F18. Wind with velocity $V_\infty$ 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 $\Lambda$, with the conditions:

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

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 $v \geq 1\text{m/s}$ 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.