



Design of Helical Gears Formulas

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List of 55 Design of Helical Gears Formulas

Design of Helical Gears 🕑

Basic Formulas of Helical Gear 🕑



fx
$$n_{g} = rac{n_{p}}{i}$$

ex
$$8.272727 \text{rad/s} = \frac{18.2 \text{rad/s}}{2.2}$$

2) Angular Velocity of Pinion given Speed Ratio 🕑

fx
$$\mathbf{n}_{\mathrm{p}} = \mathrm{i} \cdot \mathbf{n}_{\mathrm{g}}$$

$$18.04 \text{rad/s} = 2.2 \cdot 8.2 \text{rad/s}$$

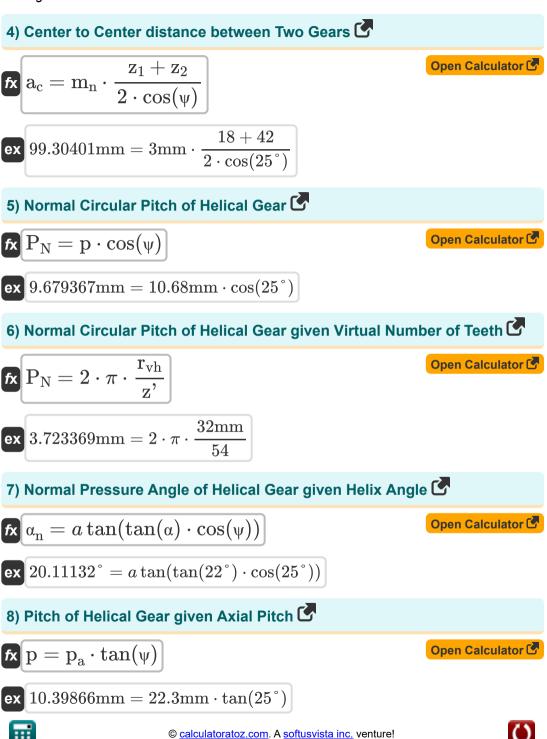
3) Axial Pitch of Helical Gear given Helix Angle 🕑

fx
$$p_a = \frac{p}{\tan(\psi)}$$

ex $22.90333 \text{mm} = \frac{10.68 \text{mm}}{\tan(25^\circ)}$

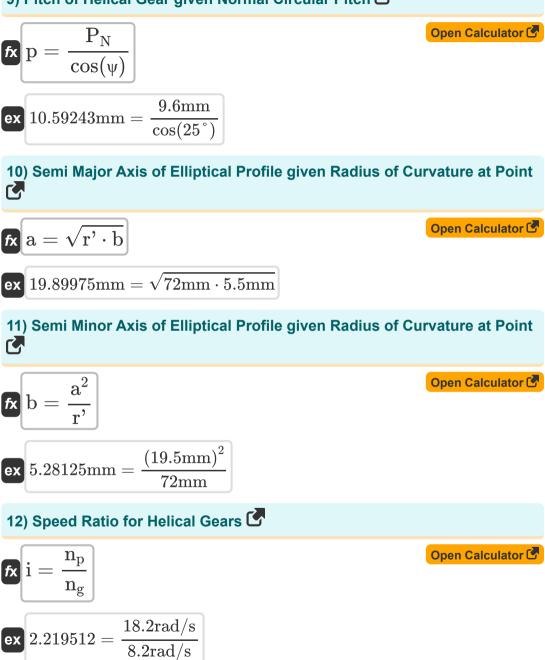


Open Calculator 🕑



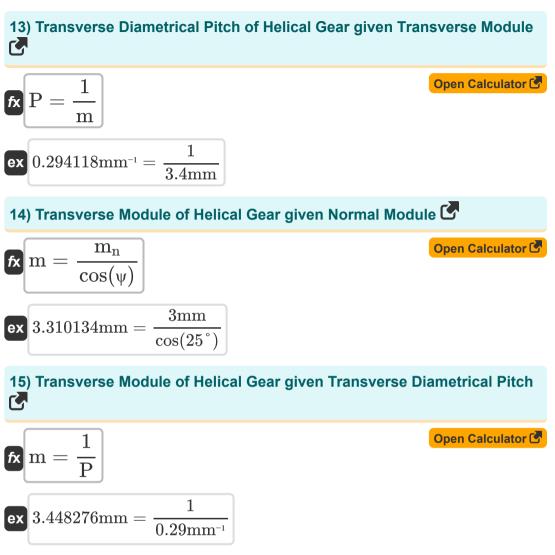


9) Pitch of Helical Gear given Normal Circular Pitch 🕑





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16) Transverse Pressure Angle of Helical Gear given Helix Angle 🕑

$$\alpha = a \tan\left(\frac{\tan(\alpha_n)}{\cos(\psi)}\right)$$
Open Calculator
$$(a = a \tan\left(\frac{\tan(20.1^{\circ})}{\cos(25^{\circ})}\right)$$

Helix Angle 🕑

17) Helix Angle of Helical Gear given Actual and Virtual Number of Teeth

$$\psi = a \cos\left(\left(rac{\mathrm{z}}{\mathrm{z}^{\prime}}
ight)^{rac{1}{3}}
ight)$$

ex
$$28.16458^{\circ} = a \cos\left(\left(rac{37}{54}
ight)^{rac{1}{3}}
ight)$$

18) Helix Angle of Helical Gear given Axial Pitch 🕑

fx
$$\psi = a \tan\left(\frac{p}{p_a}\right)$$

ex $25.59087^\circ = a \tan\left(\frac{10.68mm}{22.3mm}\right)$

Open Calculator 🕝

Open Calculator





fx $\psi = a \cos \left(\mathrm{m_n} \cdot rac{\mathrm{z_1} + \mathrm{z_2}}{2 \cdot \mathrm{a_c}}
ight)$

19) Helix Angle of Helical Gear given Center to Center Distance between Two Gears

$$ext{ex} ext{ 24.99503}^\circ = a \cos igg(3 ext{mm} \cdot rac{18+42}{2 \cdot 99.3 ext{mm}} igg)$$

20) Helix Angle of Helical Gear given Normal Circular Pitch 🕑

$$fx \quad \psi = a \cos\left(\frac{P_{\rm N}}{p}\right)$$

$$ex \quad 25.98923^{\circ} = a \cos\left(\frac{9.6 {\rm mm}}{10.68 {\rm mm}}\right)$$

$$Open Calculator C$$

21) Helix Angle of Helical Gear given Normal Module 🕑

fx
$$\psi = a \cos\left(\frac{m_n}{m}\right)$$

ex $28.07249^\circ = a \cos\left(\frac{3mm}{3.4mm}\right)$

22) Helix Angle of Helical Gear given Pitch Circle Diameter 💪

$$f_{\mathbf{X}} \Psi = a \cos\left(\mathbf{z} \cdot \frac{\mathbf{m}_{n}}{\mathbf{d}}\right)$$

$$e_{\mathbf{X}} 19.83427^{\circ} = a \cos\left(37 \cdot \frac{3\mathrm{mm}}{118\mathrm{mm}}\right)$$



Open Calculator

23) Helix Angle of Helical Gear given Pressure Angle 🕑

fx
$$\psi = a \cos\left(\frac{\tan(\alpha_n)}{\tan(\alpha)}\right)$$

ex $25.07509^\circ = a \cos\left(\frac{\tan(20.1^\circ)}{\tan(22^\circ)}\right)$

24) Helix Angle of Helical Gear given Radius of Curvature at Point 🕑

fx
$$\psi = \sqrt{a \cos \left(rac{\mathrm{d}}{2 \cdot \mathrm{r}^{\prime}}
ight)}$$

ex 44.76246° =
$$\sqrt{a \cos\left(rac{118 \mathrm{mm}}{2 \cdot 72 \mathrm{mm}}
ight)}$$

25) Helix Angle of Helical Gear given Virtual Number of Teeth

fx
$$\psi = a \cos\left(\left(\frac{d}{m_{n} \cdot z^{'}}\right)^{\frac{1}{2}}\right)$$

ex $31.40991^{\circ} = a \cos\left(\left(\frac{118mm}{3mm \cdot 54}\right)^{\frac{1}{2}}\right)$

Open Calculator 🕑

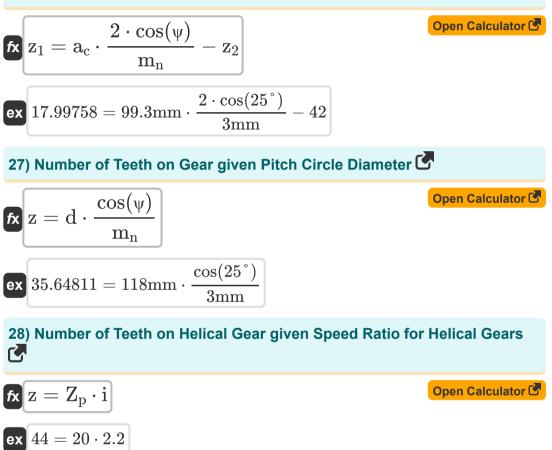


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Number of Teeth 🕑

26) Number of Teeth on First Gear given Center to Center Distance between Two Gears







29) Number of Teeth on Pinion given Speed Ratio 🕑

fx
$$Z_p = \frac{z}{i}$$

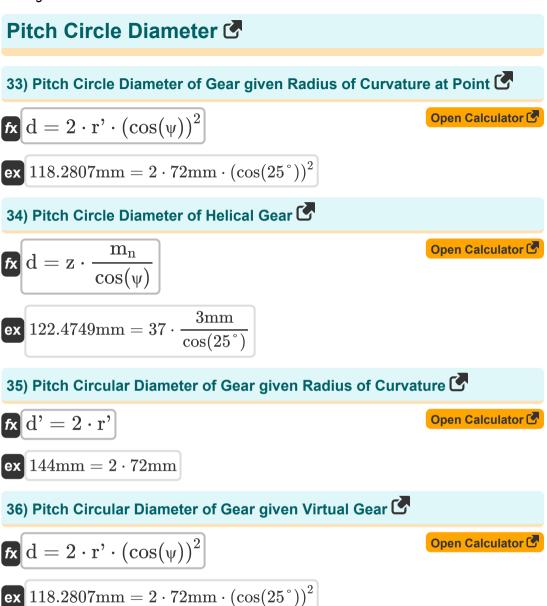
ex
$$16.81818 = \frac{37}{2.2}$$

ex
$$16.81818 = \frac{37}{2.2}$$

30) Number of Teeth on Second Helical Gear given Center to Center
Distance between Two Gears \checkmark
 $z_2 = a_c \cdot \frac{2 \cdot \cos(\psi)}{m_n} - z_1$
ex $41.99758 = 99.3 \text{mm} \cdot \frac{2 \cdot \cos(25^\circ)}{3 \text{mm}} - 18$
31) Pitch Circle Diameter of Gear given Addendum Circle Diameter \checkmark
fx $d = d_a - 2 \cdot h_a$
 $z_1 = 138 \text{mm} - 2 \cdot 4 \text{mm}$
32) Pitch Circle Diameter of Gear given Dedendum Circle Diameter \checkmark
fx $d = d_f + 2 \cdot d_h$
 $y = 136 \text{mm} - 126 \text{mm} + 2 \cdot 5 \text{mm}$



Open Calculator 🕑





12/2037) Pitch Circular Diameter of Gear given Virtual Number of Teeth 💪 Open Calculator fx $\mathbf{d} = \mathbf{m}_{\mathrm{n}} \cdot \mathbf{z}' \cdot \left(\cos(\psi)^2 \right)$ ex 133.0658mm = 3mm $\cdot 54 \cdot (\cos(25^{\circ})^2)$ Radius of Curvature 38) Radius of Curvature at Point on Helical Gear 💪 Open Calculator fx $\mathbf{r'} = \frac{\mathbf{a}^2}{\mathbf{b}}$ ex $69.13636 \text{mm} = \frac{(19.5 \text{mm})^2}{5.5 \text{mm}}$ 39) Radius of Curvature at Point on Virtual Gear 🖸 Open Calculator $\mathbf{r}' = \frac{\mathbf{d}}{2 \cdot (\cos(\psi))^2}$ $71.82913\mathrm{mm} = rac{118\mathrm{mm}}{2\cdot\left(\cos(25\degree) ight)^2}$ ex





40) Radius of Curvature of Virtual Gear given Pitch Circular Diameter 🕑



41) Radius of Curvature of Virtual Gear given Virtual Number of Teeth

Open Calculator

Open Calculator

Open Calculator

$$\begin{array}{c} \begin{array}{c} \begin{array}{c} \\ \end{array} \\ 82.50592 \mathrm{mm} \\ \end{array} = 54 \cdot \frac{9.6 \mathrm{mm}}{2 \cdot \pi} \end{array}$$

Tooth Proportions for Helical Gear 🕑

42) Actual Number of Teeth on Gear given Virtual Number of Teeth 🕑

fx
$$\mathbf{z} = \left(\cos(\mathbf{\psi})\right)^3 \cdot \mathbf{z}^2$$

fx $\mathrm{r_{vh}} = \mathrm{z}' \cdot rac{\mathrm{P_N}}{2 \cdot \pi}$

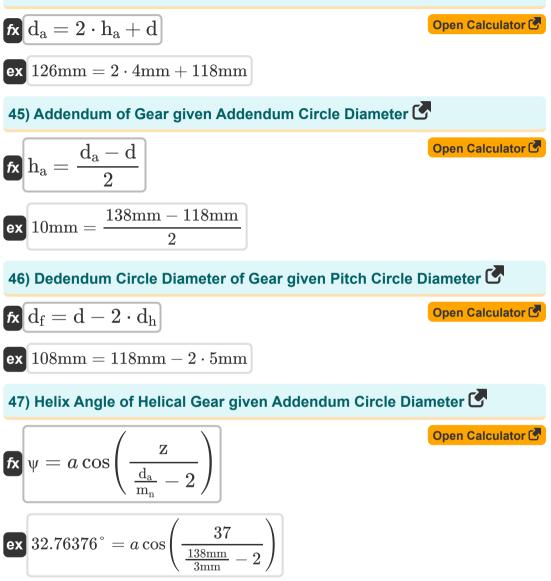
$$40.19952 = (\cos(25^{\circ}))^3 \cdot 54$$

43) Addendum Circle Diameter of Gear 🕑

fx
$$\mathbf{d}_{\mathrm{a}} = \mathrm{m}_{\mathrm{n}} \cdot \left(\left(rac{\mathrm{z}}{\cos(\psi)}
ight) + 2
ight)$$

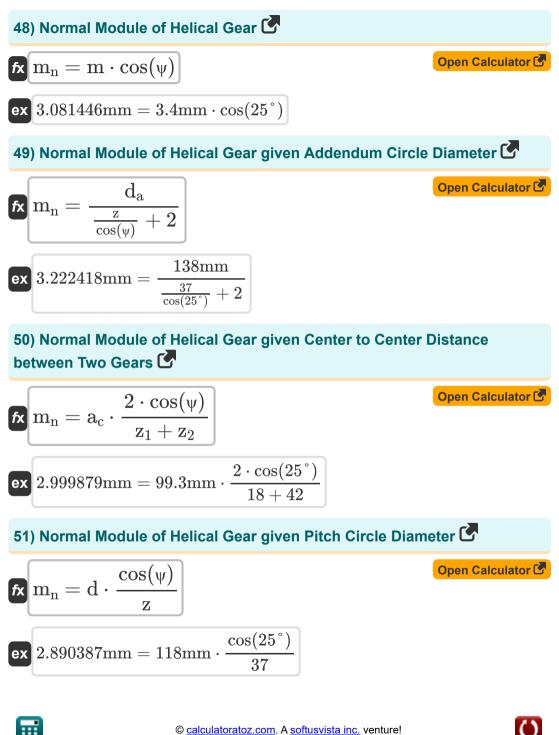
$$128.4749 \text{mm} = 3 \text{mm} \cdot \left(\left(\frac{37}{\cos(25^\circ)} \right) + 2 \right)$$











52) Normal Module of Helical Gear given Virtual Number of Teeth 🕑

$$f_{\mathbf{X}} m_{n} = \frac{d}{z'} \cdot \left(\cos(\psi)^{2} \right)$$

$$e_{\mathbf{X}} 1.794898mm = \frac{118mm}{54} \cdot \left(\cos(25^{\circ})^{2} \right)$$

$$f_{\mathbf{X}} \mathbf{X} = \left(\frac{d_{a}}{m_{n}} - 2 \right) \cdot \cos(\psi)$$

$$Open Calculator Content of Con$$

ex
$$39.87754 = \left(\frac{138 \text{mm}}{3 \text{mm}} - 2\right) \cdot \cos(25^{\circ})$$

54) Virtual Number of Teeth on Helical Gear 子

fx $\mathbf{z}' = 2 \cdot \pi \cdot \frac{\mathbf{r}_{\mathrm{vh}}}{\mathbf{P}_{\mathrm{N}}}$ ex $20.94395 = 2 \cdot \pi \cdot \frac{32\mathrm{mm}}{9.6\mathrm{mm}}$

Open Calculator 🕑

55) Virtual Number of Teeth on Helical Gear given Actual Number of Teeth

fx
$$z' = \frac{z}{(\cos(\psi))^3}$$

ex $49.70208 = \frac{37}{(\cos(25^\circ))^3}$



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Variables Used

- **a** Semi Major Axis of Helical Gear Teeth (*Millimeter*)
- ac Center to Center Distance of Helical Gears (Millimeter)
- **b** Semi Minor Axis of Helical Gear Teeth (Millimeter)
- d Diameter of Pitch Circle of Helical Gear (Millimeter)
- **d'** Pitch Circular Diameter of Helical Virtual Gear (*Millimeter*)
- **d**_a Addendum Circle Diameter of Helical Gear (*Millimeter*)
- **d**f Dedendum Circle Diameter of Helical Gear (Millimeter)
- dh Dedendum of Helical Gear (Millimeter)
- ha Addendum of Helical Gear (Millimeter)
- **i** Helical Gear Speed Ratio
- **m** Transverse Module of Helical Gear (Millimeter)
- mn Normal Module of Helical Gear (Millimeter)
- **n**_q Speed of Helical Gear (Radian per Second)
- np Speed of Pinion Helical Gear (Radian per Second)
- **p** Pitch of Helical Gear (*Millimeter*)
- P Transverse Diametrical Pitch of Helical Gear (1 per Millimeter)
- **p**_a Axial Pitch of Helical Gear (*Millimeter*)
- P_N Normal Circular Pitch of Helical Gear (*Millimeter*)
- r' Radius of Curvature of Helical Gear (Millimeter)
- **r**vh Virtual Pitch Circle Radius for Helical Gear (*Millimeter*)
- Z Number of Teeth on Helical Gear
- z' Virtual Number of Teeth on Helical Gear



- Z1 Number of Teeth on 1st Helical Gear
- Z2 Number of Teeth on 2nd Helical Gear
- Z_p Number of Teeth on Helical Pinion
- α Transverse Pressure Angle of Helical Gear (Degree)
- α_n Normal Pressure Angle of Helical Gear (*Degree*)
- **W** Helix Angle of Helical Gear (*Degree*)



Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288 Archimedes' constant
- Function: acos, acos(Number) Inverse trigonometric cosine function
- Function: atan, atan(Number) Inverse trigonometric tangent function
- Function: cos, cos(Angle) Trigonometric cosine function
- Function: **sqrt**, sqrt(Number) Square root function
- Function: tan, tan(Angle) Trigonometric tangent function
- Measurement: Length in Millimeter (mm) Length Unit Conversion
- Measurement: Angle in Degree (°) Angle Unit Conversion
- Measurement: Angular Velocity in Radian per Second (rad/s) Angular Velocity Unit Conversion
- Measurement: Reciprocal Length in 1 per Millimeter (mm⁻¹) Reciprocal Length Unit Conversion



Check other formula lists

- Design against Fluctuating Load Design of Helical Gears Formulas 🗖 Formulas 🗖 Design of Bevel Gear Design of Keys Formulas Formulas 🗖 Design of Knuckle Joint Formulas C Design of Chain Drives Formulas 🚰 Design of Lever Formulas C Design of Cotter Joint Design of Pressure Vessels Formulas Formulas Design of Coupling Formulas C Design of Shafts Formulas Design of Flywheel Formulas Design of Threaded Fasteners Formulas C **Design of Friction Clutches** Formulas Power Screws Formulas
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