*Practice problems. Do not turn in.*

Suppose a drug X is quickly injected into the bloodstream and that some organ in the body removes the drug from the blood at a rate proportional to the amount present. If the amount of the drug in the bloodstream is $x$, the initial amount is $x_0$ (called the *dose*), and the rate of withdrawal is $\mu$ then

$$\frac{dx}{dt} = -\mu x, \qquad x(0) = x_0.$$

Let $y$ be the amount of the drug in the organ and assume it is destroyed, transformed, metabolized or excreted at a rate proportional to the amount present. Then

$$\frac{dy}{dt} = -\nu y + \mu x, \qquad y(0) = 0.$$

In general one has $\mu > \nu$ so the amount of drug X in the organ will initially increase relatively rapidly to a maximum and then decreases more or less exponentially. The maximum amount accumulated in the organ is of considerable interest, since if it is too large it may cause damage.

**Problem 0127 – 1**. Solve the first differential equation above. If the organ removes 65 % of the drug X in the blood in 8 hours, find $\mu$.

**Problem 0127 – 2**. Given that 75 % of the drug X in the organ is destroyed in 24 hours, find $\nu$.

**Problem 0127 – 3**. Solve the second differential equation equation above and find the time that a maximum amount of X accumulates in the organ. Compute the maximum amount of the drug X in the organ in terms of the original dose $x_0$.

Here is a graph of $x(t)$ and $y(t)$, assuming $x_0 = 1$. You can use the graph as a rough check on your work.