Assignment 3

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a)

Differentiating $y = Ce^{3t} + e^{-t}$ we get:

$$\frac{dy}{dt}y = 3Ce^{3t} - e^{-t}$$

Then, we re-arrange our first equation:

$$Ce^{3t} = y - e^{-t}$$

And substitute it into the second equation:

$$y' = 3(y - e^{-t}) - e^{-t}$$
$$y' = 3y - 4e^{-t}$$

Therefore $y = Ce^{3t} + e^{-t}$ is indeed a general analytic solution to the equation $y' = 3y - 4e^{-t}$.

b)

Substituting the values $y = 1$ and $t = 0$ into $y = Ce^{3t} + e^{-t}$

$$1 = Ce^0 + e^0$$
$$1 = C + 1$$

Therefore $C = 0$, substituting this back in the proposed solution we find the analytic solution is indeed $y = e^{-t}$

c)

Using a computer program written in C# the following values were obtained:

$$
\begin{aligned}
y(0) &= 1 \\
y(1) &= 0.367741025173408 \\
y(2) &= 0.132504642015483 \\
y(3) &= -0.00707763902447456 \\
y(4) &= -1.1236691550673 \\
y(5) &= -22.9270219157003 \\
y(6) &= -460.561696136583 \\
y(7) &= -9249.21770901647 \\
y(8) &= -185746.199126798 \\
y(9) &= -3730223.27913773 \\
y(10) &= -74911711.536581
\end{aligned}
$$