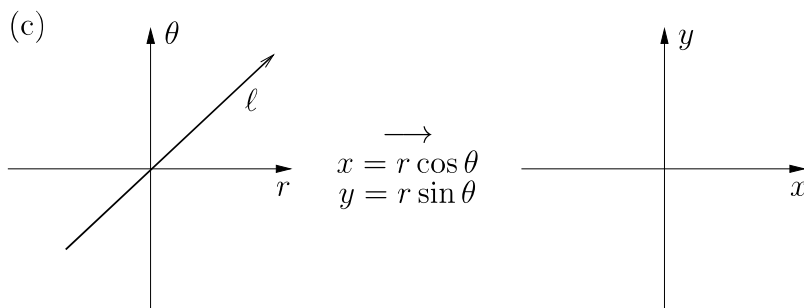
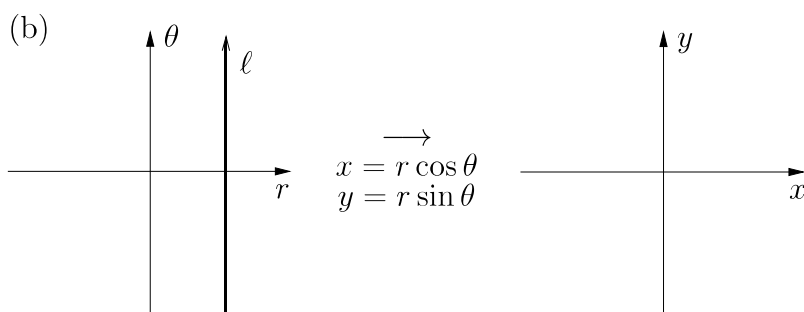
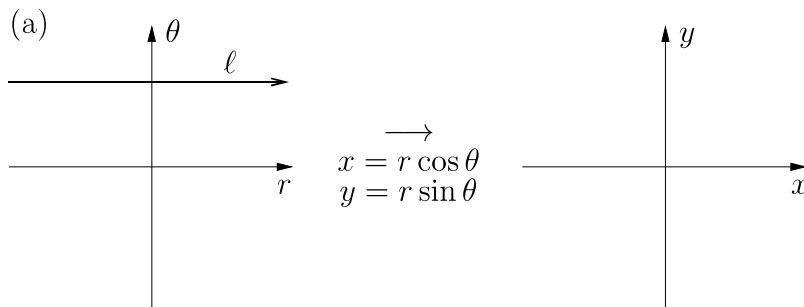


2. The polar coordinate map $x = r \cos \theta$, $y = r \sin \theta$ takes a line in the $r\theta$ -plane to a curve in the xy -plane. For each line ℓ , draw the corresponding curve in the xy -plane.



Problems

- Sketch the curve given by $r = 2 \sin \theta$ and give its equation in Cartesian coordinates. What curve is it?
- Write an equation in polar coordinates for the circle of radius $\sqrt{2}$ centered at $(x, y) = (1, 1)$.
- Consider the curve given by the polar equation $r = 3 + \cos 4\theta$.
 - Sketch this curve.
 - Find the slope of this curve at $\theta = \pi/4$.
 - At which points does $\frac{dr}{d\theta} = 0$? Remember that this is *not* the slope. What is the geometric meaning of $\frac{dr}{d\theta} = 0$?
- (a) Does the spiral $r = 1/\theta$, $\pi/2 \leq \theta < \infty$ have finite length?

- (b) Does the spiral $r = e^{-\theta}$, $0 \leq \theta < \infty$ have finite length?
5. Sketch the *lemniscate* $r^2 = a^2 \cos(2\theta)$ where a is a positive constant and calculate the area it encloses.