

UNIVERSIDAD MAYOR DE SAN SIMÓN
FACULTAD DE CIENCIAS Y TECNOLOGÍA

PRACTICA No. 1

Estudiante:

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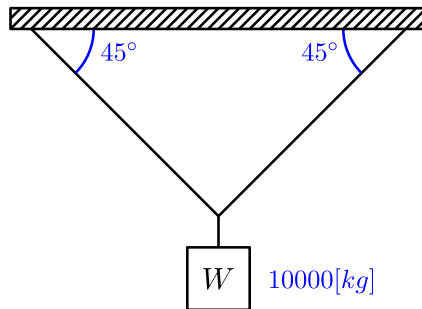
Carrera:

Ingeniería Electromecánica.

Docente:

Ing. Guido Gomez Ugarte.

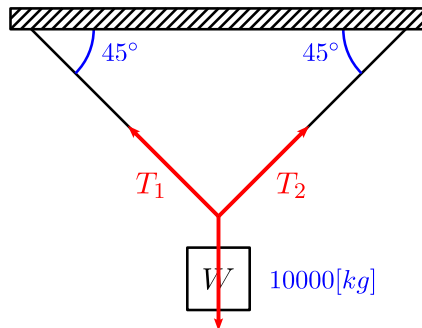
Fecha de entrega: 20 de Septiembre del 2022.

PROBLEMA 1:**Solución:****Sistema concurrente:**

Se plantean las ecuaciones de equilibrio:

$$\sum F_x = 0$$

$$\sum F_y = 0$$



Variables: T_1 , T_2 .

$$\sum F_x = 0:$$

$$T_{1x} - T_{2x} = 0$$

$$T_1 \cos(45^\circ) - T_2 \cos(45^\circ) = 0$$

$$\sum F_y = 0:$$

$$T_{1y} + T_{2y} - W = 0$$

$$T_1 \sin(45^\circ) + T_2 \sin(45^\circ) = 10000$$

Resolviendo el sistema de ecuaciones lineales 2x2:

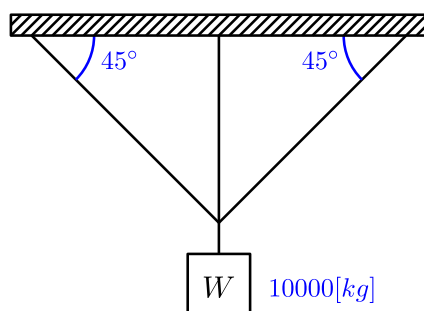
$$T_1 = 707.11[\text{kg}]$$

$$T_2 = 707.11[\text{kg}]$$

Por tanto:

Sistema isoestático

PROBLEMA 2:



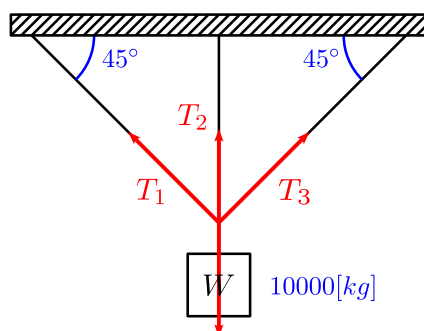
Solución:

Sistema concurrente:

Se plantean las ecuaciones de equilibrio:

$$\sum F_x = 0$$

$$\sum F_y = 0$$



Variables: T_1 , T_2 , T_3 .

$$\sum F_x = 0:$$

$$T_{1x} - T_{3x} = 0$$

$$T_1 \cos(45^\circ) - T_3 \cos(45^\circ) = 0$$

$$\sum F_y = 0:$$

$$T_{1y} + T_2 + T_{3y} - W = 0$$

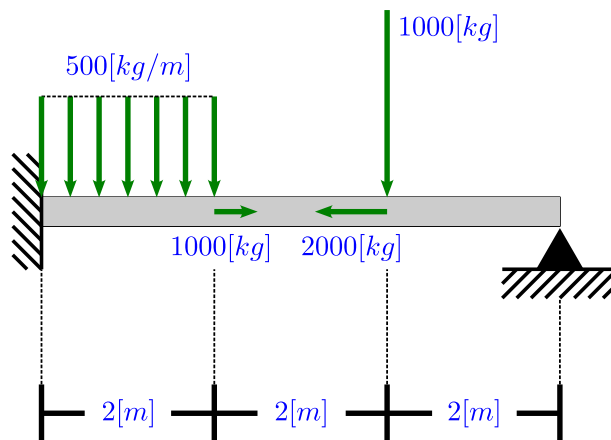
$$T_1 \sin(45^\circ) + T_2 + T_3 \sin(45^\circ) = 10000$$

Se tienen 2 ecuaciones para 3 incógnitas.

Por tanto:

Sistema hiperestático

PROBLEMA 3:



Solución:

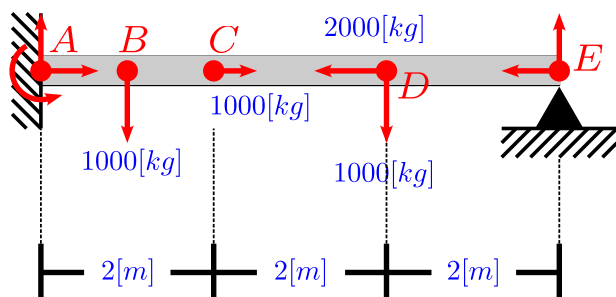
Sistema no concurrente:

Se plantean las ecuaciones de equilibrio:

$$\sum F_x = 0$$

$$\sum F_y = 0$$

Se consideran los siguientes puntos para el cálculo de momentos:



$$\sum M_A = 0$$

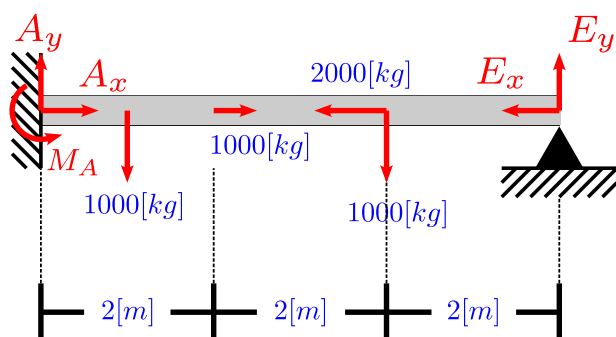
$$\sum M_B = 0$$

$$\sum M_C = 0$$

$$\sum M_D = 0$$

$$\sum M_E = 0$$

Variables: A_x , A_y , M_A , E_x , E_y .



$$\sum F_x = 0:$$

$$A_x + 1000 - E_x - 2000 = 0$$

$$A_x - E_x = 1000$$

$$\sum F_y = 0:$$

$$A_y - 1000 - 1000 + E_y = 0$$

$$A_y + E_y = 2000$$

$$\sum M_A = 0:$$

$$-M_A + 1000(1) + 1000(4) - E_y(6) = 0$$

$$M_A + 6E_y = 5000$$

$$\sum M_B = 0:$$

$$-M_A + A_y(1) + 1000(3) - E_y(5) = 0$$

$$-M_A + A_y - 5E_y = -3000$$

$$\sum M_C = 0:$$

$$-M_A + A_y(2) - 1000(1) + 1000(2) - E_y(4) = 0$$

$$-M_A + 2A_y - 4E_y = -1000$$

$$\sum M_D = 0:$$

$$-M_A + A_y(4) - 1000(3) - E_y(2) = 0$$

$$-M_A + 4A_y - 2E_y = 3000$$

$$\sum M_E = 0:$$

$$-M_A + A_y(6) - 1000(5) - 1000(2) = 0$$

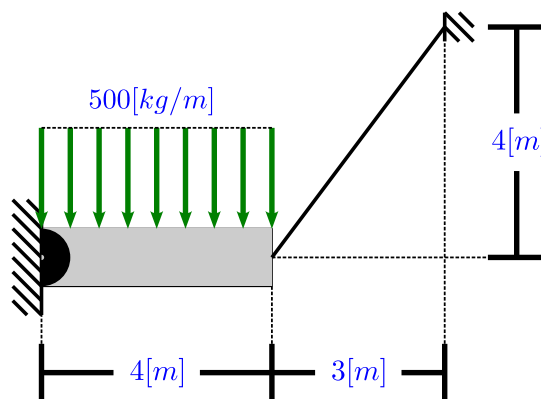
$$-M_A + 6A_y = 7000$$

Resolviendo las ecuaciones, se obtienen infinitas soluciones.

Por tanto:

Sistema hiperestático

PROBLEMA 4:



Solución:

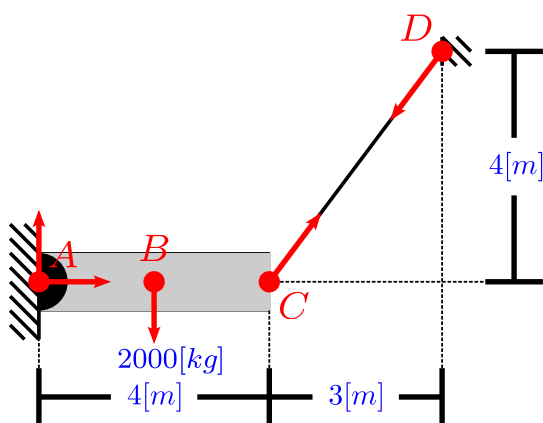
Sistema no concurrente:

Se plantean las ecuaciones de equilibrio:

$$\sum F_x = 0$$

$$\sum F_y = 0$$

Se consideran los siguientes puntos para el calculo de momentos:

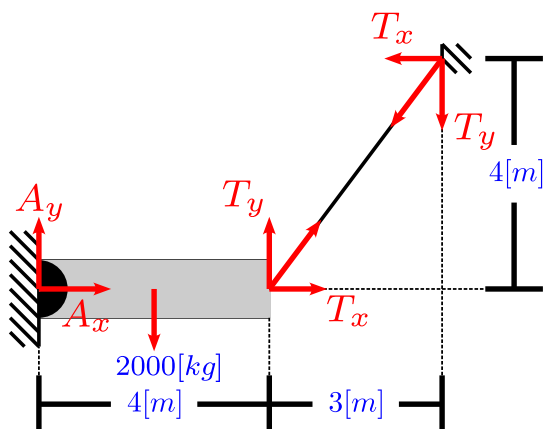


$$\sum M_A = 0$$

$$\sum M_B = 0$$

$$\sum M_C = 0$$

Variables: A_x , A_y , T .



$$\sum F_x = 0:$$

$$A_x + T_x = 0$$

$$A_x + \frac{3}{5}T = 0$$

$$\sum F_y = 0:$$

$$A_y - 2000 + T_y = 0$$

$$A_y + \frac{4}{5}T = 2000$$

$$\sum M_A = 0:$$

$$2000(2) - T_y(4) = 0$$

$$\frac{16}{5}T = 4000$$

$$\sum M_B = 0:$$

$$A_y(2) - T_y(2) = 0$$

$$2A_y - \frac{8}{5}T = 0$$

$$\sum M_C = 0:$$

$$A_y(4) - 2000(2) = 0$$

$$4A_y = 4000$$

Resolviendo el sistema de ecuaciones lineales 3x3:

$$T = 1250[\text{kg}]$$

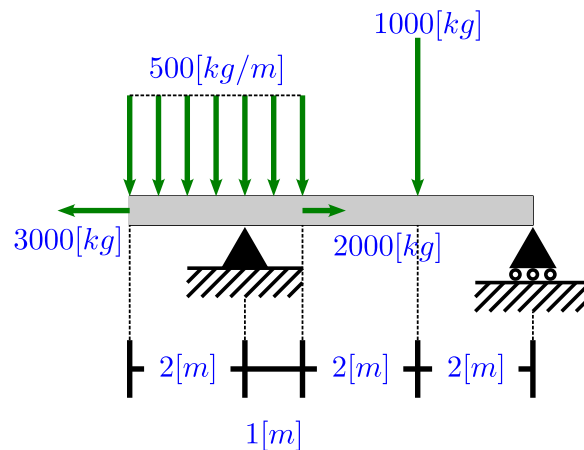
$$A_x = 750[\text{kg}]$$

$$A_y = 1000[\text{kg}]$$

Por tanto:

Sistema isoestático

PROBLEMA 5:



Solución:

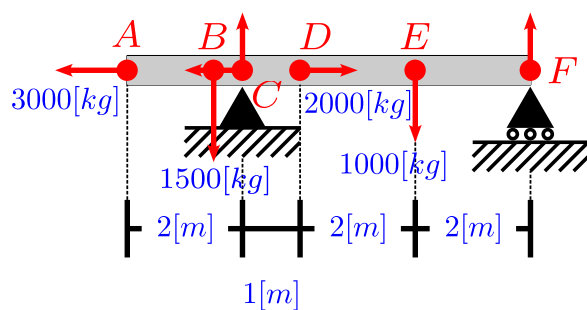
Sistema no concurrente:

Se plantean las ecuaciones de equilibrio:

$$\sum F_x = 0$$

$$\sum F_y = 0$$

Se consideran los siguientes puntos para el calculo de momentos:



$$\sum M_A = 0$$

$$\sum M_B = 0$$

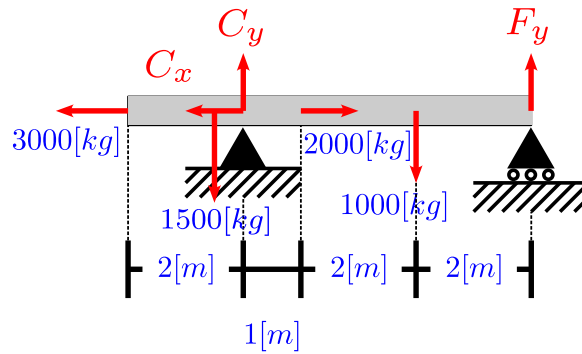
$$\sum M_C = 0$$

$$\sum M_D = 0$$

$$\sum M_E = 0$$

$$\sum M_F = 0$$

Variables: C_x , C_y , F_y .



$$\sum F_x = 0:$$

$$-3000 - C_x + 2000 = 0$$

$$C_x = -1000$$

$$\sum F_y = 0:$$

$$-1500 + C_y - 1000 + F_y = 0$$

$$C_y + F_y = 2500$$

$$\sum M_A = 0:$$

$$1500(1.5) - C_y(2) + 1000(5) - F_y(7) = 0$$

$$2C_y + 7F_y = 7250$$

$$\sum M_B = 0:$$

$$C_y(0.5) - 1000(3.5) + F_y(5.5) = 0$$

$$0.5C_y + 5.5F_y = 3500$$

$$\sum M_C = 0:$$

$$-1500(0.5) + 1000(3) - F_y(5) = 0$$

$$5F_y = 2250$$

$$\sum M_D = 0:$$

$$-1500(1.5) + C_y(1) + 1000(2) - F_y(4) = 0$$

$$C_y - 4F_y = 250$$

$$\sum M_E = 0:$$

$$-1500(3.5) + C_y(3) - F_y(2) = 0$$

$$3C_y - 2F_y = 5250$$

$$\sum M_F = 0:$$

$$-1500(5.5) + C_y(5) - 1000(2) = 0$$

$$5C_y = 10250$$

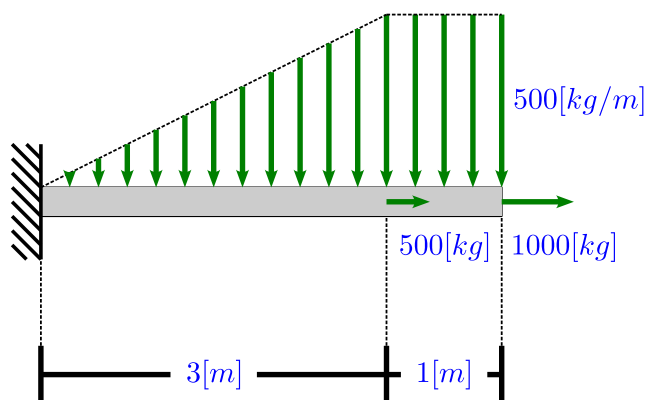
Resolviendo las ecuaciones, se obtiene:

$$\begin{aligned} C_x &= -1000[\text{kg}] \\ C_y &= 2050[\text{kg}] \\ F_y &= 450[\text{kg}] \end{aligned}$$

Por tanto:

Sistema isoestático

PROBLEMA 6:



Solución:

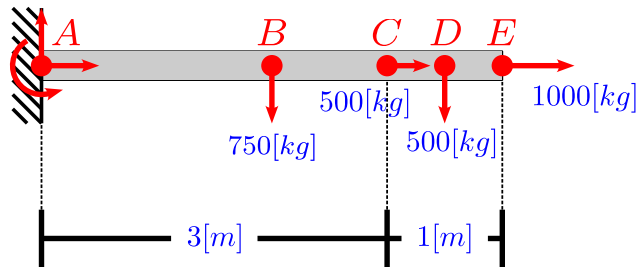
Sistema no concurrente:

Se plantean las ecuaciones de equilibrio:

$$\sum F_x = 0$$

$$\sum F_y = 0$$

Se consideran los siguientes puntos para el calculo de momentos:



$$\sum M_A = 0$$

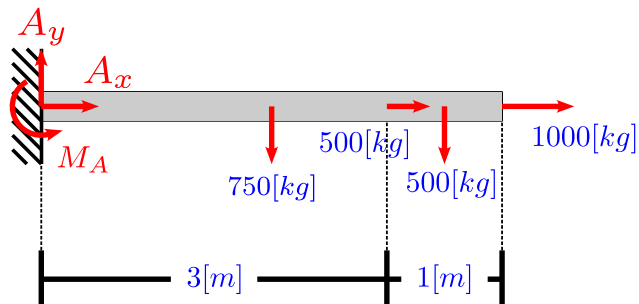
$$\sum M_B = 0$$

$$\sum M_C = 0$$

$$\sum M_D = 0$$

$$\sum M_E = 0$$

Variables: A_x , A_y , M_A .



$$\sum F_x = 0:$$

$$A_x + 500 + 1000 = 0$$

$$A_x = -1500$$

$$\sum F_y = 0:$$

$$A_y - 750 - 500 = 0$$

$$A_y = 1250$$

$$\sum M_A = 0:$$

$$-M_A + 750(2) + 500(3.5) = 0$$

$$M_A = 3250$$

$$\sum M_B = 0:$$

$$-M_A + A_y(2) + 500(1.5) = 0$$

$$-M_A + 2A_y = -750$$

$$\sum M_C = 0:$$

$$-M_A + A_y(3) - 750(1) + 500(0.5) = 0$$

$$-M_A + 3A_y = 500$$

$$\sum M_D = 0:$$

$$-M_A + A_y(3.5) - 750(1.5) = 0$$

$$-M_A + 3.5A_y = 1125$$

$$\sum M_E = 0:$$

$$-M_A + A_y(4) - 750(2) - 500(0.5) = 0$$

$$-M_A + 4A_y = 1750$$

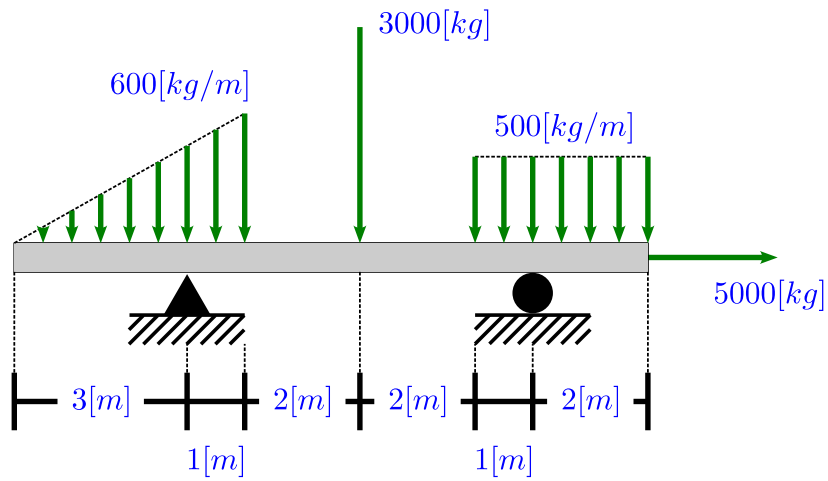
Resolviendo las ecuaciones, se obtiene:

$\begin{aligned}A_x &= -1500[\text{kg}] \\A_y &= 1250[\text{kg}] \\M_A &= 3250[\text{kg-m}]\end{aligned}$

Por tanto:

Sistema isoestático

PROBLEMA 7:

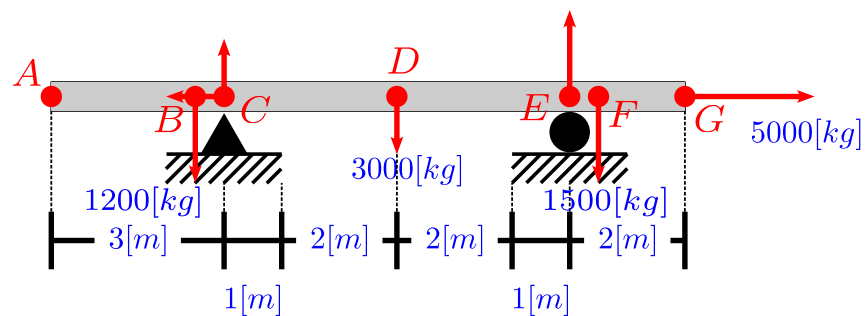
**Solución:****Sistema no concurrente:**

Se plantean las ecuaciones de equilibrio:

$$\sum F_x = 0$$

$$\sum F_y = 0$$

Se consideran los siguientes puntos para el calculo de momentos:



$$\sum M_A = 0$$

$$\sum M_B = 0$$

$$\sum M_C = 0$$

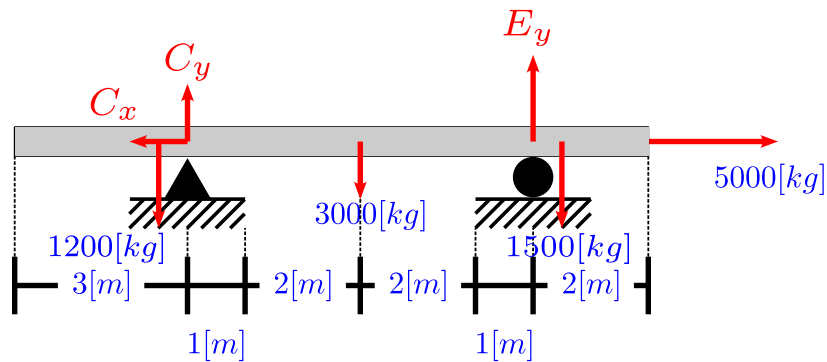
$$\sum M_D = 0$$

$$\sum M_E = 0$$

$$\sum M_F = 0$$

$$\sum M_G = 0$$

Variables: C_x , C_y , E_y .



$$\sum F_x = 0:$$

$$C_x - 5000 = 0$$

$$C_x = 5000$$

$$\sum F_y = 0:$$

$$-1200 + C_y - 3000 + E_y - 1500 = 0$$

$$C_y + E_y = 5700$$

$$\sum M_A = 0:$$

$$1200(4)\left(\frac{2}{3}\right) - C_y(3) + 3000(6) - E_y(9) + 1500(9.5) = 0$$

$$3C_y + 9E_y = 35450$$

$$\sum M_B = 0:$$

$$-C_y\left(\frac{1}{3}\right) + 3000\left(\frac{10}{3}\right) - E_y\left(\frac{19}{3}\right) + 1500\left(\frac{41}{6}\right) = 0$$

$$\frac{1}{3}C_y + \frac{19}{3}E_y = 20250$$

$$\sum M_C = 0:$$

$$-1200\left(\frac{1}{3}\right) + 3000(3) - E_y(6) + 1500(6.5) = 0$$

$$E_y = 3058.33$$

$$\sum M_D = 0:$$

$$-1200\left(\frac{10}{3}\right) + C_y(3) - E_y(3) + 1500(3.5) = 0$$

$$3C_y - 3E_y = -1250$$

$$\sum M_E = 0:$$

$$-1200\left(\frac{19}{3}\right) + C_y(6) - 3000(3) + 1500(0.5) = 0$$

$$C_y = 2641.67$$

$$\sum M_F = 0:$$

$$-1200\left(\frac{41}{6}\right) + C_y(6.5) - 3000(3.5) + E_y(0.5) = 0$$

$$6.5C_y + 0.5E_y = 18700$$

$$\sum M_G = 0:$$

$$-1200\left(\frac{25}{3}\right) + C_y(8) - 3000(5) + E_y(2) - 1500(1.5) = 0$$

$$8C_y + 2E_y = 27250$$

Resolviendo las ecuaciones, se obtiene:

$$C_x = 5000[\text{kg}]$$

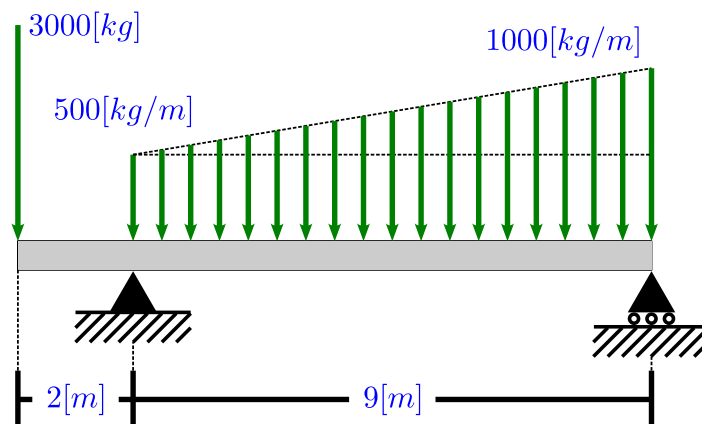
$$C_y = 2641.67[\text{kg}]$$

$$E_y = 3058.33[\text{kg}]$$

Por tanto:

Sistema isoestático

PROBLEMA 8:



Solución:

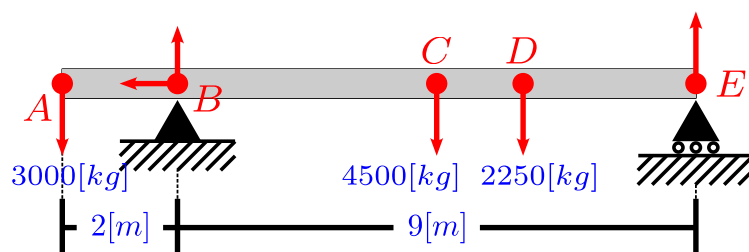
Sistema no concurrente:

Se plantean las ecuaciones de equilibrio:

$$\sum F_x = 0$$

$$\sum F_y = 0$$

Se consideran los siguientes puntos para el calculo de momentos:



$$\sum M_A = 0$$

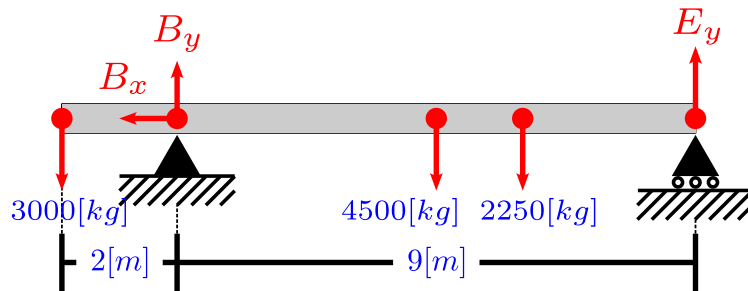
$$\sum M_B = 0$$

$$\sum M_C = 0$$

$$\sum M_D = 0$$

$$\sum M_E = 0$$

Variables: B_x , B_y , E_y .



$$\sum F_x = 0:$$

$$B_x = 0$$

$$\sum F_y = 0:$$

$$-3000 + B_y - 4500 - 2250 + E_y = 0$$

$$B_y + E_y = 9750$$

$$\sum M_A = 0:$$

$$-B_y(2) + 4500(6.5) + 2250(8) - E_y(11) = 0$$

$$2B_y + 11E_y = 47250$$

$$\sum M_B = 0:$$

$$-3000(2) + 4500(4.5) + 2250(6) - E_y(9) = 0$$

$$9E_y = 27750$$

$$\sum M_C = 0:$$

$$-3000(6.5) + B_y(4.5) + 2250(1.5) - E_y(4.5) = 0$$

$$4.5B_y - 4.5E_y = 16125$$

$$\sum M_D = 0:$$

$$-3000(8) + B_y(6) - 4500(1.5) - E_y(3) = 0$$

$$6B_y - 3E_y = 30750$$

$$\sum M_E = 0:$$

$$-3000(11) + B_y(9) - 4500(4.5) - 2250(3) = 0$$

$$9B_y = 60000$$

Resolviendo las ecuaciones, se obtiene:

$$B_x = 0[\text{kg}]$$

$$B_y = 6666.67[\text{kg}]$$

$$E_y = 3083.33[\text{kg}]$$

Por tanto:

Sistema isoestático