

Frustum (Tapered) Tank volume formula

tankvolumecalc.com/formulas/frustum-tank/

Total volume, exact partial fill, derivation, worked example and a copy-ready fill table.

TOTAL VOLUME

$$V = \pi H(R^2 + Rr + r^2)/3$$

PARTIAL FILL AT LIQUID DEPTH H

$$V(h) = \pi h(\rho^2 + \rho r + r^2)/3, \quad \rho = r + (R - r) \cdot h/H$$

Derivation

A frustum is a cone with the tip cut off; the standard volume identity applies at any level once you interpolate the wetted-surface radius ρ linearly between the bottom and top radii. Buckets, hoppers and tapered vats are all this one formula.

Worked example

Take Dbtm = 20 in, Dtop = 40 in, H = 50 in. Total capacity: 158.7 gal. At a stick reading of 20 in (40% of the 50 in maximum depth), the filled volume is 39.5 gal — 24.9% of capacity. Check it live on the calculator.

Fill ratio: % of depth → % of volume (a 2:1 taper (top diameter twice the bottom))

Depth	Volume
5%	2 . 3%
10%	4 . 7%
15%	7 . 4%
20%	10 . 4%
25%	13 . 6%
30%	17 . 1%
35%	20 . 9%
40%	24 . 9%
45%	29 . 3%
50%	33 . 9%
55%	38 . 9%
60%	44 . 2%
65%	49 . 9%
70%	55 . 9%
75%	62 . 3%
80%	69%
85%	76 . 2%
90%	83 . 7%
95%	91 . 6%

Need the full inch-by-inch table for specific dimensions? The dip chart generator prints it as a laminate-ready PDF.

FAQ

Q. What is the formula for a frustum (tapered) tank volume?

Total: $V = \pi H(R^2 + Rr + r^2)/3$. Partial fill at depth h : $V(h) = \pi h(\rho^2 + \rho r + r^2)/3$, $\rho = r + (R - r) \cdot h/H$. Derivation and a worked example are above.

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Q. Is the fill-ratio table exact?

Yes — computed by the same engine as our calculators (a 2:1 taper (top diameter twice the bottom)), verified by the automated test suite described on the methodology page.

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Q. Can I use this in a spreadsheet?

Yes — the formulas are closed-form (acos and sqrt only). Copy the 5%-step table for quick interpolation, or implement the formula directly for exact values.

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