Problem 39

3 cylindrical flasks with sufficient height and negligible thickness have radii such that
$r1 < r2 < r3$ and are each filled with water to a level of 1 inch. If you place flask 1 inside of flask 2 (so that it is standing straight up and the bottoms are flush), the water level of flask 2 rises 1 inch. Similarly, if you place flask 2 in flask 3 the water level in flask 3 rises 1 inch. If flask 1 were placed inside of flask 3, how much would the water level rise in flask 3 rise?

Answer

$\boxed{\frac{1}{3}}$

Explanation

Let B_1, B_2, B_3 be the areas of flasks $1, 2, 3$ respectively. So, $2B_2 = B_2 + 2B_1$, $2B_3 = B_3 + 2B_2$, and $hB_3 = B_3 + hB_1$. Using the first 2 equations to solve for B_3 in terms of B_1, we have $B_3 = 4B_1$. Thus, $4hB_1 = 4B_1 + hB_1 \Rightarrow h = 4/3$. So the level rises by $1/3$