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Beam Moments Formulas

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List of 24 Beam Moments Formulas

Beam Moments

1) Bending Moment of Cantilever Beam Subjected to UDL at Any Point from Free End

$$\text{fx } M = \left(\frac{w \cdot x^2}{2} \right)$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$\text{ex } 57.0037\text{kN}\cdot\text{m} = \left(\frac{67.46\text{kN/m} \cdot (1300\text{mm})^2}{2} \right)$$

2) Bending Moment of Simply Supported Beam Carrying UDL

$$\text{fx } M = \left(\frac{w \cdot L \cdot x}{2} \right) - \left(w \cdot \frac{x^2}{2} \right)$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 57.0037\text{kN}\cdot\text{m} = \left(\frac{67.46\text{kN/m} \cdot 2600\text{mm} \cdot 1300\text{mm}}{2} \right) - \left(67.46\text{kN/m} \cdot \frac{(1300\text{mm})^2}{2} \right)$$

3) Bending Moment of Simply Supported Beam Subjected to Point Load at Mid-Point

$$\text{fx } M = \left(\frac{P \cdot x}{2} \right)$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$\text{ex } 57.2\text{kN}\cdot\text{m} = \left(\frac{88\text{kN} \cdot 1300\text{mm}}{2} \right)$$



4) Fixed End Moment at Left Support Carrying Right Angled Triangular Load at Right Angled End A

$$\text{fx FEM} = \frac{q \cdot (L^2)}{20}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$\text{ex } 4.394\text{kN}\cdot\text{m} = \frac{13\text{kN/m} \cdot ((2600\text{mm})^2)}{20}$$

5) Fixed End Moment at Left Support with Couple at Distance A

$$\text{fx FEM} = \frac{M_c \cdot b \cdot (2 \cdot a - b)}{L^2}$$

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

$$\text{ex } 18.26368\text{kN}\cdot\text{m} = \frac{85\text{kN}\cdot\text{m} \cdot 350\text{mm} \cdot (2 \cdot 2250\text{mm} - 350\text{mm})}{(2600\text{mm})^2}$$

6) Fixed End Moment at Left Support with Point Load at Certain Distance from Left Support

$$\text{fx FEM} = \left(\frac{P \cdot (b^2) \cdot a}{L^2} \right)$$

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

$$\text{ex } 3.588018\text{kN}\cdot\text{m} = \left(\frac{88\text{kN} \cdot ((350\text{mm})^2) \cdot 2250\text{mm}}{(2600\text{mm})^2} \right)$$

7) Fixed End Moment of Fixed Beam Carrying Three Equi-spaced Point Loads

$$\text{fx FEM} = \frac{15 \cdot P \cdot L}{48}$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

$$\text{ex } 71.5\text{kN}\cdot\text{m} = \frac{15 \cdot 88\text{kN} \cdot 2600\text{mm}}{48}$$



8) Maximum Bending Moment of Cantilever Beam Subjected to Point Load at Free End

$$fx \quad M = P \cdot L$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 228.8kN \cdot m = 88kN \cdot 2600mm$$

9) Maximum Bending Moment of Cantilever Subject to UDL over Entire Span

$$fx \quad M = \frac{w \cdot L^2}{2}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 228.0148kN \cdot m = \frac{67.46kN/m \cdot (2600mm)^2}{2}$$

10) Maximum Bending Moment of Overhanging Beam Subjected to Concentrated Load at Free End

$$fx \quad M = -P \cdot l_o$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$ex \quad -132000kN \cdot m = -88kN \cdot 1500mm$$

11) Maximum Bending Moment of Simply Supported Beam with Point Load at Distance 'a' from Left Support

$$fx \quad M = \frac{P \cdot a \cdot b}{L}$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$ex \quad 26.65385kN \cdot m = \frac{88kN \cdot 2250mm \cdot 350mm}{2600mm}$$

12) Maximum Bending Moment of Simply Supported Beam with Uniformly Distributed Load

$$fx \quad M = \frac{w \cdot L^2}{8}$$

[Open Calculator !\[\]\(40770d9ed6ed4f1222ebf89a1396e8b2_img.jpg\)](#)

$$ex \quad 57.0037kN \cdot m = \frac{67.46kN/m \cdot (2600mm)^2}{8}$$



13) Maximum Bending Moment of Simply Supported Beams with Point Load at Centre

$$\text{fx } M = \frac{P \cdot L}{4}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 57.2\text{kN}\cdot\text{m} = \frac{88\text{kN} \cdot 2600\text{mm}}{4}$$

14) Maximum Bending Moment of Simply Supported Beams with Uniformly Varying Load

$$\text{fx } M = \frac{q \cdot L^2}{9 \cdot \sqrt{3}}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 5.637505\text{kN}\cdot\text{m} = \frac{13\text{kN/m} \cdot (2600\text{mm})^2}{9 \cdot \sqrt{3}}$$

15) Moment on Fixed End of Fixed Beam carrying Two Equi Spaced Point Loads

$$\text{fx } \text{FEM} = \frac{2 \cdot P \cdot L}{9}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$\text{ex } 50.84444\text{kN}\cdot\text{m} = \frac{2 \cdot 88\text{kN} \cdot 2600\text{mm}}{9}$$

16) Moment on Fixed End of Fixed Beam Carrying Uniform Varying Load

$$\text{fx } \text{FEM} = \frac{5 \cdot q \cdot (L^2)}{96}$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$\text{ex } 4.577083\text{kN}\cdot\text{m} = \frac{5 \cdot 13\text{kN/m} \cdot ((2600\text{mm})^2)}{96}$$



17) Moment on Fixed End of Fixed Beam having Point Load at Center

$$\text{fx FEM} = \frac{P \cdot L}{8}$$

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

$$\text{ex } 28.6\text{kN}\cdot\text{m} = \frac{88\text{kN} \cdot 2600\text{mm}}{8}$$

18) Moment on Fixed End of Fixed Beam having UDL over Entire Length

$$\text{fx FEM} = \frac{w \cdot (L^2)}{12}$$

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

$$\text{ex } 38.00247\text{kN}\cdot\text{m} = \frac{67.46\text{kN/m} \cdot ((2600\text{mm})^2)}{12}$$

Curved Beams

19) Bending Moment when Stress is Applied at Point in Curved Beam

$$\text{fx } M = \left(\frac{S \cdot A \cdot R}{1 + \left(\frac{y}{Z \cdot (R+y)} \right)} \right)$$

[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7_img.jpg\)](#)

$$\text{ex } 57\text{kN}\cdot\text{m} = \left(\frac{33.25\text{MPa} \cdot 0.04\text{m}^2 \cdot 50\text{mm}}{1 + \left(\frac{25\text{mm}}{2.0 \cdot (50\text{mm} + 25\text{mm})} \right)} \right)$$

20) Cross-Sectional Area when Stress is Applied at Point in Curved Beam

$$\text{fx } A = \left(\frac{M}{S \cdot R} \right) \cdot \left(1 + \left(\frac{y}{Z \cdot (R+y)} \right) \right)$$

[Open Calculator !\[\]\(21226b58c700e5231ab98d27101bac58_img.jpg\)](#)

$$\text{ex } 0.04\text{m}^2 = \left(\frac{57\text{kN}\cdot\text{m}}{33.25\text{MPa} \cdot 50\text{mm}} \right) \cdot \left(1 + \left(\frac{25\text{mm}}{2.0 \cdot (50\text{mm} + 25\text{mm})} \right) \right)$$



21) Stress at Point for Curved Beam as defined in Winkler-Bach Theory

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

$$f_x \quad S = \left(\frac{M}{A \cdot R} \right) \cdot \left(1 + \left(\frac{y}{Z \cdot (R + y)} \right) \right)$$

$$ex \quad 33.25MPa = \left(\frac{57kN \cdot m}{0.04m^2 \cdot 50mm} \right) \cdot \left(1 + \left(\frac{25mm}{2.0 \cdot (50mm + 25mm)} \right) \right)$$

Flitched Beam

22) Equivalent Width of Flitched Beam

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

$$f_x \quad w_f = m \cdot T_{Beam}$$

$$ex \quad 3375mm = 15 \cdot 225mm$$

23) Modular Ratio for Equivalent Width of Flitched Beam

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

$$f_x \quad m = \frac{w_f}{T_{Beam}}$$

$$ex \quad 15 = \frac{3375mm}{225mm}$$

24) Thickness of Steel given Equivalent Width of Flitched Beam

[Open Calculator !\[\]\(06a315363e7801bba8c7489a6694af19_img.jpg\)](#)

$$f_x \quad T_{Beam} = \frac{w_f}{m}$$

$$ex \quad 225mm = \frac{3375mm}{15}$$









Variables Used

- **a** Distance from Support A (Millimeter)
- **A** Cross Sectional Area (Square Meter)
- **b** Distance from Support B (Millimeter)
- **FEM** Fixed End Moment (Kilonewton Meter)
- **L** Length of Beam (Millimeter)
- **l_o** Length of Overhang (Millimeter)
- **m** Modular Ratio
- **M** Bending Moment (Kilonewton Meter)
- **M_c** Moment of Couple (Kilonewton Meter)
- **P** Point Load (Kilonewton)
- **q** Uniformly Varying Load (Kilonewton per Meter)
- **R** Radius of Centroidal Axis (Millimeter)
- **S** Stress (Megapascal)
- **T_{Beam}** Beam Thickness (Millimeter)
- **w** Load per Unit Length (Kilonewton per Meter)
- **w_f** Equivalent Width of Flitched Beam (Millimeter)
- **x** Distance x from Support (Millimeter)
- **y** Distance from Neutral Axis (Millimeter)
- **Z** Cross-Section Property



Constants, Functions, Measurements used

- **Function:** **sqrt**, `sqrt(Number)`
Square root function
- **Measurement:** **Length** in Millimeter (mm)
Length Unit Conversion 
- **Measurement:** **Area** in Square Meter (m^2)
Area Unit Conversion 
- **Measurement:** **Force** in Kilonewton (kN)
Force 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:** **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](#) 
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