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Pentagonal Cupola Formulas

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List of 20 Pentagonal Cupola Formulas

Pentagonal Cupola

Edge Length of Pentagonal Cupola

1) Edge Length of Pentagonal Cupola given Height

$$\text{fx } l_e = \frac{h}{\sqrt{1 - \left(\frac{1}{4} \cdot \cos ec\left(\frac{\pi}{5}\right)^2\right)}}$$

Open Calculator 

$$\text{ex } 9.510565\text{m} = \frac{5\text{m}}{\sqrt{1 - \left(\frac{1}{4} \cdot \cos ec\left(\frac{\pi}{5}\right)^2\right)}}$$

2) Edge Length of Pentagonal Cupola given Surface to Volume Ratio

$$\text{fx } l_e = \frac{\frac{1}{4} \cdot \left(20 + \left(5 \cdot \sqrt{3}\right) + \sqrt{5 \cdot \left(145 + \left(62 \cdot \sqrt{5}\right)\right)}\right)}{\frac{1}{6} \cdot \left(5 + \left(4 \cdot \sqrt{5}\right)\right) \cdot R_{A/V}}$$

Open Calculator 

$$\text{ex } 10.19143\text{m} = \frac{\frac{1}{4} \cdot \left(20 + \left(5 \cdot \sqrt{3}\right) + \sqrt{5 \cdot \left(145 + \left(62 \cdot \sqrt{5}\right)\right)}\right)}{\frac{1}{6} \cdot \left(5 + \left(4 \cdot \sqrt{5}\right)\right) \cdot 0.7\text{m}^{-1}}$$

3) Edge Length of Pentagonal Cupola given Total Surface Area

$$\text{fx } l_e = \sqrt{\frac{\text{TSA}}{\frac{1}{4} \cdot \left(20 + \left(5 \cdot \sqrt{3}\right) + \sqrt{5 \cdot \left(145 + \left(62 \cdot \sqrt{5}\right)\right)}\right)}}$$

Open Calculator 

$$\text{ex } 10.00611\text{m} = \sqrt{\frac{1660\text{m}^2}{\frac{1}{4} \cdot \left(20 + \left(5 \cdot \sqrt{3}\right) + \sqrt{5 \cdot \left(145 + \left(62 \cdot \sqrt{5}\right)\right)}\right)}}$$



4) Edge Length of Pentagonal Cupola given Volume 

[Open Calculator !\[\]\(4729e517bc6a7cd81c8025b9646574fb_img.jpg\)](#)

$$\text{fx } l_e = \left(\frac{V}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5}))} \right)^{\frac{1}{3}}$$

$$\text{ex } 9.965393\text{m} = \left(\frac{2300\text{m}^3}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5}))} \right)^{\frac{1}{3}}$$


Height of Pentagonal Cupola 

5) Height of Pentagonal Cupola 

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$\text{fx } h = l_e \cdot \sqrt{1 - \left(\frac{1}{4} \cdot \cos ec \left(\frac{\pi}{5} \right)^2 \right)}$$

$$\text{ex } 5.257311\text{m} = 10\text{m} \cdot \sqrt{1 - \left(\frac{1}{4} \cdot \cos ec \left(\frac{\pi}{5} \right)^2 \right)}$$


6) Height of Pentagonal Cupola given Surface to Volume Ratio 

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$\text{fx } h = \frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot R_{A/V}} \cdot \sqrt{1 - \left(\frac{1}{4} \cdot \cos ec \left(\frac{\pi}{5} \right)^2 \right)}$$

$$\text{ex } 5.357954\text{m} = \frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot 0.7\text{m}^{-1}} \cdot \sqrt{1 - \left(\frac{1}{4} \cdot \cos ec \left(\frac{\pi}{5} \right)^2 \right)}$$




7) Height of Pentagonal Cupola given Total Surface Area 

fx

Open Calculator 

$$h = \sqrt{\frac{\text{TSA}}{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))}\right)}} \cdot \sqrt{1 - \left(\frac{1}{4} \cdot \cos ec\left(\frac{\pi}{5}\right)^2\right)}$$

ex $5.260521\text{m} = \sqrt{\frac{1660\text{m}^2}{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))}\right)}} \cdot \sqrt{1 - \left(\frac{1}{4} \cdot \cos ec\left(\frac{\pi}{5}\right)^2\right)}$

8) Height of Pentagonal Cupola given Volume 

fx

Open Calculator 

$$h = \left(\frac{V}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5}))}\right)^{\frac{1}{3}} \cdot \sqrt{1 - \left(\frac{1}{4} \cdot \cos ec\left(\frac{\pi}{5}\right)^2\right)}$$

ex $5.239117\text{m} = \left(\frac{2300\text{m}^3}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5}))}\right)^{\frac{1}{3}} \cdot \sqrt{1 - \left(\frac{1}{4} \cdot \cos ec\left(\frac{\pi}{5}\right)^2\right)}$

Surface Area of Pentagonal Cupola 

Total Surface Area of Pentagonal Cupola 

9) Total Surface Area of Pentagonal Cupola 

fx $\text{TSA} = \frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))}\right) \cdot l_e^2$

Open Calculator 

ex $1657.975\text{m}^2 = \frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))}\right) \cdot (10\text{m})^2$



10) Total Surface Area of Pentagonal Cupola given Height 

fx

Open Calculator 

$$\text{TSA} = \frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right) \cdot \left(\frac{h^2}{1 - \left(\frac{1}{4} \cdot \cos ec \left(\frac{\pi}{5} \right)^2 \right)} \right)$$

ex $1499.652\text{m}^2 = \frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right) \cdot \left(\frac{(5\text{m})^2}{1 - \left(\frac{1}{4} \cdot \cos ec \left(\frac{\pi}{5} \right)^2 \right)} \right)$

11) Total Surface Area of Pentagonal Cupola given Surface to Volume Ratio 

fx

Open Calculator 

$$\text{TSA} = \frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right) \cdot \left(\frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5}))} \right)$$

ex

$1722.061\text{m}^2 = \frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right) \cdot \left(\frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5}))} \cdot 0.7\text{m}^{-1} \right)$

12) Total Surface Area of Pentagonal Cupola given Volume 

fx

Open Calculator 

$$\text{TSA} = \frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right) \cdot \left(\frac{V}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5}))} \right)^{\frac{2}{3}}$$

ex $1646.519\text{m}^2 = \frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right) \cdot \left(\frac{2300\text{m}^3}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5}))} \right)^{\frac{2}{3}}$



Surface to Volume Ratio of Pentagonal Cupola

13) Surface to Volume Ratio of Pentagonal Cupola

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$\text{fx } R_{A/V} = \frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot l_e}$$

$$\text{ex } 0.7134\text{m}^{-1} = \frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot 10\text{m}}$$

14) Surface to Volume Ratio of Pentagonal Cupola given Height

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$\text{fx } R_{A/V} = \frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \left(\frac{h}{\sqrt{1 - \left(\frac{1}{4} \cdot \cos ec \left(\frac{\pi}{5} \right)^2 \right)}} \right)}$$

$$\text{ex } 0.750114\text{m}^{-1} = \frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \left(\frac{5\text{m}}{\sqrt{1 - \left(\frac{1}{4} \cdot \cos ec \left(\frac{\pi}{5} \right)^2 \right)}} \right)}$$

15) Surface to Volume Ratio of Pentagonal Cupola given Total Surface Area

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$\text{fx } R_{A/V} = \frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \sqrt{\frac{\text{TSA}}{\frac{1}{4} \cdot (20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))}}}}}}$$

$$\text{ex } 0.712965\text{m}^{-1} = \frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \sqrt{\frac{1660\text{m}^2}{\frac{1}{4} \cdot (20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))}}}}}}$$




16) Surface to Volume Ratio of Pentagonal Cupola given Volume 

[Open Calculator !\[\]\(feabb98897b440bc8695a03336a6e2df_img.jpg\)](#)

$$\text{fx } R_{A/V} = \frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \left(\frac{V}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5}))} \right)^{\frac{1}{3}}}$$

$$\text{ex } 0.715878\text{m}^{-1} = \frac{\frac{1}{4} \cdot \left(20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))} \right)}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \left(\frac{2300\text{m}^3}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5}))} \right)^{\frac{1}{3}}}$$


Volume of Pentagonal Cupola 

17) Volume of Pentagonal Cupola 

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)

$$\text{fx } V = \frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot l_e^3$$

$$\text{ex } 2324.045\text{m}^3 = \frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot (10\text{m})^3$$

18) Volume of Pentagonal Cupola given Height 

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\)](#)

$$\text{fx } V = \frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \left(\frac{h}{\sqrt{1 - \left(\frac{1}{4} \cdot \cos ec \left(\frac{\pi}{5} \right)^2 \right)}} \right)^3$$

$$\text{ex } 1999.234\text{m}^3 = \frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \left(\frac{5\text{m}}{\sqrt{1 - \left(\frac{1}{4} \cdot \cos ec \left(\frac{\pi}{5} \right)^2 \right)}} \right)^3$$




19) Volume of Pentagonal Cupola given Surface to Volume Ratio 

fx

Open Calculator 

$$V = \frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \left(\frac{\frac{1}{4} \cdot (20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))})}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot R_{A/V}}} \right)^3$$

ex $2460.088\text{m}^3 = \frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \left(\frac{\frac{1}{4} \cdot (20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))})}{\frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot 0.7\text{m}^{-1}}} \right)^3$

20) Volume of Pentagonal Cupola given Total Surface Area 

fx

Open Calculator 

$$V = \frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \left(\frac{\text{TSA}}{\frac{1}{4} \cdot (20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))})} \right)^{\frac{3}{2}}$$

ex $2328.304\text{m}^3 = \frac{1}{6} \cdot (5 + (4 \cdot \sqrt{5})) \cdot \left(\frac{1660\text{m}^2}{\frac{1}{4} \cdot (20 + (5 \cdot \sqrt{3}) + \sqrt{5 \cdot (145 + (62 \cdot \sqrt{5}))})} \right)^{\frac{3}{2}}$







Variables Used

- **h** Height of Pentagonal Cupola (*Meter*)
- **l_e** Edge Length of Pentagonal Cupola (*Meter*)
- **$R_{A/V}$** Surface to Volume Ratio of Pentagonal Cupola (*1 per Meter*)
- **TSA** Total Surface Area of Pentagonal Cupola (*Square Meter*)
- **V** Volume of Pentagonal Cupola (*Cubic Meter*)



Constants, Functions, Measurements used

- **Constant:** **pi**, 3.14159265358979323846264338327950288
Archimedes' constant
- **Function:** **cosec**, cosec(Angle)
Trigonometric cosecant function
- **Function:** **sec**, sec(Angle)
Trigonometric secant function
- **Function:** **sqrt**, sqrt(Number)
Square root function
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Volume** in Cubic Meter (m³)
Volume Unit Conversion 
- **Measurement:** **Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement:** **Reciprocal Length** in 1 per Meter (m⁻¹)
Reciprocal Length Unit Conversion 



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