

Answer on Question #68367 – Math – Differential Equations

Question

Form Partial differential eq. of

$$2u = \frac{x^2}{a^2} + \frac{y^2}{b^2}$$

Solution

We have a relation

$$2u = \frac{x^2}{a^2} + \frac{y^2}{b^2} \quad (1)$$

We differentiate (1) first with respect to x and then with respect to y

$$2 \frac{\partial u}{\partial x} = \frac{2x}{a^2} \quad \text{or} \quad \frac{1}{a^2} = \frac{1}{x} \frac{\partial u}{\partial x} = \frac{p}{x}$$

$$2 \frac{\partial u}{\partial y} = \frac{2y}{b^2} \quad \text{or} \quad \frac{1}{b^2} = \frac{1}{y} \frac{\partial u}{\partial y} = \frac{q}{y}$$

Substituting these values of $1/a^2$ and $1/b^2$ into (1) we get

$$2u = xp + yq$$

or

$$2u = x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}.$$

Answer: The required partial equation is $2u = xp + yq$, that is, $2u = x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$.