Assignment#1

Mth401

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Question:1

Find the orthogonal trajectories of the family of rectangular hyperbola $xy = c$

Answer:

To Find the orthogonal trajectories of the family of rectangular hyperbola $xy = c$ ***, where c is a constant, we use the fact that the product of the slopes of two perpendicular curves is -1.***

The given hyperbola is $xy = c$ ***.***

1. ***Find the slope of hyperbola:***

Differentiate $xy = c$ ***implicitly to get*** $\frac{dy}{dx} = -\frac{y}{x}$ ***.***

2. ***Fund the negative reciprocal of the slope;***

The negative reciprocal of $-\frac{y}{x} = \frac{y}{x}$ ***.***

3. ***Set this expression equal to the slope of the orthogonal trajectories.*** $\frac{y}{x}$ ***=m.***
4. ***Solve the resulting differential equation to find the family of orthogonal trajectories.***

The orthogonal trajectories are curves that intersect the hyperbolas at right angles.

Question:2

Solve the initial value problem:

$$\left(y + 2xy^2\right)dx + \left(x + 2x^2 y\right)dy = 0 \quad for \;\; y = 1 \, when \, x = 1.$$

Answer:

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$\left(y+2xy^2\right)dx+\left(x+2x^2y\right)dy=0 \quad for \;\; y=1 when\, x=1.$

We can use separation of var*iables.*

Given equation : $\left(y+2xy^2\right)dx+\left(x+2x^2y\right)dy=0$

Separate var*iables* :

$$\frac{1}{x+2xy^2}dx+\frac{1}{x+2x^2y}dy=0$$

Integrable both sides :

$$\int\frac{1}{x+2xy^2}dx+\int\frac{1}{x+2x^2y}dy=C$$

Now, solve each int*egral separately After f* in*ding the cons* tan*ts of* int*egration, apply the initial condition* $y=1 when\, x=1$ *to* det*er* min*e the specific values of the cons* tan*ts.*

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