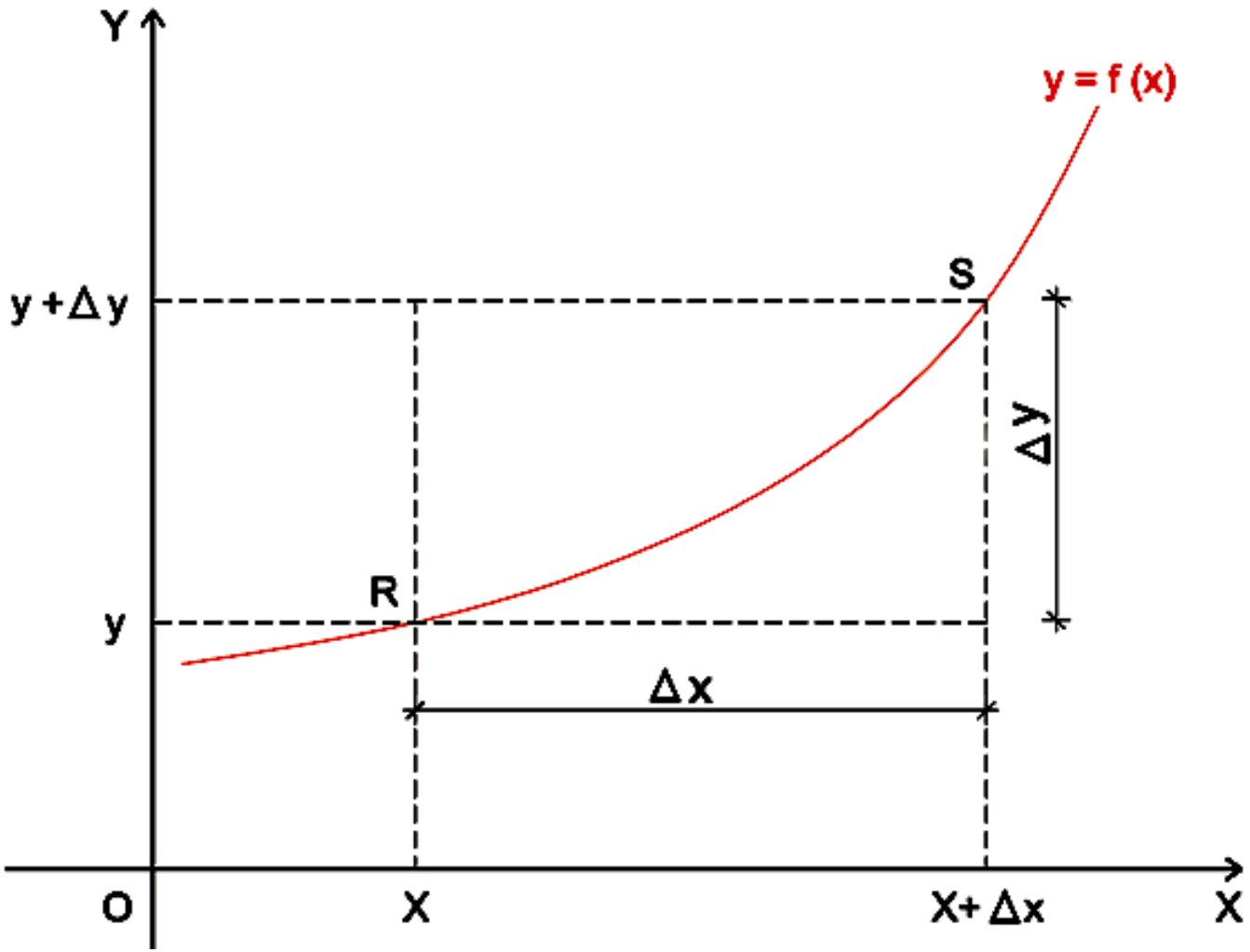
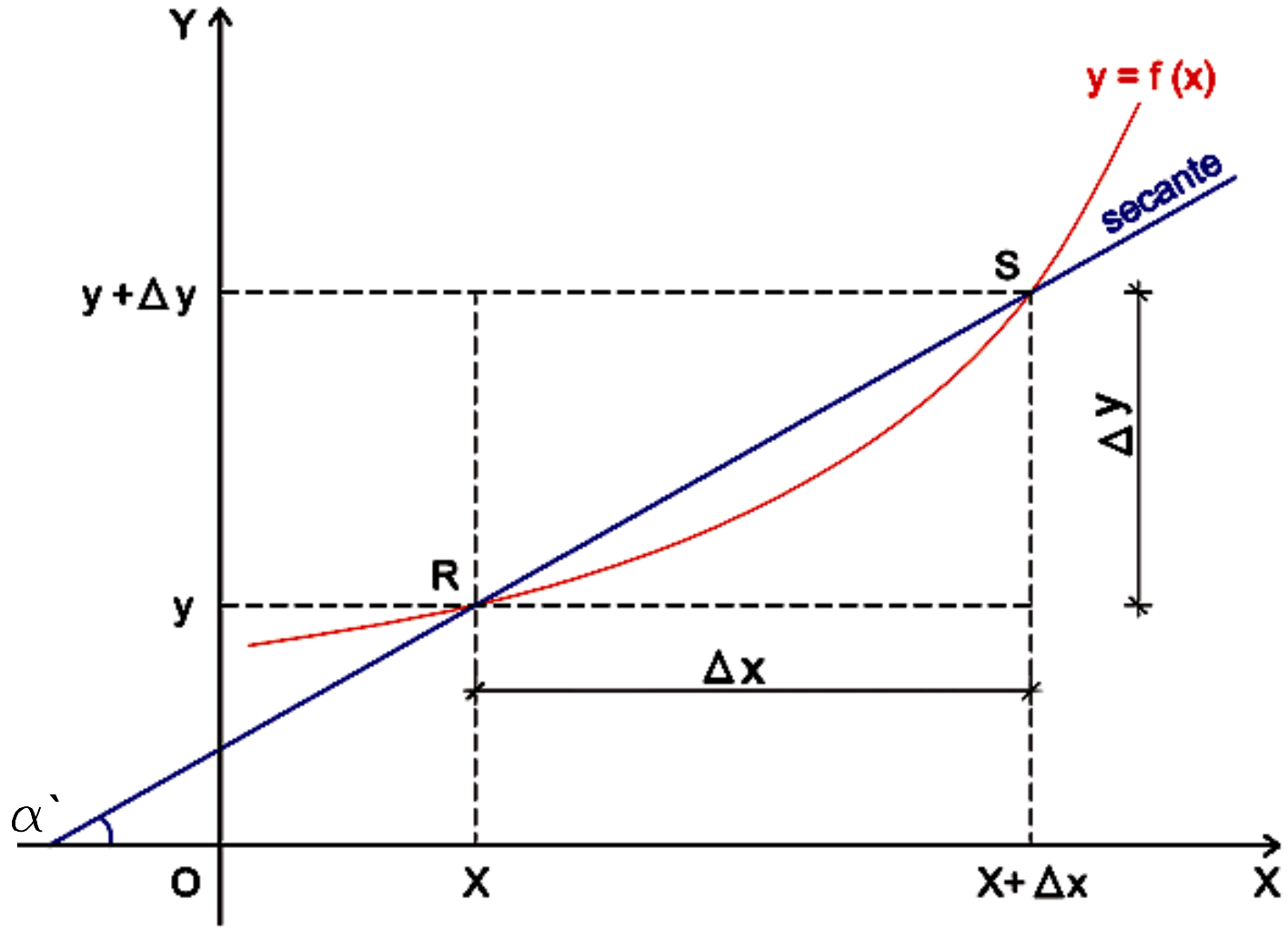
TERCERA FAMILIA de ESTRUCTURAS: ESTRUCTURAS FLEXADAS

2. RELACIONES entre CARGA (p), CORTANTE (V) y MOMENTO (M).

DERIVADA



DERIVADA



tgα` = Δy / Δx (coeficiente angular o pendiente de la recta secante)

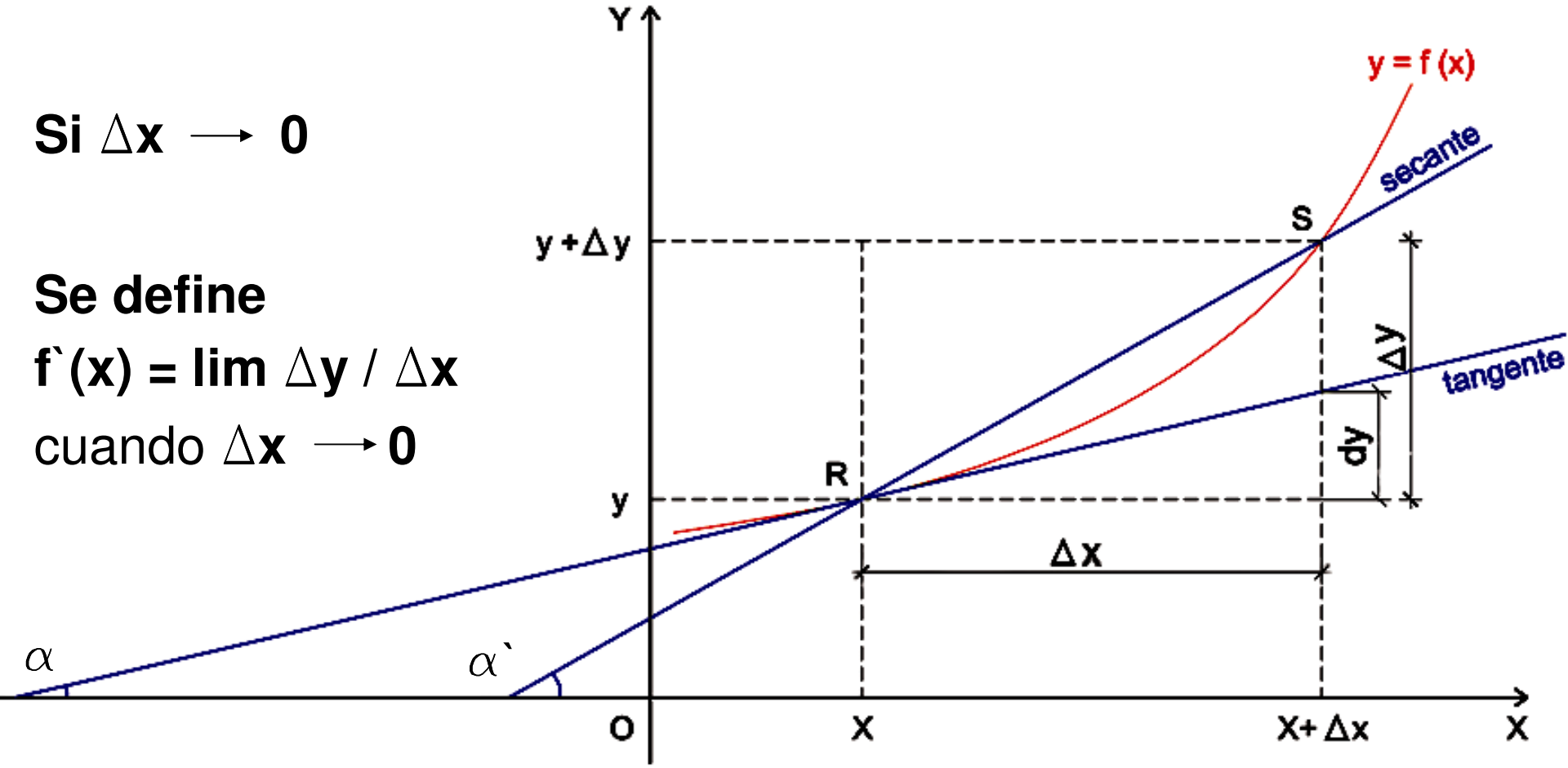
DERIVADA

Si $\Delta x \longrightarrow 0$

Se define

$f'(x) = \lim \Delta y / \Delta x$

cuando **$\Delta x \longrightarrow 0$**



La derivada en un punto representa el coeficiente angular o pendiente de la recta tangente a la función en ese punto.

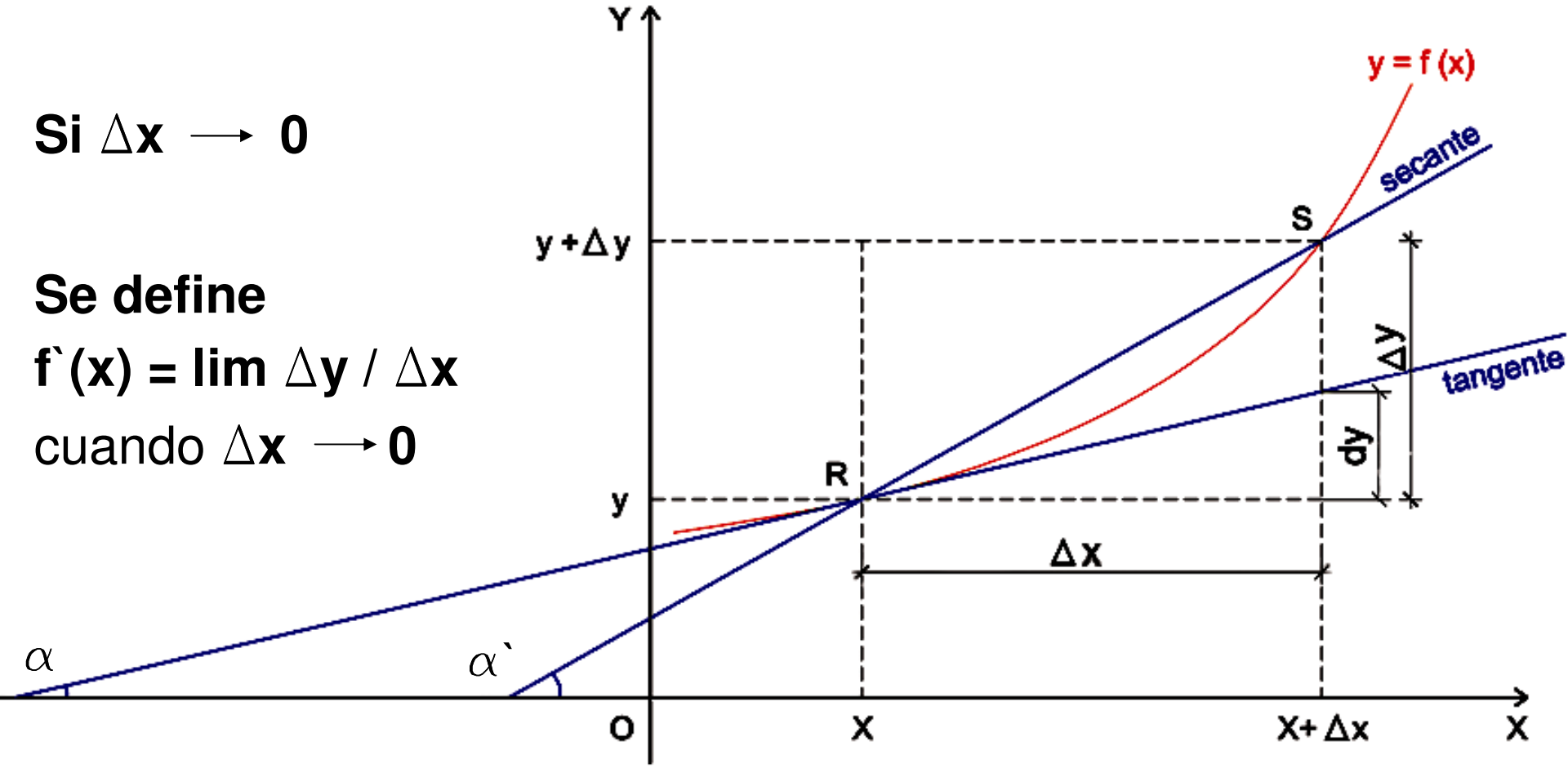
DERIVADA

Si $\Delta x \longrightarrow 0$

Se define

$f'(x) = \lim \Delta y / \Delta x$

cuando **$\Delta x \longrightarrow 0$**



tg α = f`(x) = dy / dx = y`(x)

dx = Δx si $\Delta x \longrightarrow 0$

INTEGRAL INDEFINIDO

F (x) es primitiva de f (x) si F`(x) = f (x)

es la operación contraria a la derivación

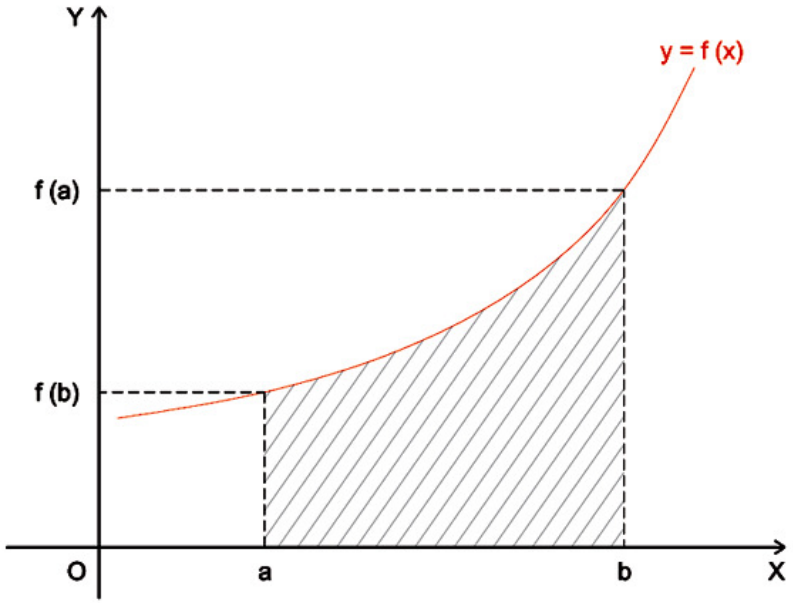
Ejemplo: $f(x) = x^2$ $\qquad$ $f(x) = x^n$

$f'(x) = 2 \cdot x$ $\qquad$ $f'(x) = n \cdot x^{n-1}$

$F(x) = x^3/3 + c$ $\qquad$ $F(x) = (x^{n+1} / n+1) + c$

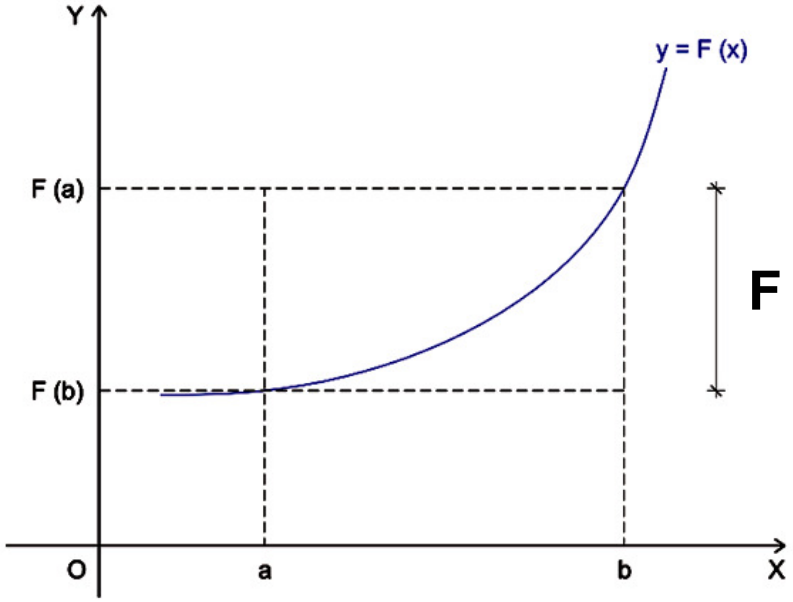
$$\int f(x)\, dx = F(x) + c$$

INTEGRAL DEFINIDO



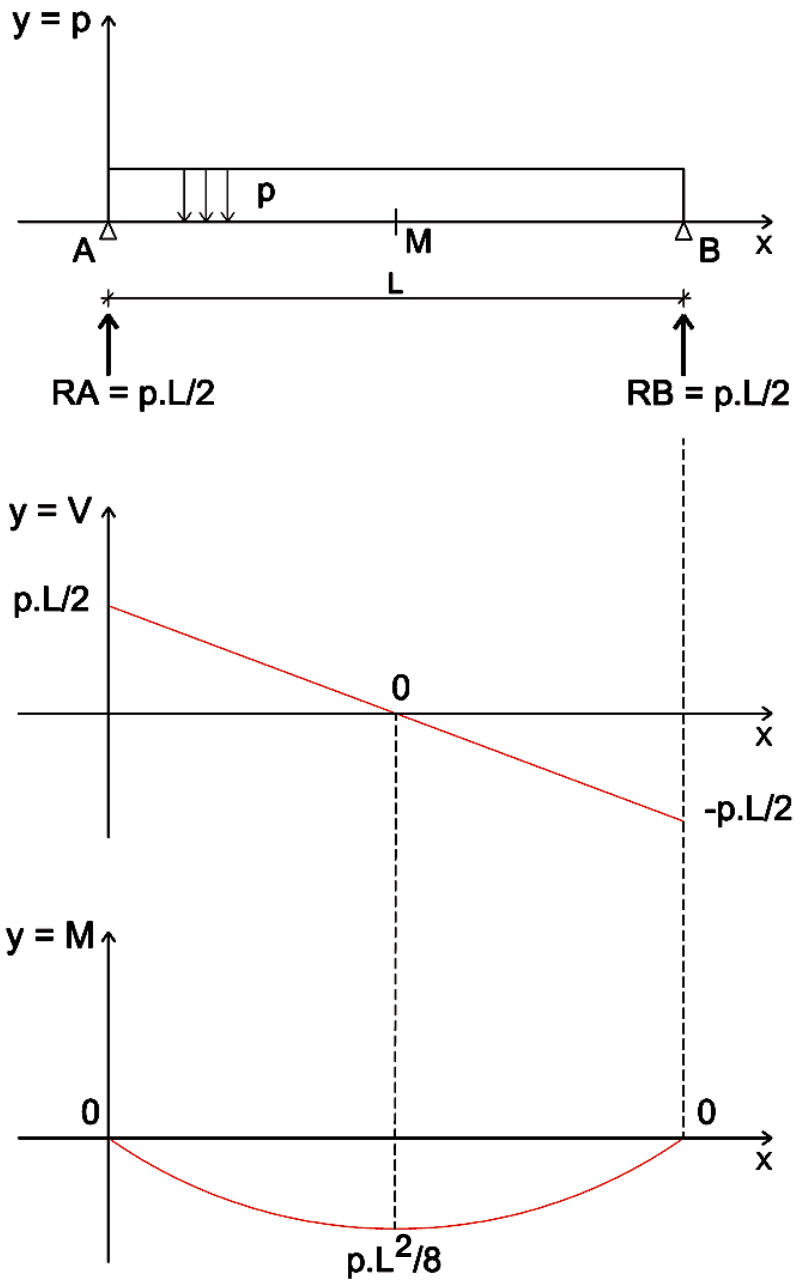
$$\int_a^b f(x)\,dx = F(b) - F(a)$$

siendo F(x) una primitiva de f(x)

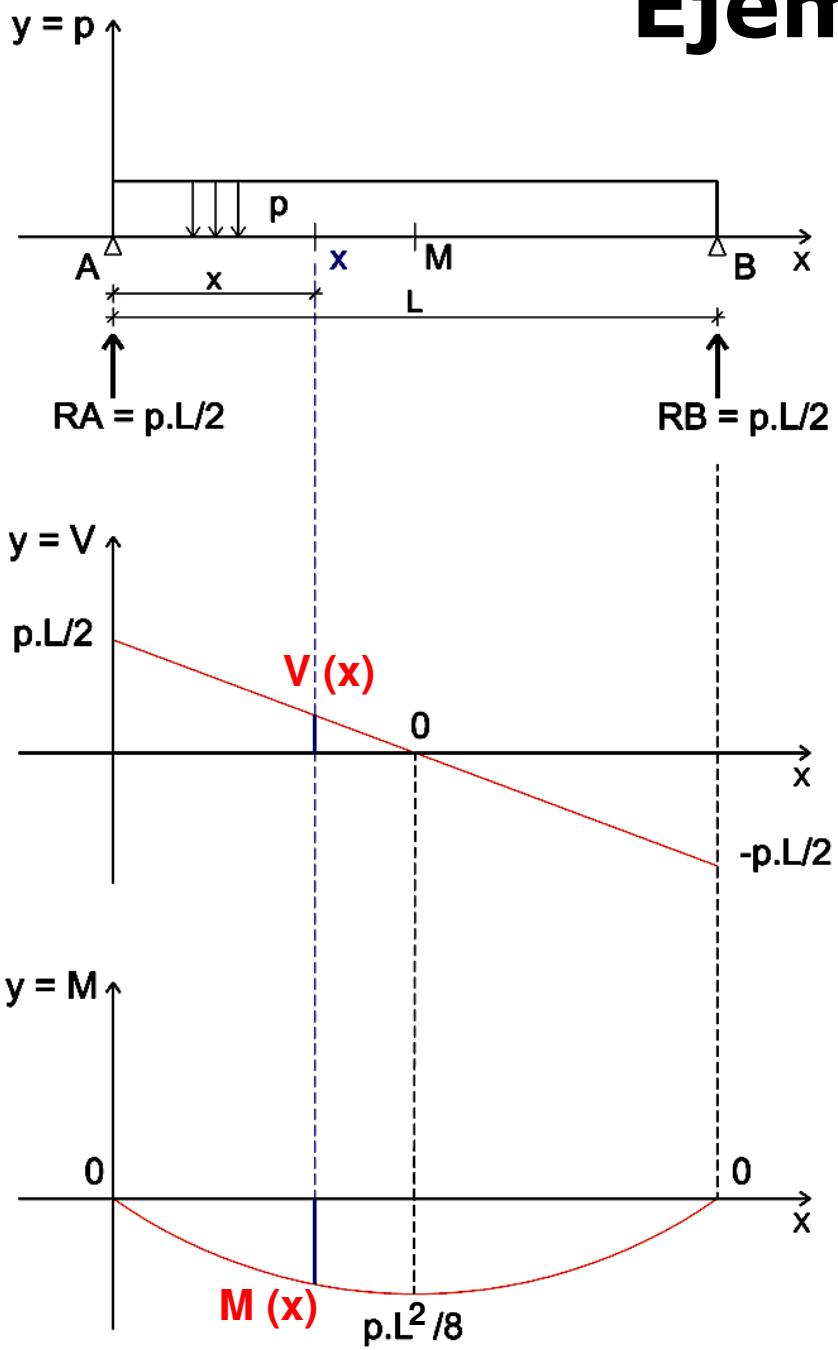


F (b) – F(a)

Ejemplo: viga



Ejemplo: viga



$$V(x) = p.L / 2 - p.x$$

$V(0) = p.L / 2$

$V(L/2) = 0$

$V(L) = -p.L / 2$

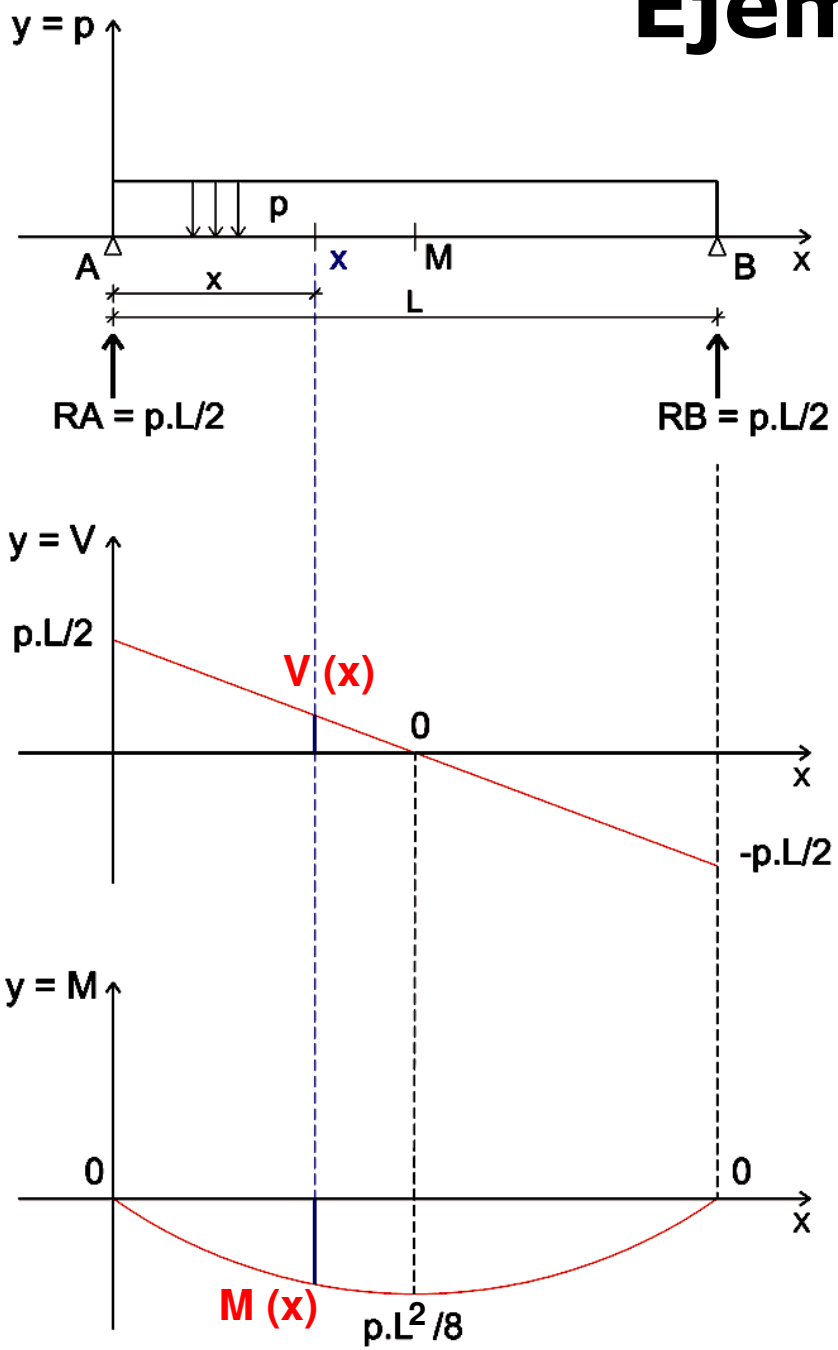
$$M(x) = (p.L/2).x - p.x^2 /2$$

$M(0) = 0$

$M(L/2) = p.l^2 / 8$

$M(L) = 0$

Ejemplo: viga



$$M(x) = (p.L/2).x - p.x^2/2$$

$$M`(x) = p.L/2 - (2.p/2).x$$

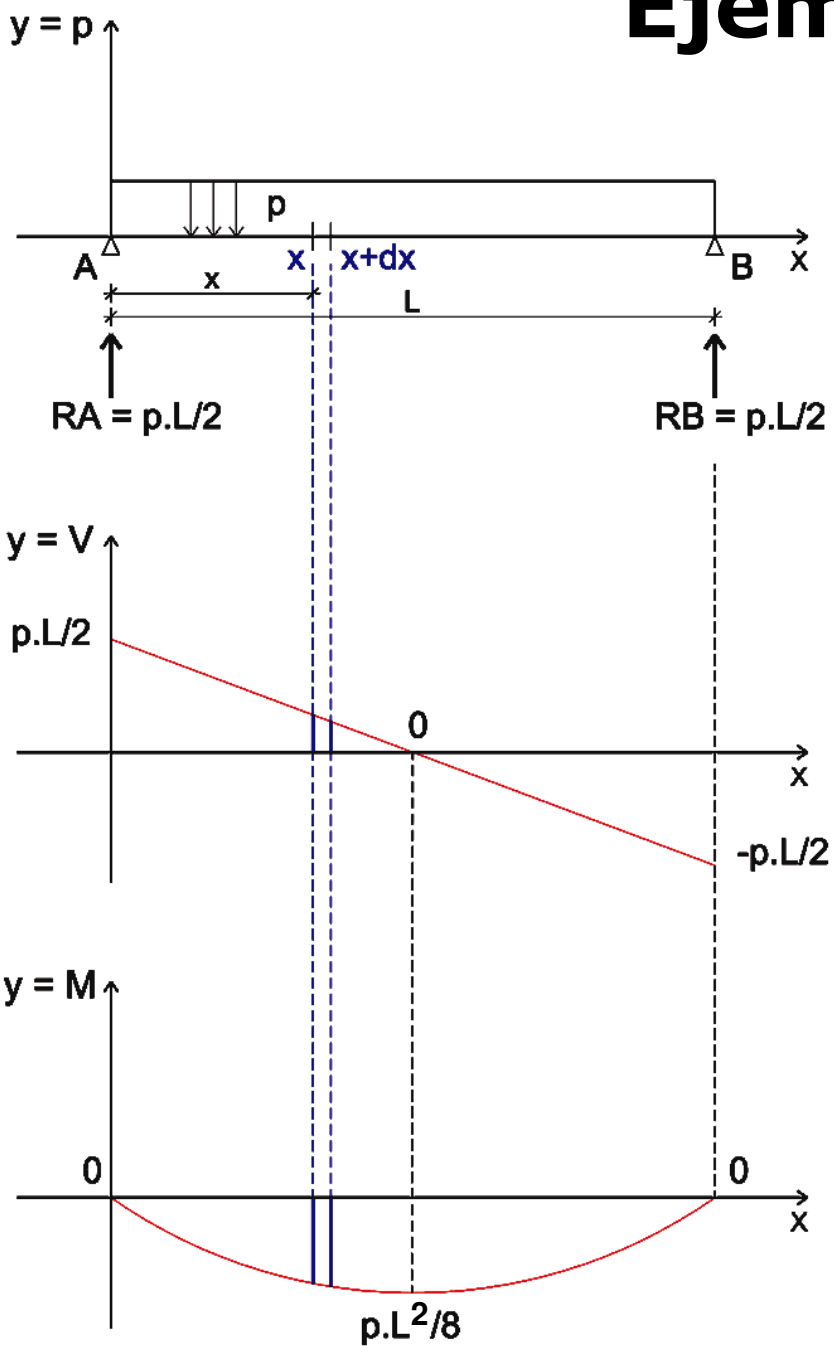
$$M`(x) = p.L/2 - p.x$$

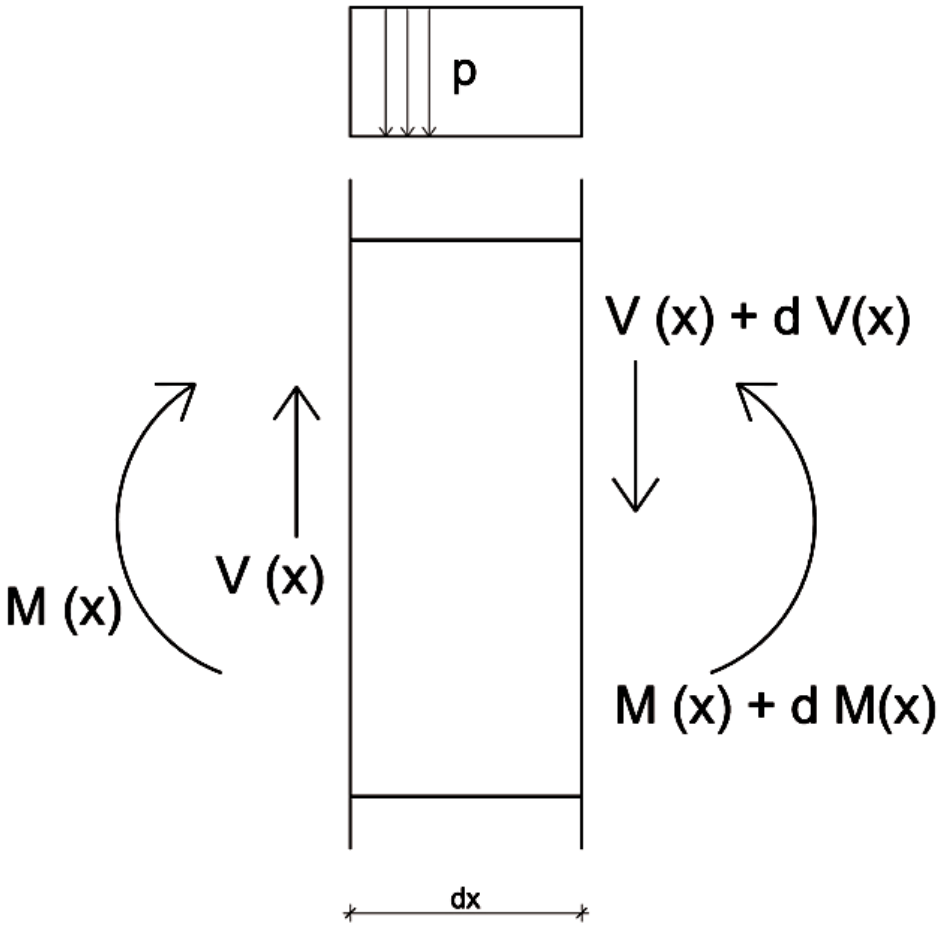
$$M`(x) = p.L/2 - p.x = V(x)$$

$$V`(x) = -p$$

$$M``(x) = V`(x) = -p$$

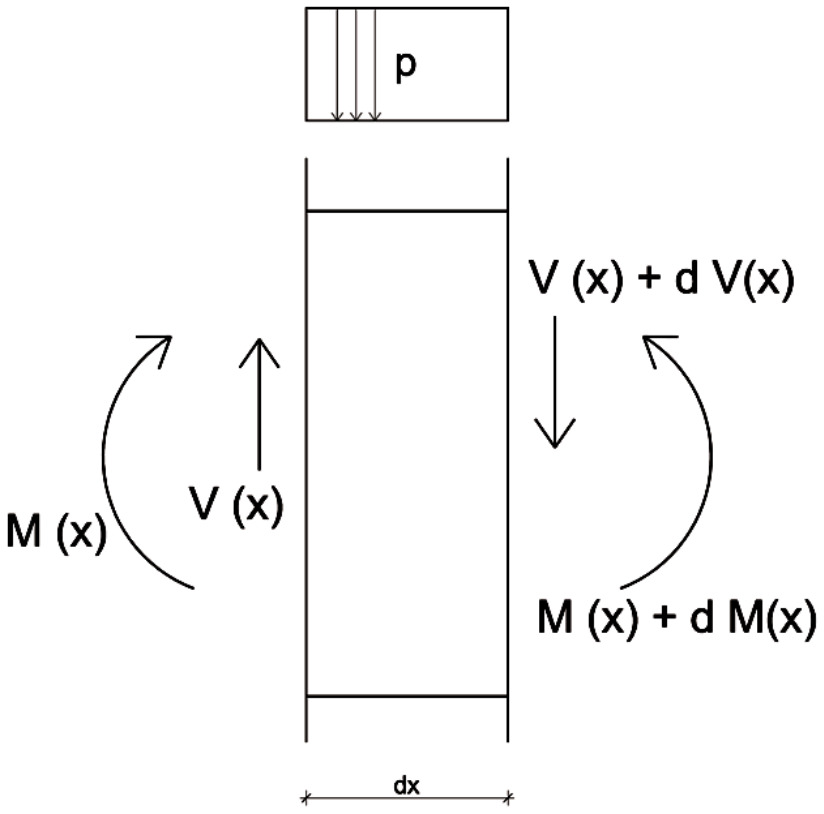
Ejemplo: viga





Dovela de ancho diferencial

Ejemplo: viga



Equilibrio de la dovela:

$\sum Fv = 0$

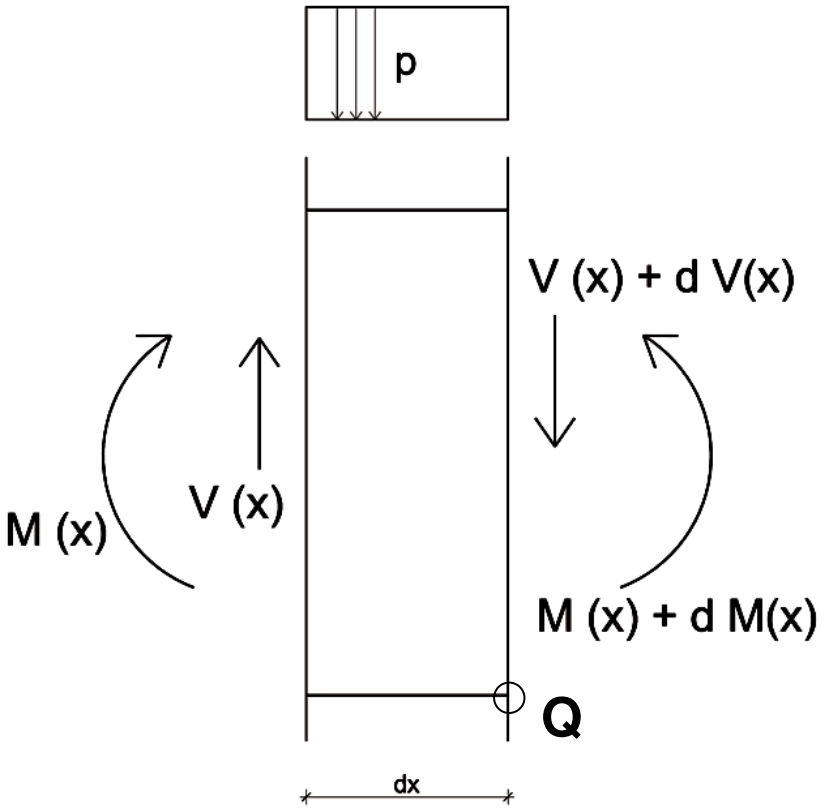
$$V(x) - p.dx - \left(V(x) + dV(x)\right) = 0$$

$$V(x) - p.dx - V(x) - dV(x) = 0$$

$$-p.dx = dV(x)$$

$$-p = dV(x) / dx = V`(x)$$

$$\boxed{-p = V`(x)}$$



Equilibrio de la dovela:

$\sum M_Q = 0$

$$M(x) - \left(M(x) + dM(x)\right) + V(x).dx - p.dx.dx/2 = 0$$

$$M(x) - M(x) - dM(x) + V(x).dx - p.dx^2/2 = 0$$

$$- dM(x) + V(x).dx = 0$$

$$V(x).dx = dM(x)$$

$$V(x) = dM(x) / dx = M`(x)$$

$$\boxed{V(x) = M`(x)}$$

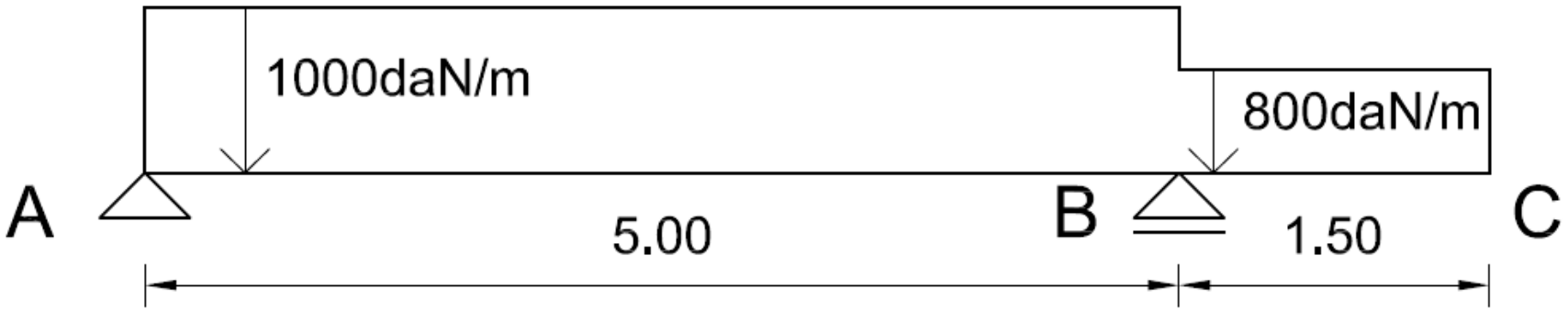
$$-p = V`(x)$$

$$V(x) = M`(x)$$

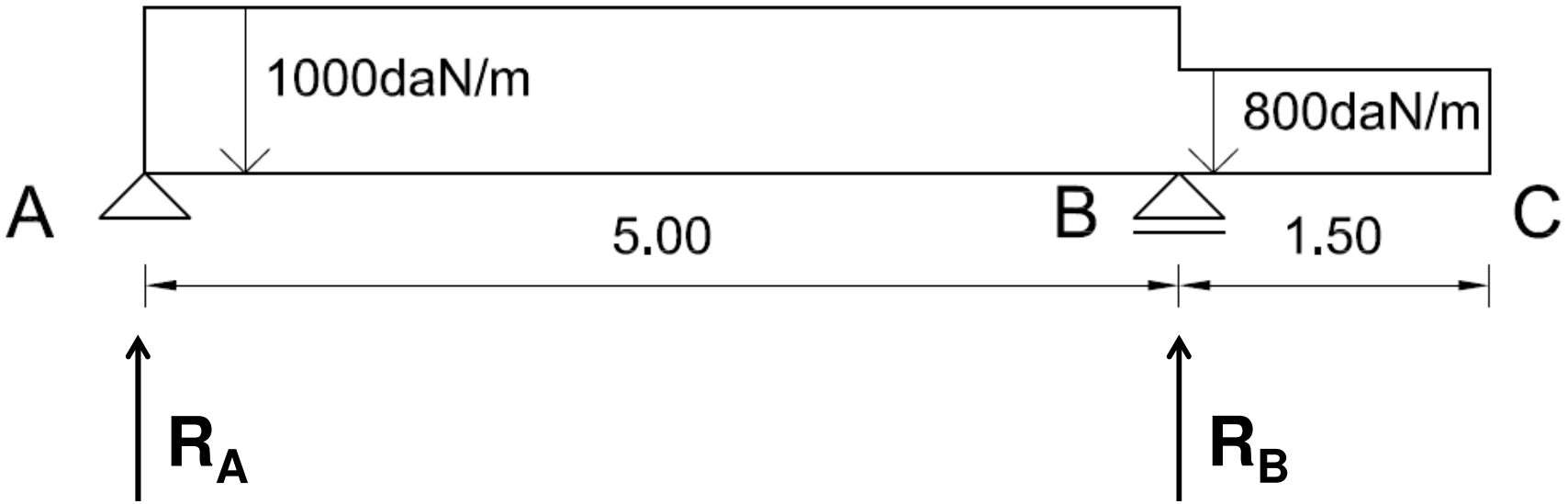
$$\boxed{M``(x) = V`(x) = -p}$$

ecuación fundamental de las vigas rectas

EJEMPLO



EJEMPLO



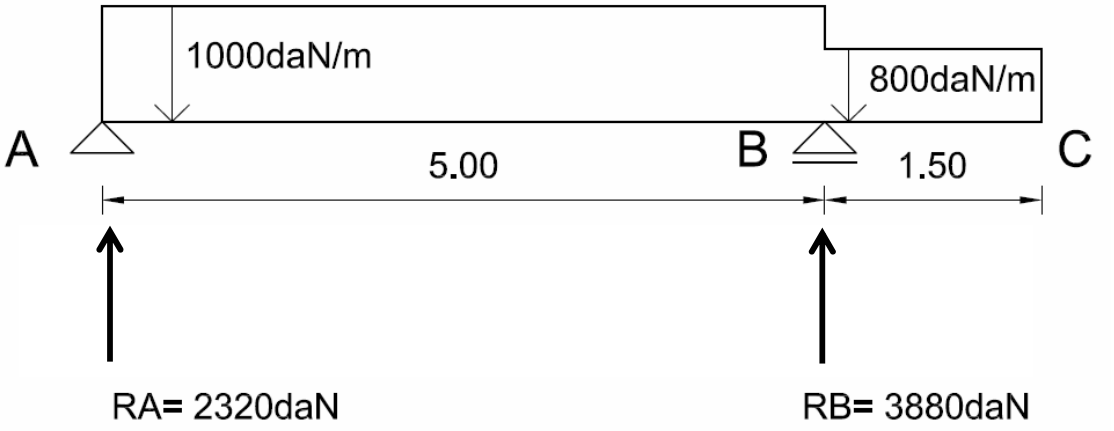
EQUILIBRIO GLOBAL:

$\sum M_B = 0$ $\quad -5000x2,5 + 1200x0,75 + R_A x5 = 0$

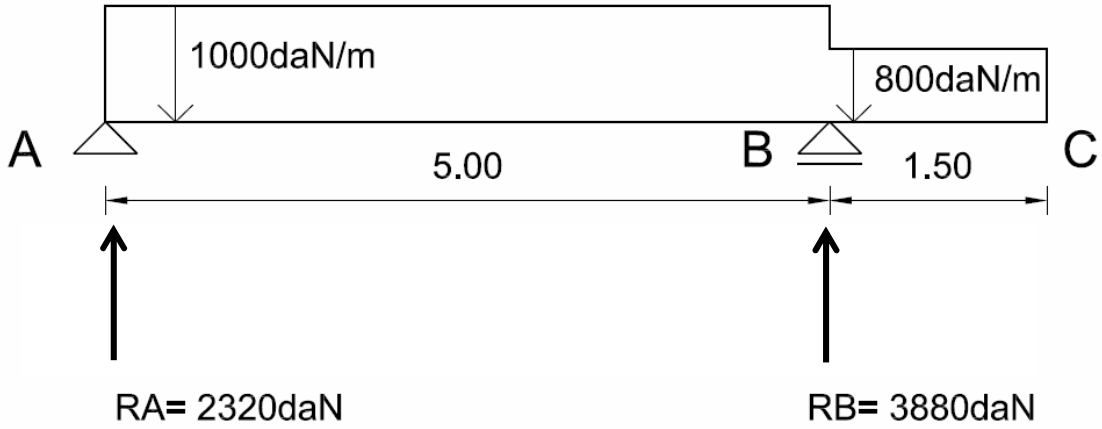
$R_A = 2320$ daN

$\sum M_A = 0$ $\quad 5000x2,5 + 1200x5,75 - R_B x5 = 0$

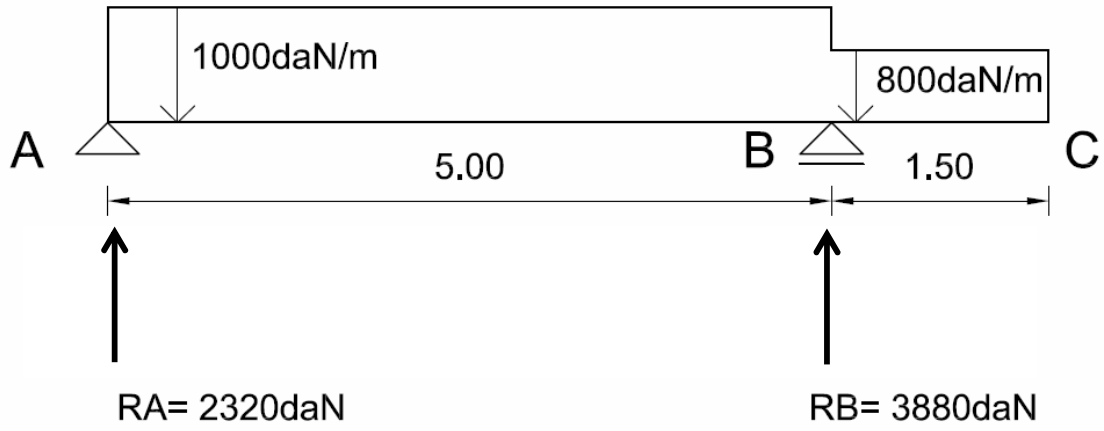
$R_B = 3880$ daN

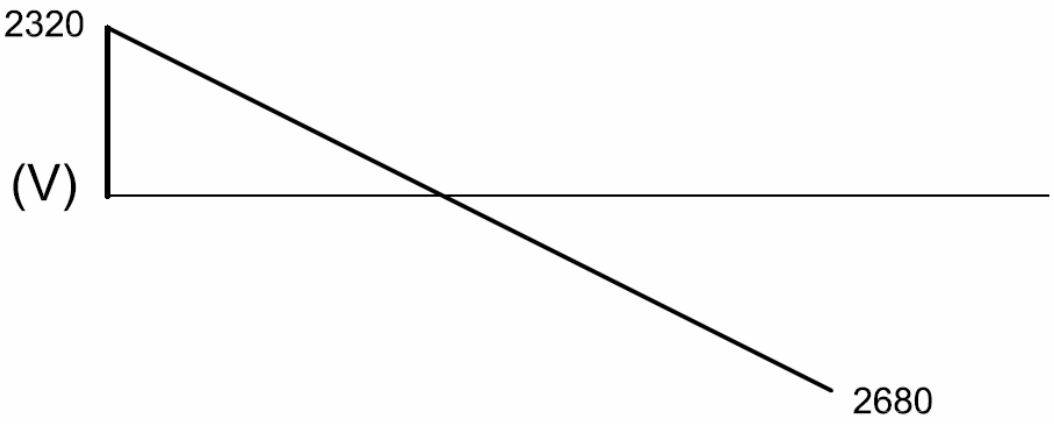


(V)


1000daN/m
800daN/m
A
B
C
5.00
1.50
RA= 2320daN
RB= 3880daN

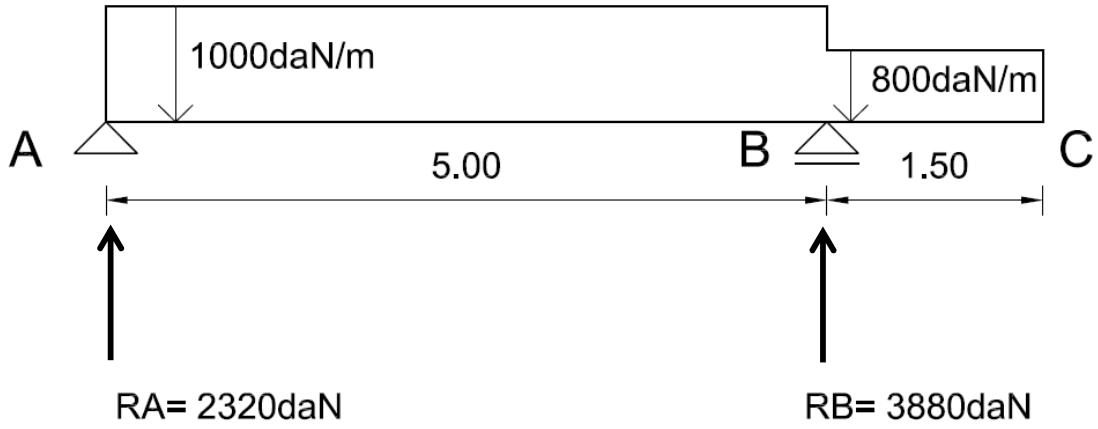

2320
(V)
Rizq A = RA = 2320daN

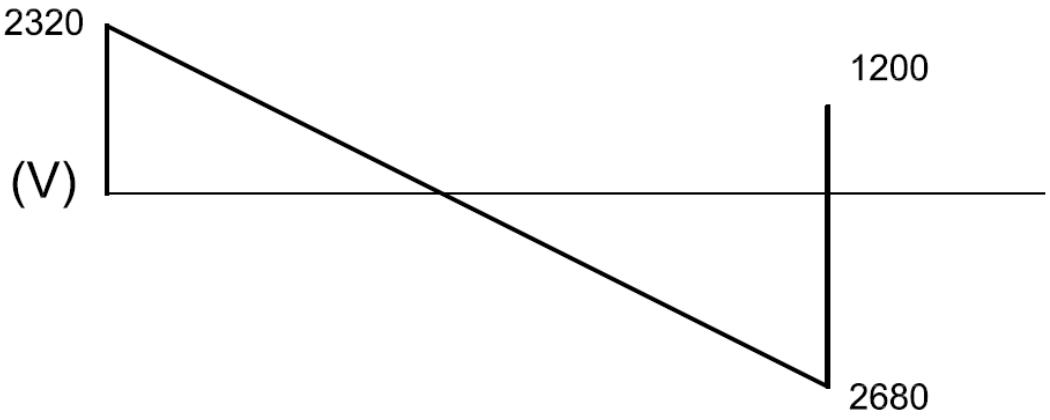




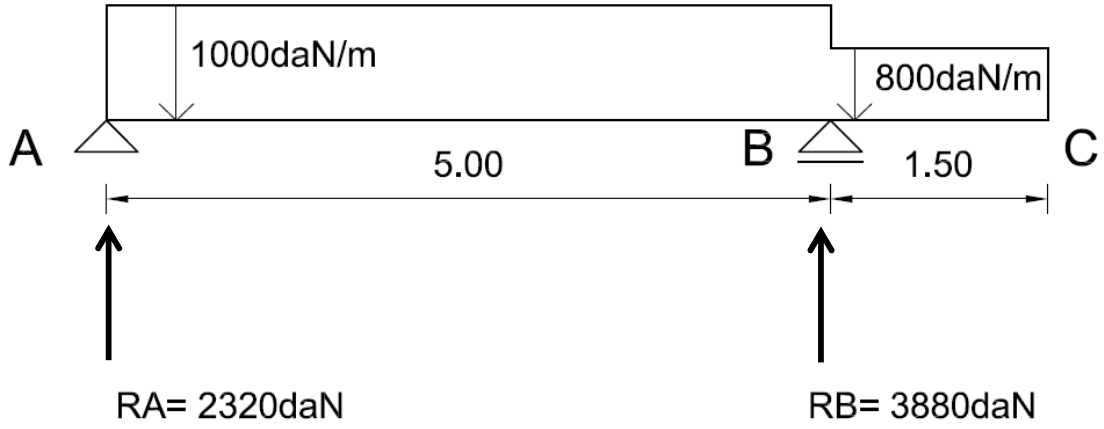
Rizq A = RA = 2320daN

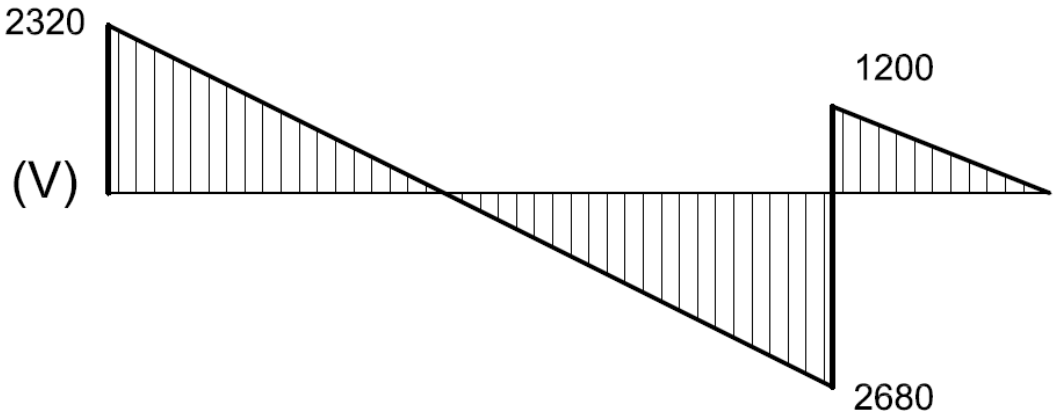
Rizq B1 = RA - 5000daN = -2680daN



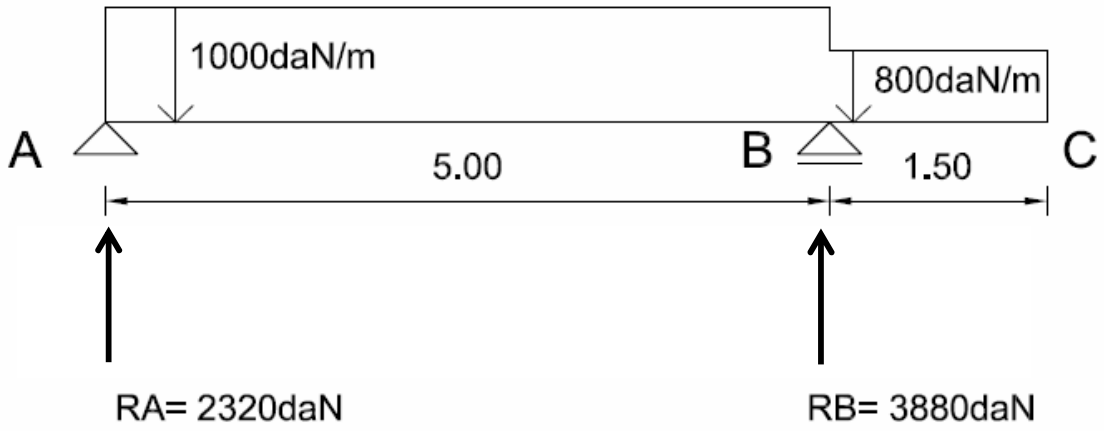


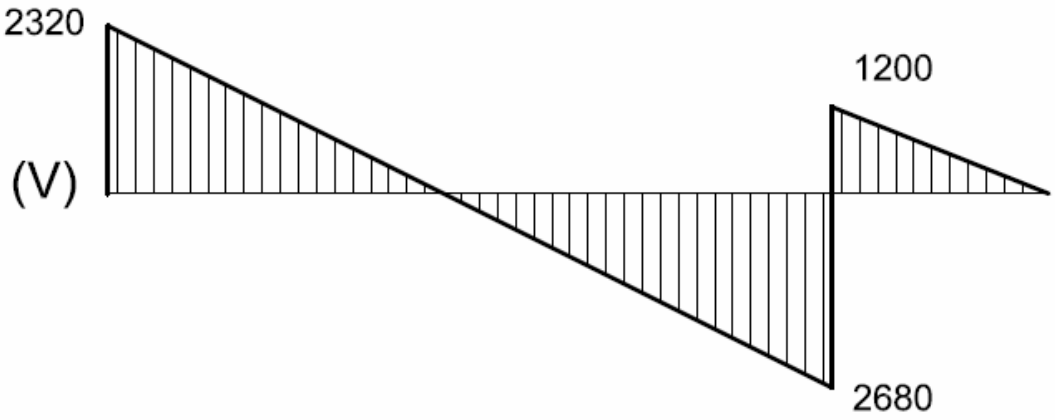
Rizq A = RA = 2320daN
Rizq B1 = RA - 5000daN = -2680daN
Rizq B2 = RA - 5000daN + RB = 1200daN



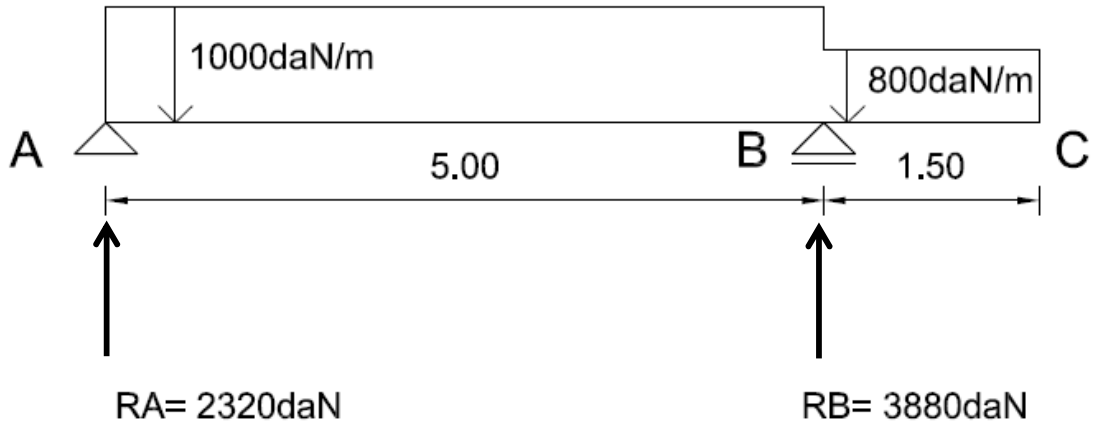


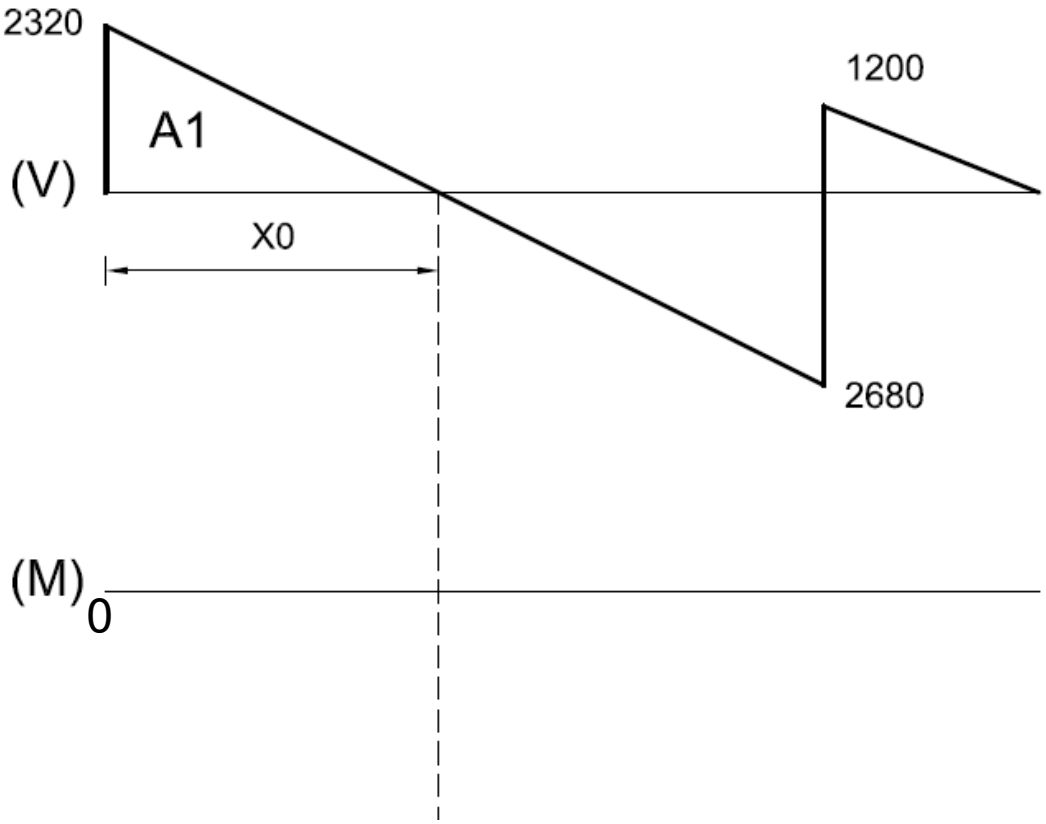
Rizq A = RA = 2320daN
Rizq B1 = RA - 5000daN = -2680daN
Rizq B2 = RA - 5000daN + RB = 1200daN
Rizq C = RA - 5000daN + RB - 1200daN = 0

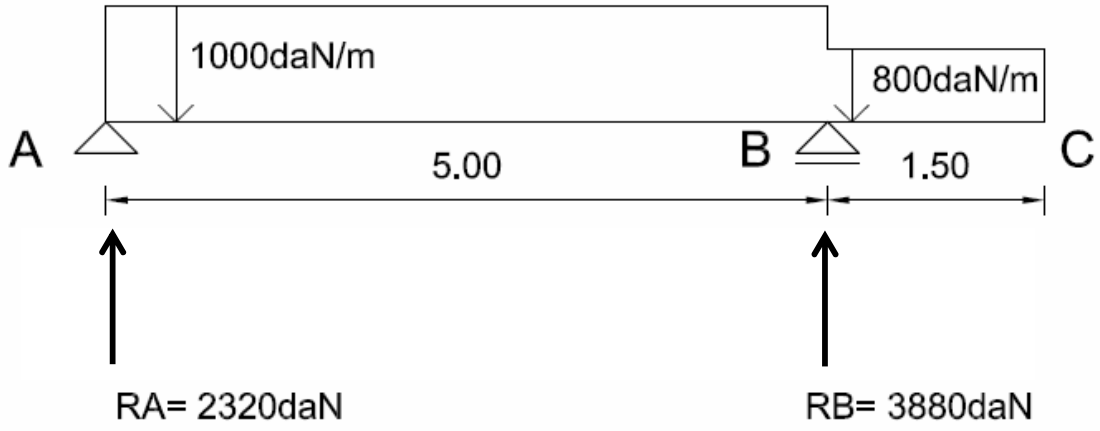

1000daN/m
800daN/m
A
B
C
5.00
1.50
RA= 2320daN
RB= 3880daN

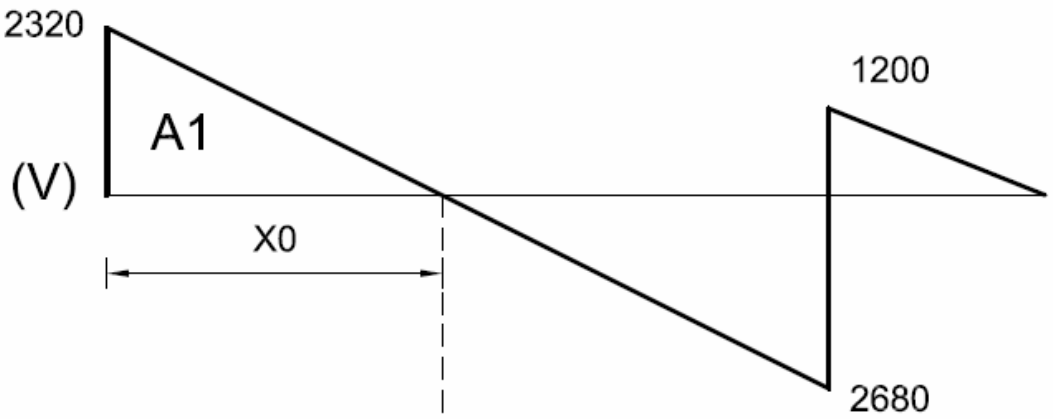

2320
1200
(V)
2680

(M)


1000daN/m
800daN/m
A
B
C
5.00
1.50
RA= 2320daN
RB= 3880daN


2320
1200
A1
(V)
X0
2680
(M)0
MA = 0
M0 = A1

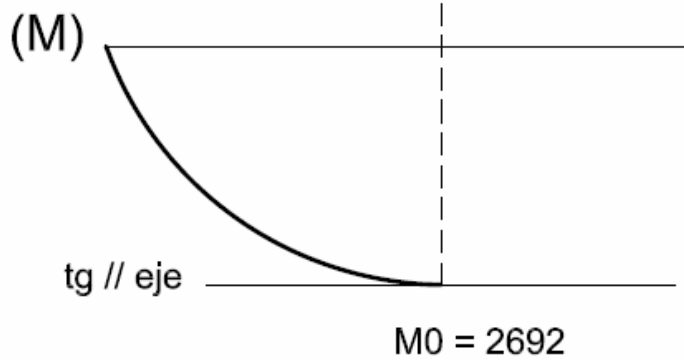




$$X0 = \frac{V}{p}$$

$$X0 = \frac{2320daN}{1000daN/m}$$

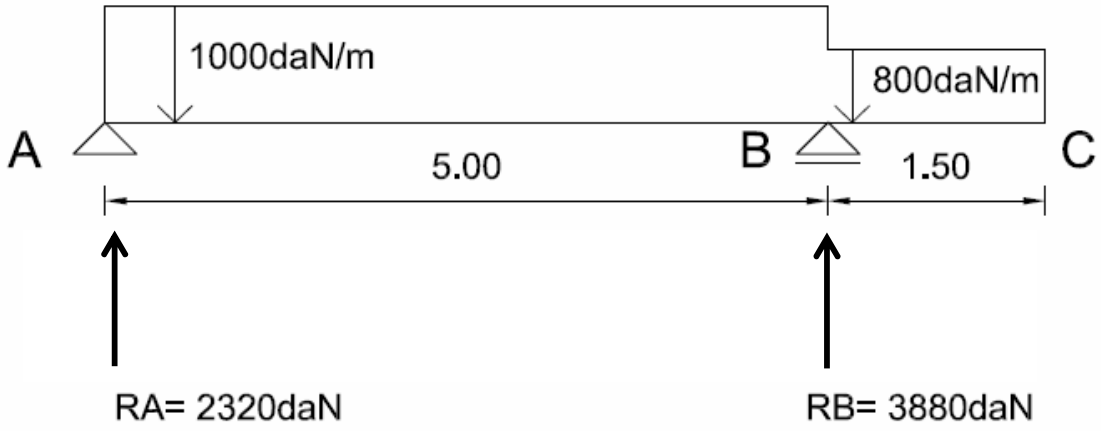
$X0 = 2.32m$

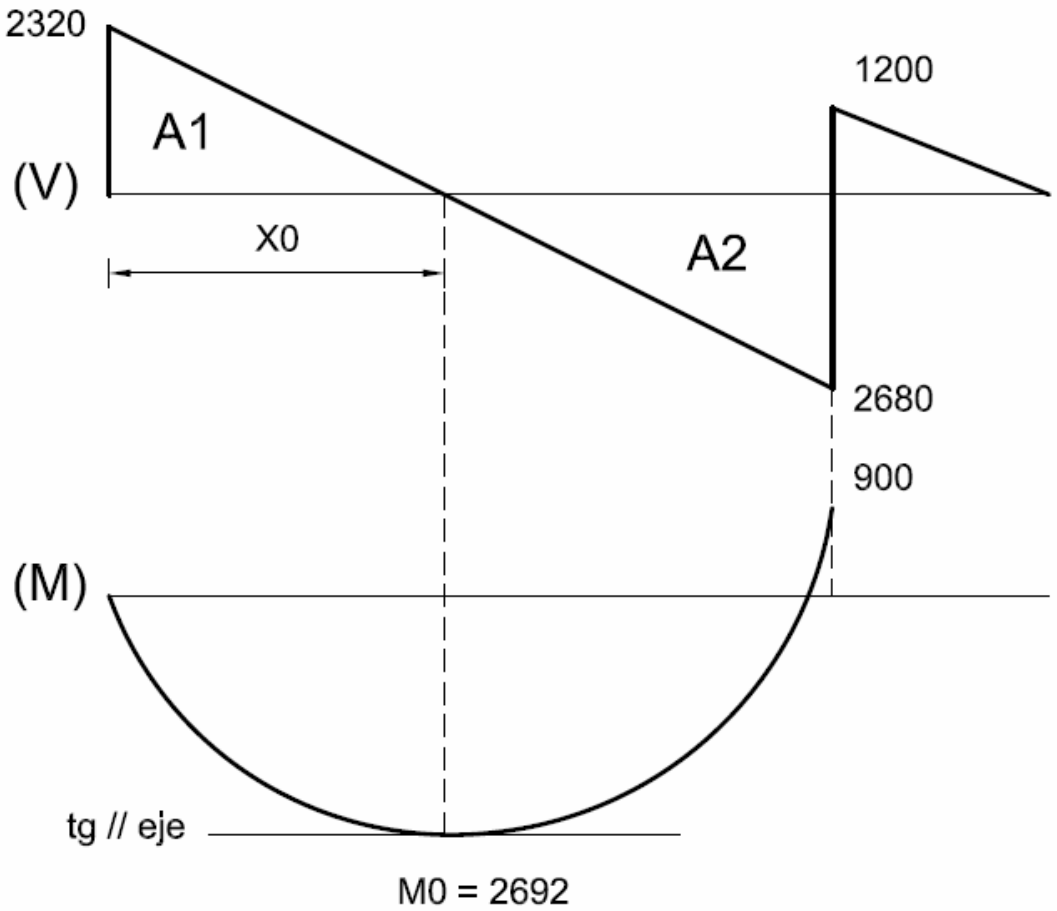


$MA = 0$

$$M0 = A1 = \frac{2320daN \times 2.32m}{2}$$

$M0 = 2692daNm$





$$X0 = \frac{V}{p}$$

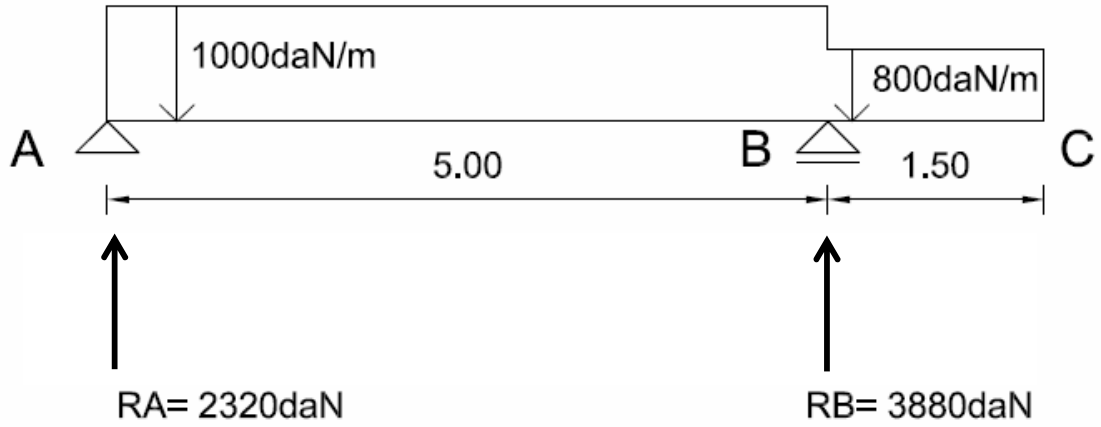
$$X0 = \frac{2320daN}{1000daN/m}$$

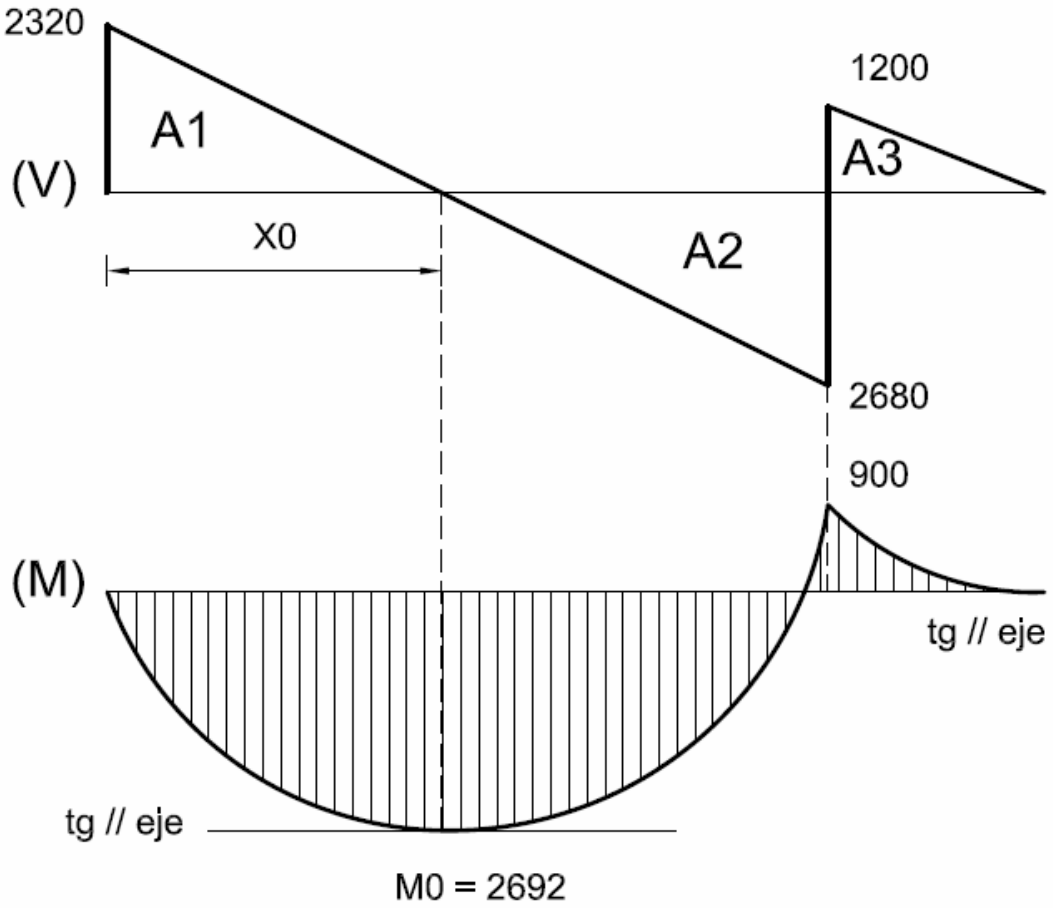
X0 = 2.32m

MA = 0

M0 = A1 = 2692daNm

MB = A1 - A2 = -900daNm





$$X0 = \frac{V}{p}$$

$$X0 = \frac{2320daN}{1000daN/m}$$

$X0 = 2.32m$

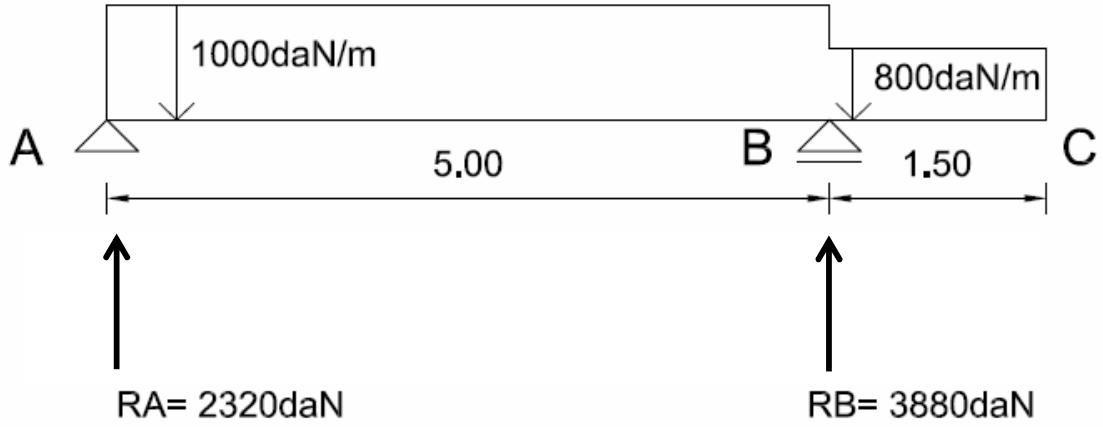
$MA = 0$

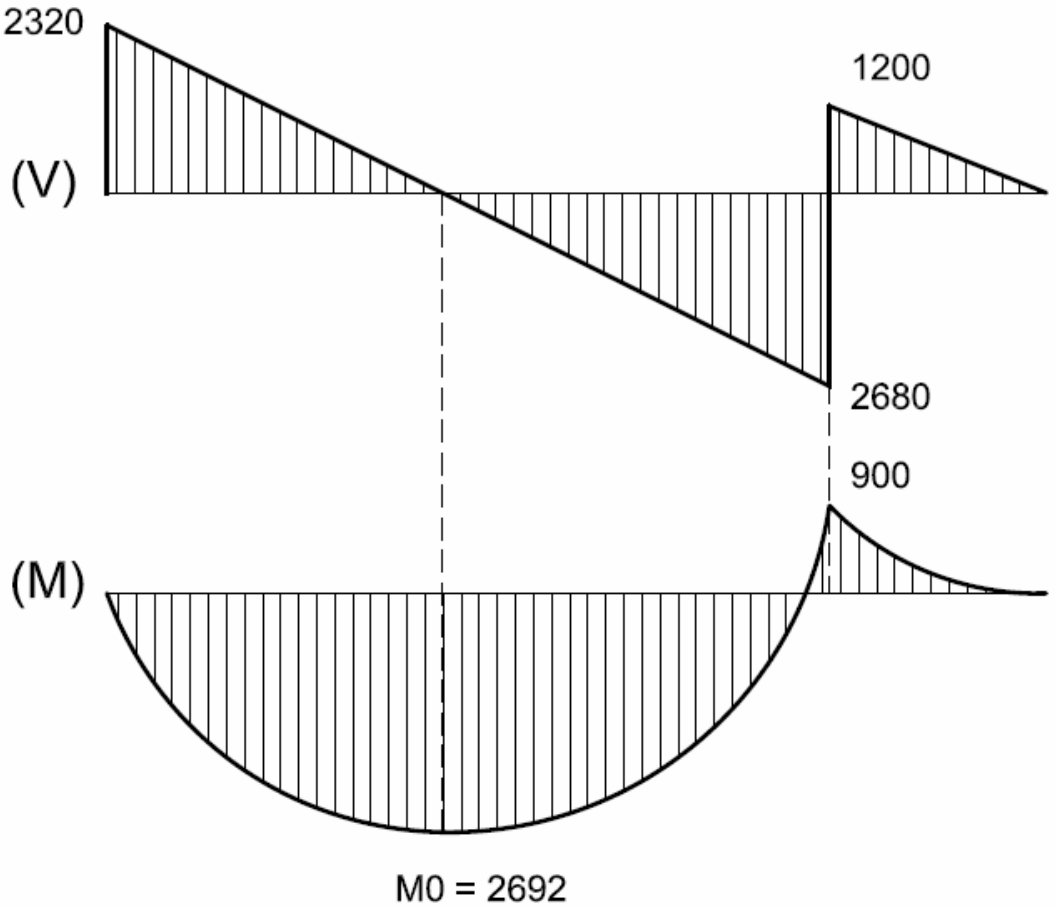
$M0 = A1 = 2692daNm$

$MB = A1 - A2 = -900daNm$

$MB = A1 - A2 = A3$

$MC = A1 - A2 + A3 = 0$


1000daN/m
800daN/m
A
B
C
5.00
1.50
RA= 2320daN
RB= 3880daN


2320
1200
(V)
2680
900
(M)
M0 = 2692