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Geostationary Orbit Formulas

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List of 14 Geostationary Orbit Formulas

Geostationary Orbit

1) Acute Value

Open Calculator

fx $\angle\theta_{acute} = \angle\theta_{S} - \angle\theta_{z}$

ex $80^\circ = 180^\circ - 100^\circ$

2) Angle of Elevation

Open Calculator

fx $\angle\theta_{el} = \angle\theta_{R} - \angle\theta_{tilt} - \lambda_{e}$

ex $42^\circ = 90^\circ - 31^\circ - 17^\circ$

3) Angle of Tilt

Open Calculator

fx $\angle\theta_{tilt} = \angle\theta_{R} - \angle\theta_{el} - \lambda_{e}$

ex $31^\circ = 90^\circ - 42^\circ - 17^\circ$

4) Apogee Heights

Open Calculator

fx $H_{apogee} = r_{apogee} - [\text{Earth-R}]$

ex $2476.991\text{km} = 8848\text{km} - [\text{Earth-R}]$

5) Azimuth Angle

Open Calculator

fx $\angle\theta_{z} = \angle\theta_{S} - \angle\theta_{acute}$

ex $100^\circ = 180^\circ - 80^\circ$

6) Earth Station Latitude

Open Calculator

$$\lambda_e = \angle\theta_R - \angle\theta_{el} - \angle\theta_{tilt}$$

$$17^\circ = 90^\circ - 42^\circ - 31^\circ$$

7) Geostationary Height

Open Calculator

$$H_{gso} = R_{gso} - [\text{Earth-R}]$$

$$381.7912\text{km} = 6752.8\text{km} - [\text{Earth-R}]$$

8) Geostationary Radius

Open Calculator

$$R_{gso} = H_{gso} + [\text{Earth-R}]$$

$$6752.809\text{km} = 381.8\text{km} + [\text{Earth-R}]$$

9) Length of Radius Vectors at Apogee

Open Calculator

$$r_{apogee} = a_{orbit} \cdot (1 + e)$$

$$8848\text{km} = 7900\text{km} \cdot (1 + 0.12)$$

10) Length of Radius Vectors at Perigee

Open Calculator

$$r_{perigee} = a_{orbit} \cdot (1 - e)$$

$$6952\text{km} = 7900\text{km} \cdot (1 - 0.12)$$

11) Perigee Heights

Open Calculator

$$H_p = r_{perigee} - [\text{Earth-R}]$$

$$580.9912\text{km} = 6952\text{km} - [\text{Earth-R}]$$

12) Power Density at Satellite Station

Open Calculator

$$P_d = EIRP - L_{path} - L_{total} - (10 \cdot \log 10(4 \cdot \pi)) - (20 \cdot \log 10(R_{sat}))$$

ex

$$922.9255W = 1100W - 12dB - 50dB - (10 \cdot \log 10(4 \cdot \pi)) - (20 \cdot \log 10(160km))$$

13) Satellite Geostationary Radius

Open Calculator

$$R_{gso} = \left(\frac{[GM.Earth] \cdot P_{day}}{4 \cdot \pi^2} \right)^{\frac{1}{3}}$$

ex

$$6752.877km = \left(\frac{[GM.Earth] \cdot 353d}{4 \cdot \pi^2} \right)^{\frac{1}{3}}$$

14) Time of Perigee Passage

Open Calculator

$$L_{perigee} = t_{min} - \left(\frac{M}{n} \right)$$

ex

$$19.79342min = 20min - \left(\frac{31.958^\circ}{0.045rad/s} \right)$$

Variables Used

- $\angle\theta_{acute}$ Acute Angle *(Degree)*
- $\angle\theta_{el}$ Angle of Elevation *(Degree)*
- $\angle\theta_{R}$ Right Angle *(Degree)*
- $\angle\theta_{S}$ Straight Angle *(Degree)*
- $\angle\theta_{tilt}$ Tilt Angle *(Degree)*
- $\angle\theta_{z}$ Azimuth Angle *(Degree)*
- a_{orbit} Major Orbital Axis *(Kilometer)*
- e Eccentricity
- $EIRP$ Effective Isotropic Radiated Power *(Watt)*
- H_{apogee} Apogee Height *(Kilometer)*
- H_{gso} Geostationary Height *(Kilometer)*
- H_{p} Perigee Height *(Kilometer)*
- L_{path} Path Loss *(Decibel)*
- $L_{perigee}$ Perigee Passage *(Minute)*
- L_{total} Total Loss *(Decibel)*
- M Mean Anomaly *(Degree)*
- n Mean Motion *(Radian per Second)*
- P_{d} Power Density at Satellite Station *(Watt)*
- P_{day} Orbital Period in Days *(Day)*
- r_{apogee} Apogee Radius *(Kilometer)*
- R_{gso} Geostationary Radius *(Kilometer)*
- $r_{perigee}$ Perigee Radius *(Kilometer)*
- R_{sat} Range of Satellite *(Kilometer)*
- t_{min} Time in Minutes *(Minute)*

- λ_e Earth Station Latitude *(Degree)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[Earth-R]**, 6371.0088 Kilometer
  Earth mean radius
- Constant: **[GM.Earth]**, 3.986004418×10^14 m^3 s^−2
  Earth's Geocentric Gravitational Constant
- Function: **log10**, log10(Number)
  Common logarithm function (base 10)
- Measurement: **Length** in Kilometer (km)
  Length Unit Conversion
- Measurement: **Time** in Day (d), Minute (min)
  Time Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Angular Velocity** in Radian per Second (rad/s)
  Angular Velocity Unit Conversion
- Measurement: **Sound** in Decibel (dB)
  Sound Unit Conversion

Check other formula lists

- **Geostationary Orbit Formulas**
- **Radio Wave Propagation Formulas**
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