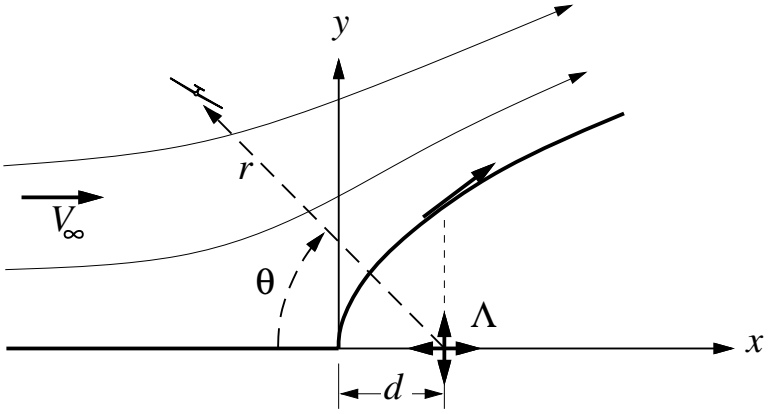
F18. Wind with velocity V_∞ is flowing over a mountain ridge have the shape $Y(x) = \sqrt{Cx}$. The flow is to be modeled by superimposing a uniform flow with a source located at some location $x, y = (d, 0)$.

$$\psi(x,y) \;=\; V_\infty y \;+\; \frac{\Lambda}{4\pi} \ln\left[(x-d)^2 + y^2\right]$$



a) Determine both the source's location d, and the strength Λ, with the conditions:

$$\begin{array}{lll} u = 0 & \text{at} & x, y = (0, 0) \\ v/u = dY/dx & \text{at} & x, y = (d, \sqrt{Cd}) \end{array}$$

The second condition simply requires that the flow direction on the ridge surface directly above the source is parallel to the ridge surface.

b) A sailplane flying in the slope lift upwind of the ridge requires a vertical velocity of at least $v \geq 1$m/s to stay aloft. For a wind speed of $V_\infty = 15$m/s (33 mph) and ridge size scale $C = 500$m, determine the maximum flyable radius $r(\theta)$ inside which the sailplane can sustain flight. Plot the $r(\theta)$ boundary superimposed on a plot of the ridge.