

## Problems: Polar Coordinates and the Jacobian

1. Let  $r = \sqrt{x^2 + y^2}$  and  $\theta = \tan^{-1} \frac{y}{x}$ . Directly calculate the Jacobian  $\frac{\partial(r, \theta)}{\partial(x, y)} = \frac{1}{r}$ .
2. For the change of variables  $x = u$ ,  $y = \sqrt{r^2 - u^2}$ , write  $dx dy$  in terms of  $u$  and  $r$ .

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