

Math 231 Fall 2008- lecture 1 homework

1,2. Show that the equation on the right defines an implicit solution of the differential equation on the left. Recall this has two steps: (i) showing (by differentiating the equation) that any function $y(x)$ that satisfies the relation on the right necessarily satisfies the differential equation; (ii) showing that there exists an interval in which the relation on the right defines a function $y(x)$ (for example, by solving explicitly for y in terms of x , stating an interval where this is possible.)

1. $y^2 - 1 - (2y + xy)y' = 0$, $y^2 - 1 = (x + 2)^2$.

2. $e^{x-y} + e^{y-x}y' = 0$, $e^{2y} + e^{2x} = 1$.

3. Construct a direction field for the differential equation:

$$y' = 2x.$$

Draw three different integral curves.

4. Consider the differential equation:

$$y' = y^2$$

Find a one-parameter family of solutions (use the method 'separating variables and integrating both sides' used in class.) Find the interval of definition for the solution $y(x)$ satisfying $y(0) = 1$.