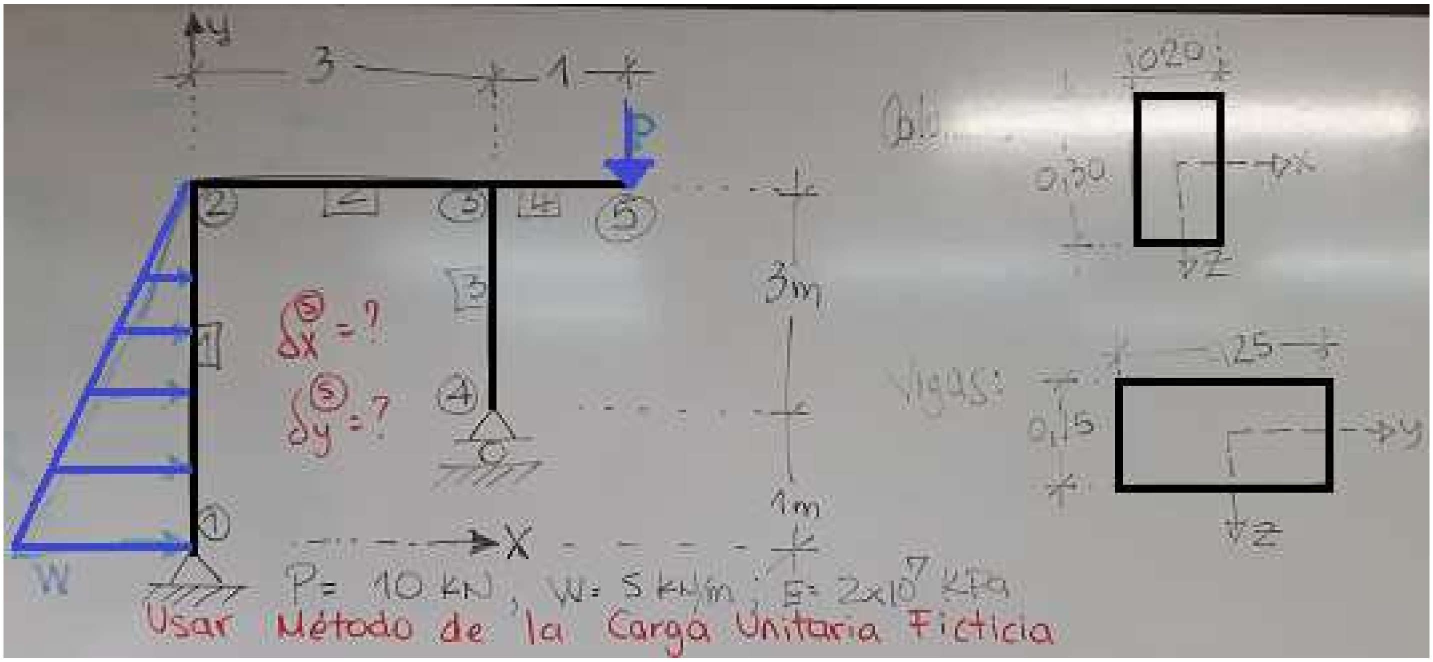


#1: [DisplayFormat := Normal, CaseMode := Sensitive, InputMode := Word]

#2: [W :=, P :=, E :=, Ic :=, Iv :=]

#3: $$\left[W := 5,\ P := 10,\ E := 2\cdot 10^{7},\ Ic := \frac{0.3\cdot 0.2^{3}}{12},\ Iv := \frac{0.15\cdot 0.25^{3}}{12}\right]$$

#4: $$\left[W := 5,\ P := 10,\ E := 2\cdot 10^{7},\ Ic := \frac{1}{5000},\ Iv := \frac{1}{5120}\right]$$

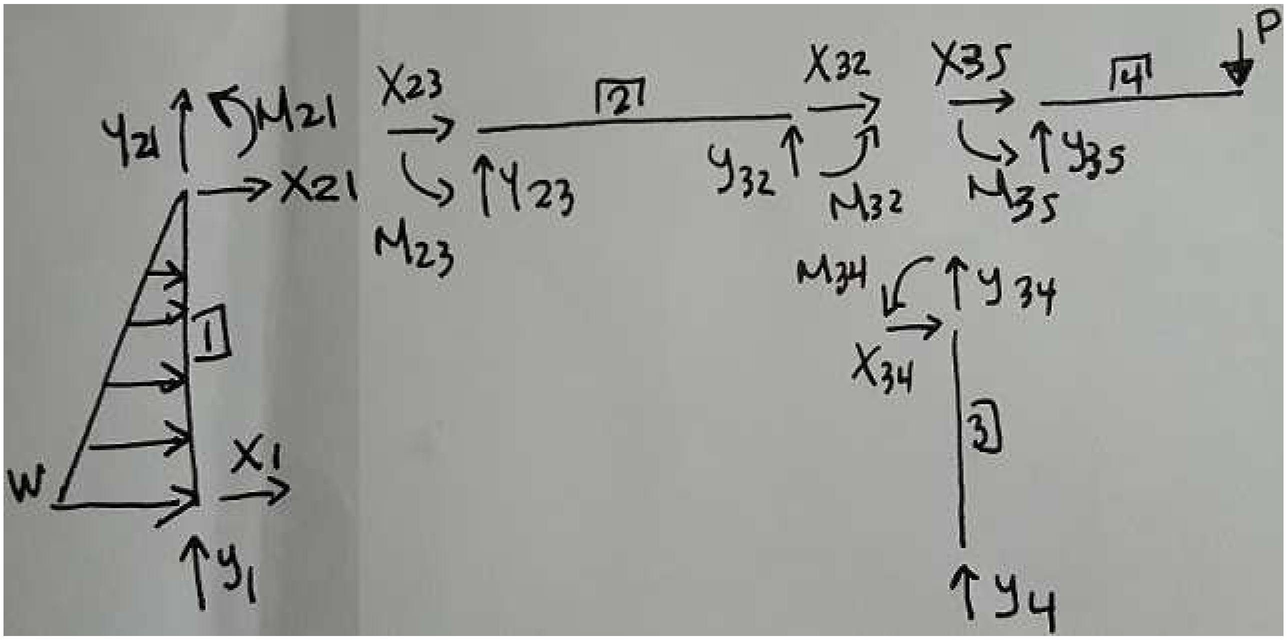
#5: $$\left[W := 5,\ P := 10,\ E := 2\cdot 10^{7},\ Ic := 0.0002,\ Iv := 0.0001953125\right]$$

Cálculo de reacciones:

#6: [x1 :=, y1 :=, y4 :=]

#7: $$\left[\begin{bmatrix} \frac{W\cdot 4}{2} + x1 = 0 \\ y1 + y4 - P = 0 \\ -\frac{W\cdot 4}{2}\cdot\frac{4}{3} - P\cdot 4 + y4\cdot 3 = 0 \end{bmatrix},\ \begin{bmatrix} x1 := -10 \\ y1 := -\frac{70}{9} \\ y4 := \frac{160}{9} \end{bmatrix},\ \begin{bmatrix} x1 = -10 \\ y1 = -7.777777777 \\ y4 = 17.77777777 \end{bmatrix}\right]$$

Diagramas de cuerpo libre por elementos:



#8: [x21 :=, y21 :=, M21 :=, x23 :=, y23 :=, M23 :=, x32 :=, y32 :=, M32 :=, x23 :=, y35 :=, M35 :=, x34 :=, y34 :=, M34 :=]

#9:
$$\left[\left[\begin{matrix} x1 + x21 + \frac{W\cdot 4}{2} = 0 \\ y1 + y21 = 0 \\ M21 - x21\cdot 4 - \frac{W\cdot 4}{2}\cdot\frac{4}{3} = 0 \end{matrix}\right], \left[\begin{matrix} M21 := \frac{40}{3} \\ x21 := 0 \\ y21 := \frac{70}{9} \end{matrix}\right], \left[\begin{matrix} M21 = 13.33333333 \\ x21 = 0 \\ y21 = 7.777777777 \end{matrix}\right]\right]$$

#10:
$$\left[\left[\begin{matrix} x21 + x23 = 0 \\ y21 + y23 = 0 \\ M21 + M23 = 0 \end{matrix}\right], \left[\begin{matrix} M23 := -\frac{40}{3} \\ x23 := 0 \\ y23 := -\frac{70}{9} \end{matrix}\right], \left[\begin{matrix} M23 = -13.33333333 \\ x23 = 0 \\ y23 = -7.777777777 \end{matrix}\right]\right]$$

#11:
$$\left[\left[\begin{matrix} x23 + x32 = 0 \\ y23 + y32 = 0 \\ M23 + M32 + y32\cdot 3 = 0 \end{matrix}\right], \left[\begin{matrix} M32 := -10 \\ x32 := 0 \\ y32 := \frac{70}{9} \end{matrix}\right], \left[\begin{matrix} M32 = -10 \\ x32 = 0 \\ y32 = 7.777777777 \end{matrix}\right]\right]$$

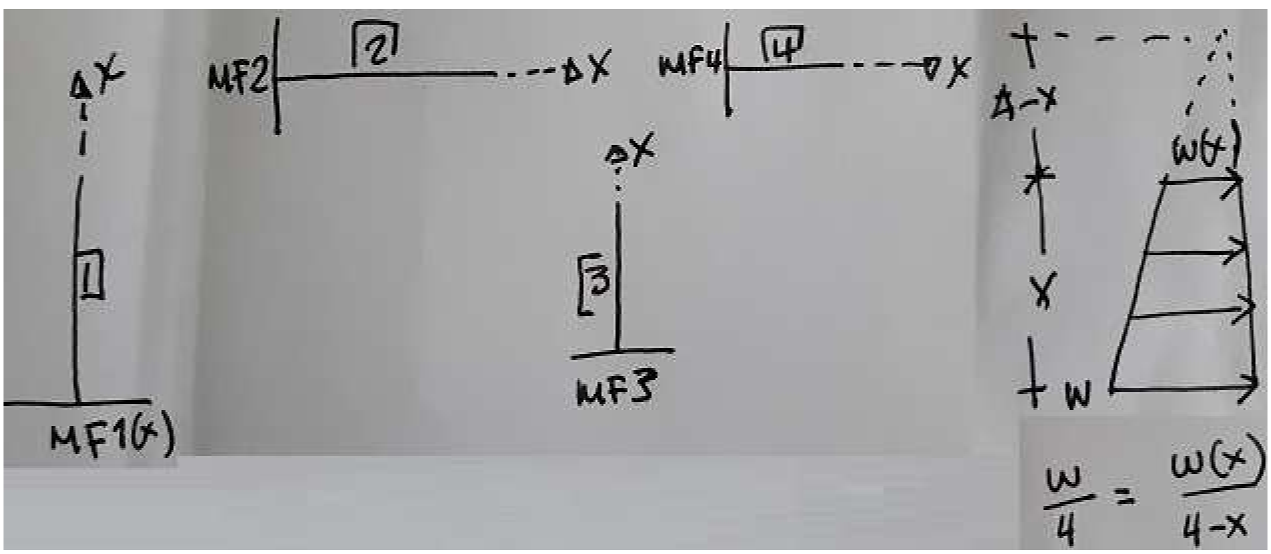
#12: $$\left[\begin{bmatrix} x34 = 0 \\ y4 + y34 = 0 \\ M34 = 0 \end{bmatrix}, \begin{bmatrix} M34 := 0 \\ x34 := 0 \\ y34 := -\dfrac{160}{9} \end{bmatrix}, \begin{bmatrix} M34 = 0 \\ x34 = 0 \\ y34 = -17.77777777 \end{bmatrix}\right]$$

#13: $$\left[\begin{bmatrix} x32 + x34 + x35 = 0 \\ y32 + y34 + y35 = 0 \\ M32 + M34 + M35 = 0 \end{bmatrix}, \begin{bmatrix} M35 := 10 \\ x35 := 0 \\ y35 := 10 \end{bmatrix}\right]$$

#14: $$\begin{bmatrix} x35 = 0 \\ y35 - P = 0 \\ M35 - P\cdot 1 = 0 \end{bmatrix} = \begin{bmatrix} true \\ true \\ true \end{bmatrix}$$

Momentos flectores de la estructura con las cargas originales:

#15: [MF1(x) :=, MF2(x) :=, MF3(x) :=, MF4(x) :=]

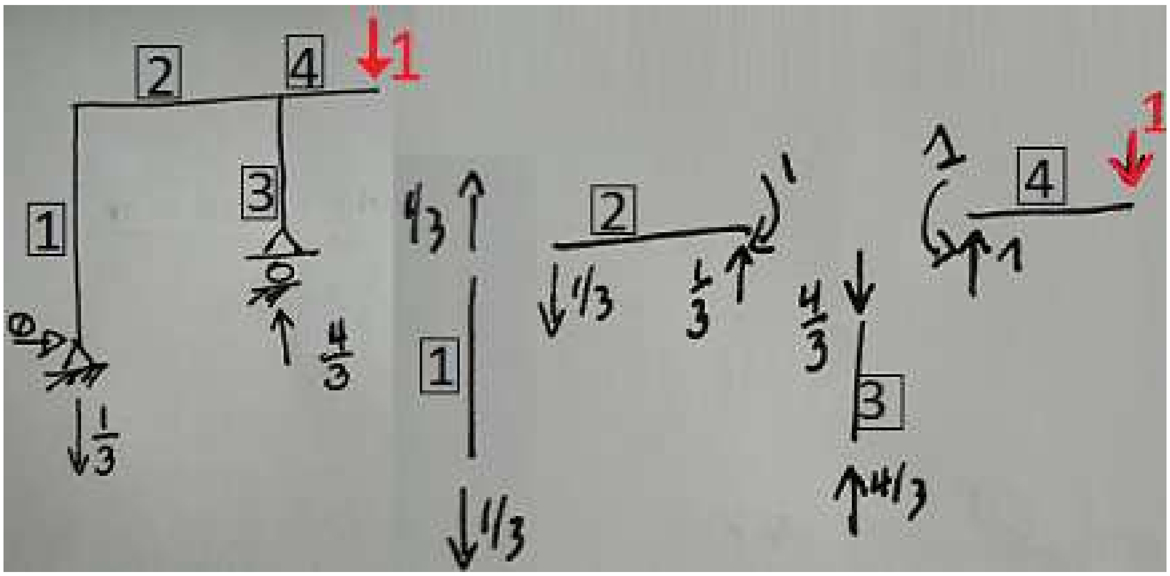


#16: $$\left[w(x) := \frac{W\cdot(4 - x)}{4},\ w(x) := 5 - 1.25\cdot x\right]$$

#17: $$\begin{bmatrix} MF1(x) := -\ x1\cdot x - \left(\dfrac{W + w(x)}{2}\cdot x\right)\cdot\dfrac{x}{3}\cdot\dfrac{2\cdot W + w(x)}{W + w(x)} \\ MF2(x) := -M23 + y23\cdot x \\ MF3(x) := 0 \\ MF4(x) := -M35 + y35\cdot x \end{bmatrix}$$

#18:
$$\left[\begin{array}{c} MF1(x) := \frac{5 \cdot x^3}{24} - \frac{5 \cdot x^2}{2} + 10 \cdot x \\ MF2(x) := \frac{40}{3} - \frac{70 \cdot x}{9} \\ MF3(x) := 0 \\ MF4(x) := 10 \cdot x - 10 \end{array}\right]$$

Aplicación de la carga unitaria ficticia para desplazamiento vertical hacia abajo en el nudo 5:



Momentos flectores de la estructura con carga unitaria:

#19: [mf1y(x) :=, mf2y(x) :=, mf3y(x) :=, mf4y(x) :=]

#20:
$$\left[\begin{array}{c} mf1y(x) := 0 \\ mf2y(x) := - \frac{1}{3} \cdot x \\ mf3y(x) := 0 \\ mf4y(x) := -1 + 1 \cdot x \end{array}\right]$$

Deformación del nudo 5 hacia abajo:

#21:
$$d5y = \frac{1}{E \cdot Ic} \cdot \int_0^4 MF1(x) \cdot mf1y(x)\ dx + \frac{1}{E \cdot Iv} \cdot \int_0^3 MF2(x) \cdot mf2y(x)\ dx + \frac{1}{E \cdot Ic} \cdot \int_0^3$$

$$\mathrm{MF3}(x)\cdot \mathrm{mf3y}(x)\ dx + \frac{1}{E\cdot Iv}\cdot\int_0^1 \mathrm{MF4}(x)\cdot \mathrm{mf4y}(x)\ dx$$

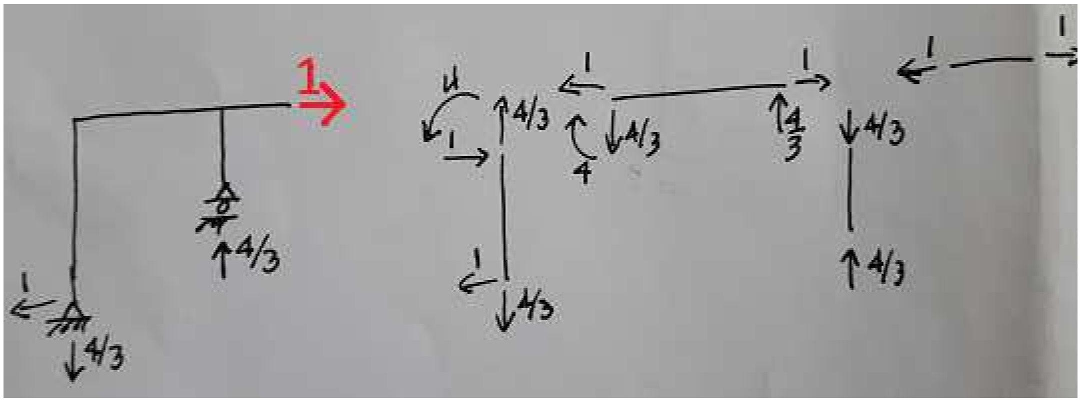
#22: $$d5y = \frac{1}{4000}\cdot\int_0^4 \left(\frac{5\cdot x^3}{24} - \frac{5\cdot x^2}{2} + 10\cdot x\right)\cdot 0\ dx + \frac{1}{3906.25}\cdot\int_0^3 \left(\frac{40}{3} - \frac{70\cdot x}{9}\right)\cdot\left(-\frac{x}{3}\right) dx + \frac{1}{4000}\cdot\int_0^3 0\cdot 0\ dx + \frac{1}{3906.25}\cdot\int_0^1 (10\cdot x - 10)\cdot(x - 1)\ dx$$

#23: $$d5y = \frac{1}{4000}\cdot\int_0^4 (0.2083333333\cdot x^3 - 2.5\cdot x^2 + 10\cdot x)\cdot 0\ dx + \frac{1}{3906.25}\cdot\int_0^3 (13.33333333 - 7.777777777\cdot x)\cdot\left(-\frac{x}{3}\right) dx + \frac{1}{4000}\cdot\int_0^3 0\cdot 0\ dx + \frac{1}{3906.25}\cdot\int_0^1 (10\cdot x - 10)\cdot(x - 1)\ dx$$

#24: $$d5y = \frac{16}{9375}$$

#25: $$d5y = 0.001706666666$$

Aplicación de la carga unitaria ficticia para desplazamiento horizontal a la derecha en el nudo 5:



Momentos flectores con carga untaria:

#26: [mf1x(x) :=, mf2x(x) :=, mf3x(x) :=, mf4x(x) :=]

#27:
$$\begin{bmatrix} mf1x(x) := 1\cdot x \\ mf2x(x) := 4 - \frac{4}{3}\cdot x \\ mf3x(x) := 0 \\ mf4x(x) := 0 \end{bmatrix}$$

Deformación del nudo 5 a la derecha:

#28:
$$d5x = \frac{1}{E\cdot Ic}\cdot\int_0^4 MF1(x)\cdot mf1x(x)\,dx + \frac{1}{E\cdot Iv}\cdot\int_0^3 MF2(x)\cdot mf2x(x)\,dx + \frac{1}{E\cdot Ic}\cdot\int_0^3 MF3(x)\cdot mf3x(x)\,dx + \frac{1}{E\cdot Iv}\cdot\int_0^1 MF4(x)\cdot mf4x(x)\,dx$$

#29:
$$d5x = \frac{61}{1875}$$

#30:
$$d5x = 0.03253333333$$

#31:
$$d5x = \frac{1}{4000}\cdot\int_0^4 \left(\frac{5\cdot x^3}{24} - \frac{5\cdot x^2}{2} + 10\cdot x\right)\cdot x\,dx + \frac{1}{3906.25}\cdot\int_0^3 \left(\frac{40}{3} - \frac{70\cdot x}{9}\right)\cdot\left(4 -\right.$$

$$\left.\frac{4\cdot x}{3}\right) dx + \frac{1}{4000}\cdot\int_0^3 0\cdot 0\ dx + \frac{1}{3906.25}\cdot\int_0^1 (10\cdot x - 10)\cdot 0\ dx$$

#32: $$d5x = \frac{1}{4000}\cdot\int_0^4 (0.2083333333\cdot x^3 - 2.5\cdot x^2 + 10\cdot x)\cdot x\ dx + \frac{1}{3906.25}\cdot\int_0^3 (13.33333333$$

$$- 7.777777777\cdot x)\cdot\left(4 - \frac{4\cdot x}{3}\right) dx + \frac{1}{4000}\cdot\int_0^3 0\cdot 0\ dx + \frac{1}{3906.25}\cdot\int_0^1 (10\cdot x - 10)\cdot 0\ dx$$