Problem 2.07
This problem is from "Advanced Fluid Mechanics Problems" by A.H. Shapiro and A.A. Sonin
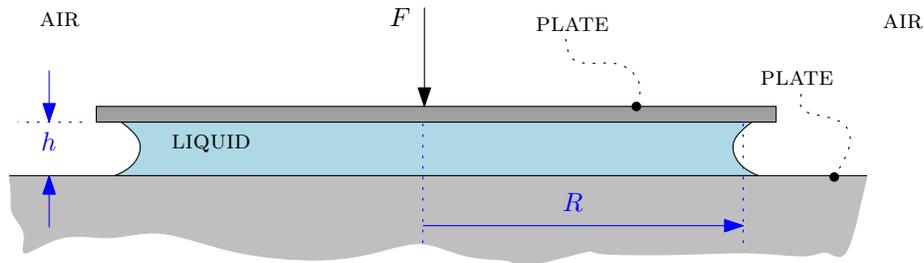
A drop of liquid of volume V is squeezed between two parallel smooth plates until the liquid thickness h is very small compared with the liquid's radial extent R. The liquid/plate/air contact angle α, and the liquid/air surface tension is σ. Gravitational effects are negligible.

(a) Derive an expression for the downward force F required to hold the plates in position. Express F in terms V, α, σ, and R.

(b) If $\alpha = \pi$ radians (a perfectly nonwetting situation) and $T = 0.07\,\mathrm{N/m}$, say (representing a clean air-water interface), what downward force is required to press a $3\,\mathrm{mm}^3$ drop of liquid into a thin disc or radius $R = 2\,\mathrm{cm}$?

2.25 Advanced Fluid Mechanics
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