



## Item Navigation

## Cartesian Partial Derivatives

Transform the Cartesian partial derivatives into polar form.

(a) Let  $f = f(x(r, \theta), y(r, \theta))$ . Using the chain rule and the definition of polar coordinates, show that

$$\frac{\partial f}{\partial r} = \cos \theta \frac{\partial f}{\partial x} + \sin \theta \frac{\partial f}{\partial y}, \quad \frac{\partial f}{\partial \theta} = -r \sin \theta \frac{\partial f}{\partial x} + r \cos \theta \frac{\partial f}{\partial y}.$$

(b) Invert the result of Part (a) to show that

$$\frac{\partial}{\partial x} = \cos \theta \frac{\partial}{\partial r} - \frac{\sin \theta}{r} \frac{\partial}{\partial \theta}, \quad \frac{\partial}{\partial y} = \sin \theta \frac{\partial}{\partial r} + \frac{\cos \theta}{r} \frac{\partial}{\partial \theta}.$$

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