Brady Metherall

11 November 2019

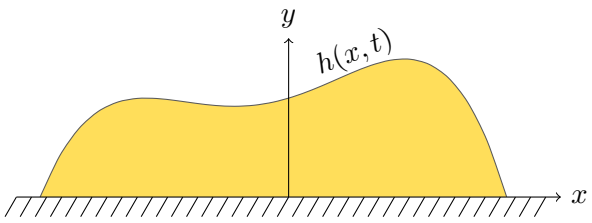

Figure 1: Beer spilled on a table.

$$\varepsilon := H/L \ll 1$$

$$\rho\left(\frac{\partial \mathbf{u}}{\partial t} + (\mathbf{u}\cdot\nabla)\mathbf{u}\right) = -\nabla p + \mu\nabla^2\mathbf{u} + \rho\mathbf{g}$$

$$\mathrm{Re}'(u_t + u\,u_x + v\,u_y) = -p_x + \varepsilon^2 u_{xx} + u_{yy}, \quad (1)$$

$$\mathrm{Re}'\varepsilon^2(v_t + u\,v_x + v\,v_y) = \\ -p_y + \varepsilon^4 v_{xx} + \varepsilon^2 v_{yy} - 1 \quad (2)$$

$$\mathcal{O}(1) : p_x = u_{yy} \quad (3)$$

$$\mathcal{O}(1) : p_y = -1 \quad (4)$$

$$u = -\frac{1}{2}\left(2hy - y^2\right)h_x \quad (5)$$

integrate to find flux
conservation of mas then becomes

$$h_t = \frac{1}{3}\nabla\cdot\left(h^3\nabla h\right) \quad (6)$$

$$\int_{\mathbb{R}} h\,\mathrm{d}x \quad (7)$$

$h(x,t) = t^\alpha f(\eta)$ where $\eta = xt^{-\beta}$
$\alpha = -1/5$ $\beta = 1/5$

$$\frac{-3}{5}\left(\eta f' + f\right) = \left(f^3 f\right)'$$

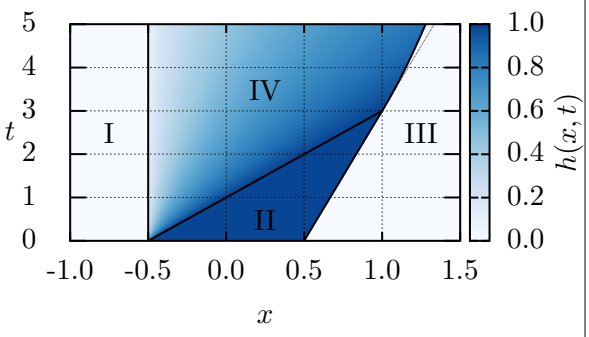

Figure 2: $\alpha = \pi/6$

$$f = \left(\frac{9}{10}\right)^{1/3}\left(\eta_*^2 - \eta^2\right)^{1/3}$$

$$\eta_* = \left(\frac{6075\Gamma^6\left(\frac{2}{3}\right)\Gamma^6\left(\frac{11}{6}\right)}{16\pi^9}\right)^{1/10} \\ \approx 0.747412$$

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1 Polar

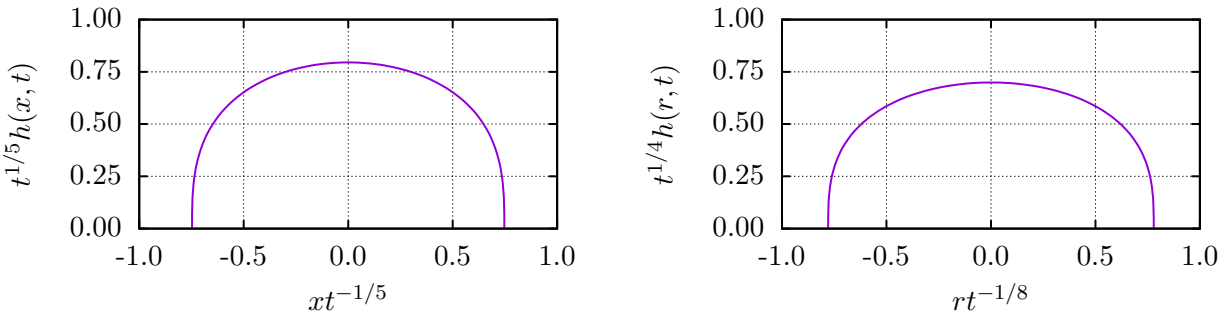
solve (6) and (7) in polar
$\alpha = -1/4$ $\beta = 1/8$

$$\frac{-3}{8}\left(2\eta f + \eta^2 f'\right) = \left(\eta f^3 f'\right)'$$

$$f = \left(\frac{9}{16}\right)^{1/3}\left(\eta_*^2 - \eta^2\right)^{1/3}$$

$$\begin{aligned}\eta_* &= \left(\frac{1024}{243\pi^3}\right)^{1/8} \\ &\approx 0.779212\end{aligned}$$

[**?**, **?**]



(a) (b)

Figure 3

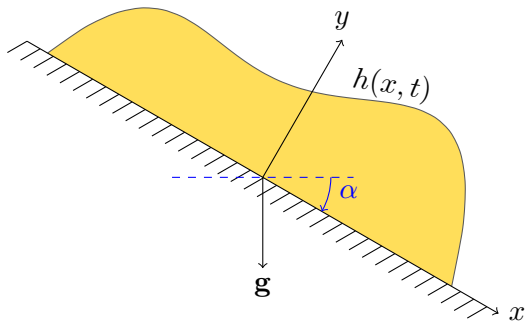


Figure 4: Beer spilled on a crooked table.