

calculatoratoz.comunitsconverters.com

Slope and Deflection Formulas

[Calculators!](#)[Examples!](#)[Conversions!](#)

Bookmark calculatoratoz.com, unitsconverters.com

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**

Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**

Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

[Please leave your feedback here...](#)



List of 28 Slope and Deflection Formulas

Slope and Deflection

Cantilever Beam

1) Deflection at Any Point on Cantilever Beam carrying Couple Moment at Free End

$$\text{fx } \delta = \left(\frac{M_c \cdot x^2}{2 \cdot E \cdot I} \right)$$

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

$$\text{ex } 1.496354\text{mm} = \left(\frac{85\text{kN}\cdot\text{m} \cdot (1300\text{mm})^2}{2 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$

2) Deflection at Any Point on Cantilever Beam carrying UDL

$$\text{fx } \delta = \left((w' \cdot x^2) \cdot \left(\frac{(x^2) + (6 \cdot l^2) - (4 \cdot x \cdot l)}{24 \cdot E \cdot I} \right) \right)$$

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

$$\text{ex } 4.425335\text{mm} = \left((24\text{kN/m} \cdot (1300\text{mm})^2) \cdot \left(\frac{((1300\text{mm})^2) + (6 \cdot (5000\text{mm})^2) - (4 \cdot 1300\text{mm} \cdot 5000\text{mm})}{24 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right) \right)$$

3) Deflection of Cantilever Beam carrying Point Load at Any Point

$$\text{fx } \delta = \frac{P \cdot (a^2) \cdot (3 \cdot l - a)}{6 \cdot E \cdot I}$$

[Open Calculator !\[\]\(f1c5da15572e3e09d343161be98f508d_img.jpg\)](#)

$$\text{ex } 19.72266\text{mm} = \frac{88\text{kN} \cdot ((2250\text{mm})^2) \cdot (3 \cdot 5000\text{mm} - 2250\text{mm})}{6 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4}$$

4) Maximum Deflection of Cantilever Beam carrying Point Load at Free End

$$\text{fx } \delta = \frac{P \cdot (l^3)}{3 \cdot E \cdot I}$$

[Open Calculator !\[\]\(166772600a13ad0a433053f90fe45649_img.jpg\)](#)

$$\text{ex } 76.38889\text{mm} = \frac{88\text{kN} \cdot ((5000\text{mm})^3)}{3 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4}$$



5) Maximum Deflection of Cantilever Beam carrying UDL [Open Calculator](#) 

$$\text{fx } \delta = \frac{w' \cdot (l^4)}{8 \cdot E \cdot I}$$

$$\text{ex } 39.0625\text{mm} = \frac{24\text{kN/m} \cdot ((5000\text{mm})^4)}{8 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4}$$

6) Maximum Deflection of Cantilever Beam Carrying UVL with Maximum Intensity at Free End [Open Calculator](#) 

$$\text{fx } \delta = \left(\frac{11 \cdot q \cdot (l^4)}{120 \cdot E \cdot I} \right)$$

$$\text{ex } 44.75911\text{mm} = \left(\frac{11 \cdot 37.5\text{kN/m} \cdot ((5000\text{mm})^4)}{120 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$

7) Maximum Deflection of Cantilever Beam carrying UVL with Maximum Intensity at Support [Open Calculator](#) 

$$\text{fx } \delta = \frac{q \cdot (l^4)}{30 \cdot E \cdot I}$$

$$\text{ex } 16.27604\text{mm} = \frac{37.5\text{kN/m} \cdot ((5000\text{mm})^4)}{30 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4}$$

8) Maximum Deflection of Cantilever Beam with Couple Moment at Free End [Open Calculator](#) 

$$\text{fx } \delta = \frac{M_c \cdot (l^2)}{2 \cdot E \cdot I}$$

$$\text{ex } 22.13542\text{mm} = \frac{85\text{kN} \cdot \text{m} \cdot ((5000\text{mm})^2)}{2 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4}$$

9) Slope at Free End of Cantilever Beam Carrying Concentrated Load at Any Point from Fixed End [Open Calculator](#) 

$$\text{fx } \theta = \left(\frac{P \cdot x^2}{2 \cdot E \cdot I} \right)$$

$$\text{ex } 0.001549\text{rad} = \left(\frac{88\text{kN} \cdot (1300\text{mm})^2}{2 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$



10) Slope at Free End of Cantilever Beam Carrying Concentrated Load at Free End

$$\theta = \left(\frac{P \cdot l^2}{2 \cdot E \cdot I} \right)$$

Open Calculator 

$$\text{ex } 0.022917\text{rad} = \left(\frac{88\text{kN} \cdot (5000\text{mm})^2}{2 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$

11) Slope at Free End of Cantilever Beam Carrying Couple at Free End

$$\theta = \left(\frac{M_c \cdot l}{E \cdot I} \right)$$

Open Calculator 

$$\text{ex } 0.008854\text{rad} = \left(\frac{85\text{kN} \cdot \text{m} \cdot 5000\text{mm}}{30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$

12) Slope at Free End of Cantilever Beam carrying UDL

$$\theta = \left(\frac{w \cdot l^3}{6 \cdot E \cdot I} \right)$$

Open Calculator 

$$\text{ex } 0.010417\text{rad} = \left(\frac{24\text{kN/m} \cdot (5000\text{mm})^3}{6 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$

13) Slope at Free End of Cantilever Beam Carrying UVL with Maximum Intensity at Fixed End

$$\theta = \left(\frac{q \cdot l^3}{24 \cdot E \cdot I} \right)$$

Open Calculator 

$$\text{ex } 0.004069\text{rad} = \left(\frac{37.5\text{kN/m} \cdot (5000\text{mm})^3}{24 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$

Simply Supported Beam 14) Center Deflection of Simply Supported Beam carrying Couple Moment at Right End

$$\delta = \left(\frac{M_c \cdot l^2}{16 \cdot E \cdot I} \right)$$

Open Calculator 

$$\text{ex } 2.766927\text{mm} = \left(\frac{85\text{kN} \cdot \text{m} \cdot (5000\text{mm})^2}{16 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$



15) Center Deflection on Simply Supported Beam carrying UVL with Maximum Intensity at Right support Open Calculator 

$$\delta = \left(0.00651 \cdot \frac{q \cdot (l^4)}{E \cdot I} \right)$$

$$\text{ex } 3.178711\text{mm} = \left(0.00651 \cdot \frac{37.5\text{kN/m} \cdot (5000\text{mm})^4}{30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$

16) Deflection at Any Point on Simply Supported carrying Couple Moment at Right End Open Calculator 

$$\delta = \left(\left(\frac{M_c \cdot l \cdot x}{6 \cdot E \cdot I} \right) \cdot \left(1 - \left(\frac{x^2}{l^2} \right) \right) \right)$$

$$\text{ex } 1.788719\text{mm} = \left(\left(\frac{85\text{kN}\cdot\text{m} \cdot 5000\text{mm} \cdot 1300\text{mm}}{6 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right) \cdot \left(1 - \left(\frac{(1300\text{mm})^2}{(5000\text{mm})^2} \right) \right) \right)$$

17) Deflection at Any Point on Simply Supported Beam carrying UDL Open Calculator 

$$\delta = \left(\left(\left(\frac{w' \cdot x}{24 \cdot E \cdot I} \right) \cdot ((l^3) - (2 \cdot l \cdot x^2) + (x^3)) \right) \right)$$

$$\text{ex } 2.98721\text{mm} = \left(\left(\left(\frac{24\text{kN/m} \cdot 1300\text{mm}}{24 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right) \cdot ((5000\text{mm})^3 - (2 \cdot 5000\text{mm} \cdot (1300\text{mm})^2) + ((1300\text{mm})^3)) \right) \right)$$

18) Maximum and Center Deflection of Simply Supported Beam carrying Point Load at Center Open Calculator 

$$\delta = \frac{P \cdot (l^3)}{48 \cdot E \cdot I}$$

$$\text{ex } 4.774306\text{mm} = \frac{88\text{kN} \cdot ((5000\text{mm})^3)}{48 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4}$$

19) Maximum and Center Deflection of Simply Supported Beam carrying UDL over its Entire Length Open Calculator 

$$\delta = \frac{5 \cdot w' \cdot (l^4)}{384 \cdot E \cdot I}$$

$$\text{ex } 4.06901\text{mm} = \frac{5 \cdot 24\text{kN/m} \cdot ((5000\text{mm})^4)}{384 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4}$$



20) Maximum Deflection of Simply Supported Beam carrying Couple Moment at Right End

$$\text{fx } \delta = \left(\frac{M_c \cdot l^2}{15.5884 \cdot E \cdot I} \right)$$

Open Calculator 

$$\text{ex } 2.839986\text{mm} = \left(\frac{85\text{kN} \cdot \text{m} \cdot (5000\text{mm})^2}{15.5884 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$

21) Maximum Deflection of Simply Supported Beam carrying Triangular Load with Max Intensity at Center

$$\text{fx } \delta = \left(\left(\frac{q \cdot (l^4)}{120 \cdot E \cdot I} \right) \right)$$

Open Calculator 

$$\text{ex } 4.06901\text{mm} = \left(\left(\frac{37.5\text{kN/m} \cdot (5000\text{mm})^4}{120 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right) \right)$$

22) Maximum Deflection on Simply Supported Beam carrying UVL Max Intensity at Right Support

$$\text{fx } \delta = \left(0.00652 \cdot \frac{q \cdot (l^4)}{E \cdot I} \right)$$

Open Calculator 

$$\text{ex } 3.183594\text{mm} = \left(0.00652 \cdot \frac{37.5\text{kN/m} \cdot (5000\text{mm})^4}{30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$

23) Slope at Free Ends of Simply Supported Beam carrying Concentrated Load at Center

$$\text{fx } \theta = \left(\frac{P \cdot l^2}{16 \cdot E \cdot I} \right)$$

Open Calculator 

$$\text{ex } 0.002865\text{rad} = \left(\frac{88\text{kN} \cdot (5000\text{mm})^2}{16 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$

24) Slope at Free Ends of Simply Supported Beam carrying UDL

$$\text{fx } \theta = \left(\frac{w' \cdot l^3}{24 \cdot E \cdot I} \right)$$

Open Calculator 

$$\text{ex } 0.002604\text{rad} = \left(\frac{24\text{kN/m} \cdot (5000\text{mm})^3}{24 \cdot 30000\text{MPa} \cdot 0.0016\text{m}^4} \right)$$



25) Slope at Left End of Simply Supported Beam carrying Couple at Right End [Open Calculator](#) 

$$\text{fx } \theta = \left(\frac{M_c \cdot l}{6 \cdot E \cdot I} \right)$$

$$\text{ex } 0.001476 \text{ rad} = \left(\frac{85 \text{ kN} \cdot \text{m} \cdot 5000 \text{ mm}}{6 \cdot 30000 \text{ MPa} \cdot 0.0016 \text{ m}^4} \right)$$

26) Slope at Left End of Simply Supported Beam carrying UVL with Maximum Intensity at Right End [Open Calculator](#) 

$$\text{fx } \theta = \left(\frac{7 \cdot q \cdot l^3}{360 \cdot E \cdot I} \right)$$

$$\text{ex } 0.001899 \text{ rad} = \left(\frac{7 \cdot 37.5 \text{ kN/m} \cdot (5000 \text{ mm})^3}{360 \cdot 30000 \text{ MPa} \cdot 0.0016 \text{ m}^4} \right)$$

27) Slope at Right End of Simply Supported Beam carrying Couple at Right End [Open Calculator](#) 

$$\text{fx } \theta = \left(\frac{M_c \cdot l}{3 \cdot E \cdot I} \right)$$

$$\text{ex } 0.002951 \text{ rad} = \left(\frac{85 \text{ kN} \cdot \text{m} \cdot 5000 \text{ mm}}{3 \cdot 30000 \text{ MPa} \cdot 0.0016 \text{ m}^4} \right)$$

28) Slope at Right End of Simply Supported Beam carrying UVL with Maximum Intensity at Right End [Open Calculator](#) 

$$\text{fx } \theta = \left(\frac{q \cdot l^3}{45 \cdot E \cdot I} \right)$$

$$\text{ex } 0.00217 \text{ rad} = \left(\frac{37.5 \text{ kN/m} \cdot (5000 \text{ mm})^3}{45 \cdot 30000 \text{ MPa} \cdot 0.0016 \text{ m}^4} \right)$$



Variables Used

- **a** Distance from Support A (Millimeter)
- **E** Elasticity Modulus of Concrete (Megapascal)
- **I** Area Moment of Inertia (Meter⁴)
- **l** Length of Beam (Millimeter)
- **M_c** Moment of Couple (Kilonewton Meter)
- **P** Point Load (Kilonewton)
- **q** Uniformly Varying Load (Kilonewton per Meter)
- **w'** Load per Unit Length (Kilonewton per Meter)
- **x** Distance x from Support (Millimeter)
- **δ** Deflection of Beam (Millimeter)
- **θ** Slope of Beam (Radian)



Constants, Functions, Measurements used

- **Measurement: Length** in Millimeter (mm)
Length Unit Conversion 
- **Measurement: Force** in Kilonewton (kN)
Force Unit Conversion 
- **Measurement: Angle** in Radian (rad)
Angle Unit Conversion 
- **Measurement: Surface Tension** in Kilonewton per Meter (kN/m)
Surface Tension Unit Conversion 
- **Measurement: Moment of Force** in Kilonewton Meter (kN*m)
Moment of Force Unit Conversion 
- **Measurement: Second Moment of Area** in Meter⁴ (m⁴)
Second Moment of Area Unit Conversion 
- **Measurement: Stress** in Megapascal (MPa)
Stress Unit Conversion 



Check other formula lists

- [Mohr's Circle of Stresses Formulas](#) 
- [Beam Moments Formulas](#) 
- [Bending Stress Formulas](#) 
- [Combined Axial and Bending Loads Formulas](#) 
- [Elastic Stability of Columns Formulas](#) 
- [Principal Stress Formulas](#) 
- [Slope and Deflection Formulas](#) 
- [Strain Energy Formulas](#) 

Feel free to SHARE this document with your friends!

PDF Available in

[English](#) [Spanish](#) [French](#) [German](#) [Russian](#) [Italian](#) [Portuguese](#) [Polish](#) [Dutch](#)

1/1/2024 | 5:37:25 AM UTC

[Please leave your feedback here...](#)

