

# First Order Ordinary Differential Equations

**Standard Form:**

$$y' = f(x, y) \quad (1)$$

**Differential Form:** Write

$$f(x, y) = -\frac{M(x, y)}{N(x, y)}$$

(There are many ways to do this. Choose a way that is helpful for the problem at hand.) Then Eqn(1) becomes

$$M(x, y) dx + N(x, y) dy = 0$$

**Theorem: (Uniqueness)**

If  $f$  and  $\frac{\partial f}{\partial y}$  are continuous in a rectangle  $|x - x_0| \leq a$ ,  $|y - y_0| \leq b$ , then there exists an interval about  $x_0$  in which the initial value problem  $y' = f(x, y)$ ,  $y(x_0) = y_0$  has a unique solution.

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