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Hypocycloid Formulas

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List of 14 Hypocycloid Formulas

Hypocycloid

Area and Number of Cusps of Hypocycloid

1) Area of Hypocycloid

Open Calculator

fx $$A = \pi \cdot \frac{(N_{Cusps} - 1) \cdot (N_{Cusps} - 2)}{N_{Cusps}^2} \cdot r_{Large}^2$$

ex $$150.7964\text{m}^2 = \pi \cdot \frac{(5 - 1) \cdot (5 - 2)}{(5)^2} \cdot (10\text{m})^2$$

2) Area of Hypocycloid given Chord Length

Open Calculator

fx $$A = \pi \cdot \frac{(N_{Cusps} - 1) \cdot (N_{Cusps} - 2)}{N_{Cusps}^2} \cdot \left(\frac{l_c}{2 \cdot \sin\left(\frac{\pi}{N_{Cusps}} \right)} \right)^2$$

ex $$157.129\text{m}^2 = \pi \cdot \frac{(5 - 1) \cdot (5 - 2)}{(5)^2} \cdot \left(\frac{12\text{m}}{2 \cdot \sin\left(\frac{\pi}{5} \right)} \right)^2$$

3) Area of Hypocycloid given Perimeter

Open Calculator

fx $$A = \frac{\pi}{64} \cdot \frac{N_{Cusps} - 2}{N_{Cusps} - 1} \cdot P^2$$

ex $$155.5457\text{m}^2 = \frac{\pi}{64} \cdot \frac{5 - 2}{5 - 1} \cdot (65\text{m})^2$$

4) Number of Cusps of Hypocycloid

Open Calculator

fx $$N_{Cusps} = \frac{r_{Large}}{r_{Small}}$$

ex $$5 = \frac{10\text{m}}{2\text{m}}$$

Chord Length of Hypocycloid

5) Chord Length of Hypocycloid

Open Calculator

fx $$l_c = 2 \cdot \sin\left(\frac{\pi}{N_{Cusps}}\right) \cdot r_{Large}$$

ex $$11.75571\text{m} = 2 \cdot \sin\left(\frac{\pi}{5}\right) \cdot 10\text{m}$$

6) Chord Length of Hypocycloid given Area

Open Calculator

$$l_c = 2 \cdot \sin\left(\frac{\pi}{N_{Cusps}}\right) \cdot N_{Cusps} \cdot \sqrt{\frac{A}{\pi \cdot (N_{Cusps} - 1) \cdot (N_{Cusps} - 2)}}$$

ex $$11.72462\text{m} = 2 \cdot \sin\left(\frac{\pi}{5}\right) \cdot 5 \cdot \sqrt{\frac{150\text{m}^2}{\pi \cdot (5 - 1) \cdot (5 - 2)}}$$

7) Chord Length of Hypocycloid given Perimeter

Open Calculator

$$l_c = \sin\left(\frac{\pi}{N_{Cusps}}\right) \cdot \frac{P \cdot N_{Cusps}}{4 \cdot (N_{Cusps} - 1)}$$

ex $$11.93939\text{m} = \sin\left(\frac{\pi}{5}\right) \cdot \frac{65\text{m} \cdot 5}{4 \cdot (5 - 1)}$$

Perimeter of Hypocycloid

8) Perimeter of Hypocycloid

Open Calculator

$$P = \frac{8 \cdot r_{Large} \cdot (N_{Cusps} - 1)}{N_{Cusps}}$$

ex $$64\text{m} = \frac{8 \cdot 10\text{m} \cdot (5 - 1)}{5}$$

9) Perimeter of Hypocycloid given Area

Open Calculator

fx $$P = 8 \cdot \sqrt{\frac{A \cdot (N_{Cusps} - 1)}{\pi \cdot (N_{Cusps} - 2)}}$$

ex $$63.83076\text{m} = 8 \cdot \sqrt{\frac{150\text{m}^2 \cdot (5 - 1)}{\pi \cdot (5 - 2)}}$$

10) Perimeter of Hypocycloid given Chord Length

Open Calculator

fx $$P = \frac{4 \cdot l_c}{\sin\left(\frac{\pi}{N_{Cusps}}\right)} \cdot \frac{N_{Cusps} - 1}{N_{Cusps}}$$

ex $$65.32998\text{m} = \frac{4 \cdot 12\text{m}}{\sin\left(\frac{\pi}{5}\right)} \cdot \frac{5 - 1}{5}$$

Radius of Large Circle of Hypocycloid

11) Larger Radius of Hypocycloid given Area

fx

Open Calculator

$$r_{Large} = N_{Cusps} \cdot \sqrt{\frac{A}{\pi \cdot (N_{Cusps} - 1) \cdot (N_{Cusps} - 2)}}$$

ex $$9.973557\text{m} = 5 \cdot \sqrt{\frac{150\text{m}^2}{\pi \cdot (5 - 1) \cdot (5 - 2)}}$$

12) Larger Radius of Hypocycloid given Chord Length

Open Calculator

fx $$r_{Large} = \frac{l_c}{2 \cdot \sin\left(\frac{\pi}{N_{Cusps}}\right)}$$

ex $$10.20781\text{m} = \frac{12\text{m}}{2 \cdot \sin\left(\frac{\pi}{5}\right)}$$

13) Larger Radius of Hypocycloid given Perimeter

Open Calculator

fx $$r_{Large} = \frac{P \cdot N_{Cusps}}{8 \cdot (N_{Cusps} - 1)}$$

ex $$10.15625\text{m} = \frac{65\text{m} \cdot 5}{8 \cdot (5 - 1)}$$

14) Larger Radius of Hypocycloid given Smaller Radius

Open Calculator

fx $$r_{Large} = N_{Cusps} \cdot r_{Small}$$

ex $$10\text{m} = 5 \cdot 2\text{m}$$

Variables Used

- **A** Area of Hypocycloid *(Square Meter)*
- **l_c** Chord Length of Hypocycloid *(Meter)*
- **N_{Cusps}** Number of Cusps of Hypocycloid
- **P** Perimeter of Hypocycloid *(Meter)*
- **r_{Large}** Larger Radius of Hypocycloid *(Meter)*
- **r_{Small}** Smaller Radius of Hypocycloid *(Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion

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- Concave Regular Hexagon Formulas
- Concave Regular Pentagon Formulas
- Crossed Rectangle Formulas
- Cut Rectangle Formulas
- Cyclic Quadrilateral Formulas
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