Spherical Cap and Dome: Radius, Surface Area and Volume

Sphere radius, curved surface area, volume and rise angle of a spherical cap or dome from its base diameter and rise (height), for domes, dished ends and lenses.

Method: Spherical cap formulas

Input parameters

Unit system: SI

Parameter	Value	Unit
Base diameter	20.000	m
Rise (cap height)	4.0000	m

Calculated results

Parameter	Value	Unit
Sphere radius	14.500	m
Curved surface area	364.42	m²
Volume of the cap	661.83	m³
Half-angle at the sphere centre	43.603	°
Base area	314.16	m²

Notes for this case

• From the base radius a and rise h: R = (a² + h²)/(2h). Curved area S = 2πRh (Archimedes: the same as the band of a circumscribed cylinder); volume V = πh²(3R − h)/3 = πh(3a² + h²)/6. A rise larger than the base radius gives more than a hemisphere. Use the mean surface for roofing or cladding quantities of thick shells.

Formula and method

$$R = \frac{a^2 + h^2}{2h}, \quad S = 2\pi Rh, \quad V = \frac{\pi h^2 (3R - h)}{3}$$

Variables

a	Base diameter	m
h	Rise (cap height)	m
R	Sphere radius	m
S	Curved surface area	m²
V	Volume of the cap	m³
θ	Half-angle at the sphere centre	rad
A_b	Base area	m²

Method and standards

Spherical cap.

Assumptions and limits

- Exact sphere geometry.

References

Spherical cap formulas

Report details

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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/spherical-cap-dome

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.