Assignment

Mth401

Section: Faiz Ur Rehman

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:

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

Answer:

$(y+2xy^2)dx+(x+2x^2y)dy=0$ *for* $y=1$ *when* $x=1$.

We can use separation of variables.

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

Separate variables:

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

Integrable both sides:

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

Now, solve each integral separately. After finding the constants of integration, apply the initial condition $y=1$ *when* $x=1$ *to determine the specific values of the constants.*