

STATIKA

4 SKS

Garis Pengaruh



FAKULTAS TEKNIK
JURUSAN SIPIL
UNIVERSITAS BRAWIJAYA

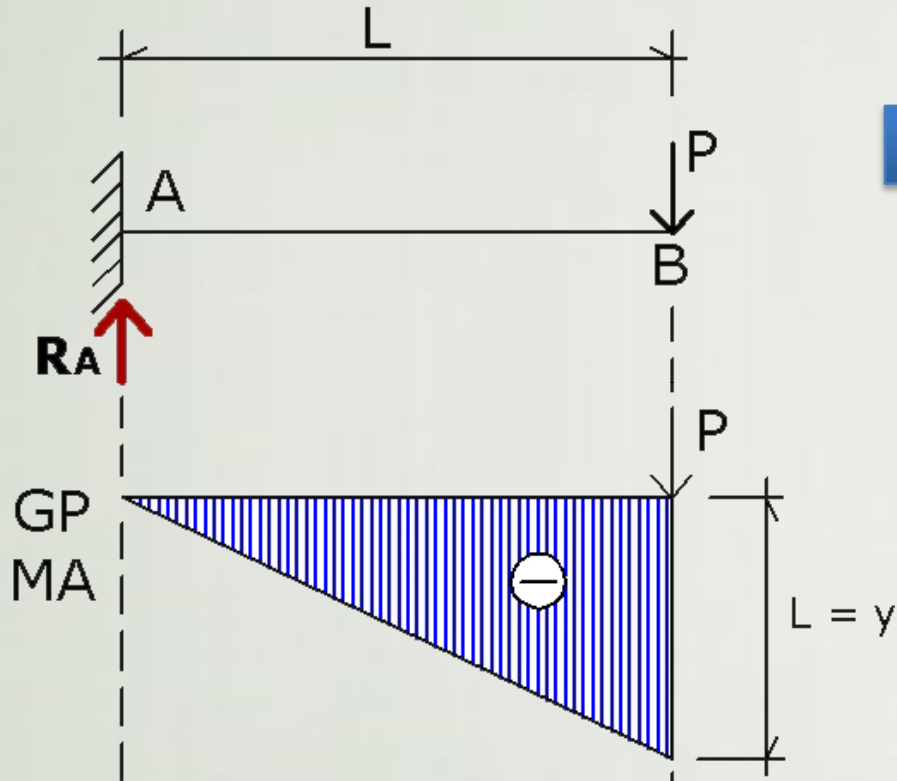
- Konstruksi pada umumnya dan jembatan pada khususnya mendukung beban yang bergerak.
- Kedudukan beban tersebut selalu berubah-ubah, sehingga pengaruhnya pada setiap tampang konstruksi akan selalu berubah-ubah pula.
- Maka perlu diketahui posisi yang bagaimana yang akan menimbulkan maksimum . Untuk keperluan ini kita mempergunakan GARIS PENGARUH

Garis Pengaruh :

Suatu grafik yang menunjukkan besarnya pengaruh dari suatu satuan beban untuk setiap perubahan kedudukan

Garis Pengaruh Momen dan Gaya Lintang

Contoh. 1

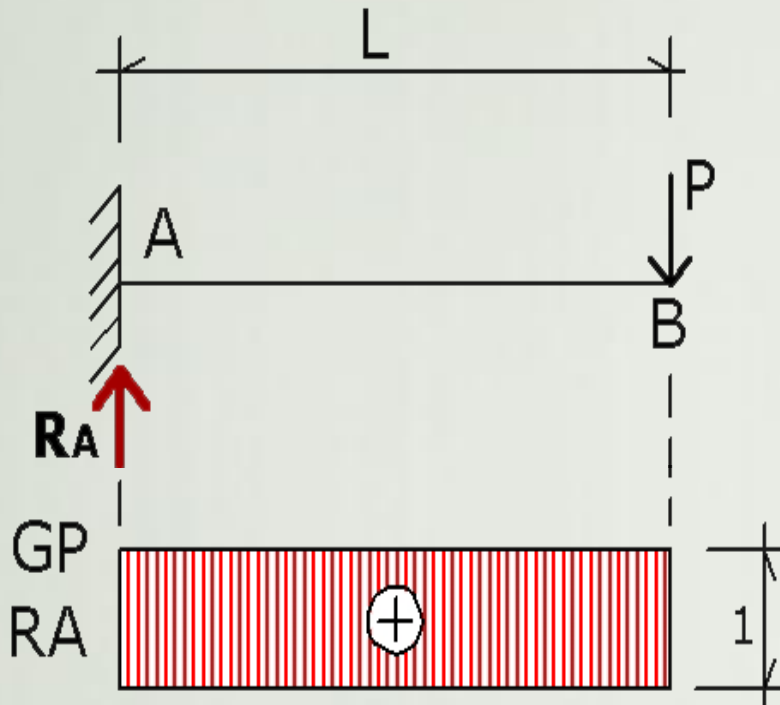


Mencari Momen Cara Garis Pengaruh

$$MA = P \cdot y$$

P = beban

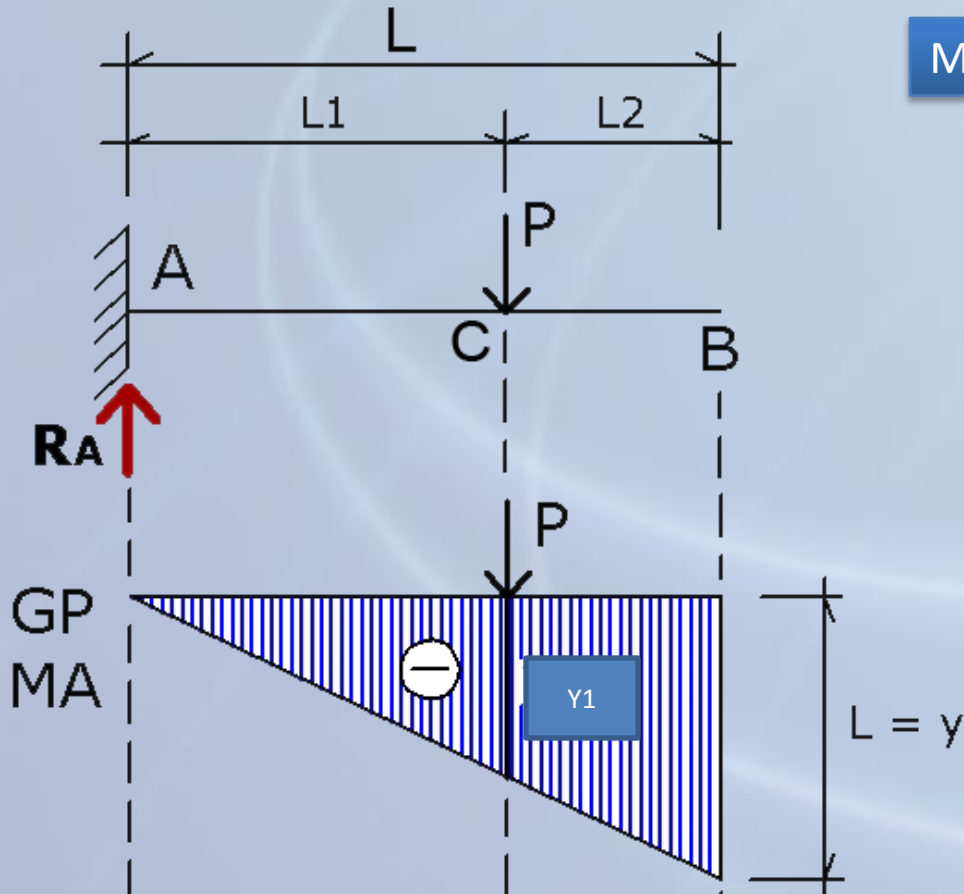
y = ordinat



Mencari Gaya Lintang Cara Garis Pengaruh

$$R_A = P$$

Contoh. 2

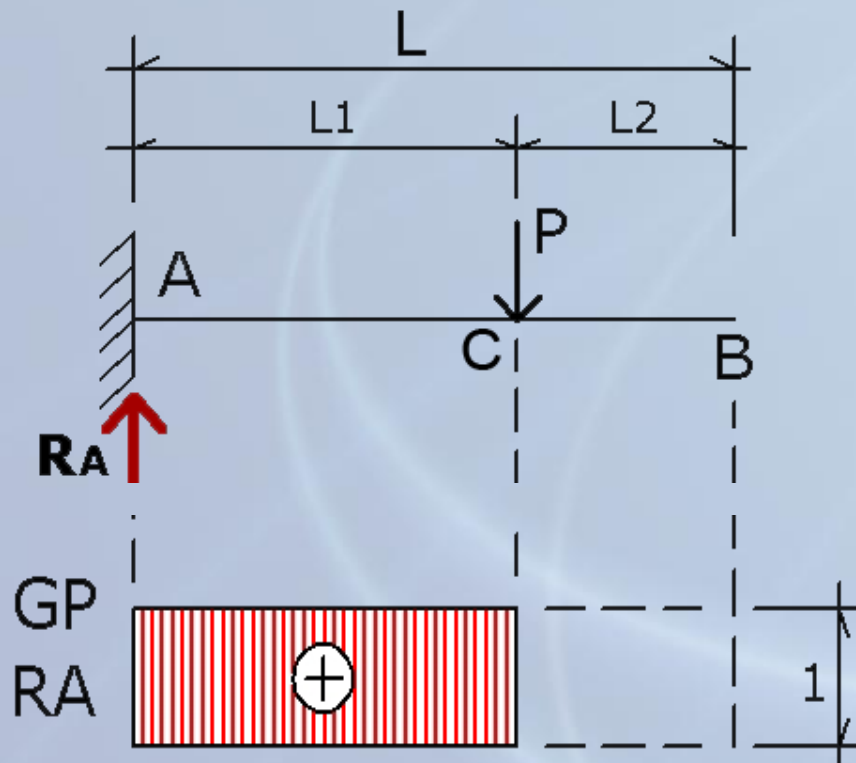


Mencari Momen Cara Garis Pengaruh

$$\frac{y_1}{y} = \frac{L_1}{L}$$

$$y_1 = \frac{y \cdot L_1}{L}$$

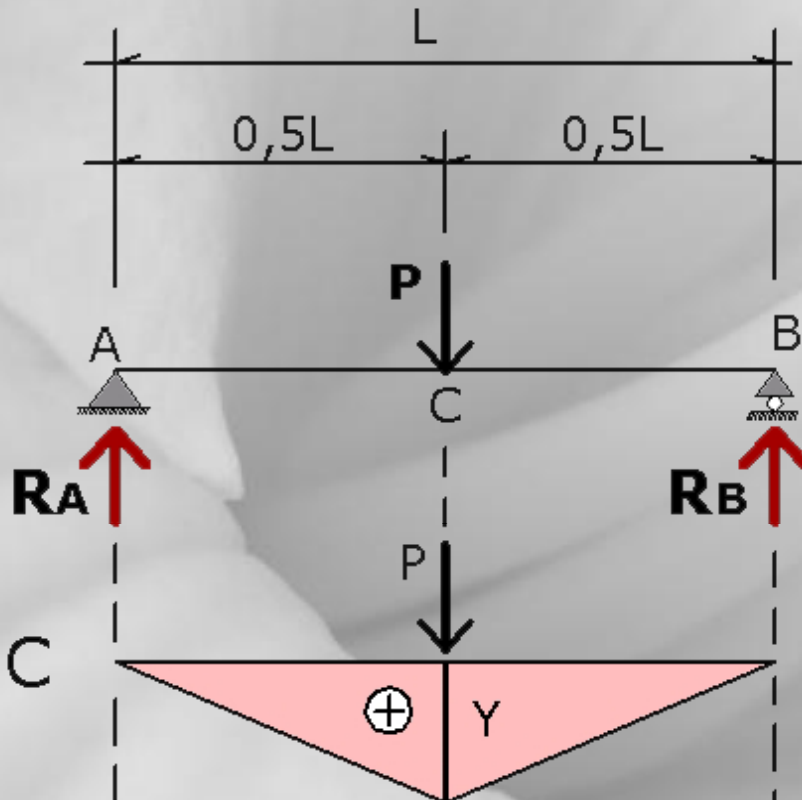
$$M_A = P \frac{y \cdot L_1}{L}$$



Mencari Gaya Lintang Cara Garis Pengaruh

$$R_A = P$$

Contoh. 3



Mencari Momen Cara Biasa

$$\Sigma V = 0$$

$$R_A = R_B \\ = 0,5 P$$

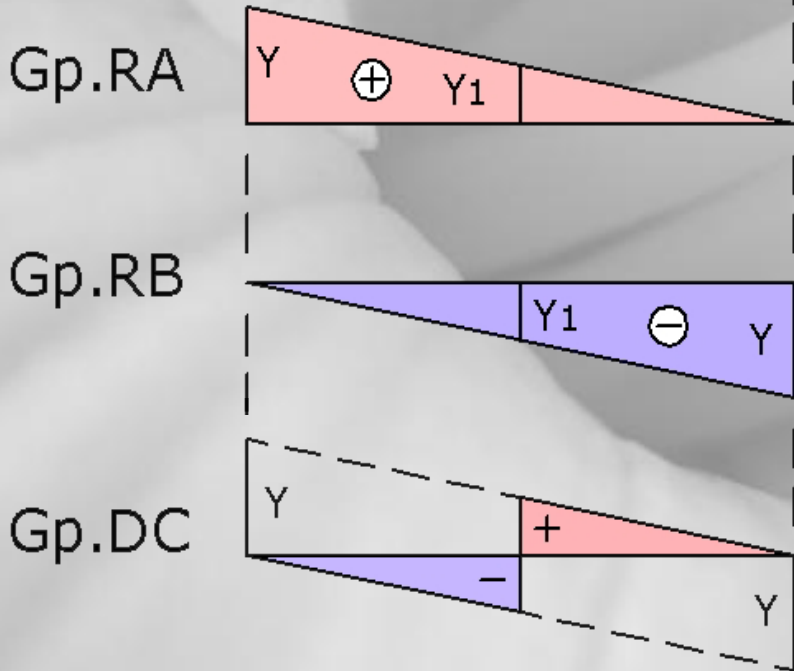
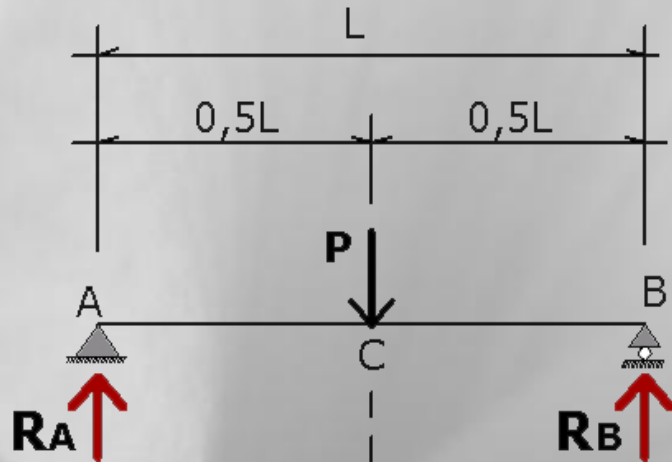
$$M_C = R_A \cdot 0,5 L \\ = 0,5 P \cdot 0,5 L \\ = 0,25 P \cdot L \\ = \frac{1}{4} P \cdot L$$

Mencari Momen Cara Garis Pengaruh

$$y = \frac{0,5L \cdot 0,5L}{L} \\ = 0,25L \\ = \frac{1}{4} L$$

$$M_C = P \cdot \frac{1}{4} L \\ = \frac{1}{4} P \cdot L$$

Mencari Gaya Lintang Cara Garis Pengaruh



Garis pengaruh : RA (DA)

$$y = 1$$

$$\frac{y_1}{y} = \frac{0,5L}{L}$$

$$y_1 = 0,5$$

$$R_A = 0,5 P$$

Garis pengaruh : RB (DB)

$$y = 1$$

$$\frac{y_1}{y} = \frac{0,5L}{L}$$

$$y_1 = 0,5$$

$$R_B = 0,5 P$$

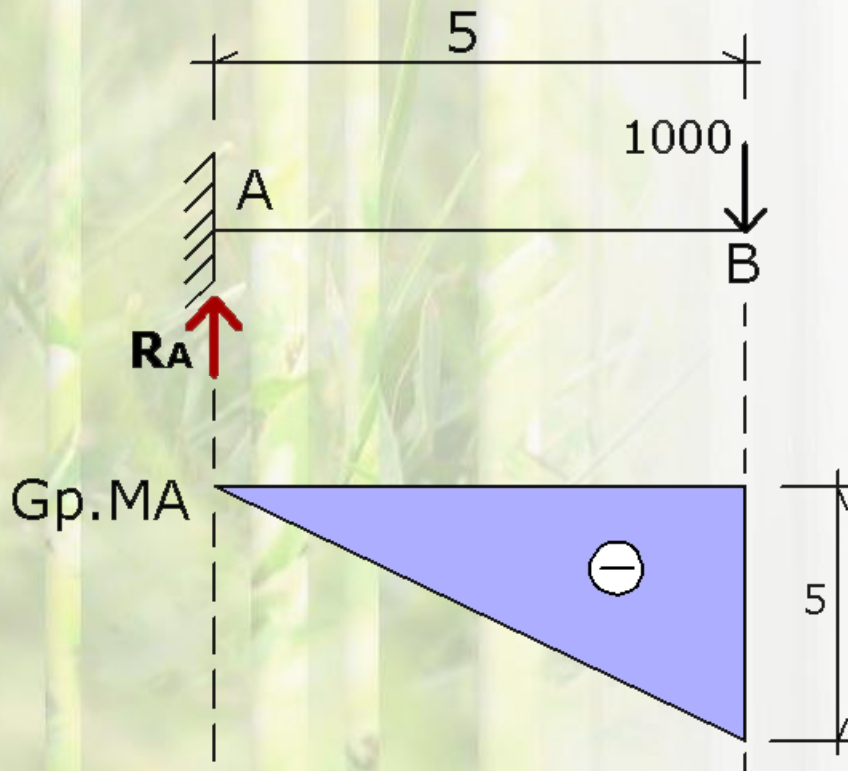
Garis pengaruh : RC (DC)

$$y = 1$$

Ayo Coba
Soalnya...!!!



37) Gambar bidang momen dan gaya lintang.



MOMEN

a) Cara biasa.

$$P = 1000 \text{ kg}$$

$$\Sigma V = 0$$

$$\begin{aligned} R_A &= P \\ &= 1000 \text{ kg} \end{aligned}$$

$$\begin{aligned} M_A &= P \cdot L \\ &= 1000 \cdot 5 \\ &= \mathbf{5000 \text{ kgm}} \end{aligned}$$

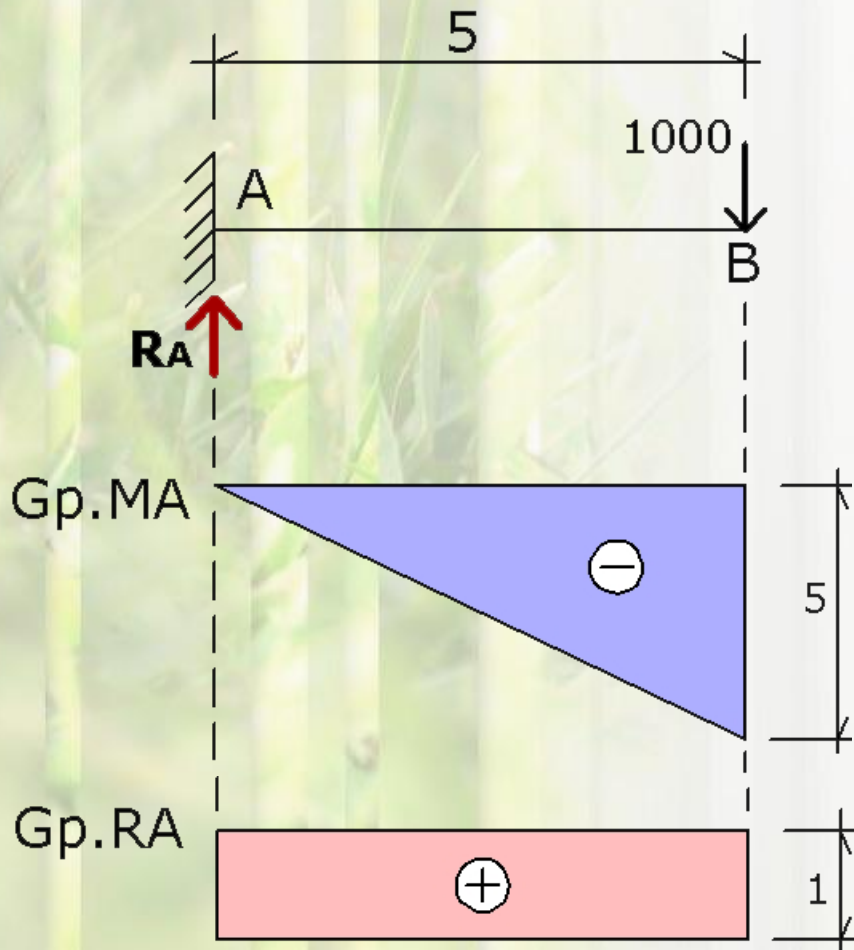
b) Cara garis pengaruh.

Ordinat :

$$y = L = 5 \text{ m}$$

$$\begin{aligned} M_A &= P \cdot y \\ &= 1000 \cdot 5 \\ &= \mathbf{5000 \text{ kgm}} \end{aligned}$$

37) Gambar bidang momen dan gaya lintang.



GAYA LINTANG

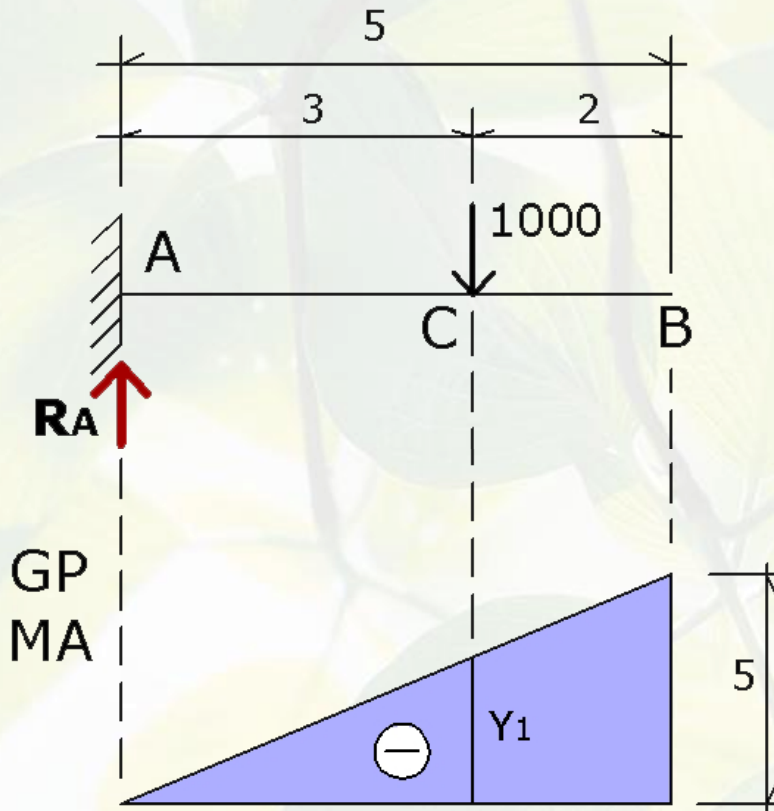
Ordinat : $y = 1$

$$R_A = P$$

$$= 1000$$

$$= \mathbf{1000 \text{ kg}}$$

38) Gambar bidang momen dan gaya lintang.
 $P = 1000 \text{ kg}$



MOMEN

a) Cara Biasa

$$\Sigma V = 0$$

$$\begin{aligned} RA &= P \\ &= 1000 \text{ kg} \end{aligned}$$

$$\begin{aligned} MA &= P \cdot 3 \\ &= 1000 \cdot 3 \\ &= 3000 \text{ kgm} \end{aligned}$$

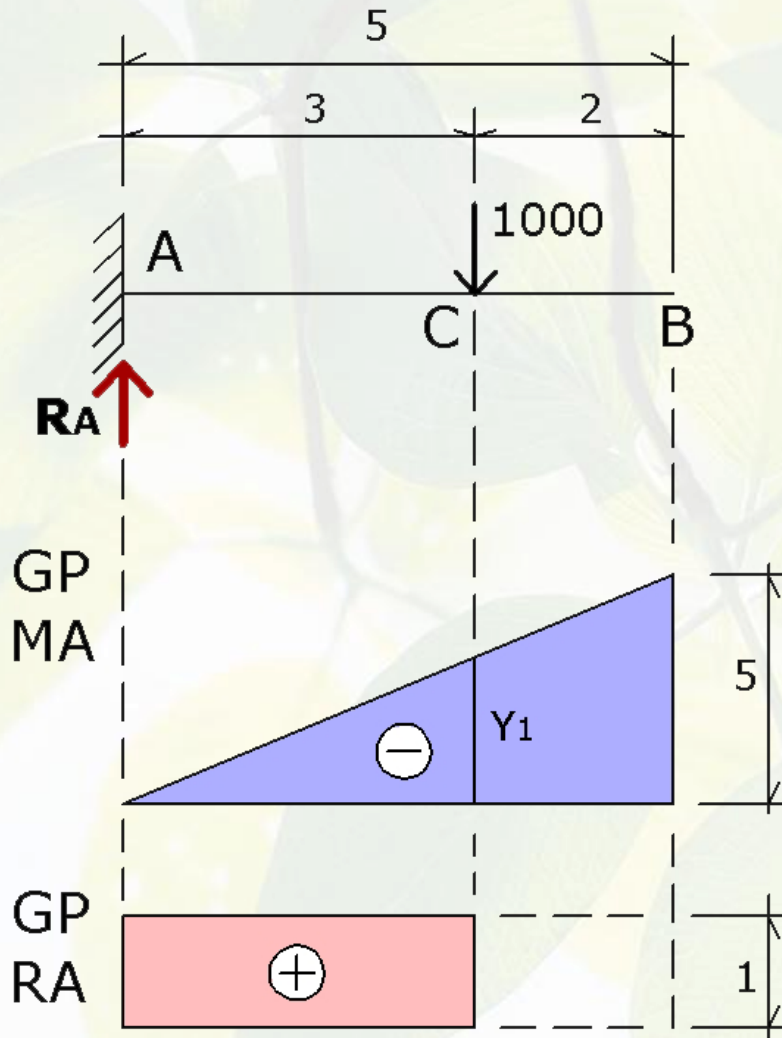
b) Cara garis pengaruh.

Ordinat : $y = L = 5 \text{ m}$

$$\frac{y_1}{5} = \frac{3}{5}$$

$$\begin{aligned} MA &= P \cdot y_1 \\ &= 1000 \cdot 3 \\ &= 3000 \text{ kgm} \end{aligned}$$

38) Gambar bidang momen dan gaya lintang.
 $P = 1000 \text{ kg}$

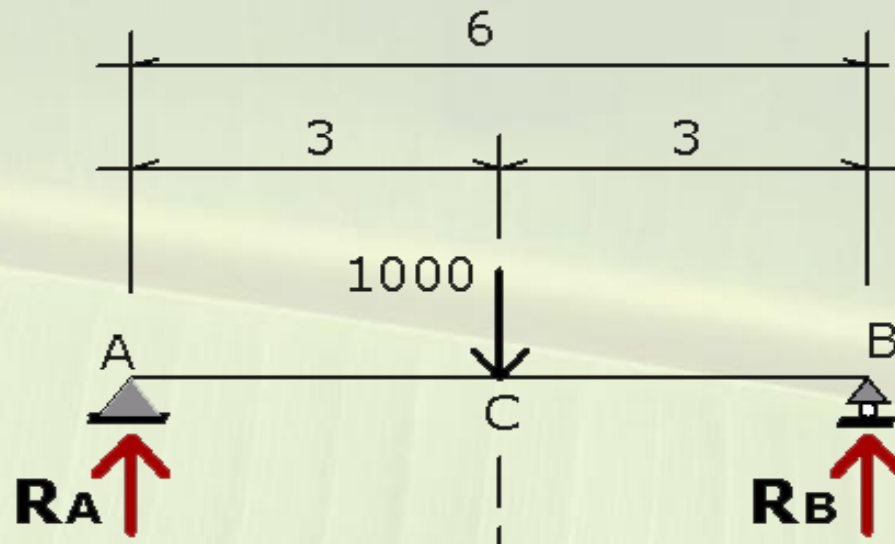


GAYA LINTANG

Ordinat : $y = 1$

$$RA = P$$
$$= 1000$$
$$= 1000 \text{ kg}$$

39) Gambar bidang momen dan gaya lintang.
P = 1000 kg



Cara Biasa

$$\Sigma V = 0$$

$$R_A + R_B = P$$

$$R_A + R_B = 1000$$

$$R_A = R_B = 0,5 \cdot 1000$$
$$= 500 \text{ kg}$$

$$M_C = R_A \cdot 3$$

$$= 500 \cdot 3$$

$$= 1500 \text{ kgm}$$

Cara Garis Pengaruh

Momen

Ordinat : y

$$y = \frac{3.3}{6}$$

$$y = 1,5$$

$$\begin{aligned} MC &= P \cdot y \\ &= 1000 \cdot 1,5 \\ &= \mathbf{1500 \text{ kgm}} \end{aligned}$$

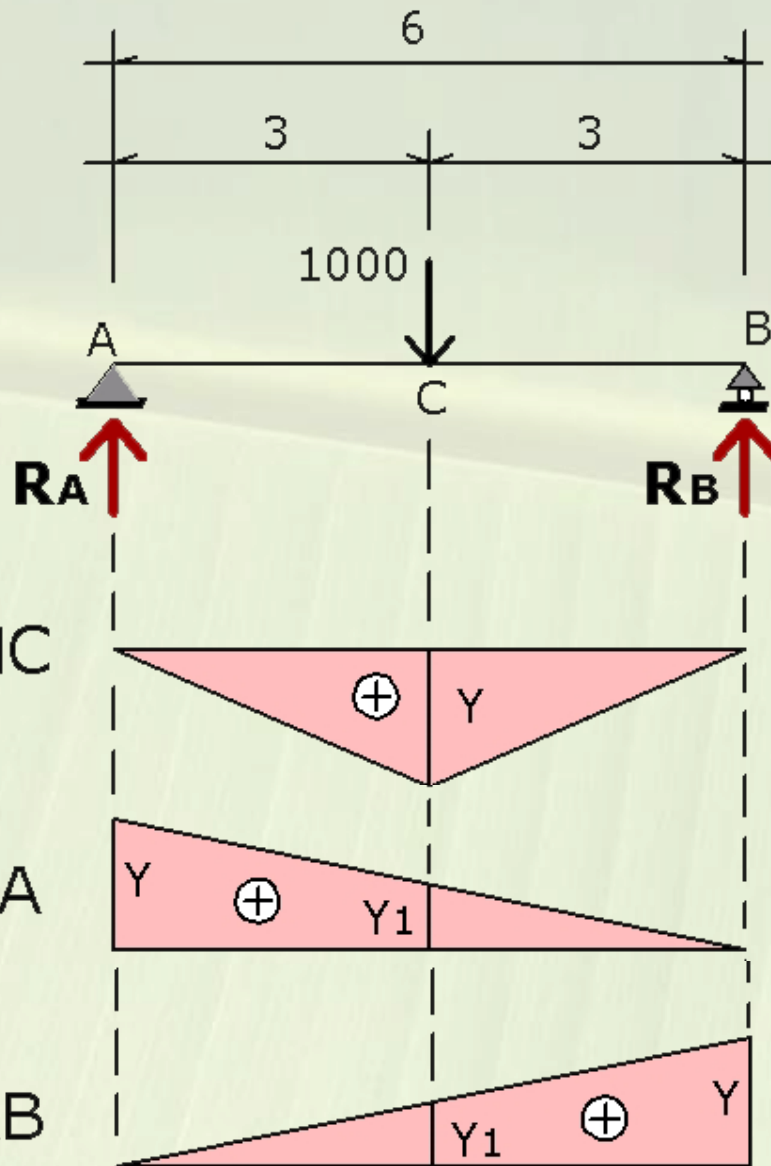
Gaya Lintang

Ordinat : y = 1

$$\frac{y_1}{1} = \frac{3}{6}$$

$$\begin{aligned} RA &= P \cdot y_1 \\ &= 1000 \cdot 0,5 \\ &= \mathbf{500 \text{ kg}} \end{aligned}$$

$$\begin{aligned} RB &= P \cdot y_1 \\ &= 1000 \cdot 0,5 \\ &= \mathbf{500 \text{ kg}} \end{aligned}$$



40) Gambar bidang momen dan gaya lintang.
P = 1000 kg

Cara Biasa

$$\Sigma M_B = 0$$

$$R_A \cdot 6 - P \cdot 3 - P \cdot 1,5 = 0$$

$$6 R_A - 1000 \cdot 3 - 1000 \cdot 1,5 = 0$$

$$6 R_A - 3000 - 1500 = 0$$

$$6 R_A - 4500 = 0$$

$$R_A = 750 \text{ kg}$$

$$\Sigma M_A = 0$$

$$R_B \cdot 6 - P \cdot 3 - P \cdot 4,5 = 0$$

$$6 R_B - 1000 \cdot 3 - 1000 \cdot 4,5 = 0$$

$$6 R_B - 3000 - 4500 = 0$$

$$6 R_B - 7500 = 0$$

$$R_B = 1250 \text{ kg}$$

$$\Sigma V = 0$$

$$R_A + R_B = 2 P$$

$$750 + 1250 = 2 \cdot 1000$$

$$2000 = 2000 \rightarrow \text{ok}$$

$$M_C = R_A \cdot 3$$

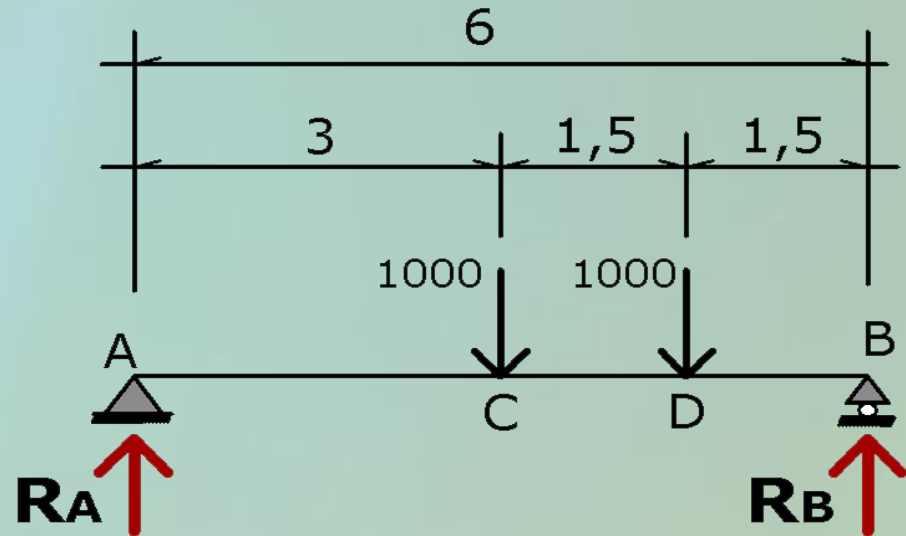
$$= 750 \cdot 3$$

$$= 2250 \text{ kgm}$$

$$M_D = R_B \cdot 1,5$$

$$= 1250 \cdot 1,5$$

$$= 1875 \text{ kgm}$$



Cara Garis Pengaruh

Momen

Ordinat : $y \rightarrow MC$

$$y = \frac{3.3}{6}$$

$$y = 1,5$$

$$\frac{y_1}{1,5} = \frac{1,5}{3}$$

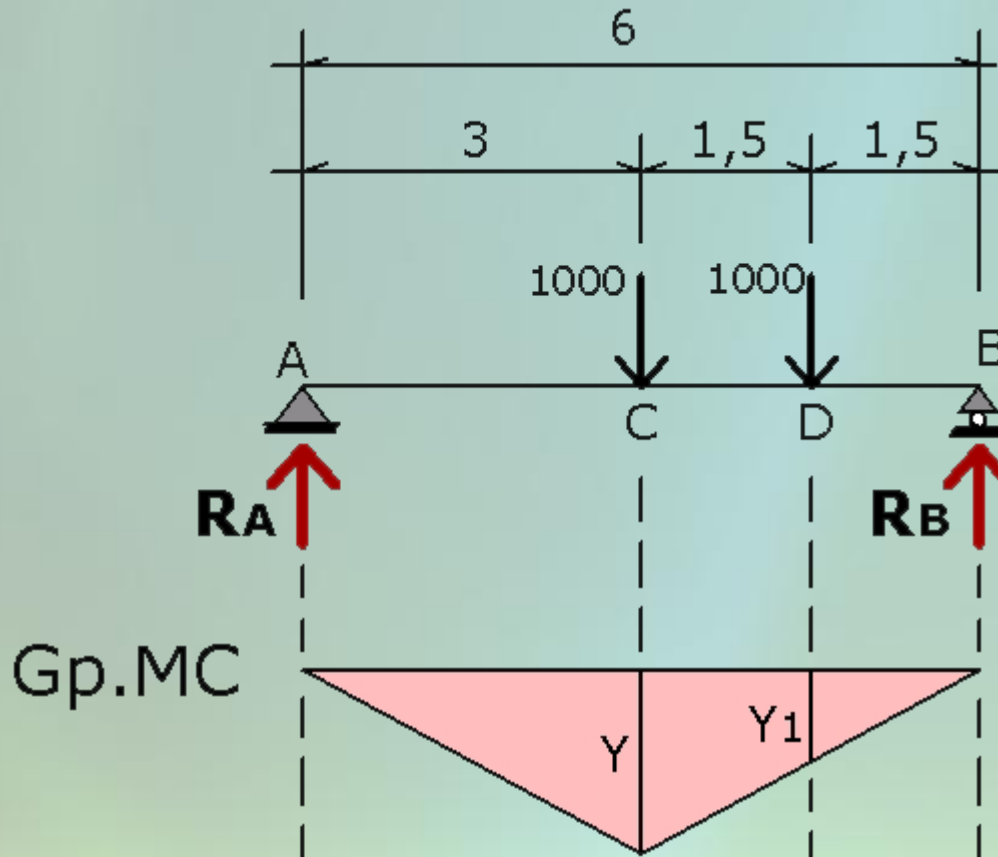
$$y_1 = 0,75$$

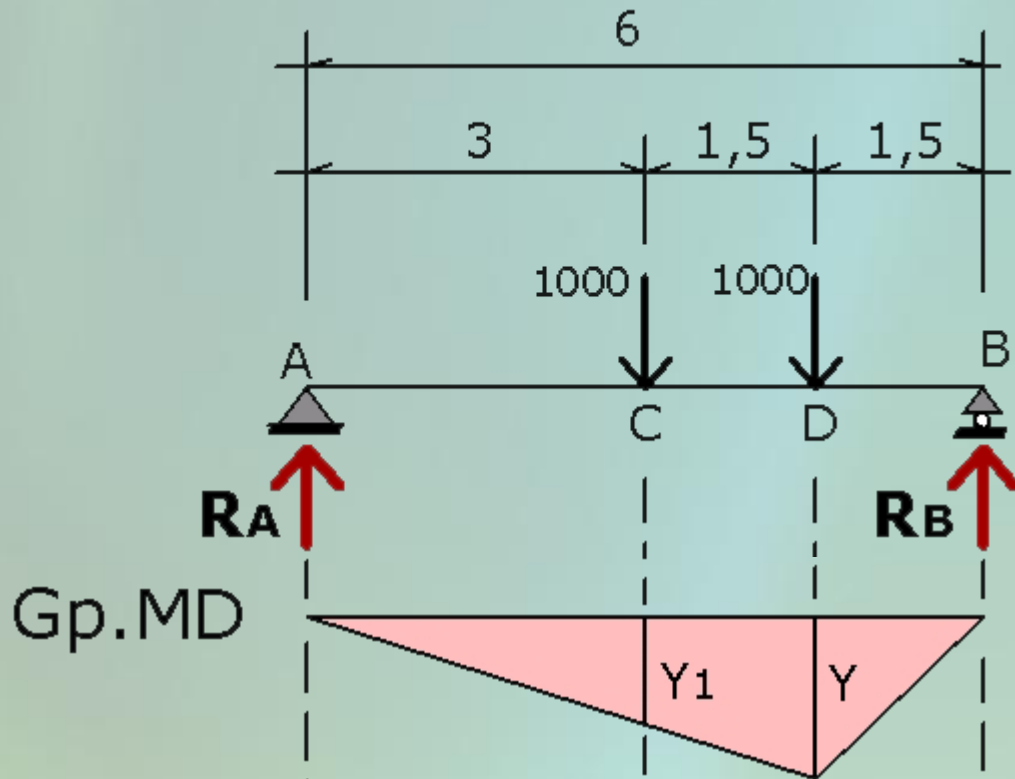
$$MC = P. y + P. y_1$$

$$= 1000. 1,5 + 1000. 0,75$$

$$= 1500 + 750$$

$$= \mathbf{2250 \text{ kgm}}$$





Ordinat : $y \rightarrow MD$

$$y = \frac{1,5 \cdot 4,5}{6}$$

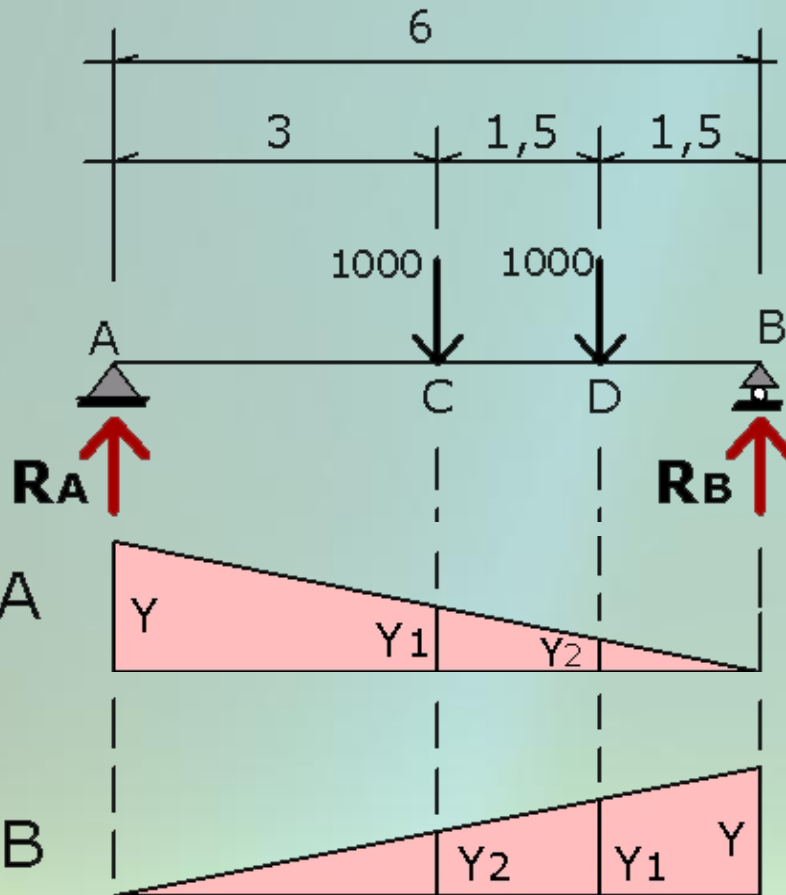
$$y = 1,125$$

$$\frac{y_1}{1,125} = \frac{3}{4,5}$$

$$y_1 = 0,75$$

$$\begin{aligned} MD &= P \cdot y + P \cdot y_1 \\ &= 1000 \cdot 1,125 + 1000 \cdot 0,75 \\ &= 1125 + 750 \\ &= \mathbf{1875 \text{ kgm}} \end{aligned}$$

Gaya Lintang



Garis pengaruh RA

Ordinat : $y = 1$

$$y_1 = \frac{3}{6} \quad \left| \quad y_2 = \frac{1,5}{6}$$
$$y_1 = 0,5 \quad \left| \quad y_2 = 0,25$$

$$\begin{aligned} RA &= P \cdot y_1 + P \cdot y_2 \\ &= 1000 \cdot 0,5 + 1000 \cdot 0,25 \\ &= 500 + 250 \\ &= \mathbf{750 \text{ kg}} \end{aligned}$$

Garis pengaruh RB

Ordinat : $y = 1$

$$y_1 = \frac{4,5}{6} \quad \left| \quad y_2 = \frac{3}{6}$$
$$y_1 = 0,75 \quad \left| \quad y_2 = 0,5$$

$$\begin{aligned} RB &= P \cdot y_1 + P \cdot y_2 \\ &= 1000 \cdot 0,75 + 1000 \cdot 0,5 \\ &= 750 + 500 \\ &= \mathbf{1250 \text{ kg}} \end{aligned}$$

Contoh. 3

Mencari Momen Cara Garis Pengaruh

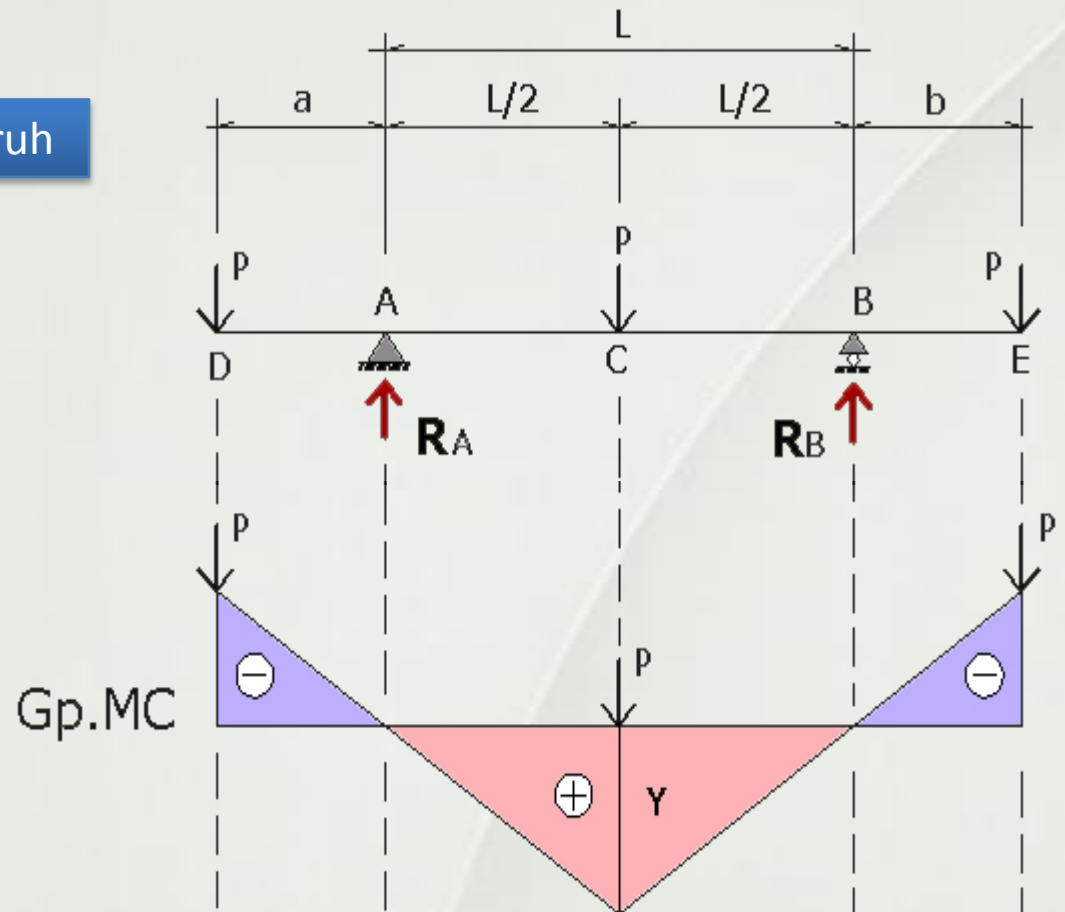
$$y = \frac{0,5L \cdot 0,5L}{L}$$

$$y = 0,25L$$

$$\frac{y}{y + y_2} = \frac{0,5L}{0,5L + b} \rightarrow y_2$$

$$\frac{y}{y + y_2} = \frac{0,5L}{0,5L + a} \rightarrow y_1$$

$$\mathbf{MC = P \cdot y - P \cdot y_1 - P \cdot y_2}$$



Garis pengaruh : RA (DA)

$$\frac{y_1}{y} = \frac{0,5L}{L} \rightarrow y_1 = 0,5$$

$$\frac{y}{y_2} = \frac{L}{L+a}$$

$$y_2 = \frac{L+a}{L}$$

$$\frac{y_1}{y_3} = \frac{0,5L}{0,5L+b}$$

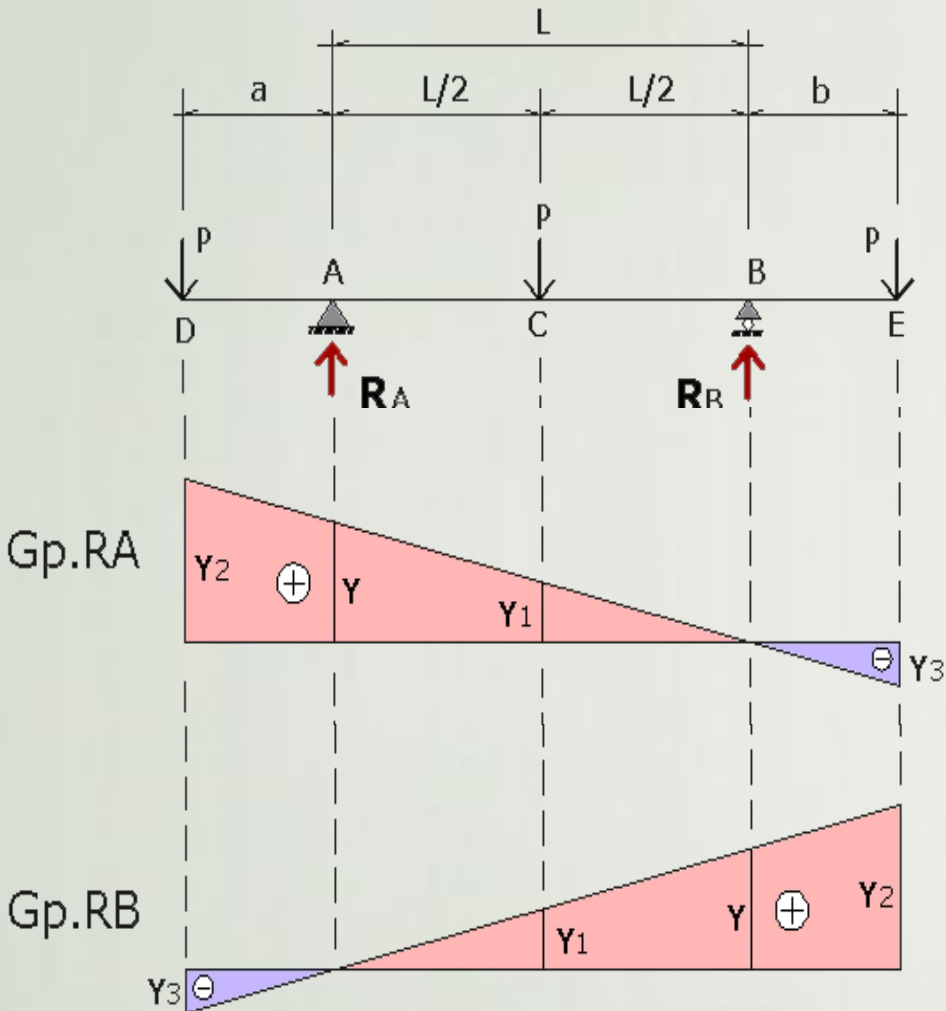
$$y_3 = \frac{y_1(0,5L+b)}{0,5L}$$

$$RA = P \cdot y_1 + P \cdot y_2 - P \cdot y_3$$

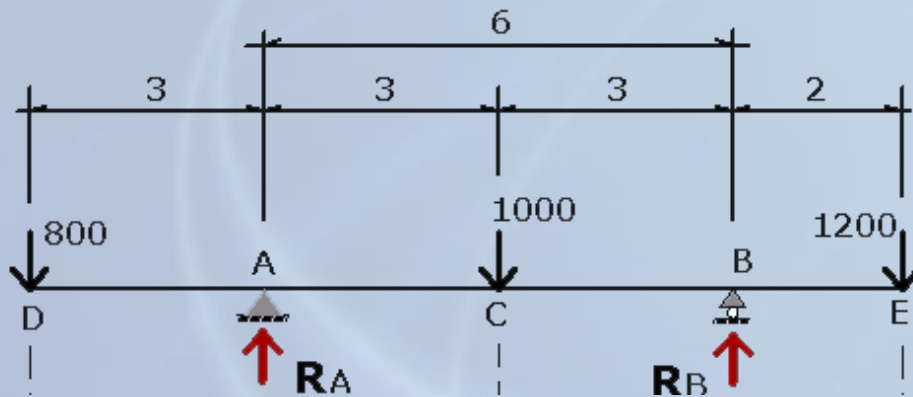
Garis pengaruh : RB (DB)

$$y = 1$$

$$RB = P \cdot y_1 + P \cdot y_2 - P \cdot y_3$$



41) Gambar bidang momen dan gaya lintang.
 $P_1 = 800 \text{ kg}$, $P_2 = 1000 \text{ kg}$, $P_3 = 1200 \text{ kg}$



$$MA = 800 \cdot 3$$

$$= 2400 \text{ kgm}$$

$$MB = 1200 \cdot 2$$

$$= 2400 \text{ kgm}$$

$$MC = 1700 \cdot 3 - 1200 \cdot 5$$

$$= -900 \text{ k}$$

Cara Biasa

$$\Sigma MB = 0$$

$$RA \cdot 6 + P_3 \cdot 2 - P_1 \cdot 9 - P_2 \cdot 3 = 0$$

$$RA \cdot 6 + 1200 \cdot 2 - 800 \cdot 9 - 1000 \cdot 3 = 0$$

$$6 RA + 2400 - 7200 - 3000 = 0$$

$$6 RA - 7800 = 0$$

$$RA = 1300 \text{ kg}$$

$$\Sigma MA = 0$$

$$RB \cdot 6 + P_1 \cdot 3 - P_2 \cdot 3 - P_3 \cdot 8 = 0$$

$$RB \cdot 6 + 800 \cdot 3 - 1000 \cdot 3 - 1200 \cdot 8 = 0$$

$$6 RB + 2400 - 3000 - 9600 = 0$$

$$6 RB - 10200 = 0$$

$$RB = 1700 \text{ kg}$$

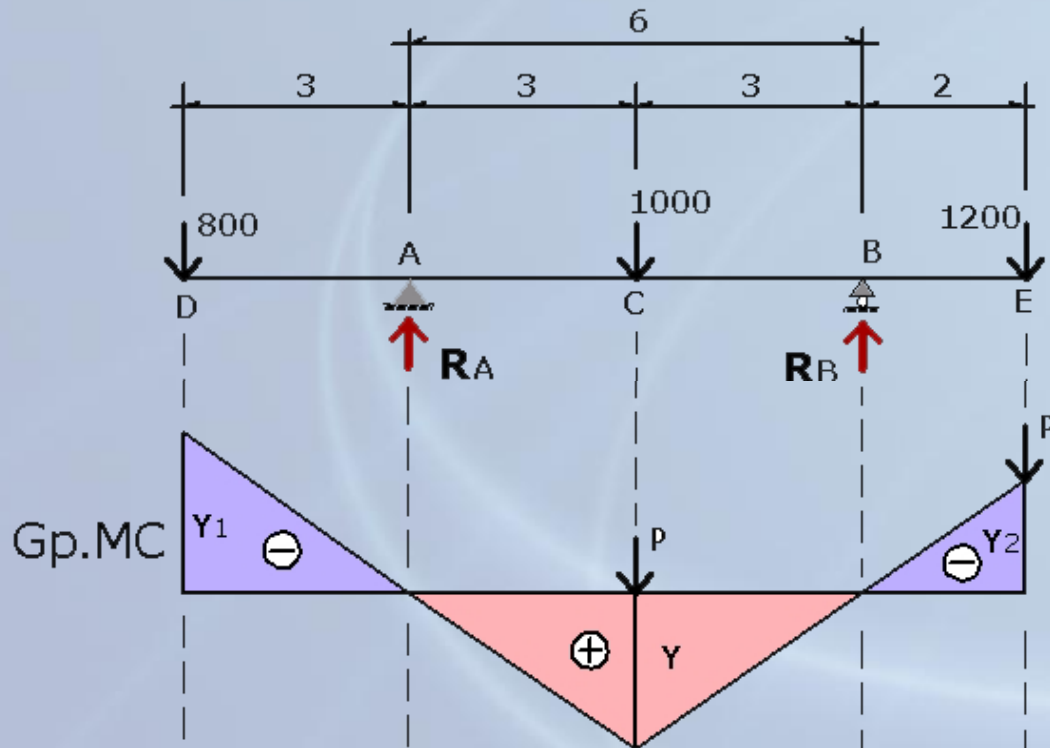
$$\Sigma V = 0$$

$$RA + RB = P_1 + P_2 + P_3$$

$$1300 + 1700 = 800 + 1000 + 1200$$

$$3000 = 3000 \rightarrow \text{ok}$$

Cara Garis Pengaruh



Momen

Ordinat : $y \rightarrow MC$

$$y = \frac{3.3}{6}$$

$$y = 1.5$$

$$\frac{1.5}{y_1 + 1.5} = \frac{3}{6} \rightarrow y_1 = 1.5$$

$$\frac{1.5}{y_2 + 1.5} = \frac{3}{5} \rightarrow y_2 = 1$$

$$\begin{aligned} MC &= P_2 \cdot y - P_1 \cdot y_1 - P_3 \cdot y_2 \\ &= 1000 \cdot 1.5 - 800 \cdot 1.5 - 1200 \cdot 1 \\ &= 1500 - 1200 - 1200 \\ &= -900 \text{ kgm} \end{aligned}$$

Gaya Lintang

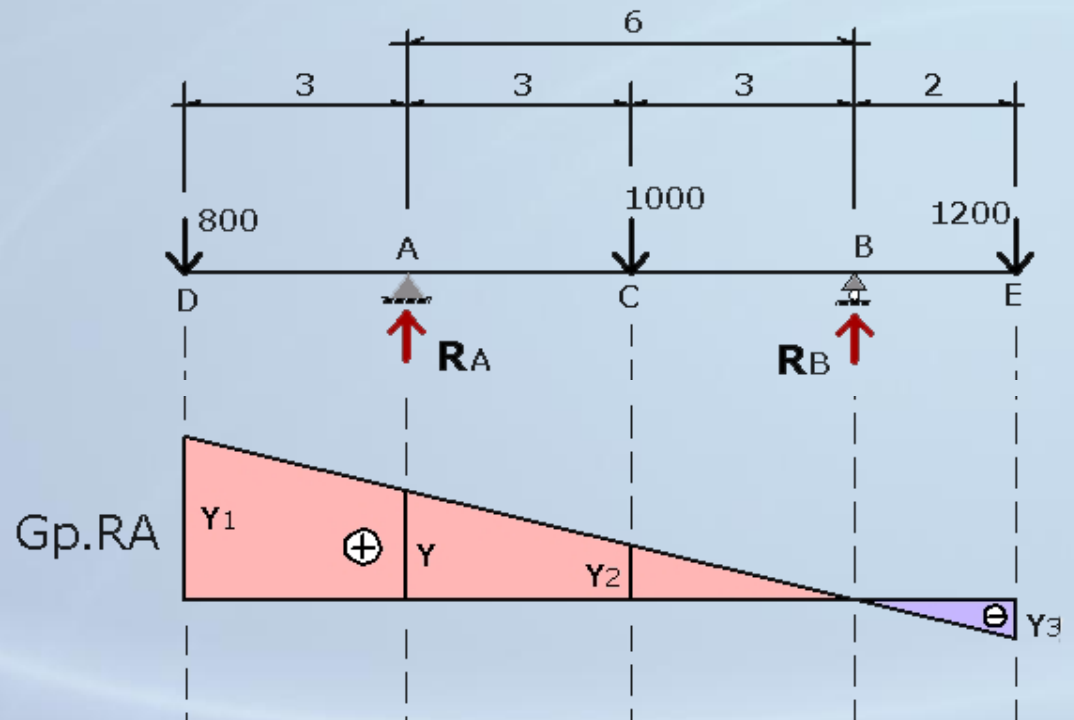
Garis pengaruh RA.

Ordinat : $y = 1$

$$\frac{1}{y_1} = \frac{6}{8} \rightarrow y_1 = 1,333$$

$$\frac{y_2}{1} = \frac{3}{6} \rightarrow y_2 = 0,5$$

$$\frac{1}{y_3+1} = \frac{6}{9} \rightarrow y_3 = 0,5$$



$$\begin{aligned} RA &= P_1 \cdot y_1 + P_2 \cdot y_2 - P_3 \cdot y_3 \\ &= 800 \cdot 1,5 + 1000 \cdot 0,5 - 1200 \cdot 0,333 \\ &= 1200 + 500 - 400 \\ &= \mathbf{1300 \text{ kg}} \end{aligned}$$

Gaya Lintang

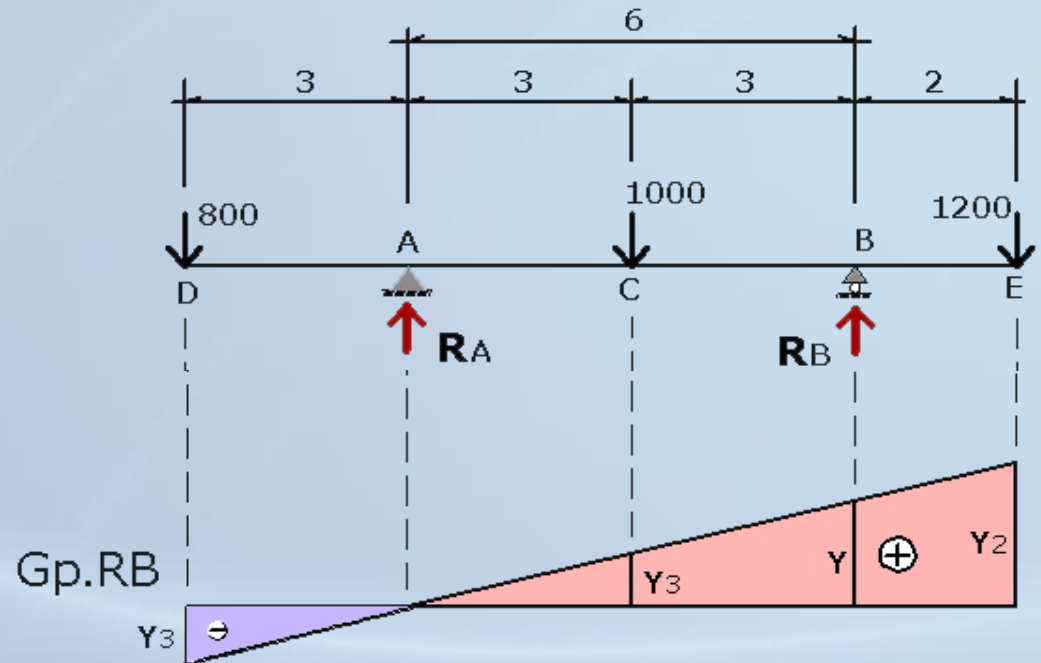
Garis pengaruh RB.

Ordinat : $y = 1$

$$\frac{1}{y_1} = \frac{6}{9} \rightarrow y_1 = 1,5$$

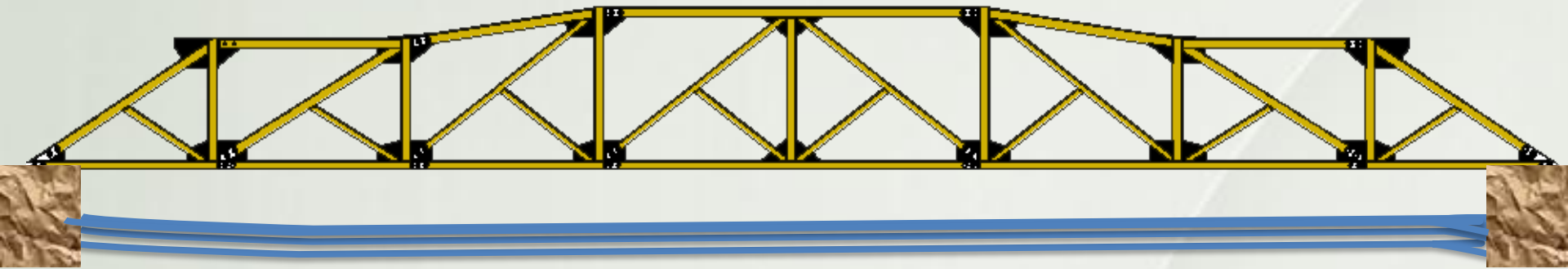
$$\frac{y_2}{1} = \frac{3}{6} \rightarrow y_2 = 0,5$$

$$\frac{1}{y_3+1} = \frac{6}{8} \rightarrow y_3 = 0,333$$

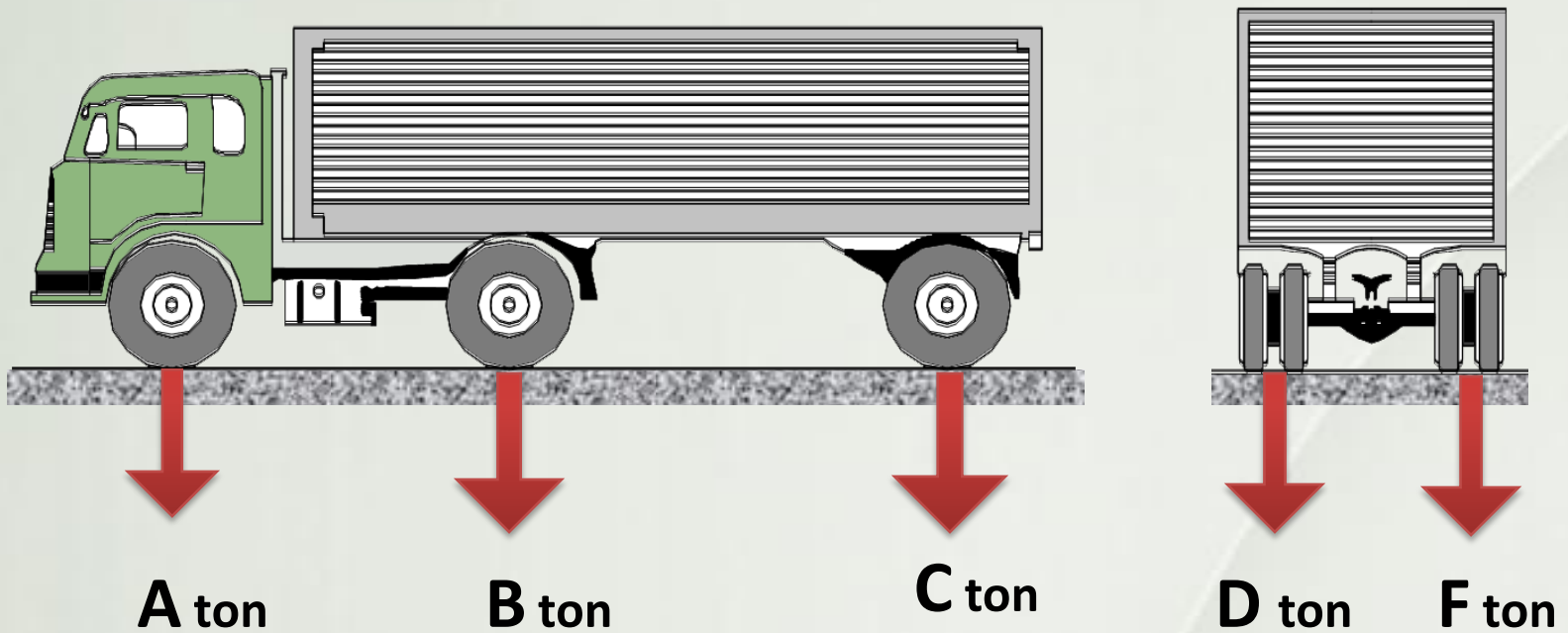


$$\begin{aligned} RB &= P_3 \cdot y_2 + P_2 \cdot y_3 - P_1 \cdot y_1 \\ &= 1200 \cdot 1,333 + 1000 \cdot 0,5 - 800 \cdot 0,5 \\ &= 1600 + 500 - 400 \\ &= \mathbf{1700 \text{ kg}} \end{aligned}$$

BEBAN BERJALAN

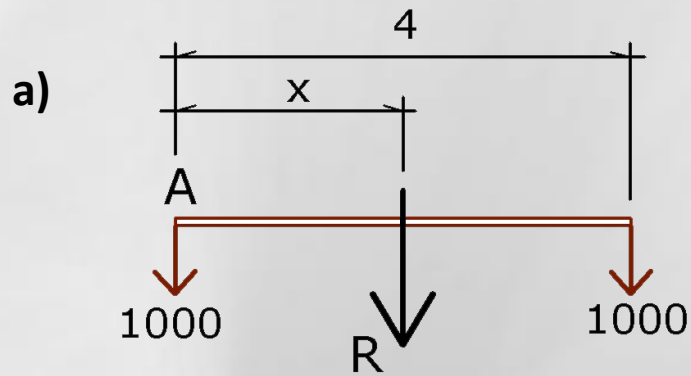


Bagaimana cara membuat pembebanan oleh Sebuah truk untuk Rangka Jembatan diatas?



Apakah Besar beban terpusat A, B, C, D dan F adalah sama?

3.2 Rangkaian Beban Bergerak

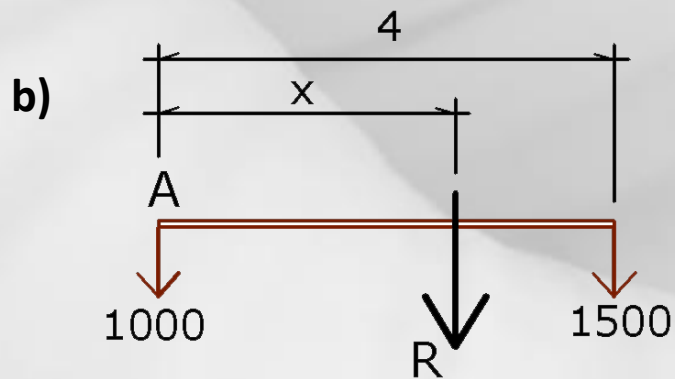


R = resultante gaya vertikal

$$P = 1000 \text{ kg}$$

$$\begin{aligned} R = \Sigma P &= \text{jumlah gaya vertikal} \\ &= P + P \\ &= 1000 + 1000 \\ &= \mathbf{2000 \text{ kg}} \end{aligned}$$

$$\begin{aligned} R \cdot x &= P \cdot 4 \quad (\text{terhadap titik A}) \\ 2000 x &= 1000 \cdot 4 \\ \mathbf{x} &= \mathbf{2 \text{ m}} \end{aligned}$$

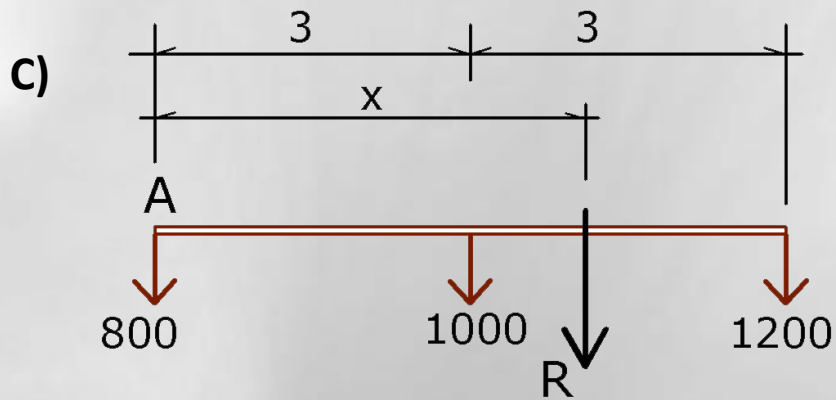


$$P_1 = 1000 \text{ kg}$$

$$P_2 = 1500 \text{ kg}$$

$$\begin{aligned} R = \Sigma P &= P_1 + P_2 \\ &= 1000 + 1500 \\ &= \mathbf{2500 \text{ kg}} \end{aligned}$$

$$\begin{aligned} R \cdot X &= P_2 \cdot 4 \rightarrow (\text{terhadap titik A}) \\ 2500 X &= 1500 \cdot 4 \\ \mathbf{X} &= \mathbf{2,4 \text{ m}} \end{aligned}$$



$$P_1 = 800 \text{ kg}$$

$$P_2 = 1000 \text{ kg}$$

$$P_3 = 1200 \text{ kg}$$

$$R = \sum P = P_1 + P_2 + P_3$$

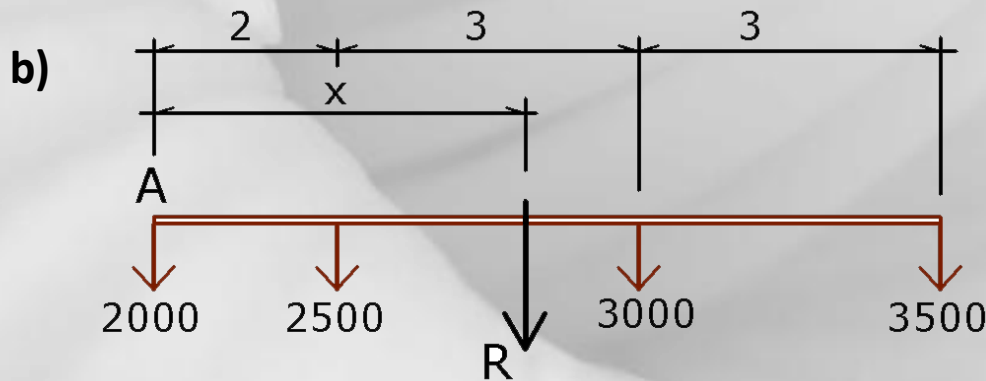
$$= 800 + 1000 + 1200$$

$$= \mathbf{3000 \text{ kg}}$$

$$R \cdot X = P_2 \cdot 3 + P_3 \cdot 6 \quad (\text{terhadap titik A})$$

$$3000 X = 1000 \cdot 3 + 1200 \cdot 6$$

$$X = \mathbf{3,4 \text{ m}}$$



$$P_1 = 2000 \text{ kg}, P_2 = 2500 \text{ kg}$$

$$P_3 = 3000 \text{ kg}, P_4 = 3500 \text{ kg}$$

$$R = \sum P = P_1 + P_2 + P_3 + P_4$$

$$= 2000 + 2500 + 3000 + 3500$$

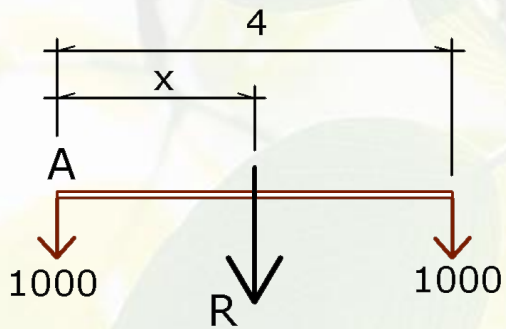
$$= \mathbf{11000 \text{ kg}}$$

$$R x = P_2 \cdot 2 + P_3 \cdot 5 + P_4 \cdot 8 \rightarrow \text{terhadap titik A}$$

$$11000 x = 2500 \cdot 2 + 3000 \cdot 5 + 3500 \cdot 8$$

$$x = \mathbf{4,36 \text{ m}}$$

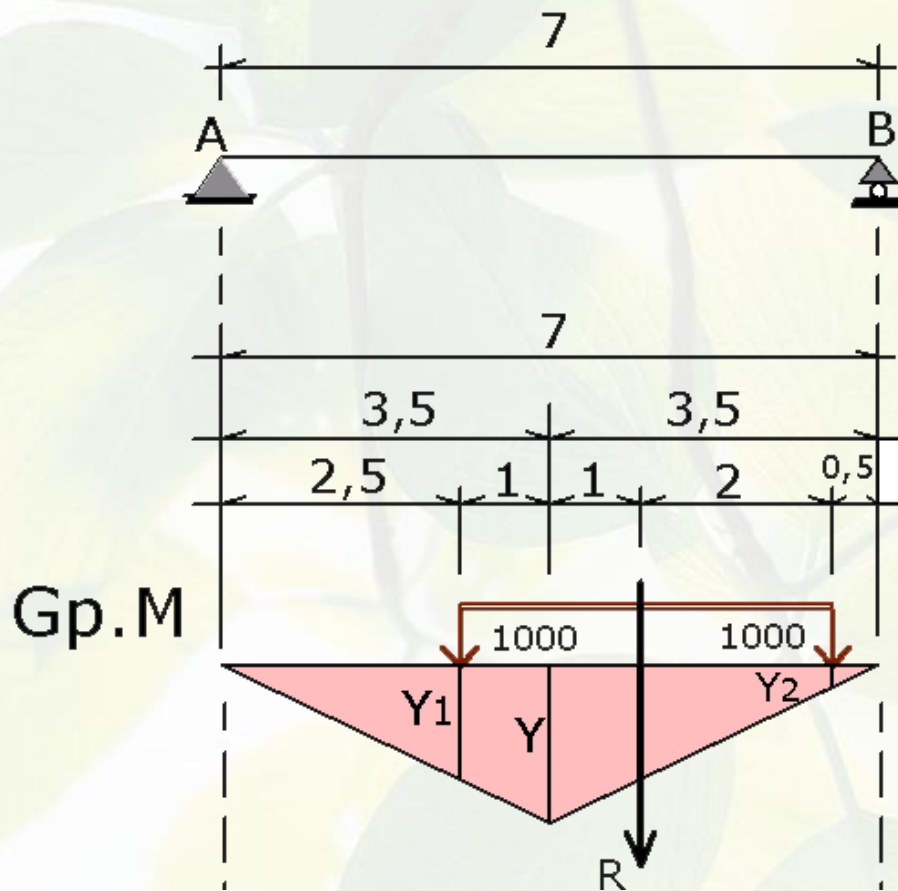
42) Menggunakan garis pengaruh hitung momen maksimum dan gaya lintang maksimum
P = 1000 kg



Letak resultante

$$\begin{aligned} R &= P + P \\ &= 1000 + 1000 \\ &= \mathbf{2000 \text{ kg}} \end{aligned}$$

$$\begin{aligned} R \cdot X &= P \cdot 4 && \text{(terhadap titik A)} \\ 2000 X &= 1000 \cdot 4 \\ X &= 2 \text{ m} \end{aligned}$$



Momen

Ordinat : y

$$y = \frac{3,5 \cdot 3,5}{7}$$

$$y = 1,75$$

$$\frac{y_1}{1,75} = \frac{2,5}{3,5} \rightarrow y_1 = 1,25 \text{ m}$$

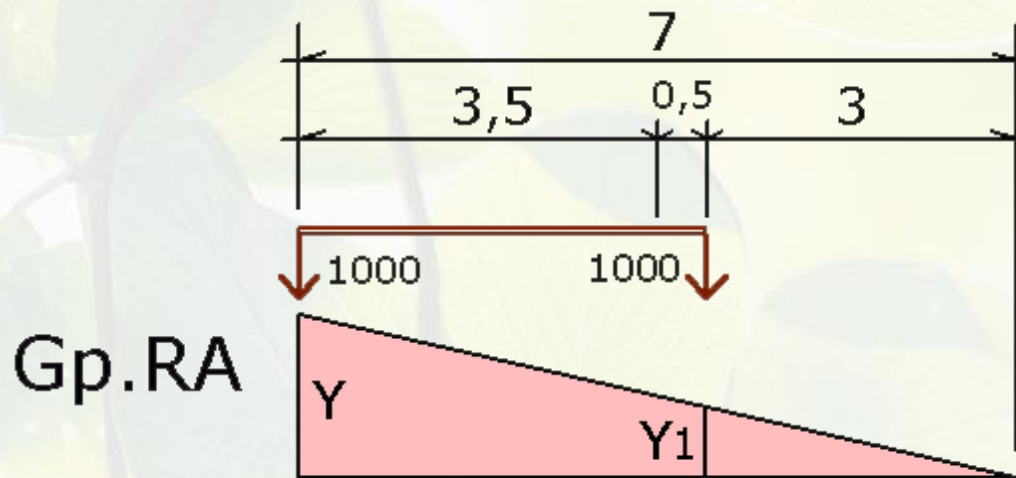
$$\frac{y_2}{1,75} = \frac{0,5}{3,5} \rightarrow y_2 = 0,25 \text{ m}$$

$$M \text{ maks} = P \cdot y_1 + P \cdot y_2$$

$$= 1000 \cdot 1,25 + 1000 \cdot 0,25$$

$$= 1250 + 250$$

$$= \mathbf{1500 \text{ kgm}}$$



Gaya lintang

Ordinat : $y = 1$

$$y_1 = \frac{3}{7}$$

$$y_1 = 0,429$$

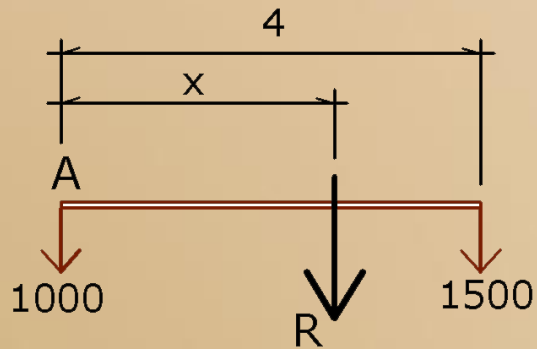
$$RA = P \cdot y + P \cdot y_1$$

$$= 1000 \cdot 1 + 1000 \cdot 0,429$$

$$= 1000 + 429$$

$$= \mathbf{1429 \text{ kg}}$$

43) Menggunakan garis pengaruh hitung momen maksimum dan gaya lintang maksimum
 $P_1 = 1000 \text{ kg}$, $P_2 = 1500 \text{ kg}$



Letak resultante

$$\begin{aligned} R &= P_1 + P_2 \\ &= 1000 + 1500 \\ &= \mathbf{2500 \text{ kg}} \end{aligned}$$

$$\begin{aligned} R \cdot X &= P_2 \cdot 4 \\ 2500 X &= 1500 \cdot 4 \\ \mathbf{X} &= \mathbf{2,4 \text{ m}} \end{aligned}$$

MOMEN

Ordinat : y

Untuk mendapatkan momen maksimum, y ditengah-tengah antara R dan beban terdekat.

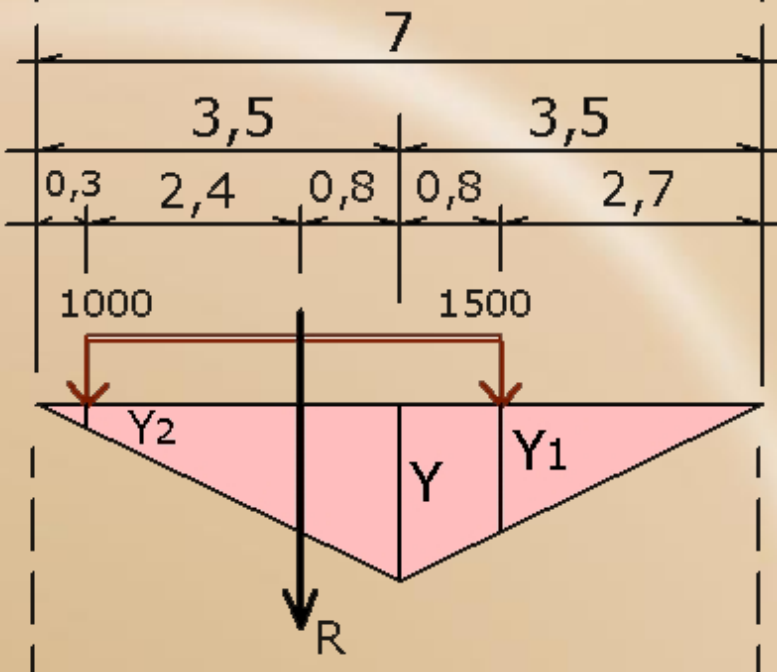
$$y = \frac{3,5 \cdot 3,5}{7} = 1,75$$

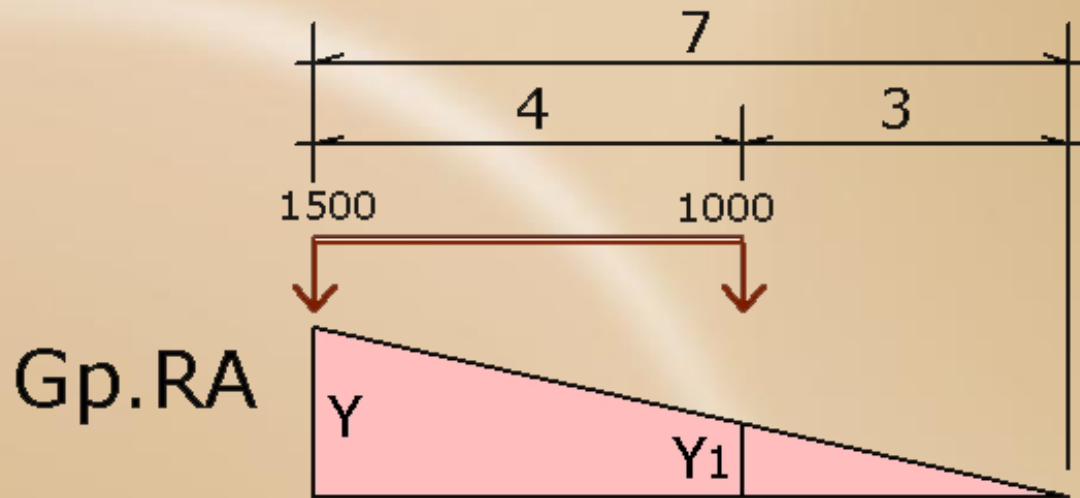
$$\frac{y_1}{1,75} = \frac{2,7}{3,5} \rightarrow y_1 = 1,35 \text{ m}$$

$$\frac{y_2}{1,75} = \frac{0,3}{3,5} \rightarrow y_2 = 0,15 \text{ m}$$

$$\begin{aligned} M \text{ maks} &= P_1 \cdot y_2 + P_2 \cdot y_1 \\ &= 1000 \cdot 0,15 + 1500 \cdot 1,35 \\ &= 150 + 2025 \\ &= \mathbf{2175 \text{ kgm}} \end{aligned}$$

Gp.M





GAYA LINTANG

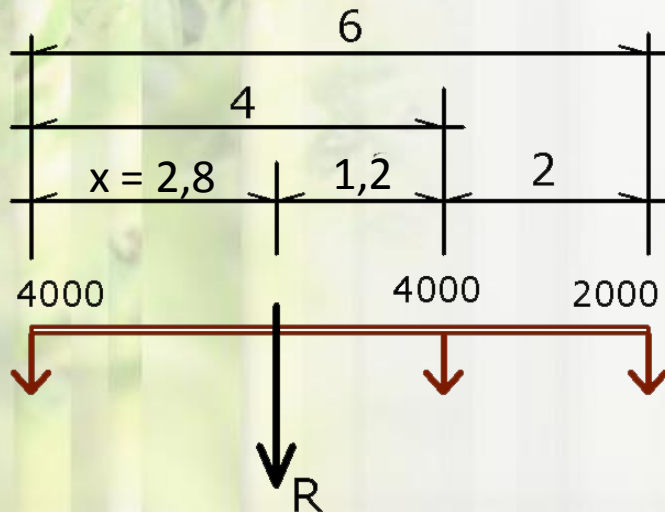
Ordinat : $y = 1$

$$y_1 = \frac{3}{7}$$

$$y_1 = 0,429$$

$$\begin{aligned} RA &= P_2 \cdot y + P_1 \cdot y_1 \\ &= 1500 \cdot 1 + 1000 \cdot 0,429 \\ &= 1500 + 429 \\ &= \mathbf{1929 \text{ kg}} \end{aligned}$$

44) Menggunakan garis pengaruh hitung momen maksimum dan gaya lintang maksimum
 $P_1 = 4000 \text{ kg}$, $P_2 = 4000 \text{ kg}$, $P_3 = 2000 \text{ kg}$

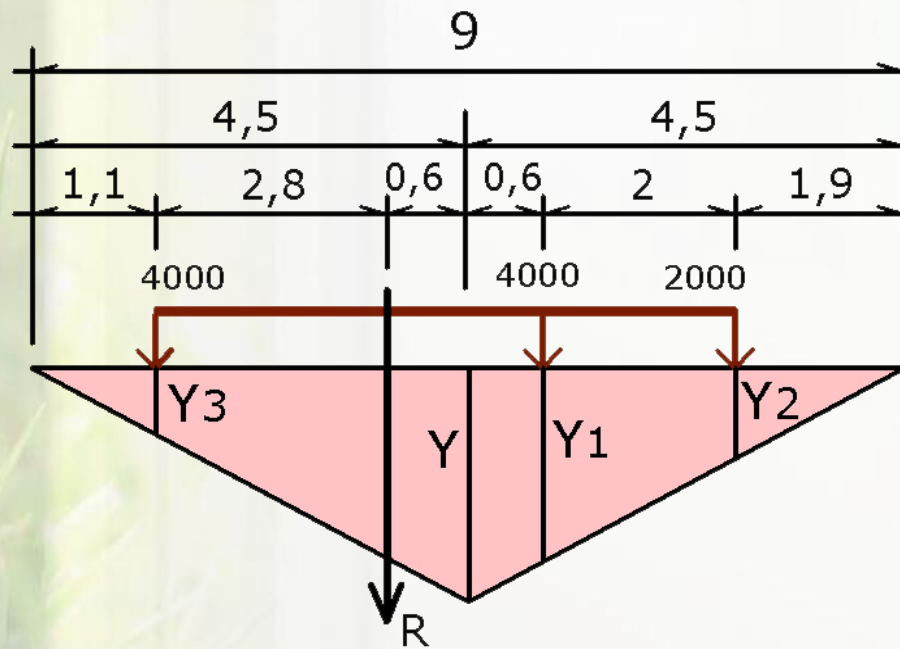


Letak resultante

$$\begin{aligned} R \cdot X &= P_2 \cdot 4 + P_3 \cdot 6 \\ 10000 X &= 4000 \cdot 4 + 2000 \cdot 6 \\ 10000 X &= 16000 + 12000 \\ X &= 2,8 \text{ m} \end{aligned}$$

$$\begin{aligned} R &= P_1 + P_2 + P_3 \\ &= 4000 + 4000 + 2000 \\ &= 10000 \text{ kg} \end{aligned}$$

Gp.M



MOMEN

Untuk mendapatkan momen maksimum, y berada ditengah-tengah antara R dan beban terdekat.

Ordinat : y

$$y = \frac{4,5 \cdot 4,5}{9} = 2,25 \text{ m}$$

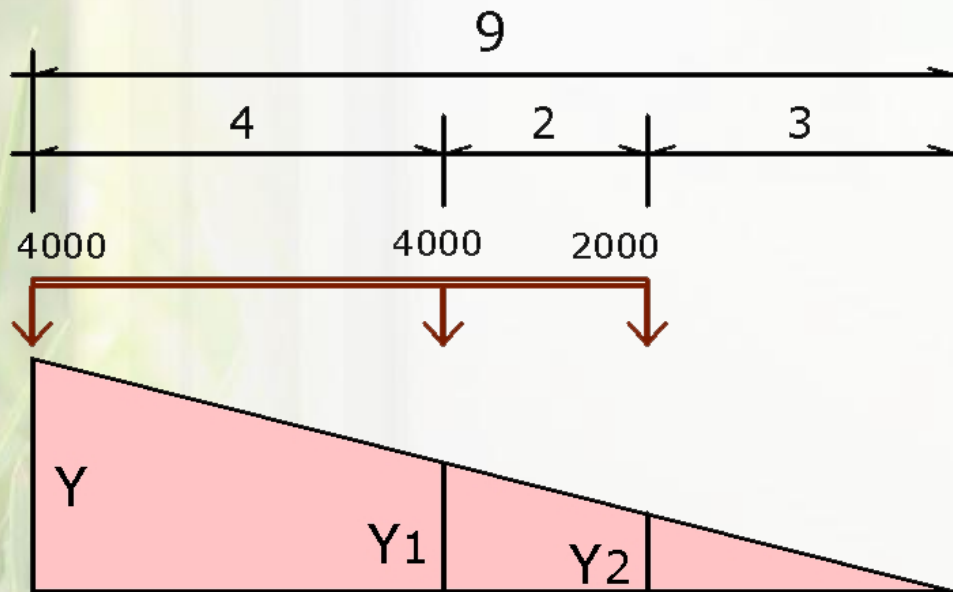
$$\frac{y_1}{2,25} = \frac{3,9}{4,5} \rightarrow y_2 = 0,95 \text{ m}$$

$$\frac{y_2}{2,25} = \frac{1,9}{4,5} \rightarrow y_1 = 1,95$$

$$\frac{y_3}{2,25} = \frac{1,1}{4,5} \rightarrow y_3 = 0,55 \text{ m}$$

$$\begin{aligned} M \text{ maks} &= P_1 \cdot y_3 + P_2 \cdot y_1 + P_3 \cdot y_2 \\ &= 4000 \cdot 0,55 + 4000 \cdot 1,95 + 2000 \cdot 0,95 \\ &= 2200 + 7800 + 1900 \\ &= \mathbf{11900 \text{ kgm}} \end{aligned}$$

Gp.RA



GAYA LINTANG

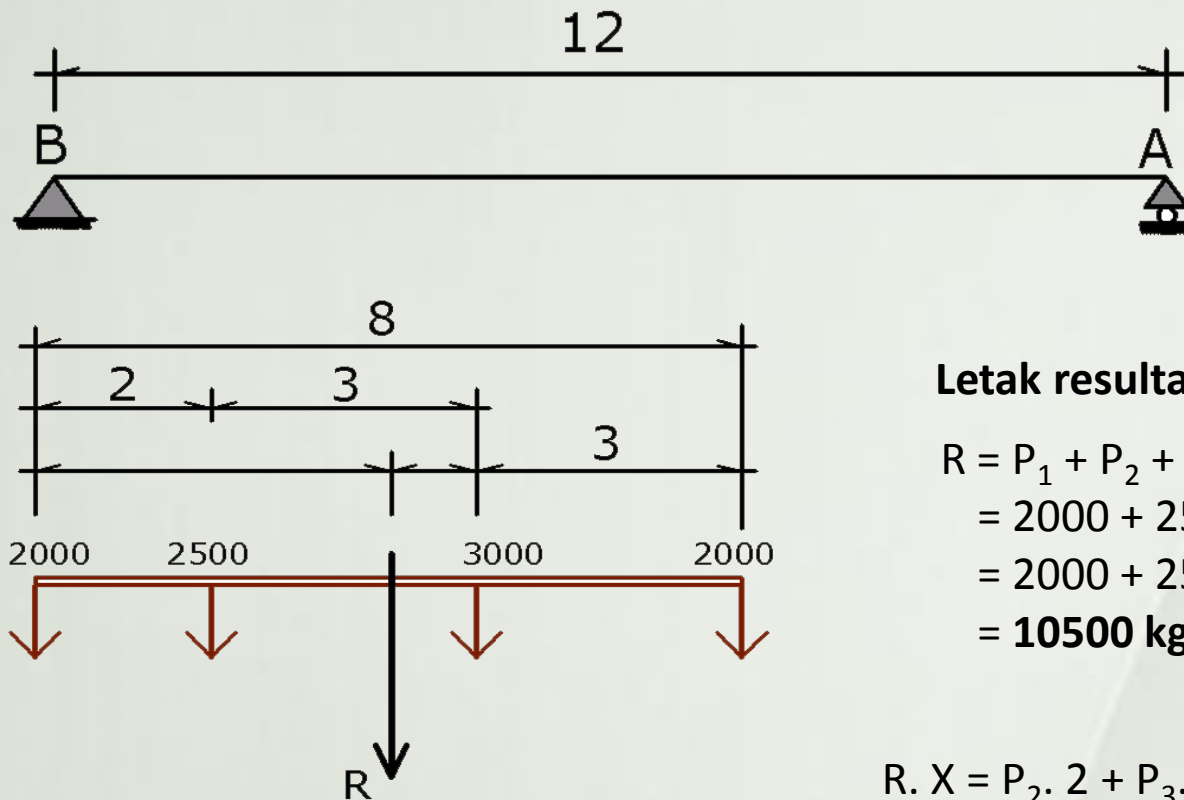
Ordinat : $y = 1$

$$y_1 = \frac{5}{9} = 0,56$$

$$y_2 = \frac{3}{9} = 0,33$$

$$\begin{aligned} RA &= P_1 \cdot y + P_2 \cdot y_1 \\ &= 4000 \cdot 1 + 4000 \cdot 0,56 + 2000 \cdot 0,33 \\ &= 4000 + 2240 + 660 \\ &= \mathbf{6900 \text{ kg}} \end{aligned}$$

45) Menggunakan garis pengaruh hitung momen maksimum dan gaya lintang maksimum
 $P_1 = 2000 \text{ kg}$, $P_2 = 2500 \text{ kg}$, $P_3 = 3000 \text{ kg}$



Letak resultante

$$\begin{aligned}
 R &= P_1 + P_2 + 2 P_3 \\
 &= 2000 + 2500 + 2 \cdot 3000 \\
 &= 2000 + 2500 + 6000 \\
 &= \mathbf{10500 \text{ kg}}
 \end{aligned}$$

$$\begin{aligned}
 R \cdot X &= P_2 \cdot 2 + P_3 \cdot 5 + P_3 \cdot 8 \\
 10500 X &= 2500 \cdot 2 + 3000 \cdot 5 + 3000 \cdot 8 \\
 10500 X &= 5000 + 15000 + 24000 \\
 \mathbf{X} &= \mathbf{4,2 \text{ m}}
 \end{aligned}$$

MOMEN

Untuk mendapatkan momen maksimum, y ditengah-tengah antara R dan beban terdekat.

Ordinat : y

$$y = \frac{6.6}{12} = 3\text{m}$$

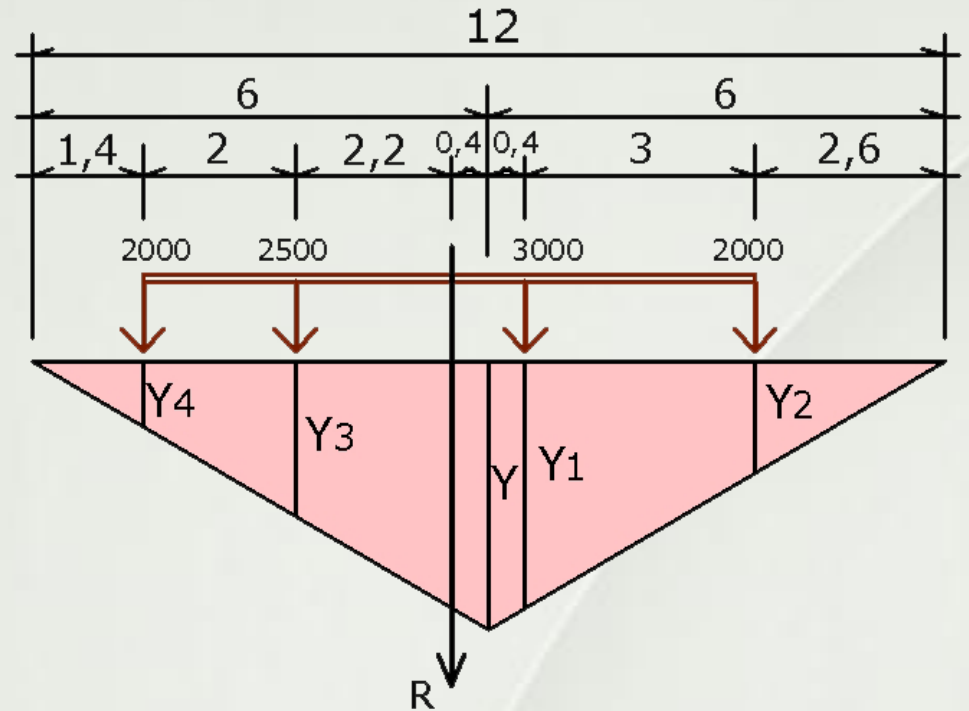
$$\frac{y_1}{3} = \frac{5.6}{6} \rightarrow y_1 = 2.8\text{ m}$$

$$\frac{y_2}{3} = \frac{2.6}{6} \rightarrow y_2 = 1.3\text{ m}$$

$$\frac{y_3}{3} = \frac{3.4}{6} \rightarrow y_3 = 1.7\text{ m}$$

$$\frac{y_4}{3} = \frac{1.4}{6} \rightarrow y_4 = 0.7\text{ m}$$

Gp.M



$$\begin{aligned} M \text{ maks} &= P_1 \cdot y_4 + P_2 \cdot y_3 + P_3 \cdot y_1 + P_3 \cdot y_2 \\ &= 2000 \cdot 0.7 + 2500 \cdot 1.7 + 3000 \cdot 2.8 + 3000 \cdot 1.3 \\ &= 1400 + 4250 + 8400 + 3900 \\ &= \mathbf{17950 \text{ kgm}} \end{aligned}$$

GAYA LINTANG

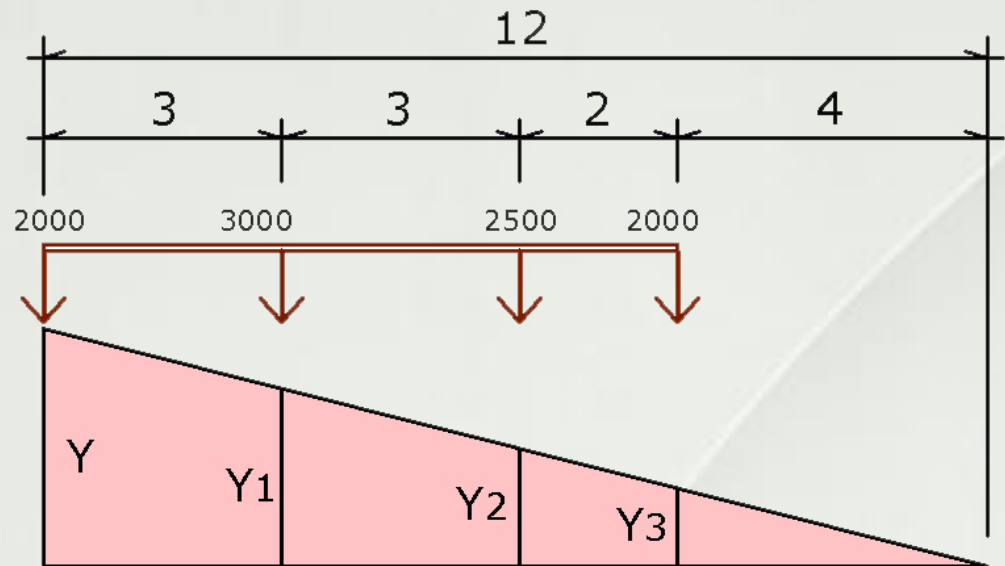
Ordinat : $y = 1$

$$y_1 = \frac{9}{12} = 0,75$$

$$y_2 = \frac{6}{12} = 0,5$$

$$y_3 = \frac{4}{12} = 0,33$$

Gp.RA



$$\begin{aligned} RA &= P_3 \cdot y + P_3 \cdot y_1 + P_2 \cdot y_2 + P_1 \cdot y_3 \\ &= 3000 \cdot 1 + 3000 \cdot 0,75 + 2500 \cdot 0,5 + 2000 \cdot 0,33 \\ &= 3000 + 2250 + 1250 + 660 \\ &= \mathbf{7160 \text{ kg}} \end{aligned}$$