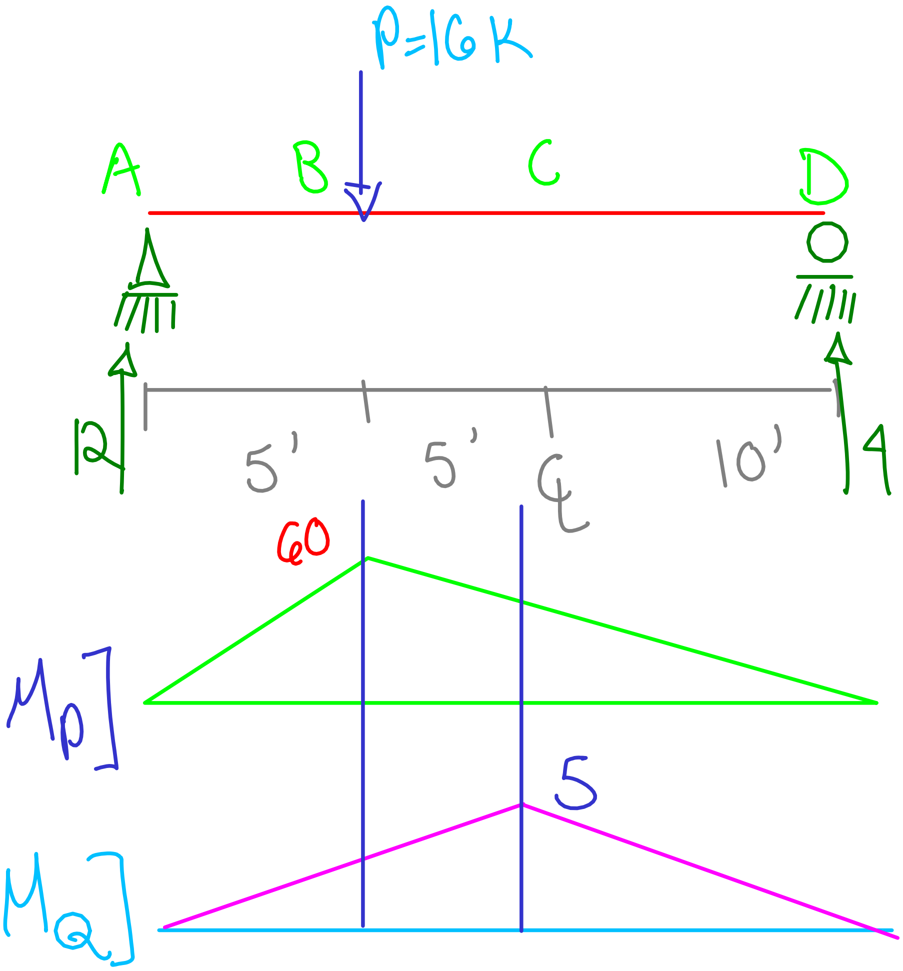
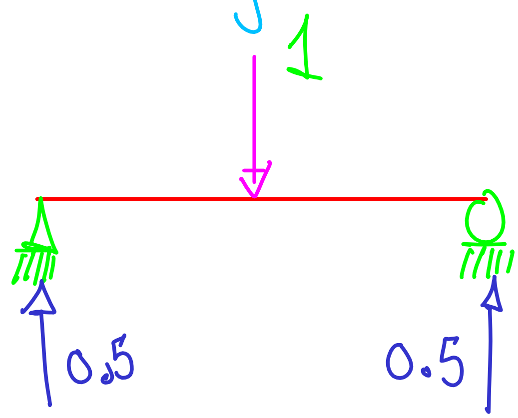
Calcule la deflexión vertical al centro del claro (delta_c).

Use el trabajo virtual.

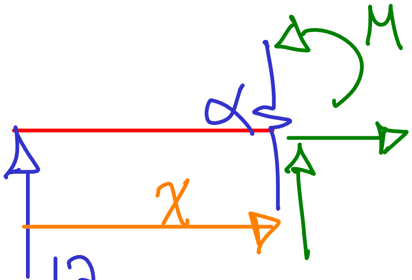
Se da EI = Constante;
$I = 240\ in^4$
$E = 29{,}000$ ksi



$$\Sigma M_A = 16(5) - D_y(20) = 0$$
$$D_y = 4$$
$$\Sigma F_y = 16 - 4 - A_y = 0$$
$$A_y = 12$$

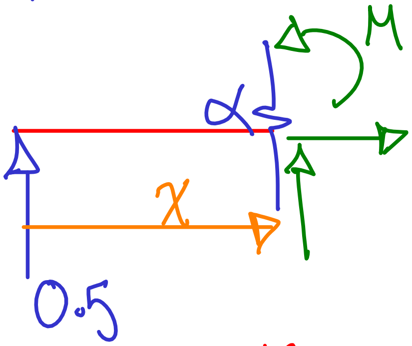


Miembro	Origen	Límites	M_p	M_Q
AB	A	0-5	$12x$	$0.5x$
BC	A	5-10	$-4x+80$	$0.5x$
CD	D	0-10	$4x$	$0.5x$



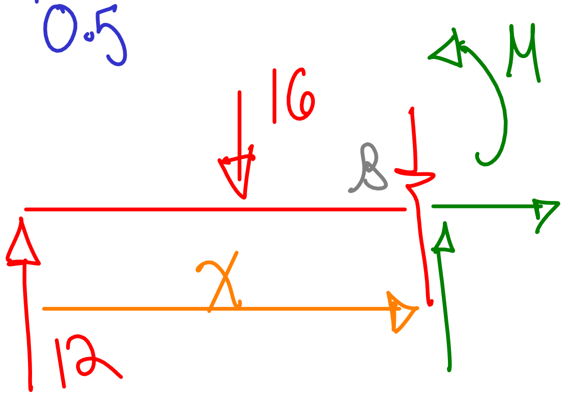
$$\Sigma M_{z_\alpha} = M - 12x = 0$$

$$M = 12x$$



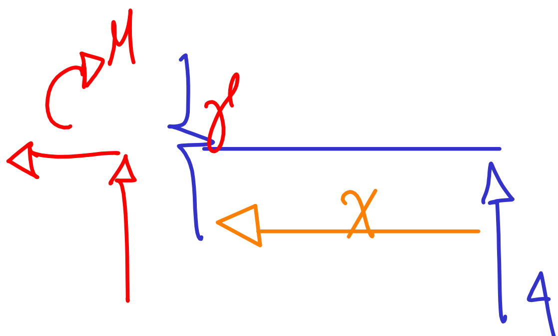
$$\Sigma M_{z_\alpha} = M - 0.5x = 0$$

$$M = 0.5x$$

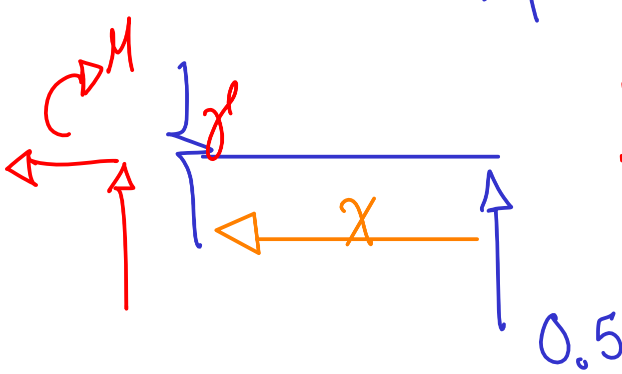


$$\Sigma M_B = 12x - 16(x-5) - M = 0$$

$$M = -4x + 80$$



$$M = 4x$$



$$M = 0.5x$$

$$EI\,1\,\delta_{vc} = \int_0^5 (12x)(0.5x)\,dx + \int_5^{10} (-4x+80)(0.5x)\,dx + \int_0^{10} (4x)(0.5x)\,dx$$

$$EI\,\delta_{v_c} = \int_0^5 6x^2\,dx + \int_5^{10} -2x^2+40x\,dx + \int_0^{10} 2x^2\,dx$$

$$EI\,\delta_{v_c} = \frac{6x^3}{3}\Big|_0^5 + \left(\frac{-2x^3}{3} + \frac{40x^2}{2}\right)\Big|_5^{10} + \frac{2x^3}{3}\Big|_0^{10}$$

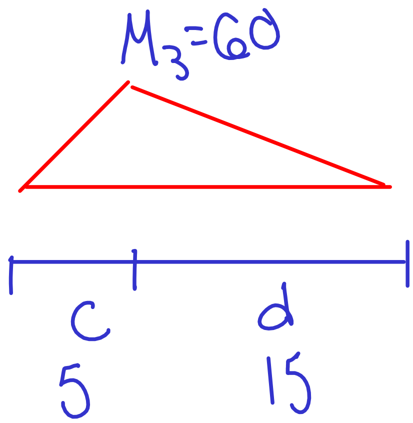
$$EI\,\delta_{v_c} = 250 + \frac{4000}{3} - \frac{1250}{3} + \frac{2000}{3} = \frac{5500}{3}$$

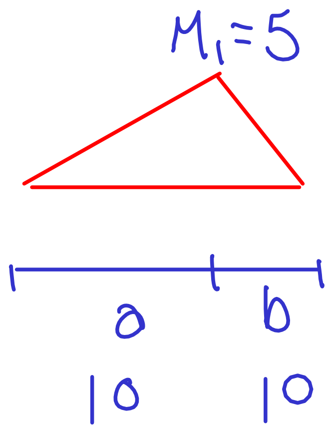
$$\delta_{vc} = \frac{5500}{3EI}(12\times12\times12) = \frac{9\,504\,000}{3(29{,}000)(240)} = 0.455 \text{ in}$$

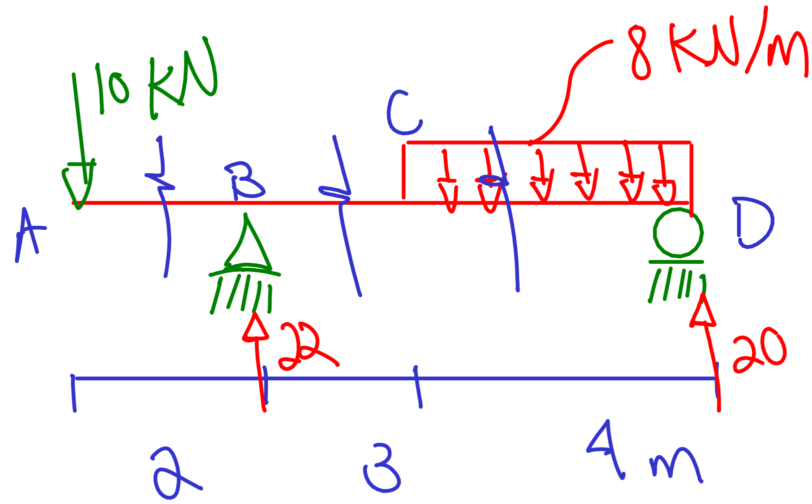
Producto Gráfico de Integrales

$$\left(\frac{1}{3} - \frac{(a-c)^2}{6ad}\right)M_1M_3L = \left(\frac{1}{3} - \frac{(10-5)^2}{6(10)(15)}\right)(5)(60)(20)$$

$$= 5500/3$$







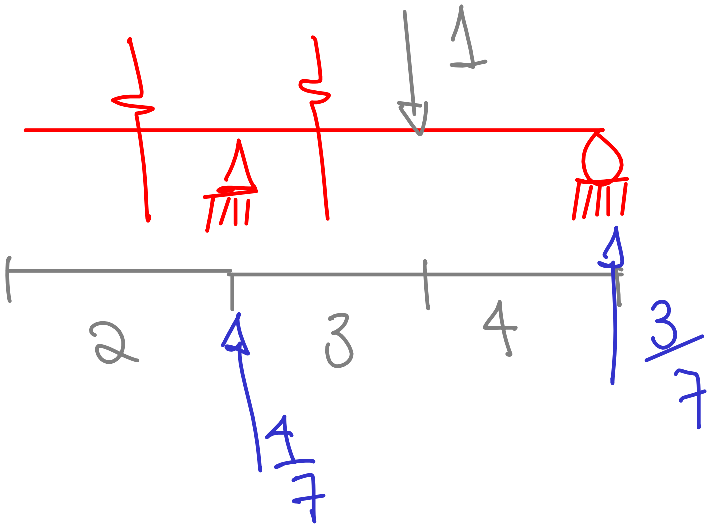
$\delta_{V_C} = ¿?$

Miembro	Origen	Límites	M_p	M_Q
AB	A	0-2	$(-)10x$	0
BC	B	0-3	$(-)[10(x+2)-22x]$	$\frac{4}{7}x$
CD	D	0-4	$20x - 8x\left(\frac{x}{2}\right)$	$\frac{3}{7}x$

$$\Sigma M_B = 10(2) - 8(4)(5) + D_y(7) = 0$$

$$D_y = 20 \text{ KN}$$

$$\Sigma F_y = -10 - 8(4) + 20 + B_y = 0 \quad \therefore B_y = 22$$



$$\Sigma M_B = 1(3) - D_y(7) = 0$$

$$D_y = \frac{3}{7}$$

$$\Sigma F_y = -1 + \frac{3}{7} + B_y = 0$$

$$B_y = 4/7$$

$$-10(x+2) + 22x = 12x - 20 \qquad \frac{4}{7}x$$

$$20x - 8x\left(\frac{x}{2}\right) = -4x^2 + 20x \qquad \frac{3}{7}x$$

$$EI\, 1\, \delta_{P_{V_C}} = \int_0^2 (-10x)(0)\,dx + \int_0^3 (12x-20)\left(\frac{4}{7}x\right)dx$$

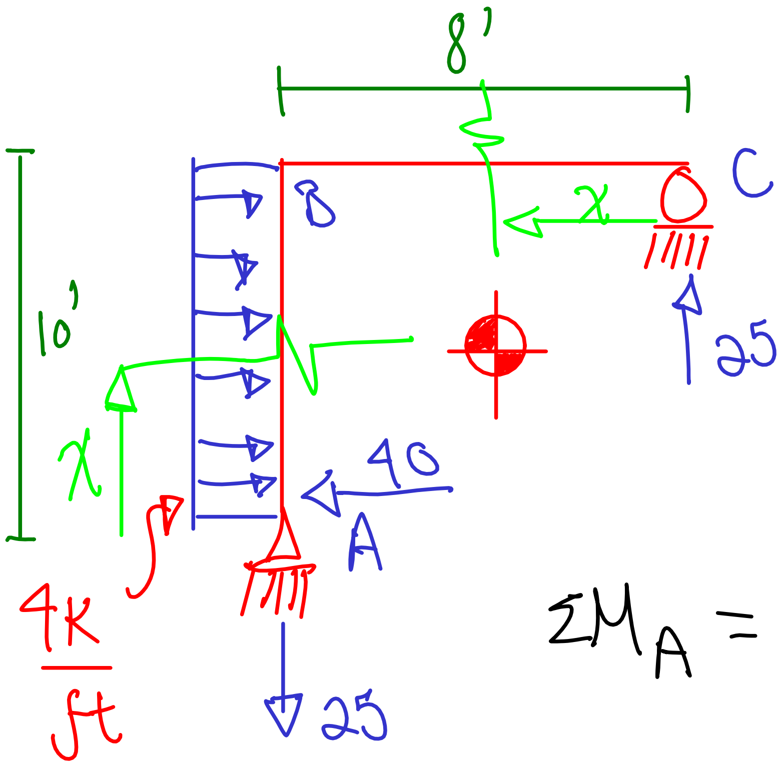
$$+ \int_0^4 (-4x^2+20x)\left(\frac{3}{7}x\right)dx$$

$$EI\,\delta_{P_{V_C}} = \int_0^3 \frac{48}{7}x^2 - \frac{80}{7}x\,dx + \int_0^4 -\frac{12}{7}x^3 + \frac{60}{7}x^2\,dx$$

$$\left(\frac{48x^3}{21} - \frac{80x^2}{14}\right)\Bigg|_0^3 + \left(-\frac{12x^4}{28} + \frac{60x^3}{21}\right)\Bigg|_0^4$$

$$\frac{432}{7} - \frac{360}{7} - \frac{768}{7} + \frac{1280}{7} = \frac{584}{7} = 83.43$$

$$\delta_{P_{V_C}} = \frac{83.43}{EI} \downarrow$$



$\delta_{H_C} = ¿?$

$E = 29{,}000$ ksi

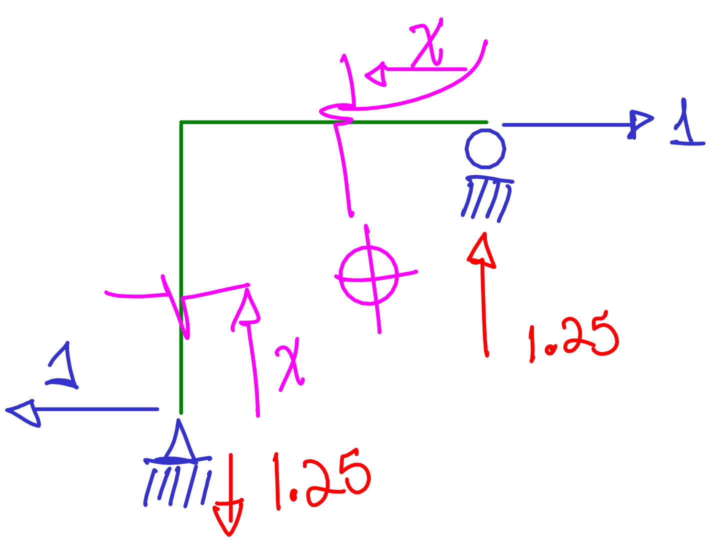
$I = 600$ in^4

$$\Sigma M_A = 4(10)(5) - C_y(8) = 0$$

$$C_y = 25$$

$$\Sigma F_y = 25 - A_y = 0 \therefore A_y = 25 \downarrow$$

$$\Sigma F_x = 4(10) - A_x = 0 \quad \therefore A_x = 40 \leftarrow$$



$$\frac{10}{8} = \frac{5}{4} = 1.25$$

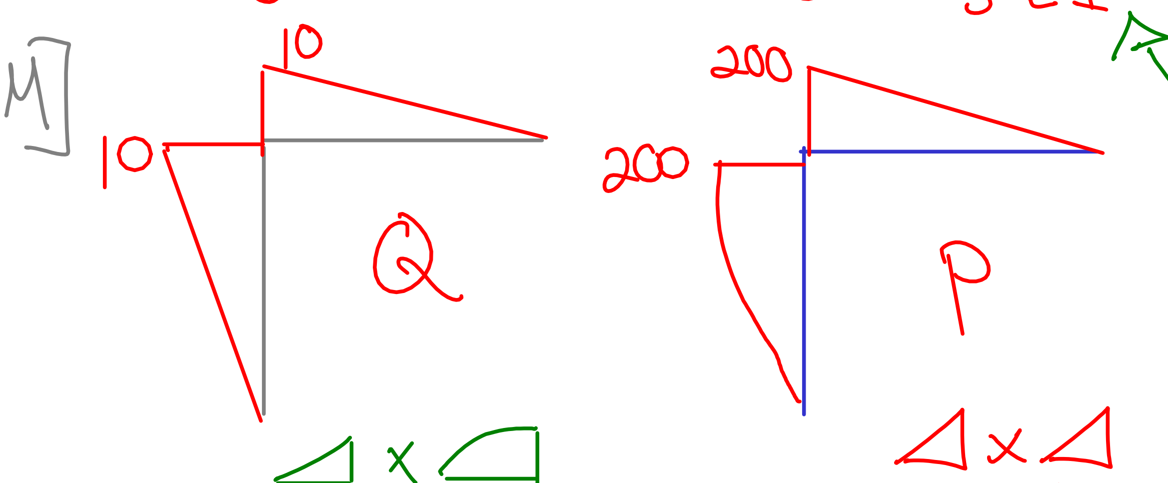
Miembro	Origen	Límites	M_p	M_Q
AB	A	0-10	$40x-4x\left(\frac{x}{2}\right)$	x
BC	C	0-8	$25x$	$1.25x$

$$EI\,1\,\delta_{p_{h_C}} = \int_0^{10} (40x-2x^2)(x)\,dx + \int_0^8 25x(1.25x)\,dx$$

$$= \int_0^{10} 40x^2-2x^3\,dx + \int_0^8 \frac{125}{4}x^2\,dx$$

$$= \left(\frac{40x^3}{3}-\frac{2x^4}{4}\right)\Bigg|_0^{10} + \frac{125x^3}{12}\Bigg|_0^8 = \frac{25{,}000}{3}+\frac{16{,}000}{3}$$

$$= \frac{41{,}000}{3} \quad \therefore \quad \delta_{p_{h_C}} = \frac{41{,}000}{3EI} \rightarrow$$



$$\frac{5}{12}(10)(200)(10) + \frac{1}{3}(10)(200)(8) = \underline{\underline{13{,}666.7}}$$

8,333.33   5333.33 =

Table for Evaluating $\int_0^L m\, m'\, dx$

$\int_0^L m\, m'\, dx$	m', L	m', L	m'_1, m'_2, L	parabola, m', L
m, L	$mm'L$	$\frac{1}{2}mm'L$	$\frac{1}{2}m(m'_1 + m'_2)L$	$\frac{2}{3}mm'L$
m, L	$\frac{1}{2}mm'L$	$\frac{1}{3}mm'L$	$\frac{1}{6}m(m'_1 + 2m'_2)L$	$\frac{5}{12}mm'L$
m_1, m_2, L	$\frac{1}{2}m'(m_1 + m_2)L$	$\frac{1}{6}m'(m_1 + 2m_2)L$	$\frac{1}{6}[m'_1(2m_1 + m_2) + m'_2(m_1 + 2m_2)]L$	$\frac{1}{12}[m'(3m_1 + 5m_2)]L$
m, a, b, L	$\frac{1}{2}mm'L$	$\frac{1}{6}mm'(L + a)$	$\frac{1}{6}m[m'_1(L + b) + m_2(L + a)]$	$\frac{1}{12}mm'\left(3 + \frac{3a}{L} - \frac{a^2}{L^2}\right)L$
m, L	$\frac{1}{2}mm'L$	$\frac{1}{6}mm'L$	$\frac{1}{6}m(2m'_1 + m'_2)L$	$\frac{1}{4}mm'L$

Tablas en alta resolución en el final de los libros, o en DCNetwork.com.mx.

Table 4: Values of Product Integrals $\int_{x=0}^{x=L} M_Q M_P\, dx$

M_Q / M_P	M_1, L	M_1, L	M_1, M_2, L	M_1, a, b, L
M_3, L	M_1M_3L	$\frac{1}{2}M_1M_3L$	$\frac{1}{2}(M_1 + M_2)M_3L$	$\frac{1}{2}M_1M_3L$
M_3, L	$\frac{1}{2}M_1M_3L$	$\frac{1}{3}M_1M_3L$	$\frac{1}{6}(M_1 + 2M_2)M_3L$	$\frac{1}{6}M_1M_3(L + a)$
M_3, L	$\frac{1}{2}M_1M_3L$	$\frac{1}{6}M_1M_3L$	$\frac{1}{6}(2M_1 + M_2)M_3L$	$\frac{1}{6}M_1M_3(L + b)$
M_3, M_4, L	$\frac{1}{2}M_1(M_3 + M_4)L$	$\frac{1}{6}M_1(M_3 + 2M_4)L$	$\frac{1}{6}M_1(2M_3 + M_4)L + \frac{1}{6}M_2(M_3 + 2M_4)L$	$\frac{1}{6}M_1M_3(L + b) + \frac{1}{6}M_1M_4(L + a)$
M_3, c, d, L	$\frac{1}{2}M_1M_3L$	$\frac{1}{6}M_1M_3(L + c)$	$\frac{1}{6}M_1M_3(L + d) + \frac{1}{6}M_2M_3(L + c)$	for $c \le a$: $\left(\frac{1}{3} - \frac{(a - c)^2}{6ad}\right)M_1M_3L$
Parabola, M_3, L	$\frac{2}{3}M_1M_3L$	$\frac{1}{3}M_1M_3L$	$\frac{1}{3}(M_1 + M_2)M_3L$	$\frac{1}{3}M_1M_3\left(L + \frac{ab}{L}\right)$
Parabola, M_3, L	$\frac{1}{3}M_1M_3L$	$\frac{1}{4}M_1M_3L$	$\frac{1}{12}(M_1 + 3M_2)M_3L$	$\frac{1}{12}M_1M_3\left(3a + \frac{a^2}{L}\right)$