

Initial Value Problems

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- An n th-order initial-value problem (IVP):

$$\text{Solve: } \frac{d^n y}{dx^n} = f(x, y, y' \dots y^{n-1})$$

$$\text{Subject to: } y(x_0) = y_0, y'(x_0) = y_1^{n-1}(x_0) = y_{n-1}$$

- Existence of Uniqueness of a Solution – Let R be a rectangular region in the xy plane defined by $a \leq x \leq b, c \leq y \leq d$ that contains the point (x_0, y_0) in its interior. If $f(x, y)$ and $\partial f / \partial y$ are continuous on R then there exists some interval $I_0 : (x_0 - h, x_0 + h), h > 0$ contained in $[a, b]$, and a unique function $y(x)$, defined on I_0 , that is a solution of the first order initial value problem