Wind with velocity $V_\infty$ is flowing over a mountain ridge which has the parabolic shape as sketched.

$$Y(x) = \sqrt{C(x + d)}$$

The flow is to be approximately modeled by superimposing a uniform flow with a source located at the origin $x, y = (0, 0)$

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

which is placed some distance $d$ (to be determined) inside the ridge.

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a) Determine the required origin offset distance $d$ and also the source strength $\Lambda$, with the conditions:

$$u = 0 \quad \text{at } x, y = (-d, 0)$$

$$v/u = dY/dx \quad \text{at } x, y = (0, \sqrt{Cd})$$

The second condition 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 $v \geq 1\text{m/s}$ to stay aloft. For a wind speed of $V_\infty = 15\text{m/s}$ (33 mph) and ridge size scale $C = 500\text{m}$, 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.