

## Math 305

### Section 2.1 Differential Equations and Solutions

**Definition** An ordinary differential equation is an equation involving an unknown function of a single variable together with one or more of its derivatives.

**Definition** The order of a differential equation is the order of the highest derivative that occurs in the equation.

**Definition** A first order ordinary differential equation of the form  $y' = f(t, y)$  is said to be in normal form. Similarly,  $y^{(n)} = f(t, y, y', \dots, y^{(n-1)})$  is the normal form for an  $n$ th order equation.

**Definition** A solution of the first order ordinary differential equation  $\Phi(t, y, y') = 0$  is a differentiable function  $y(t)$  such that  $\Phi(t, y(t), y'(t)) = 0$  for all  $t$  in the interval where  $y(t)$  is defined.

**Definition** A first order differential equation together with an initial condition,

$$y' = f(t, y), \quad y(t_0) = y_0,$$

is called an initial value problem (IVP). A solution of an IVP is a differentiable function satisfying both the equation and the initial condition.

**Definition** The interval of existence of a solution to a differential equation is the largest interval over which the function is defined and remains a solution.