

## **BC Calculus: Special DE's (*not that every ...*)**

*The following special Differential Equations occur so often that you should memorize these forms:*

***Exponential*** (see p. 623 & 648):

$$\frac{dy}{dt} = ky \implies y = y_0 e^{kt}$$

***Newton's Law of Cooling*** (see p. 653):

$$\frac{dT}{dt} = k(T - T_s) \implies T(t) = T_s + T_D e^{kt}$$

*Note: Though this solution is not explicitly stated on page 653, the book suggests solving NLC problems by letting  $y(t) = T(t) - T_s$  and then solving as an exponential case. Thus, the solution would be  $y(t) = y_0 e^{kt}$  with  $y_0 = T_0 - T_s$  and  $y(t) = T(t) - T_s$ . By substitution this becomes  $T(t) - T_s = (T_0 - T_s) e^{kt}$  which is simply  $T(t) = T_s + T_D e^{kt}$ , where  $T_D = T_0 - T_s$ .*

***Logistic Model*** (see p. 662):

$$\frac{dP}{dt} = kP \left( 1 - \frac{P}{K} \right) \implies P = \frac{K}{1 + A e^{-kt}}$$

*(Each one of these will occur on the test at least once. If you memorize the solution, you will not have to derive it on the test. This will save you time!))*