= r cos ? and y =
r sin ? , one can derive a relationship between derivatives in Cartesian and polar coordinates . For a given function , u (x , y) , it follows that (by computing its total derivatives)
<formula>
<formula>
or
<formula>
<formula>
Hence , we have the following formulae :
<formula>
<formula>
Using the inverse coordinates transformation , an analogous reciprocal relationship can be derived between the derivatives . Given a function u (r , ?) , it follows that
<formula>
<formula>
or
<formula>
<formula>
Hence , we have the following formulae :
<formula>
<formula>
To find the Cartesian slope of the tangent line to a polar curve r (?) at any given point , the curve is first expressed as a system of parametric equations .
<formula>
<formula>
Differentiating both equations with respect to ? yields
<formula>
<formula>
Dividing the second equation by the first yields the Cartesian slope of the tangent line to the curve at the point (r (?) , ?) :
<formula>
For other useful formulas including divergence , gradient , and Laplacian in polar coordinates , see curvilinear coordinates .

= = = Integral calculus (arc length) = = =