Triangular Truss Member Forces (Method of Joints)

Support reactions and member forces of a simple triangular truss (two rafters and a tie) carrying a vertical load at the apex, with the apex anywhere along the span.

Method: Method of joints (Timoshenko and Young, Theory of Structures, 2nd ed. (McGraw-Hill))

Input parameters

Unit system: SI

Parameter	Value	Unit
Span	10.000	m
Rise of the apex	2.5000	m
Apex distance from the left support	5.0000	m
Vertical load at the apex	50.000	kN

Calculated results

Parameter	Value	Unit
Left reaction	25.000	kN
Right reaction	25.000	kN
Left rafter force (compression)	55.902	kN
Right rafter force (compression)	55.902	kN
Tie force (tension)	50.000	kN

Notes for this case

- Pin-jointed members, load at the apex only, one support on rollers. Flat trusses (small rise) give very large rafter and tie forces.

Formula and method

$$R_A = P\frac{L-a}{L}, \quad F_{AC} = \frac{R_A}{\sin\theta_1}, \quad T = F_{AC}\cos\theta_1, \quad \tan\theta_1 = \frac{h}{a}$$

Variables

L	Span	m
h	Rise of the apex	m
a	Apex distance from the left support	m
P	Vertical load at the apex	N
R_A	Left reaction	N
R_B	Right reaction	N
F_{AC}	Left rafter force (compression)	N
F_{BC}	Right rafter force (compression)	N
T_{AB}	Tie force (tension)	N

Method and standards

Joint equilibrium.

Assumptions and limits

- Pin joints; load at apex.

References

- Method of joints (Timoshenko and Young, Theory of Structures, 2nd ed. (McGraw-Hill))

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/steel/truss-method-of-joints

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.