5. 2 APPLICATIONS OF THE MODELS $\int_0^T P_0 e^{kt}\,dt$ AND $\int_0^T P_0 e^{-kt}\,dt$

Keeping with the concept of the integral of a rate of change gives us a total we are going to go back to the concept of exponential growth and decay models discussed in chapter 3.

First a refresher …

Example: Find the amount in a savings account 4 years after an initial investment of \$700 at an interest rate of 6% compounded continuously.

What if you didn't start with \$700, but you invested money over time at a given rate, say $R(t)$ = \$200 per year without interest being earned. It should be relatively easy to determine that after 4 years, you would have \$800.

Consider the situation where you invest your \$200 per year at a continuous rate instead of all at once, and that you earn interest on your money. Can you see how it is not as trivial to determine your account balance 4 years later?

Future Value of a Continuous Money Flow

If the yearly flow of money into an investment is given by some function $R(t)$, then the **future value of the continuous money flow** at an interest rate k, compounded continuously over T years, is given by

The key to this is to understand the difference between the first example and the next.

Example: Find the future value of a continuous money flow when \$800 per year is being invested at a constant rate, compounded continuously, at 7%, for 10 years.

Example: In 2005 ($t = 0$), bauxite production was approximately 153 million metric tons, and the demand was growing exponentially at a rate of 2.5% per year. If the demand continues to grow at this rate, how many tons of bauxite will the world use from 2005 to 2030?