1. A 100 litre tank is filled with water infested with dangerous bacteria. Clean water is pumped in and infected water is pumped out at a rate of 10 litres per minute, but the bacteria population reproduces at a rate of two percent per minute. Assume that the bacteria are always perfectly uniformly mixed in the water. If the tank begins with a bacteria concentration of one percent at what time will the bacteria population be half of its present value?

2. Compute the degree two Taylor polynomial of the function \( f(x) = e^{\tan(x)} \) around 0. Use this to estimate \( e^{\tan(0.1)} \).
3. Find the second order Taylor polynomial around 0 for \( f(x) = \int_0^x e^{-t^2} \, dt \) and use this to estimate \( f(.1) \).

4. Find the second order Taylor polynomial of \( \cos(x) \) around 0 then integrate this polynomial. Additionally, find the third order Taylor polynomial of \( \sin(x) \) around 0. Recall that \( \int \cos(x) \, dx = \sin(x) + C \) and compare your answer to the previously computed Taylor polynomial for the integral of \( \cos(x) \).