9. The temperature of a plate at the point \((x, y)\) is \(T(x, y) = xy\).
   
(a) Draw and label the level sets \(T = 0\), \(T = 1\), \(T = -1\), \(T = 2\), and \(T = -2\).

(b) A heat seeking particle always moves in the direction of the greatest increase in temperature. Place such a particle on your answer to (a) at the point \((1, -2)\). Draw the path of the particle.

(c) Find the equation which gives the path of the particle of part (b).

\[
\begin{align*}
\dot{x}(t) &= y(t) + x(t) \cdot \frac{\partial T}{\partial x} \\
\dot{y}(t) &= -x(t) + y(t) \cdot \frac{\partial T}{\partial y}
\end{align*}
\]

\[
\begin{align*}
\int \frac{\dot{x}(t)}{\dot{y}(t)} \, dt &= \int \frac{y(t)}{x(t)} \, dt \\
\int \frac{y(t)}{x(t)} \, dt &= \frac{y(t)}{x(t)}
\end{align*}
\]

In other words
\[
X(t) \cdot X'(t) = Y(t) \cdot Y'(t)
\]

Integrate w.r.t. \(t\)