

Hanin, Leonid G. 1999. Which tank empties first? *The American Mathematical Monthly*. 106(10): 943-947. Preprint.

See <https://www.tandfonline.com/doi/abs/10.1080/00029890.1999.12005143> .

From the opening of the paper, “Suppose that water towers like those shown in Figure 1 are initially filled with water and have the same volume, height, and cross-sectional outlet area. Which one empties first? This problem arises naturally when designing water supplying tanks or funnels.

“We find a formula expressing the emptying time as a function of the volume of liquid and its initial height. We compute the emptying time for several specific tank shapes, in particular, for those shown in Figure 1. We also address the question whether there exists a tank with a given volume and height for which the emptying time is minimal.”

Keywords: tank, empty, Torricelli’s Law, model, differential equation, nonlinear, emptying time, cylinder, frustum of a cone, spherical, sphere