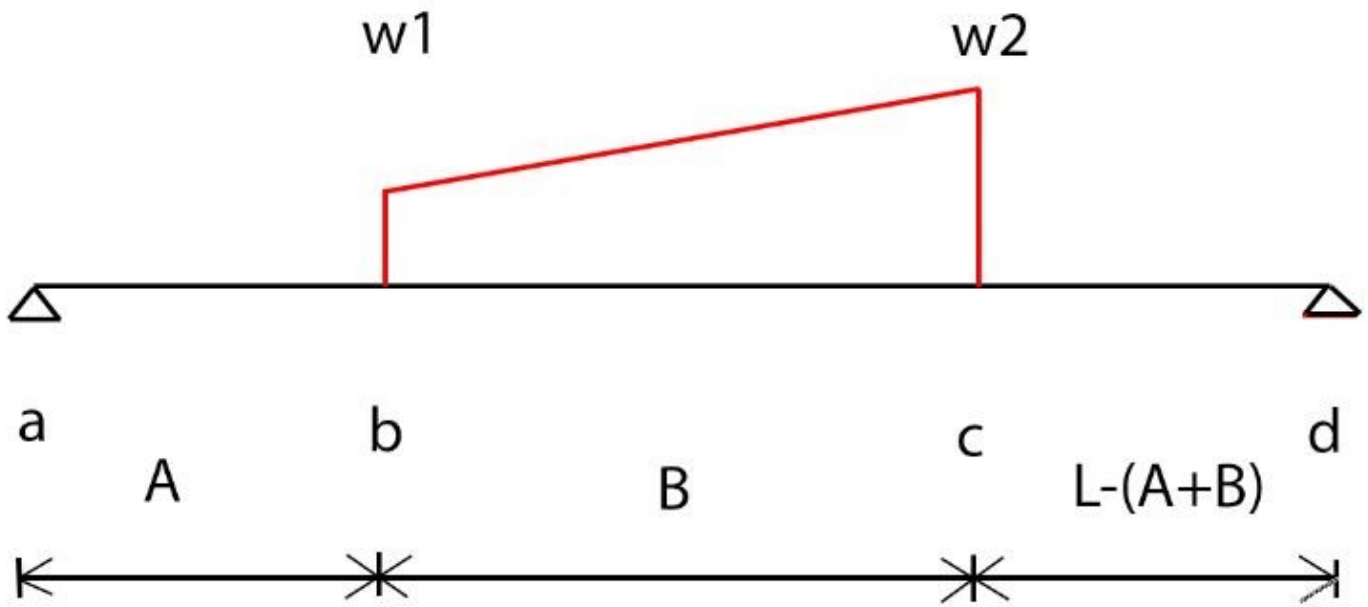
Generic Load On A Beam



$$w1 := \begin{bmatrix} 20 \\ 100 \\ 200 \\ 150 \\ 250 \\ 25 \\ 20 \\ 15 \\ 10 \end{bmatrix} plf \quad w2 := \begin{bmatrix} 20 \\ 100 \\ 200 \\ 150 \\ 250 \\ 25 \\ 20 \\ 15 \\ 10 \end{bmatrix} plf \quad A := \begin{bmatrix} 2 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \\ 8 \\ 9 \end{bmatrix} ft \quad B := \begin{bmatrix} 2 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} ft \quad i := 0 .. \operatorname{rows}(w1) - 1$$

$$L := 10 \cdot ft \quad E := 32000 \cdot MPa \quad I := (152.4 \cdot mm)^3 \cdot 304.8 \cdot mm \cdot \frac{1}{12}$$

$$R_d(w1, w2, A, B) := \left(w1 \cdot B \cdot \left(A + \frac{B}{2}\right) + (w2 - w1) \cdot \frac{B}{2} \cdot \left(A + \frac{2 \cdot B}{3}\right)\right) \cdot \frac{1}{L}$$

$$R_a(w1, w2, A, B) := \frac{w2 + w1}{2} \cdot B - R_d(w1, w2, A, B)$$

$$V_{ab}(x, w1, w2, A, B) := R_a(w1, w2, A, B)$$

$$V_{bc}(x, w1, w2, A, B) := R_a(w1, w2, A, B) - w1 \cdot (x - A) - \frac{(w2 - w1)}{B} \cdot \frac{(x - A)^2}{2}$$

$$V_{cd}(x, w1, w2, A, B) := -R_d(w1, w2, A, B)$$

$$V(x, w1, w2, A, B) := \text{if}\left(x \le A, V_{ab}(x, w1, w2, A, B), \text{if}\left(x \le (A + B), V_{bc}(x, w1, w2, A, B), V_{cd}(x, w1, w2, A, B)\right)\right)$$

$$M_{ab}(x, w1, w2, A, B) := R_a(w1, w2, A, B) \cdot x$$

$$M_{bc}(x, w1, w2, A, B) := R_a(w1, w2, A, B) \cdot x - w1 \cdot \frac{(x - A)^2}{2} - \frac{(w2 - w1)}{B} \cdot \frac{(x - A)^3}{6}$$

$$M_{cd}(x, w1, w2, A, B) := R_d(w1, w2, A, B) \cdot (L - x)$$

$$M(x, w1, w2, A, B) := \text{if}\left(x \le A, M_{ab}(x, w1, w2, A, B), \text{if}\left(x \le (A + B), M_{bc}(x, w1, w2, A, B), M_{cd}(x, w1, w2, A, B)\right)\right)$$

$$Fcong(w1, w2, A, B) := \frac{1}{E \cdot I} \int_{0 \cdot m}^{L} M(x, w1, w2, A, B)\, dx$$

$$Fxx(xx, w1, w2, A, B) := \frac{1}{E \cdot I} \cdot \int_{0 \cdot m}^{xx} M(x, w1, w2, A, B)\, dx$$

$$xcong(w1, w2, A, B) := \frac{\frac{1}{E \cdot I} \int_{0 \cdot m}^{L} M(x, w1, w2, A, B) \cdot x\, dx}{Fcong(w1, w2, A, B)}$$

$$xxcong(xx, w1, w2, A, B) := \frac{\frac{1}{E \cdot I} \cdot \int_{0 \cdot m}^{xx} M(x, w1, w2, A, B) \cdot x\, dx}{Fxx(xx, w1, w2, A, B)}$$

$$\theta_a(w1, w2, A, B) := Fcong(w1, w2, A, B) \cdot \frac{L - xcong(w1, w2, A, B)}{L}$$

$$\theta_{lhs_i} := \theta_a\left(w1_i, w2_i, A_i, B_i\right)$$

$$\theta_d(w1, w2, A, B) := -Fcong(w1, w2, A, B) \cdot \frac{xcong(w1, w2, A, B)}{L}$$

$$\theta_{rhs_i} := \theta_d\left(w1_i, w2_i, A_i, B_i\right)$$

$$\delta(xx, w1, w2, A, B) := \theta_a(w1, w2, A, B) \cdot xx - Fxx(xx, w1, w2, A, B) \cdot (xx - xxcong(xx, w1, w2, A, B))$$

$$unifspace(xs, xf, n) := \begin{bmatrix} 0..n \\ \text{matrix}(n+1, 1, \max) \cdot \dfrac{(xf - xs)}{n} + xs \end{bmatrix}$$

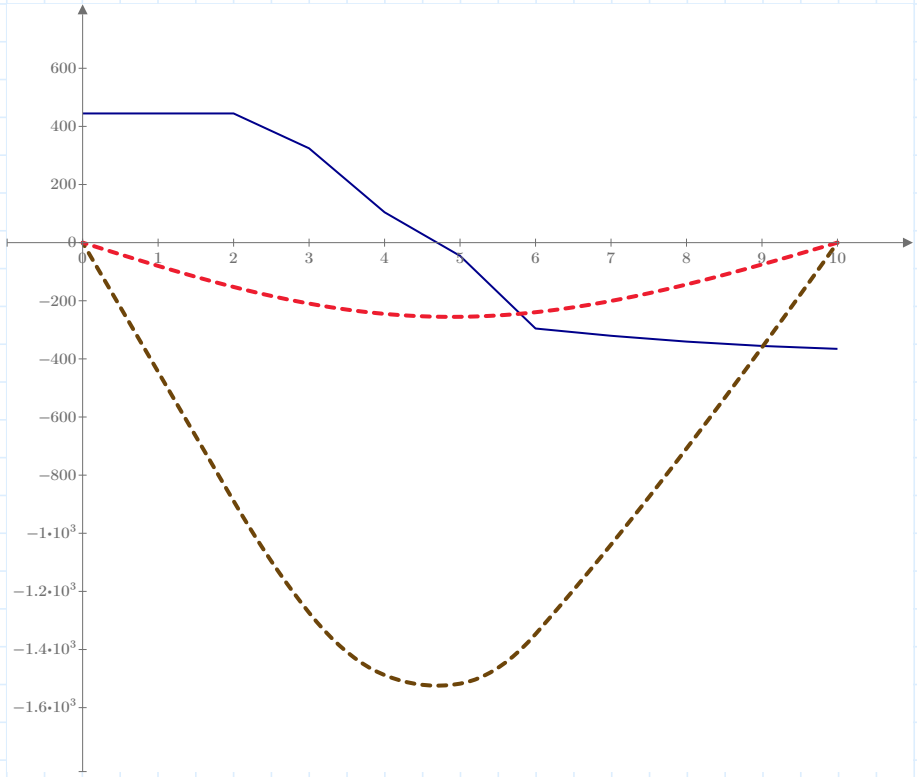
$$\begin{bmatrix} ix \\ x \end{bmatrix} := unifspace(0.0000000001 \cdot ft, L, 100)$$

$$V_{graph_{ix}} := \sum_i V\left(x_{ix}, w1_i, w2_i, A_i, B_i\right)$$

$$M_{graph_{ix}} := -\left(\sum_i M\left(x_{ix}, w1_i, w2_i, A_i, B_i\right)\right)$$

$$\delta_{graph_{ix}} := -\left(\sum_i \delta\left(x_{ix}, w1_i, w2_i, A_i, B_i\right)\right)$$

$$thou := \frac{in}{1000}$$



$V_{graph}\ (lbf)$

$M_{graph}\ (lbf \cdot ft)$

$\delta_{graph} \cdot 10\ (thou)$

$x\ (ft)$

$x := 5 \cdot ft$

$x_{max} := \mathbf{root}\left(\sum_i V\left(x, w1_i, w2_i, A_i, B_i\right), x\right) = 4.697\ ft$

$M_{max} := \sum_i M\left(x_{max}, w1_i, w2_i, A_i, B_i\right) = 1524\ lbf \cdot ft$

$min\left(M_{graph}\right) = -1524\ lbf \cdot ft$

$\delta_{max} := min\left(\delta_{graph}\right) = -25.54\ thou$