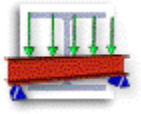
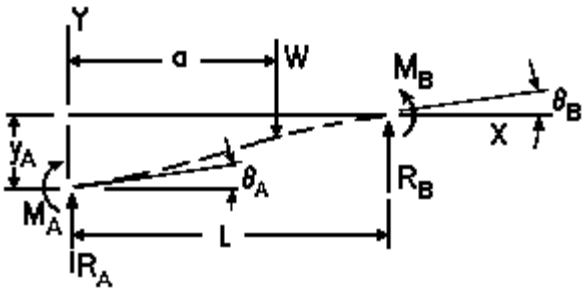
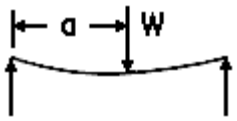


Case 1e Concentrated Intermediate Load; Left End Simply Supported, Right End Simply Supported

Concentrated intermediate load



Left end simply supported, right end simply supported



Notation file Provides a description of Table 3 and the notation used.

Enter dimensions, properties and loading

Before progressing further, calculate the moment of inertia (I) for your cross section by flipping to Table 1. Enter the computed value below:

Table 1

Area moment of inertia:	$I \equiv 3.495 \cdot in^4$
Length of beam:	$L \equiv 10 \cdot ft$
Height of beam:	$h \equiv 3 \cdot in$
Distance from left edge to load:	$a \equiv 5 \cdot ft$
Modulus of elasticity:	$E \equiv 30 \cdot 10^6 \cdot \frac{lbf}{in^2}$
Load:	$W \equiv 1500 \cdot lbf$
Yield Strength	$\sigma_y := 30ksi$

Boundary values

The following specify the reaction forces (R), moments (M), slopes (θ) and deflections (y) at the left and right ends of the beam (denoted as A and B, respectively).

At the left end of the beam (simply supported):

$$R_A := \frac{W}{L}\cdot(L - a) \qquad R_A = 750\cdot lbf$$

$$M_A := 0\cdot lbf\cdot in$$

$$\theta_A := \frac{-W\cdot a}{6\cdot E\cdot I\cdot L}\cdot(2\cdot L - a)\cdot(L - a) \qquad \theta_A = -0.738\cdot deg$$

$$y_A := 0\cdot in$$

At the right end of the beam (simply supported):

$$R_B := \frac{W\cdot a}{L} \qquad R_B = 750\cdot lbf$$

$$M_B := 0\cdot lbf\cdot in$$

$$\theta_B := \frac{W\cdot a}{6\cdot E\cdot I\cdot L}\cdot\left(L^2 - a^2\right) \qquad \theta_B = 0.738\cdot deg$$

$$y_B := 0\cdot in$$

$x := 0\cdot L, .01\cdot L .. L$ x ranges from 0 to L, the length of the beam.

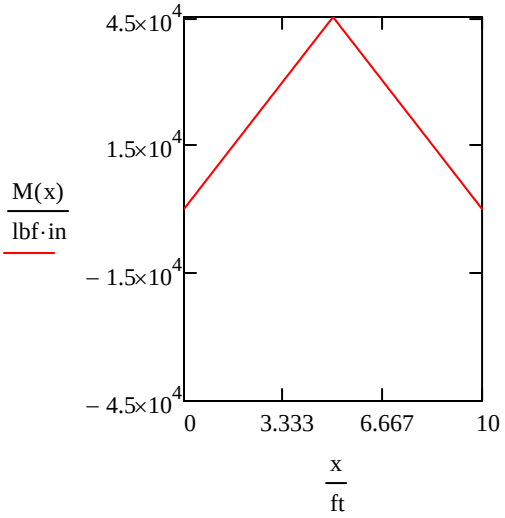
$x_1 := \frac{L}{2}$ Midpoint of the beam

Bending moment

$M(x) := M_A + R_A \cdot x - (x > a) \cdot (x - a) \cdot W$

$M(x_1) = 4.5 \times 10^4 \cdot lbf \cdot in$

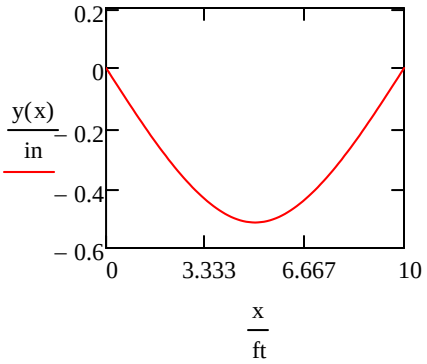
$M(5ft) \rightarrow 3750 \cdot ft \cdot lbf$



Deflection

$y(x) := y_A + \theta_A \cdot x + \frac{M_A \cdot x^2}{2 \cdot E \cdot I} + \frac{R_A \cdot x^3}{6 \cdot E \cdot I} - (x > a) \cdot \left[\frac{W}{6 \cdot E \cdot I} \cdot (x - a)^3 \right]$

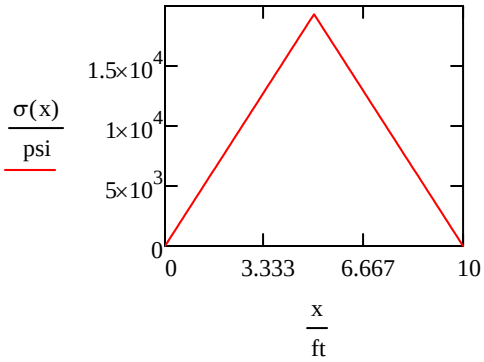
$y(x_1) = -0.515 \cdot in$



Stress

$\sigma(x) := \frac{M(x) \cdot \frac{h}{2}}{I}$

$\sigma(x_1) = 1.931 \times 10^4 \cdot psi$



$F_{max} := \frac{4 \cdot I \cdot \sigma_y}{L \cdot \frac{h}{2}} = 2.33 \times 10^3 \, lbf$