Parabolic Dish: Focal Length, Surface Area and Volume

Focal length, f/D ratio, curved surface area and volume of a paraboloid such as a satellite dish, solar concentrator or tank bottom, from its diameter and depth.

Method: Paraboloid of revolution formulas

Input parameters

Unit system: SI

Parameter	Value	Unit
Aperture (rim) diameter	1.2000	m
Depth at the centre	0.15000	m

Calculated results

Parameter	Value	Unit
Focal length	600.00	mm
Focal ratio	0.50000	
Curved surface area	1.1990	m²
Volume contained	84.823	L
Rim angle seen from the focus	53.130	°

Notes for this case

• Paraboloid z = r²/(4f), so f = D²/(16h). Curved area S = (πr/6h²)[(r² + 4h²)^{3/2} − r³]; volume = half the circumscribing cylinder, πr²h/2. The rim angle ψ = atan[r/(f − h)] (90° when the focus is in the aperture plane, f/D = 0.25). Antenna feeds are chosen to illuminate this angle; solar concentrators trade concentration against rim angle.

Formula and method

$$f = \frac{D^2}{16h}, \quad S = \frac{\pi r}{6h^2}\left[(r^2 + 4h^2)^{3/2} - r^3\right], \quad V = \frac{\pi r^2 h}{2}$$

Variables

D	Aperture (rim) diameter	m
h	Depth at the centre	m
f	Focal length	m
f/D	Focal ratio	-
S	Curved surface area	m²
V	Volume contained	m³
ψ_{rim}	Rim angle seen from the focus	rad

Method and standards

Paraboloid.

Assumptions and limits

- Symmetric paraboloid of revolution.

References

Paraboloid of revolution formulas

Report details

Report reference	FCC-KSMT-B2P0 (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/general/geometry/paraboloid-dish-geometry

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.