liking.