2.1

August 29, 2025

"Determine a region of the xy-place for which the given differential equation would have a unique solution through a point $(x_0 y_0)$ in the reigon."

1

$$\frac{dy}{dx} = y^{2/3}$$

3

$$x\frac{dy}{dx} = y$$

5

$$(4 - y^2)y' = x^2$$

7

$$(x^2 + y^2)y' = y^2$$

9

$$\frac{dy}{dx} = x^3 \cos y$$

Verify that $y = cx$ is a solution of the differential equation $xy' = y$ for every value of the parameter c. Find at least two solutions of the initial-value problem

$$xy' = y, \quad y(0) = 0$$

.Observe that the piecewise-defined function

$$y = \begin{cases} 0, & x < 0 \\ x, & x \geq 0 \end{cases}$$

satisfies the condition $y(0) = 0$. Is it a solution of the initial-value problem?

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In Problems 17–20 determine whether Theorem 2.1 guarantees that the differential equation $y' = \sqrt{y^2 - 9}$ possesses a unique solution through the given point. **For reference Theorem 2.1:** 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 exist an interval I centered at x_0 and a unique function $y(x)$ defined on I satisfying the initial-value problem (2).

17

$(1, 4)$

19

$(2, -3)$