



Analysis of Bar Formulas

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Examples!

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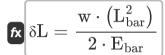


List of 15 Analysis of Bar Formulas

Analysis of Bar 🗗

Elongation of Bar due its Own Weight

1) Bar's total elongation if weight given per unit volume of bar



Open Calculator

$$=$$
 $3E^-5mm = rac{10.0 ext{N/m}^3 \cdot \left((256.66 ext{mm})^2 \right)}{2 \cdot 11 ext{MPa}}$

2) Elongation of element

$$\Delta
m L_{Bar} = rac{w \cdot \left(L_{bar}^2
ight)}{2 \cdot E}$$

Open Calculator

$$oxed{ex} 0.014321 \mathrm{mm} = rac{10.0 \mathrm{N/m^3 \cdot \left(\left(256.66 \mathrm{mm}
ight)^2
ight)}}{2 \cdot 0.023 \mathrm{MPa}}$$

3) Length of Bar given Total Elongation of Bar

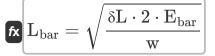
$$L_{
m bar} = rac{\delta L \cdot 2 \cdot E_{
m bar}}{
ho_A}$$

Open Calculator





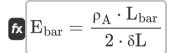
4) Length of Bar using Total Elongation and Weight per unit volume of bar



Open Calculator

$$= \sqrt{\frac{70.0 \text{mm} \cdot 2 \cdot 11 \text{MPa}}{10.0 \text{N/m}^3}}$$

5) Modulus of Elasticity given Total Elongation of Bar



Open Calculator

$$oxed{ex} 10.99971 ext{MPa} = rac{6 ext{MPa} \cdot 256.66 ext{mm}}{2 \cdot 70.0 ext{mm}}$$

6) Strain in Element

$$\epsilon = rac{ \mathbf{w} \cdot \mathbf{L}_{\mathrm{bar}}}{\mathrm{E}}$$

Open Calculator

$$0.000112 = rac{10.0 \mathrm{N/m^3 \cdot 256.66 mm}}{0.023 \mathrm{MPa}}$$

7) Stress on element of rod

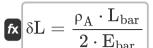
fx
$$\sigma = \mathbf{w} \cdot \mathbf{L}_{\mathrm{bar}}$$

Open Calculator 🖸

$$= 2.6 \text{E} - 6 \text{MPa} = 10.0 \text{N/m}^3 \cdot 256.66 \text{mm}$$



8) Total elongation of bar



Open Calculator

$$= \frac{6 \text{MPa} \cdot 256.66 \text{mm}}{2 \cdot 11 \text{MPa}}$$

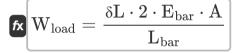
9) Weight of bar for length x



Open Calculator

$$0.164262 ext{kg} = 10.0 ext{N/m}^3 \cdot 64000 ext{mm}^2 \cdot 256.66 ext{mm}$$

10) Weight of Bar given Total Elongation of Bar



Open Calculator

$$oxed{\mathbf{ex}} 384010 \mathrm{N} = rac{70.0 \mathrm{mm} \cdot 2 \cdot 11 \mathrm{MPa} \cdot 64000 \mathrm{mm}^2}{256.66 \mathrm{mm}}$$

Strain in Bar 🗗

11) Area of lower end of bar

$$oldsymbol{A}_{2}=rac{ ext{A}_{1}}{e^{ ext{w}\cdotrac{ ext{L}_{ ext{bar}}}{\sigma}}}$$

$$oxed{ex} 3000 \mathrm{mm}^{_2} = rac{3000.642 \mathrm{mm}^{_2}}{e^{10.0 \mathrm{N/m}^3 \cdot rac{256.66 \mathrm{mm}}{0.012 \mathrm{MPa}}}}$$



12) Area of upper end of bar

$$\mathbf{K} \, \mathbf{A}_1 = \mathbf{A}_2 \cdot e^{\mathrm{w} \cdot rac{\mathbf{L}_{\mathrm{bar}}}{\sigma}}$$

Open Calculator 🛂

$$oxed{ex} 3000.642 ext{mm}^2 = 3000 ext{mm}^2 \cdot e^{10.0 ext{N/m}^3 \cdot rac{256.66 ext{mm}}{0.012 ext{MPa}}}$$

13) Change in length of Tapered Bar

$$\Delta L = \left(F_{a} \cdot rac{l}{t \cdot E \cdot \left(L^{Right} - L_{Left}
ight)}
ight) \cdot rac{\ln\left(rac{L^{Right}}{L_{Left}}
ight)}{1000000}$$

Open Calculator

$$0.0084 \text{mm} = \left(2500 \text{N} \cdot \frac{7800 \text{mm}}{1200 \text{mm} \cdot 0.023 \text{MPa} \cdot (70 \text{mm} - 100 \text{mm})}\right) \cdot \frac{\ln\left(\frac{70 \text{mm}}{100 \text{mm}}\right)}{1000000}$$

14) Elongation of bar given applied tensile load, area and length

$$\Delta = P \cdot rac{L_0}{A_{cs} \cdot E}$$

Open Calculator 🗗

$$ext{ex} \left[339.6739 ext{mm} = 10 ext{N} \cdot rac{5000 ext{mm}}{6400 ext{mm}^2 \cdot 0.023 ext{MPa}}
ight]$$

15) Longitudinal Strain using Poisson's Ratio

$$\left| \mathbf{f} \mathbf{x}
ight| \epsilon_{
m ln} = - \left(rac{\epsilon_{
m L}}{\mathbf{v}}
ight)
ight|$$

Open Calculator

$$oxed{ex} \left[0.066667 = - igg(rac{0.02}{ ext{-}0.3} igg)
ight]$$



Variables Used

- ∆ Elongation (Millimeter)
- A Cross Sectional Area of Bar (Square Millimeter)
- A₁ Area of Upper End (Square Millimeter)
- A₂ Area of The Lower End (Square Millimeter)
- A_{CS} Area of Cross-Section (Square Millimeter)
- E Young's Modulus Bar (Megapascal)
- E_{bar} Modulus of Elasticity Of Bar (Megapascal)
- **F**_a Applied Force (Newton)
- I Length of Tapered Bar (Millimeter)
- L₀ Original Length (Millimeter)
- Lbar Length of Bar (Millimeter)
- Left Length of Tapered Bar on Left (Millimeter)
- LRight Length of Tapered Bar on Right (Millimeter)
- P Axial Force (Newton)
- t Thickness (Millimeter)
- W Weight per unit volume (Newton per Cubic Meter)
- **W** Weight (Kilogram)
- W_{load} Load (Newton)
- δL Total Elongation (Millimeter)
- ΔL Change in Length of Tapered Bar (Millimeter)
- ΔL_{Bar} Increase in Bar Length (Millimeter)
- ε Strain
- ε_L Lateral Strain
- ε_{In} Longitudinal Strain
- ρ_A Weight by Area (Megapascal)





- **σ** Stress in Bar (Megapascal)
- ν Poisson's Ratio





Constants, Functions, Measurements used

- Constant: e, 2.71828182845904523536028747135266249
 Napier's constant
- Function: In, In(Number)

 The natural logarithm, also known as the logarithm to the base e, is the inverse function of the natural exponential function.
- 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 Millimeter (mm)
 Length Unit Conversion
- Measurement: Weight in Kilogram (kg)
 Weight Unit Conversion
- Measurement: Area in Square Millimeter (mm²)

 Area Unit Conversion
- Measurement: Pressure in Megapascal (MPa)
 Pressure Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Specific Weight in Newton per Cubic Meter (N/m³)
 Specific Weight Unit Conversion
- Measurement: Stress in Megapascal (MPa)
 Stress Unit Conversion





Check other formula lists

- Analysis of Bar Formulas
- Direct Strains of Diagonal Formulas
- Elastic Constants Formulas
- Mohr's Circle Formulas
- Principal Stresses and Strains
 Formulas

- Relationship between Stress and Strain Formulas
- Strain Energy Formulas
- Thermal Stress Formulas
- Types of Stresses Formulas

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