

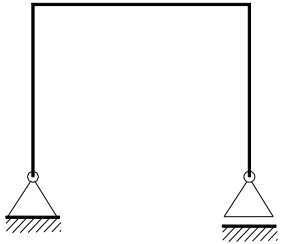
# **ESTABILIDAD**

**CONTINUACIÓN UNIDAD 3: Esfuerzos  
Internos en Estructuras de Alma Llena**

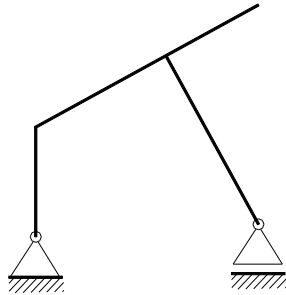
# PÓRTICOS

- Designaremos bajo el nombre de **pórticos de alma llena** a estructuras constituidas por piezas prismáticas, generalmente rectas, que se enlazan entre sí en nudos rígidos.-
- Los elementos verticales o muy inclinados se llaman **pilares o columnas** y los horizontales o tendidos **vigas o dinteles**.-

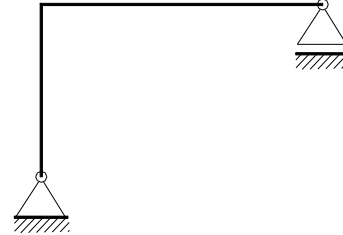
# PÓRTICOS



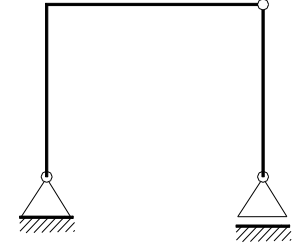
Portico simple  
ortogonal, arti-  
culado y apoyado



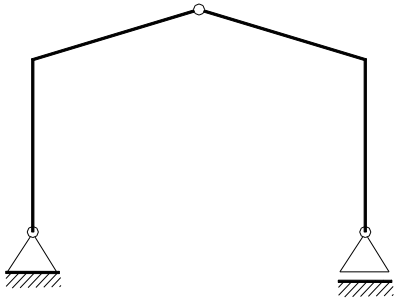
Portico simple  
oblicuo con vo-  
ladizo, articula-  
do y apoyado



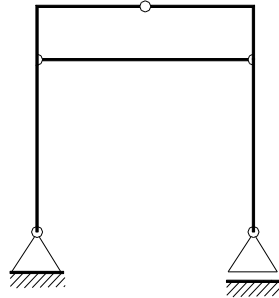
Semiportico  
articulado y  
apoyado



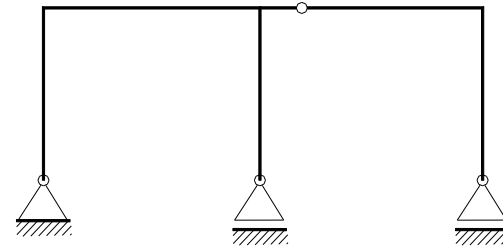
Simple Triarti-  
culado ortogonal



Portico simple  
triarticulado de  
dos vertientes



Portico simple  
atirantado



Portico doble ortogonal

Fig. 7.1

# PÓRTICOS

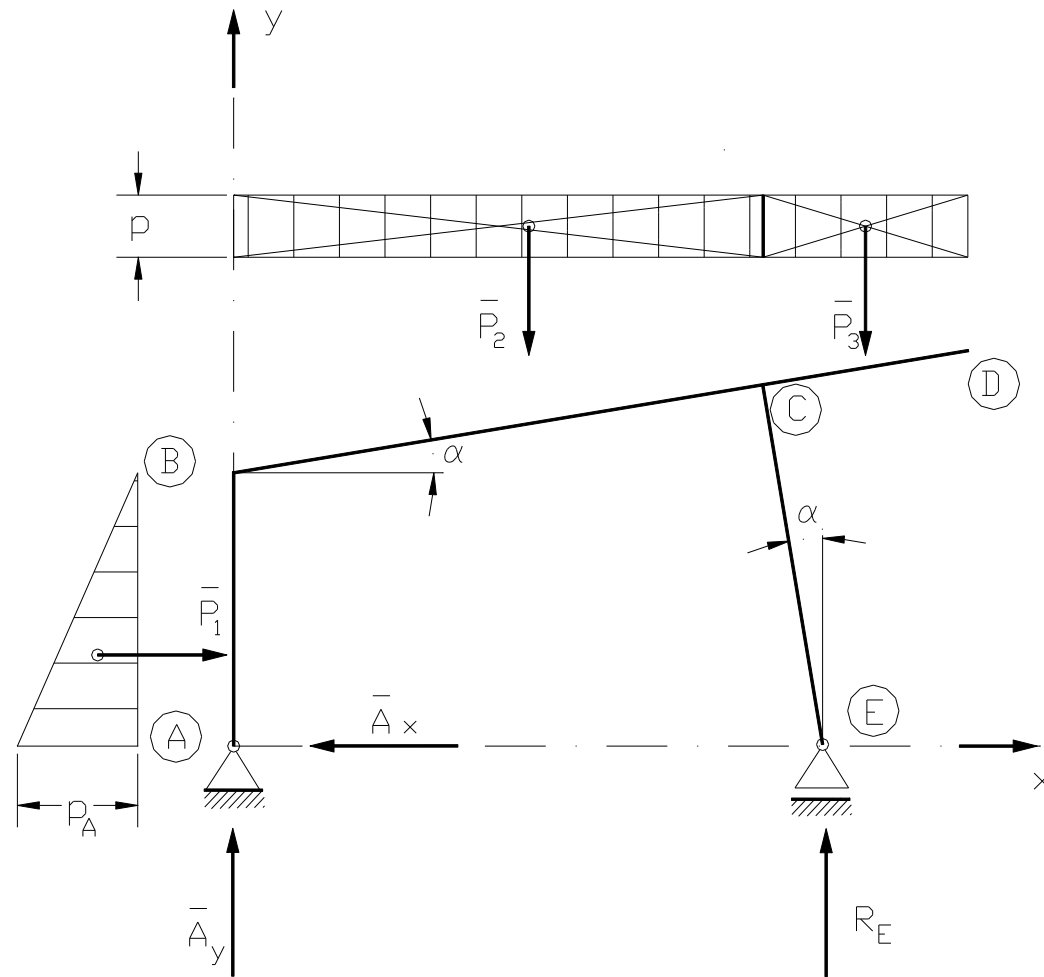


Fig. 7.7

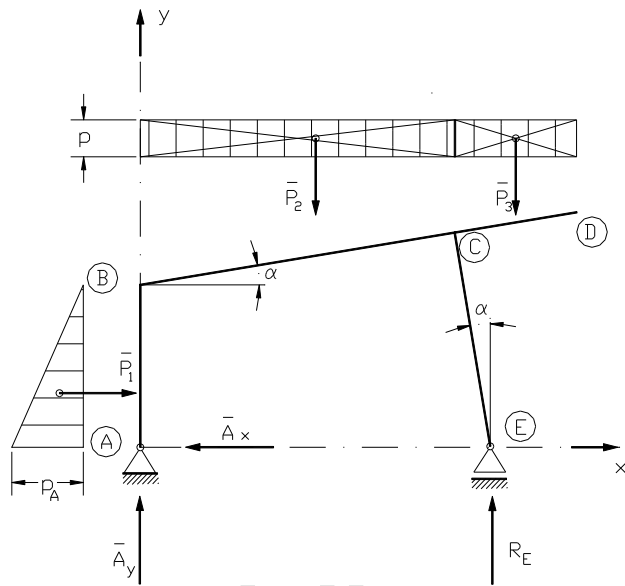


Fig. 7.7

$$P_1 = pA (y_B - y_A) / 2$$

$$P_2 = p (x_C - x_B)$$

$$P_3 = p (x_D - x_C)$$

$$\sum M_A = P_1 \frac{y_B - y_A}{3} + P_2 \frac{x_C - x_B}{2} +$$

$$+ P_3 \frac{x_D - x_C}{2} (x_C - x_B) - R_E (x_E - x_A) = 0$$

De donde se obtiene RE

$$\sum X = P_1 - A_X = 0 ; A_X = P_1$$

$$\sum Y = A_Y - P_2 - P_3 + R_E = 0$$

$$A_Y = P_2 + P_3 - R_E$$

TRAMO	Q	N	M
PILAR AB	$Q_A = A_X$ $Q_B' = A_X - P_1 = 0$	$N_A = - A_Y$ $N_B' = - A_Y$	$M_A = 0$ $M_B' = A_X (y_B - y_A) - \frac{2}{3} P_1 (y_B - y_A)$ $M_B' = \frac{1}{3} P_1 (y_B - y_A)$
VIGA BC	$Q_B'' = A_Y \cos \alpha$ $Q_C' = A_Y \cos \alpha - P_2 \cos \alpha$	$N_B'' = - A_Y \sin \alpha$ $N_C' = - A_Y \sin \alpha + P_2 \sin \alpha$	$M_B'' = \frac{1}{3} P_1 (y_B - y_A) = M_B'$ $M_C' = M_B'' + Q_B'' \frac{(x_C - x_B)}{\cos \alpha} - P_2 \frac{(x_C - x_B)}{2}$
VOLADIZO CD	$Q_C'' = P_3 \cos \alpha$ $Q_D = 0$	$N_C'' = - P_3 \sin \alpha$ $N_D = 0$	$M_C'' = - \frac{1}{2} P_3 (x_D - x_C)$ $M_D = 0$
PILAR CE	$Q_C''' = - R_E \sin \alpha$ $Q_E = - R_E \sin \alpha$	$N_C''' = - R_E \cos \alpha$ $N_E = - R_E \cos \alpha$	$M_C''' = R_E (x_E - x_C)$ $M_E = 0$

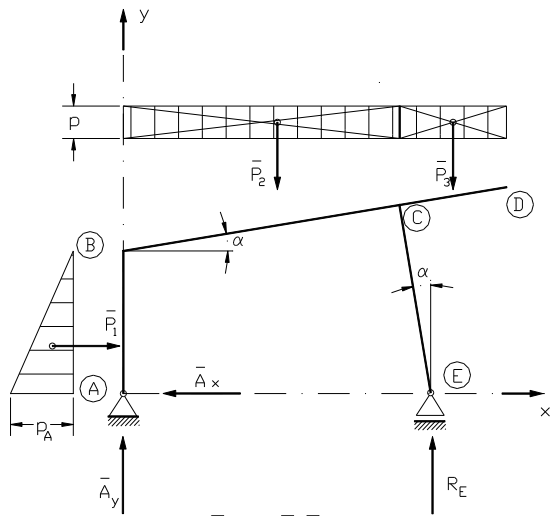


Fig. 7.7

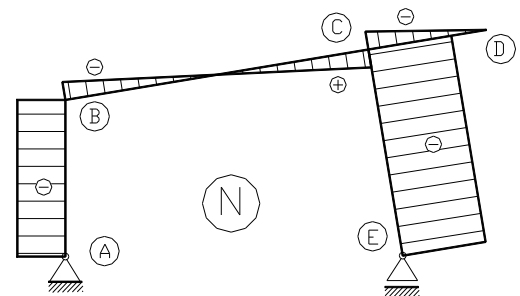
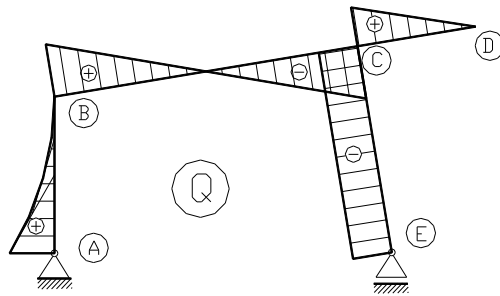


Fig. 7.8

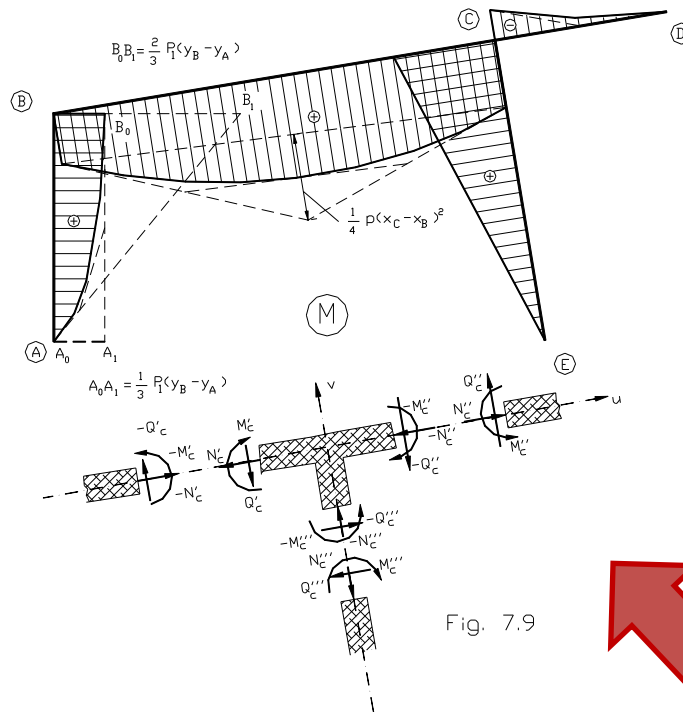
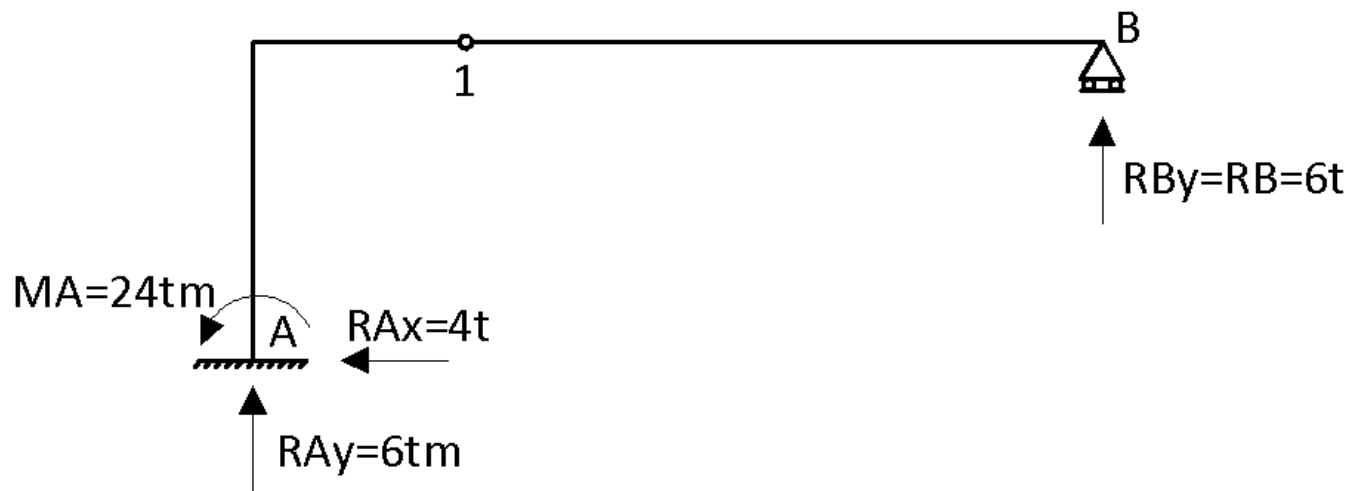
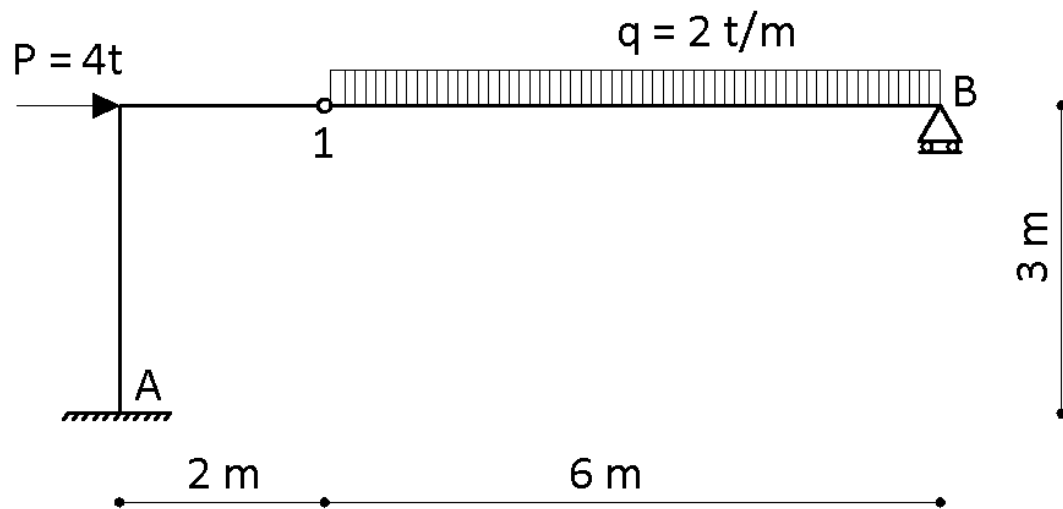


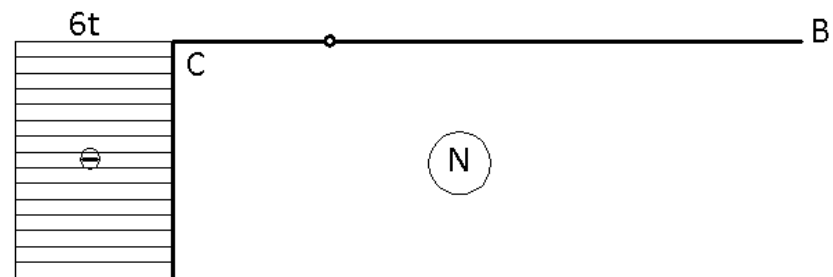
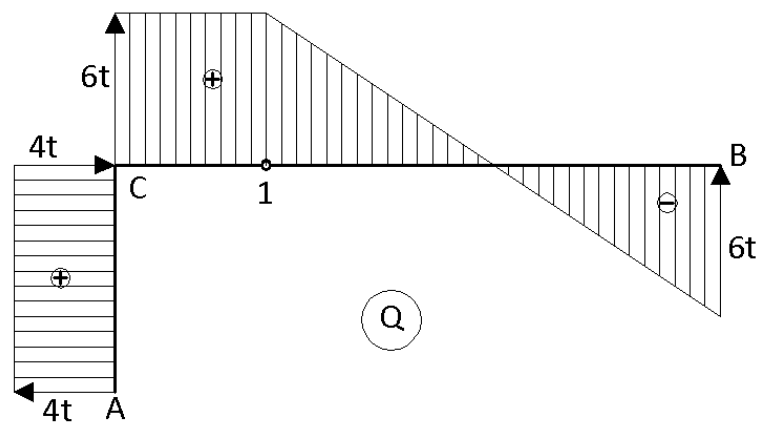
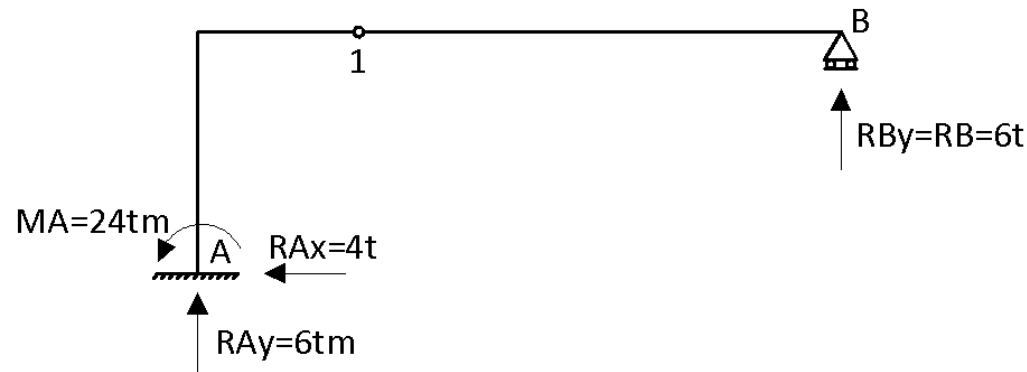
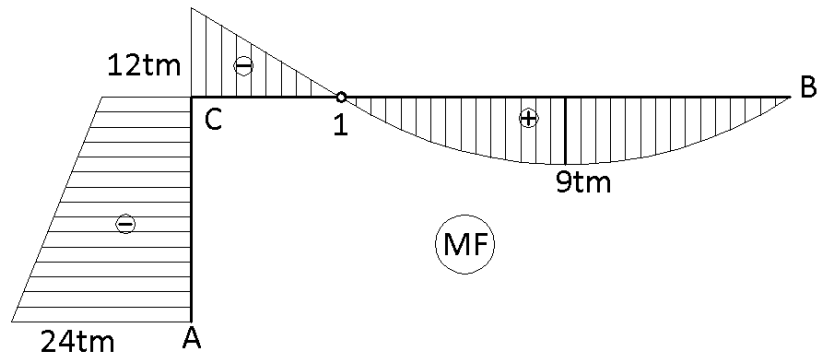
Fig. 7.9



ESTUDIO DEL  
EQUILIBRIO DEL NUDO

# EJEMPLO







# ARCOS

- *Se designa con el nombre de arco a la estructura curva que, cargada verticalmente, origina reacciones oblicuas en los apoyos.*
- Las características del arco se originan esencialmente en el tipo de sustentación que posea.

# ARCOS

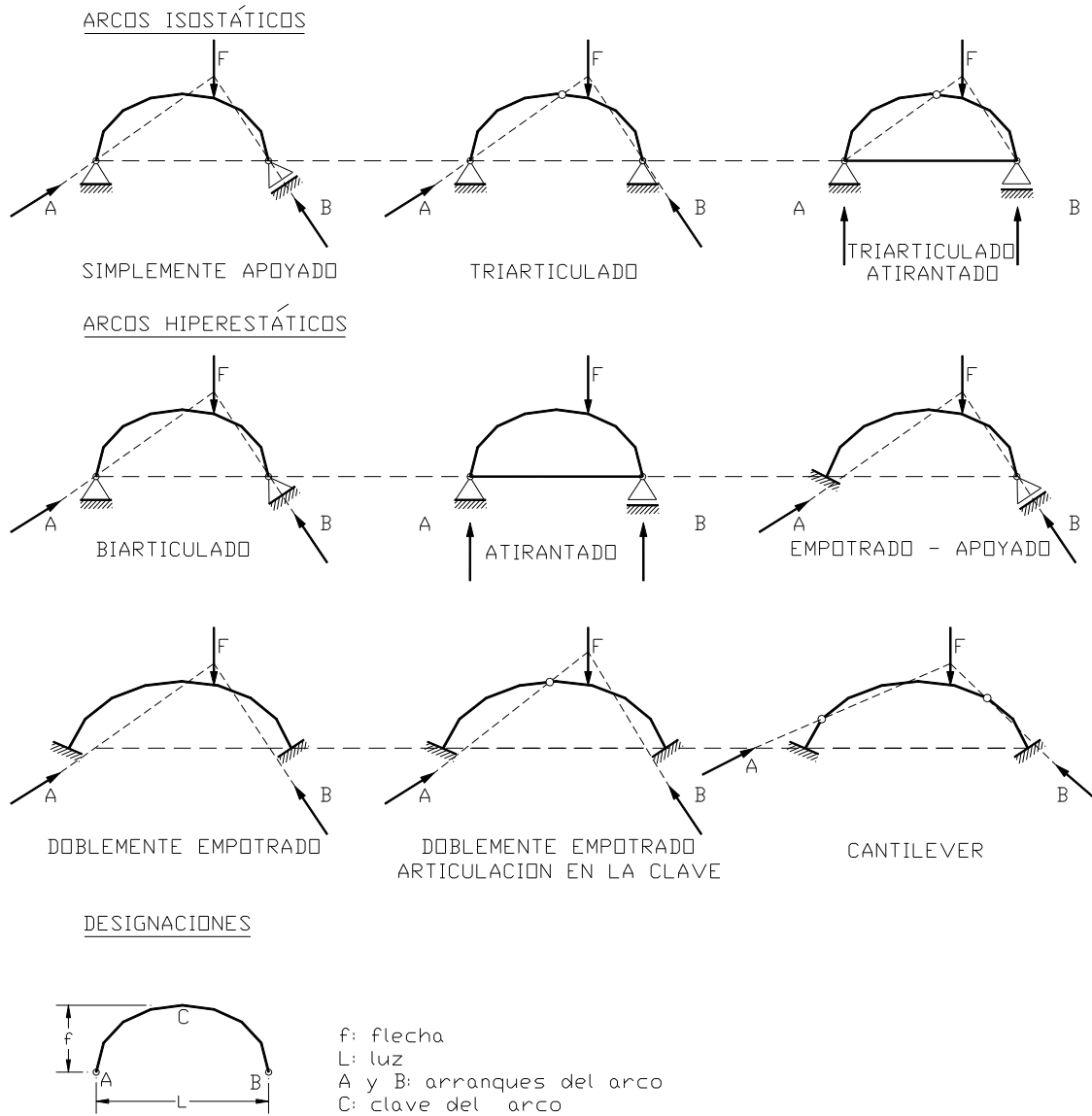
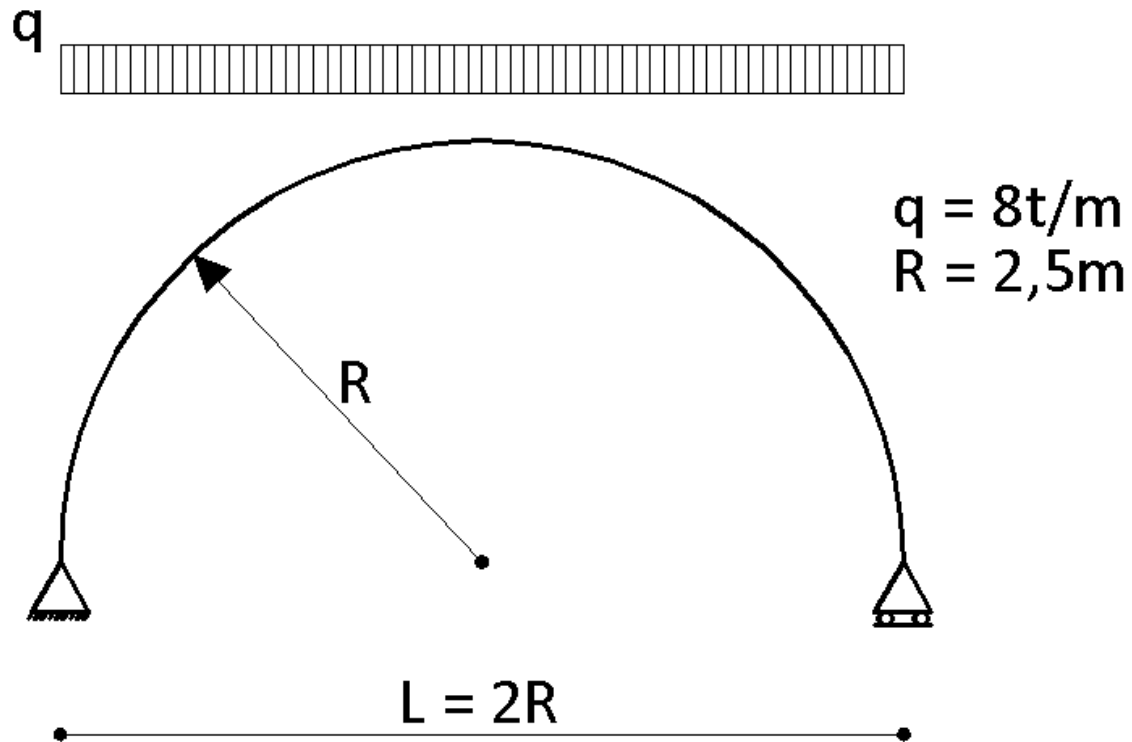
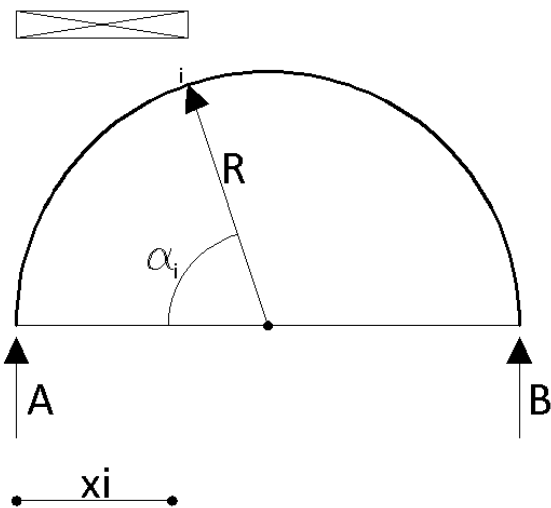
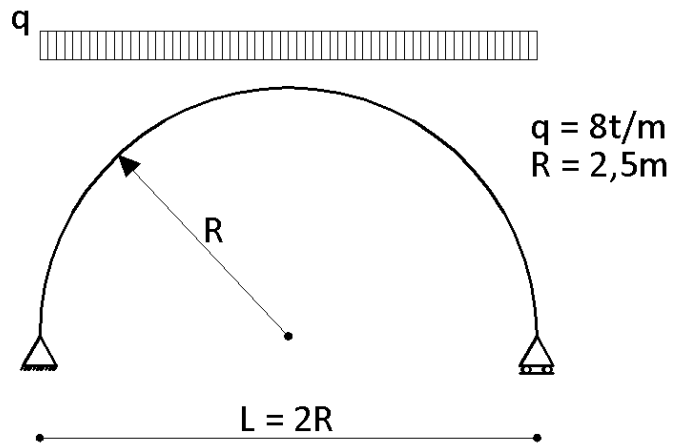


Fig. 7.12

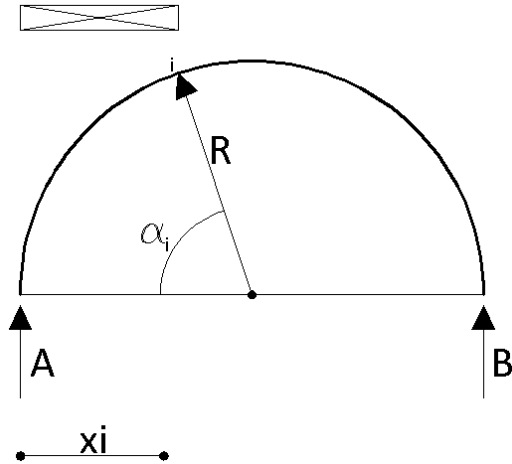
# ARCO SIMPLEMENTE APOYADO





$$Ay = By = q * \frac{L}{2} = q * R$$

# ARCOS



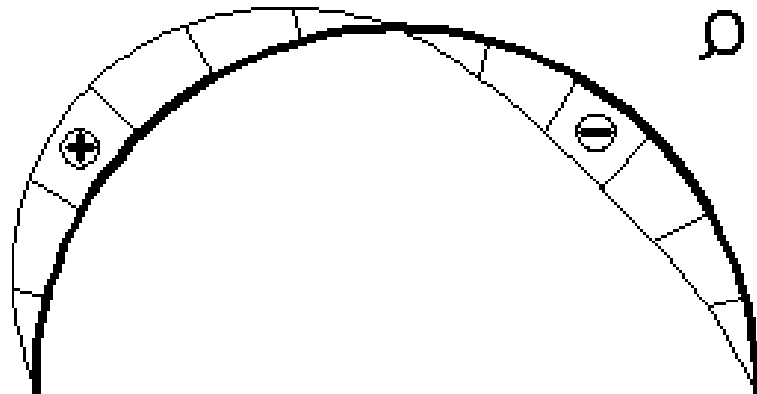
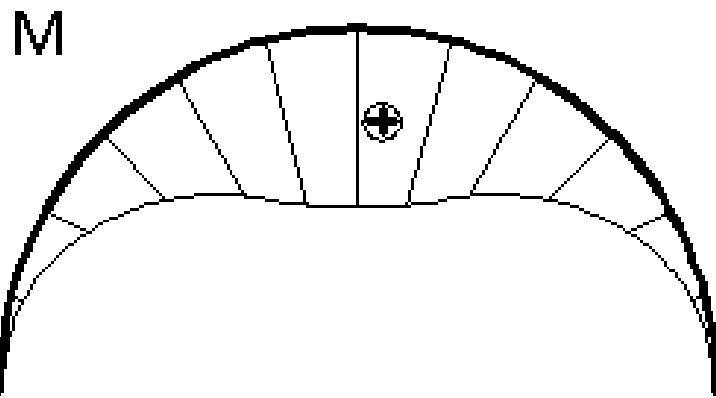
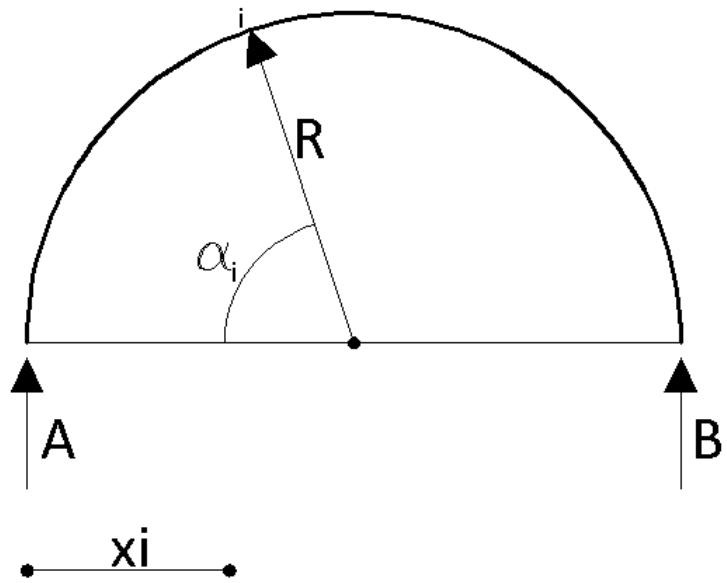
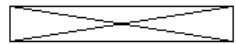
$$x_i = R - R * \cos \alpha_i$$

$$M_i = A_y * x_i - q * \frac{x_i^2}{2} =$$

$$Q_i = (A_y - q * x_i) * \text{sen} \alpha_i =$$

$$N_i = (A_y - q * x_i) * \cos \alpha_i =$$

$\alpha$	$\cos \alpha_i$	$\text{sen} \alpha_i$	$R$	$x_i$	$A_y$	$q$	$M_i$	$Q_i$	$N_i$
15	0,9659	0,2588	2,5	0,08518543	20	8	1,67	5,00	18,66
30	0,8660	0,5000	2,5	0,33493649	20	8	6,25	8,66	15,00
45	0,7071	0,7071	2,5	0,73223305	20	8	12,50	10,00	10,00
60	0,5000	0,8660	2,5	1,25	20	8	18,75	8,66	5,00
75	0,2588	0,9659	2,5	1,85295239	20	8	23,33	5,00	1,34
90	0,0000	1,0000	2,5	2,5	20	8	25,00	0,00	0,00
0	1,0000	0,0000	2,5	0	20	8	0,00	0,00	20,00



# ARCO TRIARTICULADO

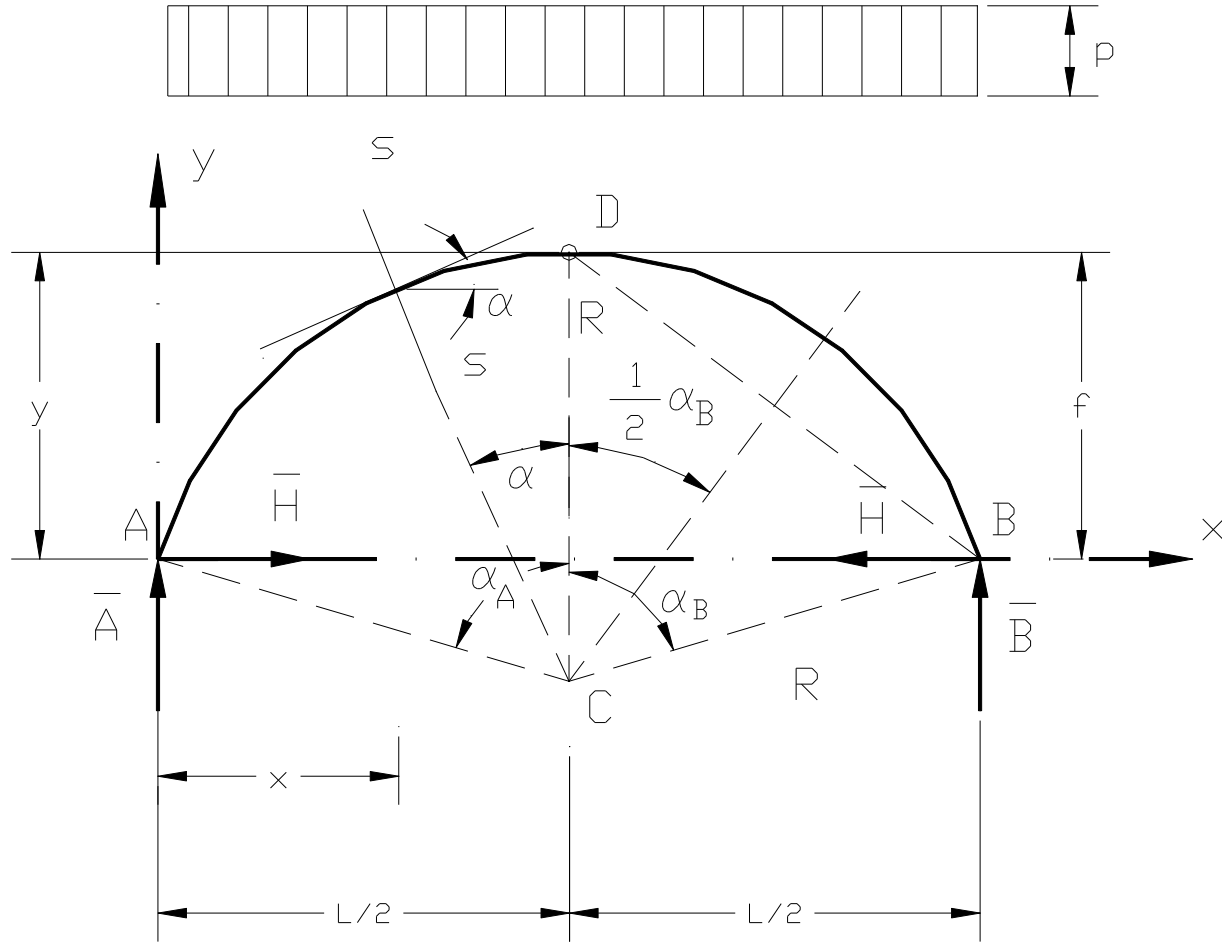


Fig. 7.19

# ARCO TRIARTICULADO

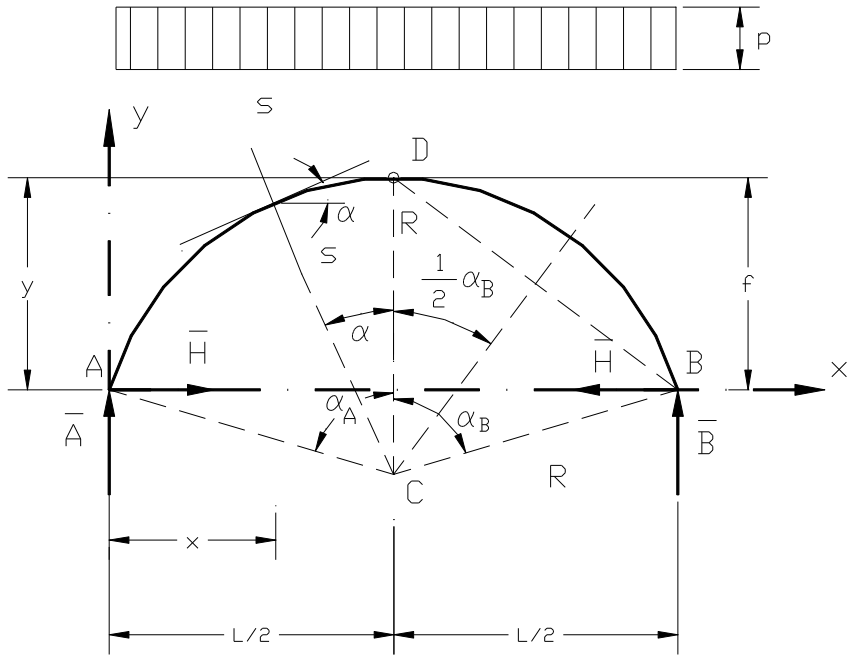


Fig. 7.19

$$\sum M_A = 0 = q \frac{L^2}{2} - B_y * L \gg B_y = q \frac{L}{2} \quad A_y = B_y$$

$$\sum M_c^I = 0 = A_y \frac{L}{2} - A_x * f - q \frac{L^2}{8} = \quad f = R(1 - \sin \alpha)$$

de la ecuación anterior tenemos que  $A_x = B_x = q \frac{L^2}{8f}$

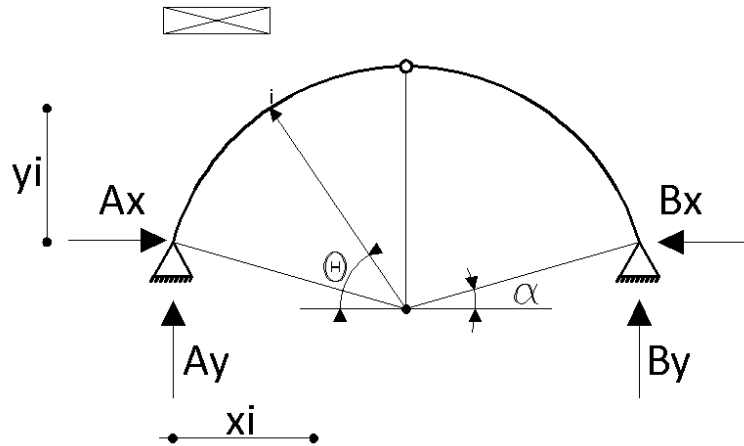
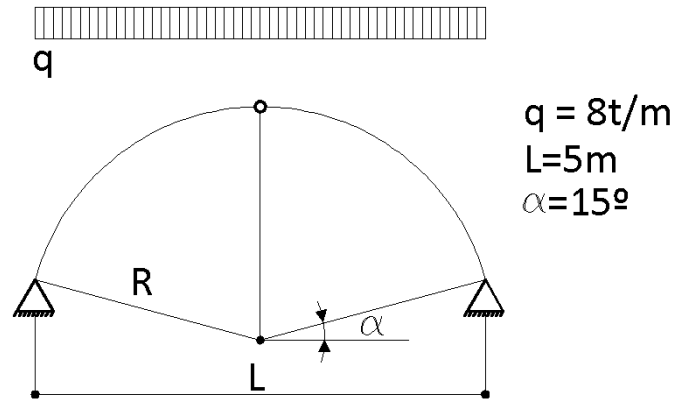
$$M_S = \frac{1}{2} p \cdot L \cdot x - H \cdot y - \frac{1}{2} p \cdot x^2$$

$$Q_S = \left( \frac{1}{2} p \cdot L - p \cdot x \right) \cos \alpha - H \sin \alpha$$

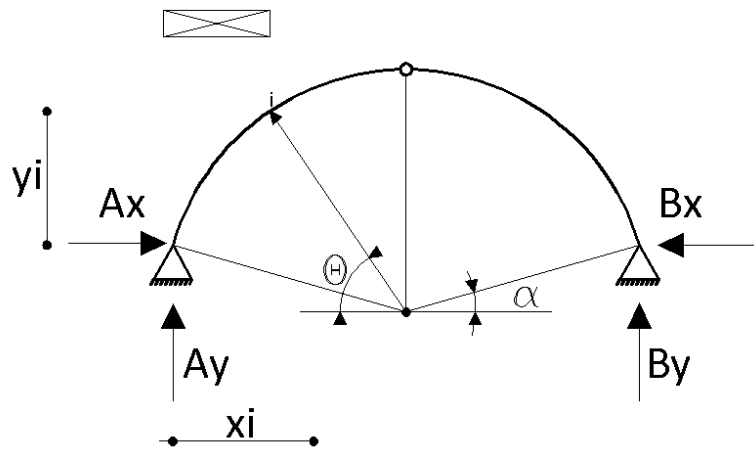
$$N_S = - \left( \frac{1}{2} p \cdot L - p \cdot x \right) \sin \alpha - H \cos \alpha$$



# ARCOS



$\theta$	$\alpha$	$R$	$L$	$f$	$x_i$	$y_i$	$A_y$	$A_x$	$q$	$M_i$	$Q_i$	$N_i$
15	15,0000	2,58819045	5	1,91831747	0,0000	0	20	13,0322537	8	0,00	-7,41	-22,69
30	15,0000	2,58819045	5	1,91831747	0,2586	0,62422224	20	13,0322537	8	-3,23	-2,32	-22,05
45	15,0000	2,58819045	5	1,91831747	0,6699	1,16025404	20	13,0322537	8	-3,52	1,14	-19,57
60	15,0000	2,58819045	5	1,91831747	1,2059	1,5715657	20	13,0322537	8	-2,18	2,45	-16,46
75	15,0000	2,58819045	5	1,91831747	1,8301	1,83012702	20	13,0322537	8	-0,65	1,80	-13,98
90	15,0000	2,58819045	5	1,91831747	2,5000	1,91831747	20	13,0322537	8	0,00	0,00	-13,03



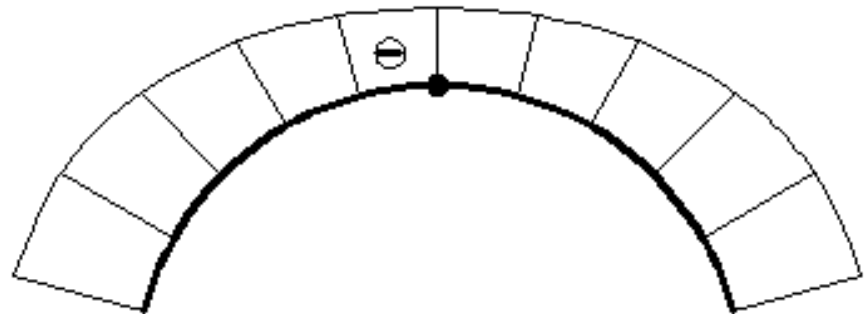
M



Q



N



# ARCO TRIARTICULADO CON TENSOR

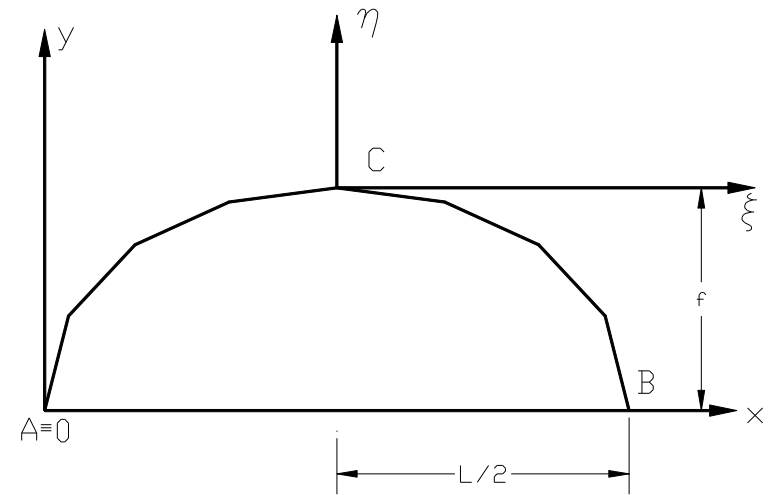
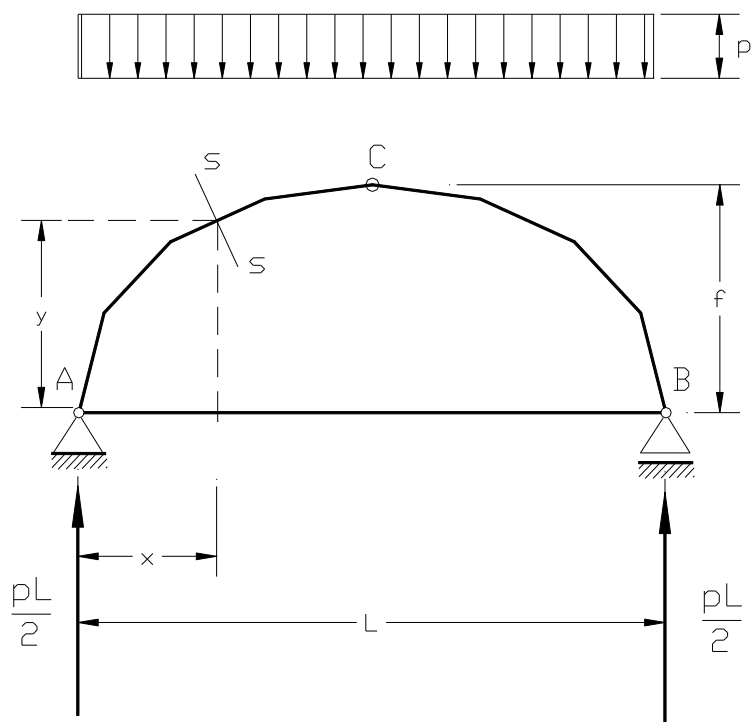


Fig. 7.15