Questions:

1. Use Dfield to plot the direction field for the equation \( T'(t) = -k(T(t) - T_A) \). Where is it steepest? Where is the direction field "flattest"? What sort of behavior is associated with steepness and flatness?

2. Are there any solution curves for this equation which are only decreasing? Are there any where the temperature is only increasing? Describe the temperature scenario associated with these two types of curves. Is there any solution curve that is a straight line rather than a curve? Are there any solution curves that are both increasing and decreasing?

3. Compute the derivative with respect to \( t \) for the following functions:
   (a) \( f(t) = \ln(t - T_0) \)
   (b) \( g(t) = \ln(e^t - T_0) \)
   (c) \( h(t) = \ln(\sin(t) - T_0) \)

4. For \( T(t) = T_A + (T_0 - T_A)e^{-kt} \) evaluate \( T(0) \), \( T\left(\frac{\ln 2}{k}\right) \), \( T\left(\frac{\ln 10}{k}\right) \). For what value of \( t \) is \( T(t) \) equal to \((T_0 + T_A)/2\)?

5. Suppose \( y = y(x) \) is a continuous function of \( x \) and let \( A(L) \) denote the area under the graph of \( y = y(x) \) between 0 and \( L \). Find a function \( y(x) \) such that:
   
   \[
   \begin{align*}
   (a) \quad A(L) &= y(L) \\
   (b) \quad A(L) &= y(L) \sin L \\
   (c) \quad A(L) &= (1 + L) y(L) \\
   (d) \quad A(L) &= \frac{y(L)}{L}
   \end{align*}
   \]