1. Problem 1.4, page 34 of text.

1. Problem 1.4, page 34 of text. Give the integral curves in parametric form with parameter t, so that the curve goes through the point (a, b, c) when $t = 0$. Show in part (b), for example, that the curves are given by

$$x = t + a, y = \pm[b^4 + (a^4 - (t + a)^4))]^{1/4}, z = c$$

2. Problem 2.7 page 41 of text. Again give the integral curves in parametric form as in problem 1.
3.Solve the following problems for $u(x, y)$. Be sure to eliminate a, b, c, t to express u as a function of x, y. In each case check your answer by partial differentiation:

$$(a) \quad xu_x + u_y = 1, u(x, 0) = e^x.$$

$$(b) \quad xu_x + (y^2 + 1)u_y = u, u(x, 0) = e^x.$$

4. Solve the linear problem

$$u_t - tx^2 u_x = 0, \; u(x, 0) = x + 1,$$

and sketch the characteristic curves in the x, t-plane. Show that the solution becomes infinite on a certain curve in the x, t plane.

5. Solve the linear first-order equation

$$u_t + e^y u_x + u_y = 0, u(x, y, 0) = x + y.$$

First find the characteristic curves in the x, y-plane and give the functions $x(a, b, t$ and $y(a, b, t)$ which determine these curves. Then find $u(x, y, t)$.