efunda

Cantilever: Triangular Load

Formula Home
- **Beam Theory**
  - Euler Beam Equation
  - Symbol Definition
  - Sign Convention
- **Beam Calculators**
  - Cantilevers
    - End Load
    - Uniform Load
    - Triangular Load
    - End Moment
    - Intermediate Load
  - Simply Supported
  - Mixed Supported
- **X-Section Data**
  - Standard I-Beams
  - Other Shapes
- **Material Data**
  - Elastic Modulii
- **Resources**
  - Bibliography

- **Trade Publications**
  - Assembly
  - Design-2-Part
  - LEDs Magazine
  - Injection Molding
  - Control Design
  - Process Heating
  - **more**

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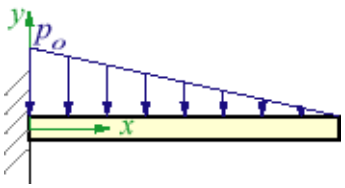
Search

Home | Membership | Store | Forum | Search Member | Calculators

Materials | Design | Processes | Units | Formulas | Math

Beam Diagram and Calculator Input



Here we display a specific beam loading case. Integrated into each beam case is a calculator that can be used to determine the maximum displacements, slopes, moments, stresses, and shear forces for this beam problem. Note that the maximum stress quoted is a positive number, and corresponds to the largest stress magnitude in the beam. It does not distinguish between tension or compression (this distinction depends on which side of the beam's neutral plane your *c* input corresponds).

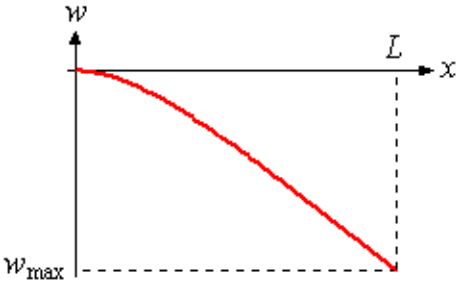
Calculator Input

Length of beam, *L*:	10	ft
Max line pressure on beam root, p_0:	10	psi-in
Young's Modulus, *E*:	30000	ksi
Distance from neutral axis to extreme fibers, *c*:	9	in
Moment of Inertia, *I*:	926	in^4

Calculate Again Default Values

Go To Solutions ⇒ Max Stress | Displacement | Slope | Moment | Shear

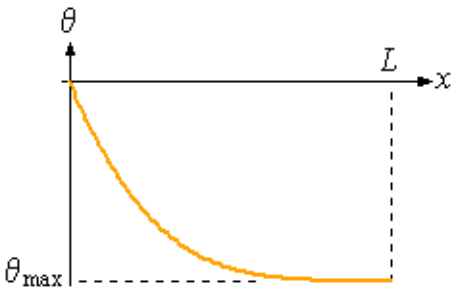
Displacement



$$w(x) = -\frac{p_0 x^2 \left(10 L^3 - 10 x L^2 + 5 x^2 L - x^3\right)}{120 EI L}$$

$w_{max} = w(L) = -\frac{L^4 p_0}{30 EI}$ = -0.00249 in in Calc. Again

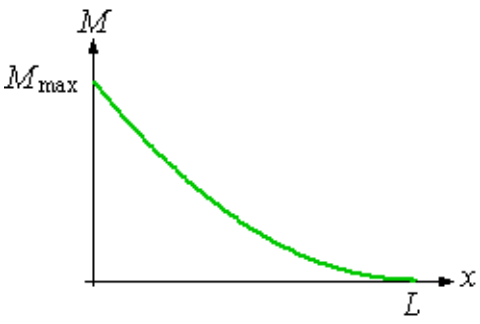
Slope



$$\theta(x) = -\frac{p_0 x \left(4 L^3 - 6 x L^2 + 4 x^2 L - x^3\right)}{24 \text{ EI } L}$$

$\theta_{max} = \theta(L) = -\frac{L^3 p_0}{24 \text{ EI}}$ = -0.00148 deg deg Calc. Again

Moment and Maximum Bending Stress

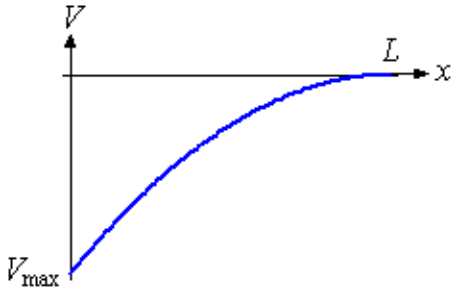


$$M(x) = \frac{p_0 (L-x)^3}{6L}$$

$$M_{max} = M(0) = \frac{L^2 p_0}{6} \quad = 2000 \text{ lbf-ft}$$ lbf-ft Calc. Again

$$\sigma_{max} = \left| M_{max} \right| \frac{c}{I} = \left| \frac{L^2 p_0}{6Z} \right| = \mathbf{233} \text{ psi}$$ psi

Shear



$$V(x) = -\frac{p_0 (L-x)^2}{2L}$$

$$V_{max} = V(0) = -\frac{L p_0}{2} = -600 \text{ lbf}$$ lbf Calc. Again