

Exercise 2.3.1

For the following partial differential equations, what ordinary differential equations are implied by the method of separation of variables?

$$(a) \quad \frac{\partial u}{\partial t} = \frac{k}{r} \frac{\partial}{\partial r} \left(r \frac{\partial u}{\partial r} \right)$$

$$(c) \quad \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$

$$(e) \quad \frac{\partial u}{\partial t} = k \frac{\partial^4 u}{\partial x^4}$$

$$(b) \quad \frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2} - v_0 \frac{\partial u}{\partial x}$$

$$(d) \quad \frac{\partial u}{\partial t} = \frac{k}{r^2} \frac{\partial}{\partial r} \left(r^2 \frac{\partial u}{\partial r} \right)$$

$$(f) \quad \frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$$