

ODE for Physicists - Homework 6

Due: May 24, 2005

16. Using an appropriate substitution method, find the general form of the primitives, respectively the solution to the IVP, for the following differential equations:

(a) (2 pts.) (Similarity) $x^2y' - x^2 - xy - y^2 = 0$

(b) (4 pts.) (Bernoulli)

(i) $y' + y + y^2(\sin x - \cos x) = 0$

(ii) $y' + 2y = e^x y^2$, with $y(0) = 1$.

(c) (4 pts.) (Riccati). Find a particular solution to

$$y' = \frac{y^2}{\cos x} - y \tan x + \cos x.$$

Then use an appropriate transformation to find the general solution. (Do not try to double-check that the final form is indeed a solution of the equation - it's too messy.)

(d) (2 pts.) (Inversion of y'). $(xy' - y)(yy' + x) = 2y'$. (*Hint*: Use $u = y^2, v = x^2$.)

(e) (4 pts.) (D'Alembert) Find all the primitives of $y = 2xy' + y^2(y')^3$.