This assignment is in two parts. The answers to questions in Part I are generally in the book. It is advisable to make every effort to solve the problem before consulting the answer.

Part I

1. p.136, #25. In part (a), solve the problem by hand as well as by Maple.

2. p.137, #28, #32.

3. p.146, #14, #16. Hint: For #16, see Theorem 3.2.1.

4. (a) p.152, #13.
   (b) Consider Example 6 on p.144. Show that it illustrates the results of part (a).

Part II

5. (a) By eliminating $c_1$ and $c_2$, find a constant coefficient linear differential equation whose general solution is $(c_1 + c_2 t) e^{-3t}$.
   (b) Find particular solutions $y_1(t)$ and $y_2(t)$ to this equation which satisfy $y_1(0) = 1$, $y_1'(0) = 1$ and $y_2(0) = 0$, $y_2'(0) = 1$, respectively. Hence demonstrate, on the basis of Theorem 3.2.5, that $\{y_1, y_2\}$ forms a fundamental set for the differential equation.

6. Sometimes the conditions needed to solve a DE involve end-points of an interval. Such conditions are called boundary conditions.
   The steady-state temperature distribution $y(x)$ in a uniform slab of length $L$ satisfies the DE
   \[ y''(x) - k^2 y(x) = 0, \quad 0 < x < L, \]
   where $-k^2 \neq 0$ is a constant which indicates that heat energy is being removed from the slab, with the boundary conditions $y(0) = A$, $y'(L) = 0$ (kept at the fixed temperature $A$ at $x = 0$, and insulated at $x = L$). Find an expression for the solution $y = \phi(x; A, k, L)$. Show that this solution may be written as $y = A \cosh(k(x - L)) / \cosh(kL)$. 

MATH-2400 Introduction to Differential Equations    Fall 2003
Assignment #3    Due: Thursday September 25th