A liquid of density $\rho$ and surface tension $\sigma$ has been spilled on a horizontal plate so that it forms a very large puddle whose depth (in the central parts) is $h$. Consider the region near the edge of the puddle, which can be viewed to good approximation as two-dimensional. If the contact angle is $\alpha$, derive an expression for the shape of the liquid surface $y_s(x)$.

Assume for simplicity that $\alpha$ is small, so that the radius of curvature of the surface is large compared with $h$ and can be approximated by

$$R = \frac{1}{\left| \frac{d^2 y_s}{dx^2} \right|}$$

ans:

$$y_s = h \left[ 1 - \exp \left( -\sqrt{\frac{\rho g}{\sigma}} x \right) \right]$$

$$h = \tan \alpha \sqrt{\frac{\sigma}{\rho g}}$$
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