1. Show that for any constants $P_0$ and $a$, the function

$$ P = P_0 e^t - a $$

satisfies the differential equation

$$ \frac{dP}{dt} = P + a. $$

$$ \frac{dP}{dt} = P_0 e^t \quad \text{Same} \\
\frac{P_0 e^t}{a} - \frac{P_0 e^t}{a} = P_0 e^t \left( 1 - \frac{1}{a} \right) \neq P_0 e^t $$

2. Use 2 steps of Euler's Method to approximate $y$-values for

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

starting at $(1, 0)$ and using $\Delta t = 0.2$. Show your work by hand, also verify your answers with a graphing calculator program.

\[
\begin{array}{c|c|c|c}
 t & y_0 & \Delta y & y_1 \\
1 & 0 & 1 & 1 \\
1.2 & 1 & 1.72 & 2.72 \\
1.4 & 2.72 & 3.44 & 5.44 \\
\end{array}
\]

3. Match up the differential equations in (a), (b), and (c) with one of the slope fields provided in Figures 1, 2, and 3.

(a) $y' = -y$ 
(b) $y' = x - y$ 
(c) $y' = e^{-0.5x}$
Figure 1: Figure for problem number 3

Figure 2: Figure for problem number 3
Figure 3: Figure for problem number 3