STATIKA

3 sks

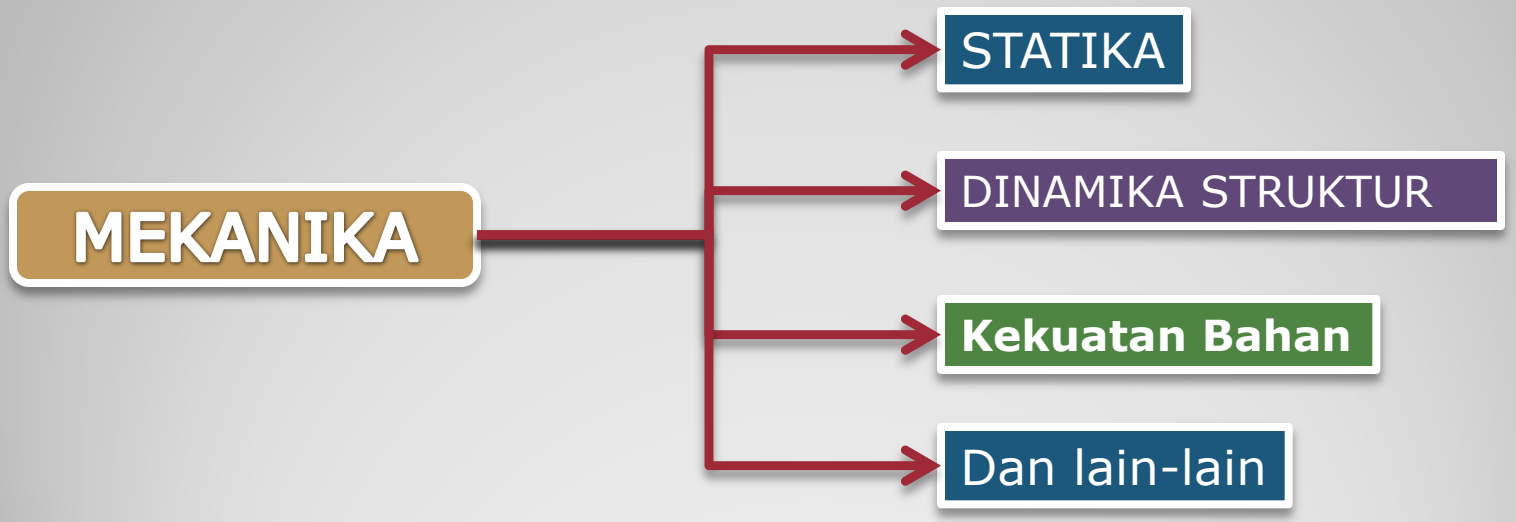


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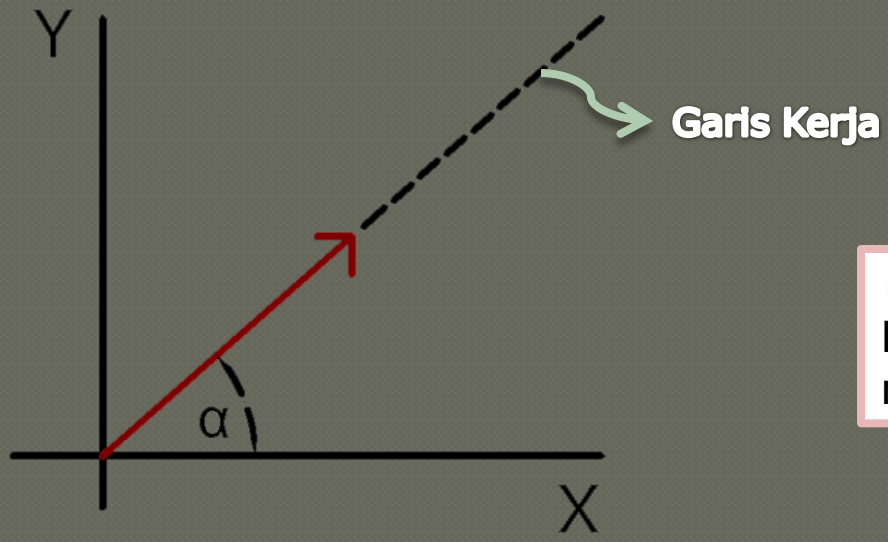
- Ilmu pengetahuan terapan yang berhubungan dengan ***GAYA*** dan ***GERAK***
- Statika Ilmu Mekanika berhubungan dengan gaya-gaya yang bekerja pada benda.



Besaran Skalar dan Vektor

- **Besaran skalar** dikarakteristikan dengan **besar nilainya** saja, sedangkan besaran vektor dikarateristikkan oleh **besar nilai** dan **arahnya**.

- **Setiap besaran vektor** dapat dinyatakan dengan ***garis,*** **arah garis** terhadap sumbu tetap menunjukkan ***arah*** besaran vektor.

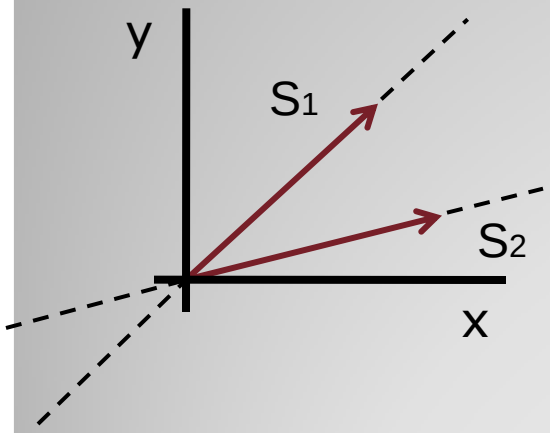


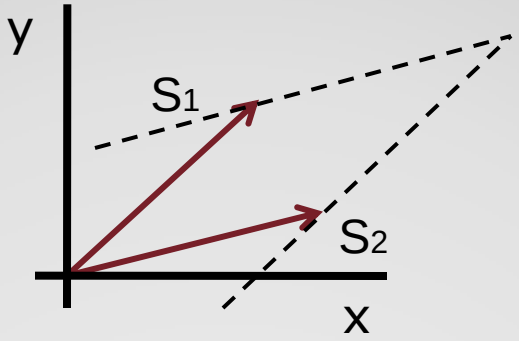
Panjang garis (dengan skala) menunjukkan besarnya.

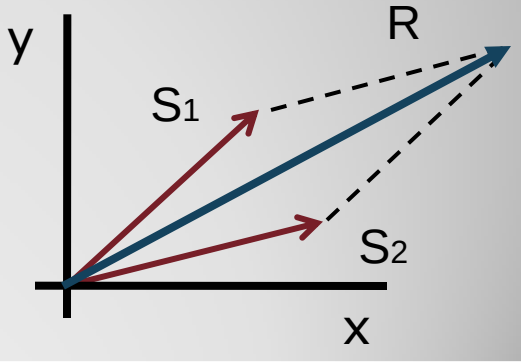
Garis kerja suatu gaya adalah garis yang panjangnya tak tentu yang mana terdapat ***vektor*** gaya tersebut.

Metode Penjumlahan Vektor dengan Jajaran Genjang

Apabila ada dua garis kerja gaya berpotongan, maka ada satu gaya ***Resultan*** yang ekuivalen dengan kedua gaya tersebut.

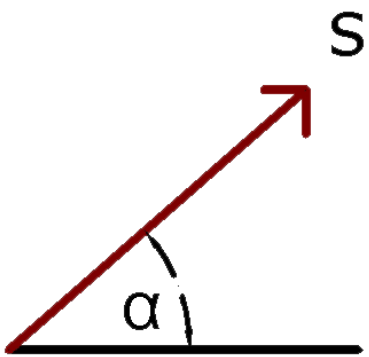




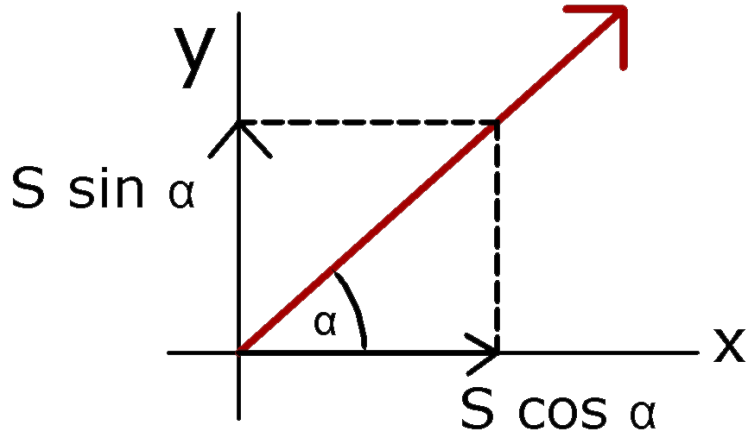


Komposisi Gaya

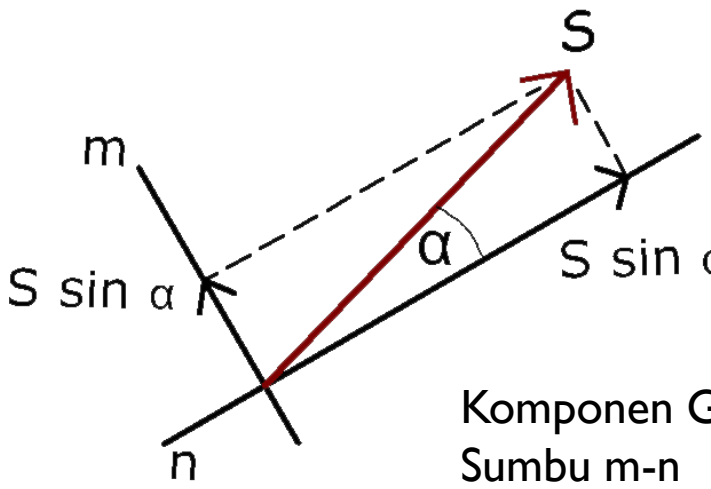
Jajaran genjang adalah penguraian satu gaya menjadi dua atau lebih gaya yang membentuk sistem gaya, yang ekivalen dengan gaya semula.



Vektor Gaya



Komponen Gaya pada Sumbu X-Y



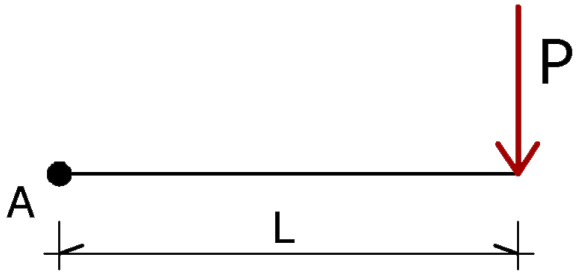
Komponen Gaya pada Sumbu m-n

Baut, Kunci Pas, dan Gaya

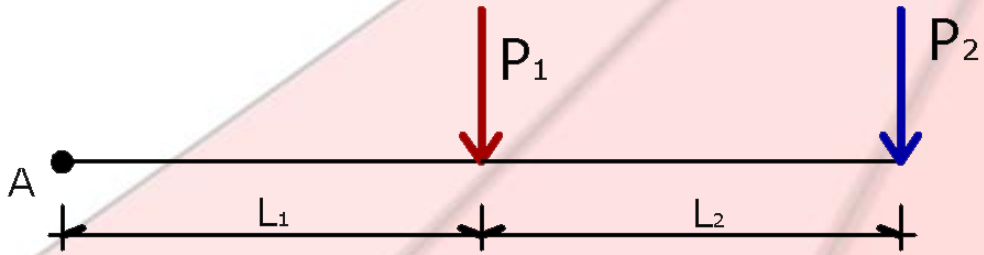
Perhatikan…!



MOMEN



MA = P.L (dalam satuan : kgm, tm, kNm dstnya)



$$MA = P_1 L_1 + P_2 (L_1 + L_2)$$

Momen = gaya x jarak

A = titik

P = gaya

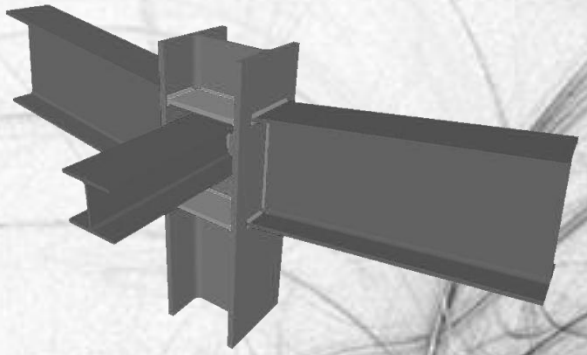
L = jarak dari titik A ke P yang arahnya tegak lurus

BEBAN

Beban Mati

Berat benda yang tidak bergerak, berat sendiri struktur (beton, baja dll).





Beban Hidup

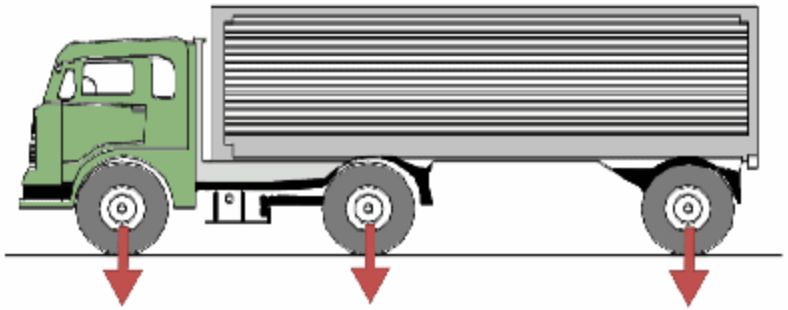
Beban bergerak, berubah tempat atau berubah beratnya (orang, meja, kursi dll).





Beban Terpusat

Beban titik, beban roda kendaraan, orang berdiri, berat tiang, balok anak dll.





Beban Terbagi Rata

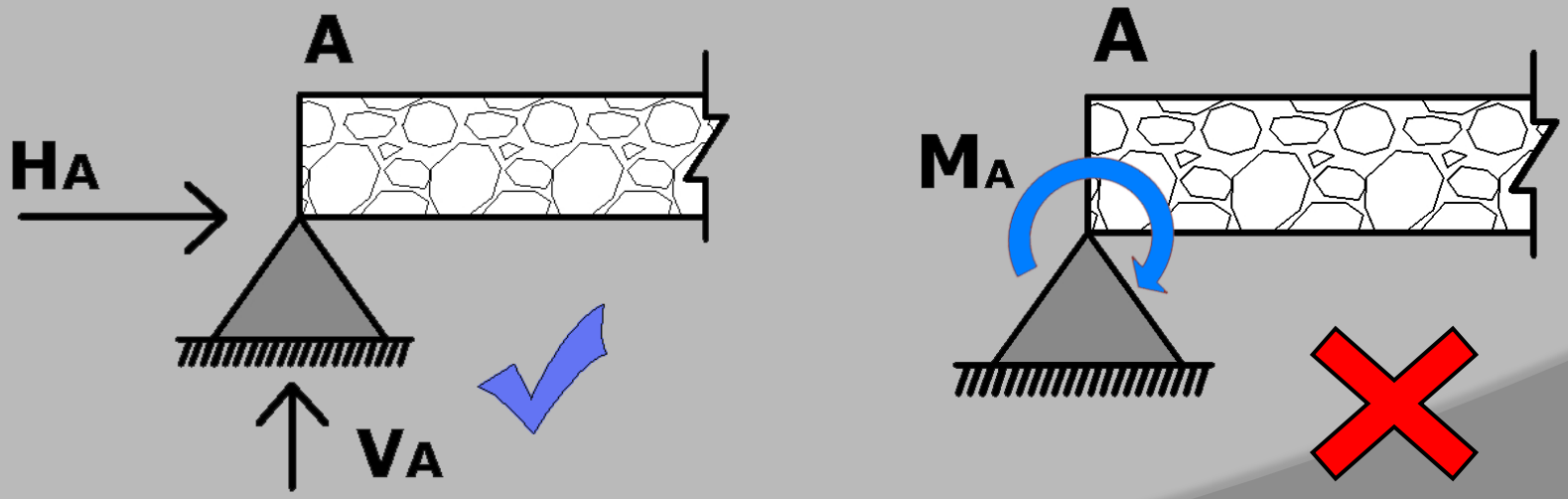
Beban yang terbagi pada sebuah bidang yang cukup luas.



Tumpuan

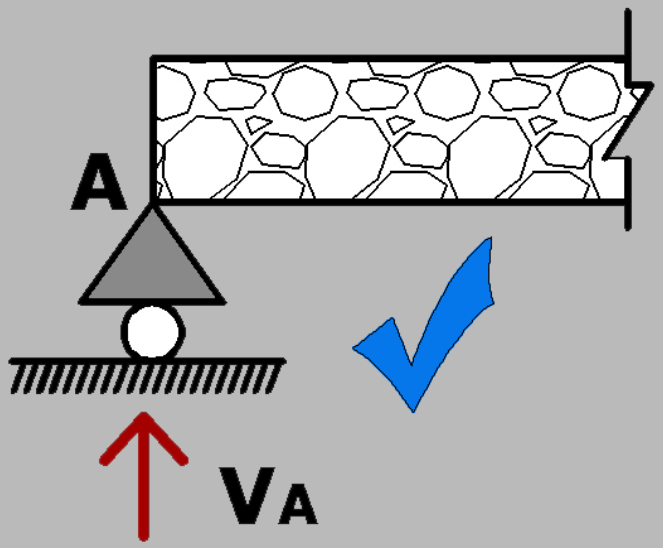
Tumpuan *Sendi* dapat mendukung **gaya *tarik*** dan **gaya *tekan***, garis kerjanya selalu melalui pusat sendi. Sendi tidak dapat meneruskan ***momen*****,** sendi menghasilkan

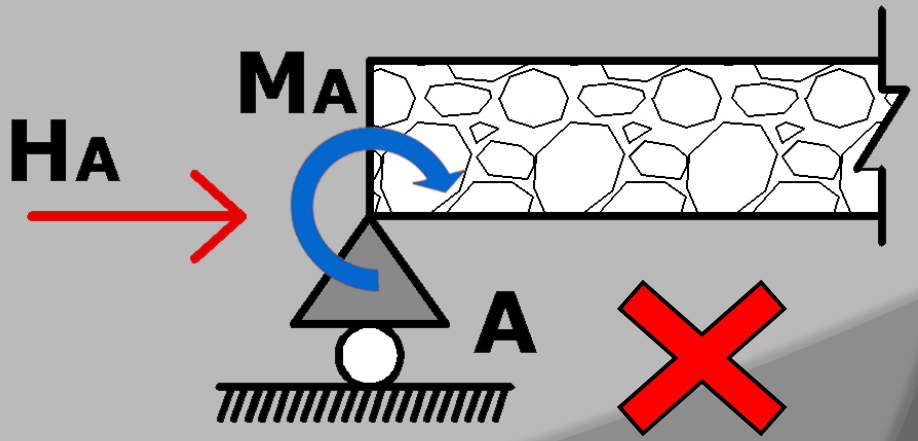
DUA ANU : RA dan VA.



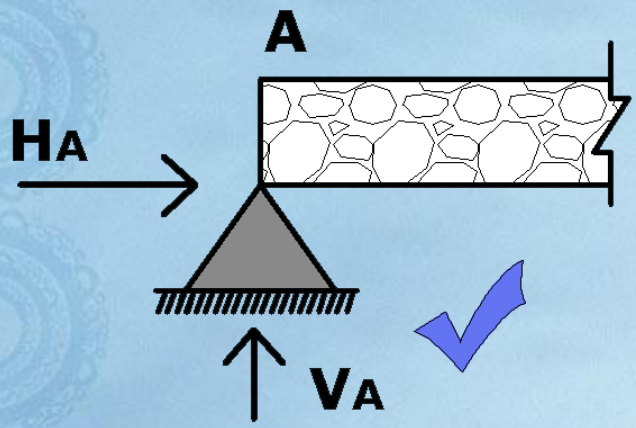
Tumpuan *rol* hanya dapat meneruskan gaya tekan ⊥ **(tegak lurus)** bidang perletakan.

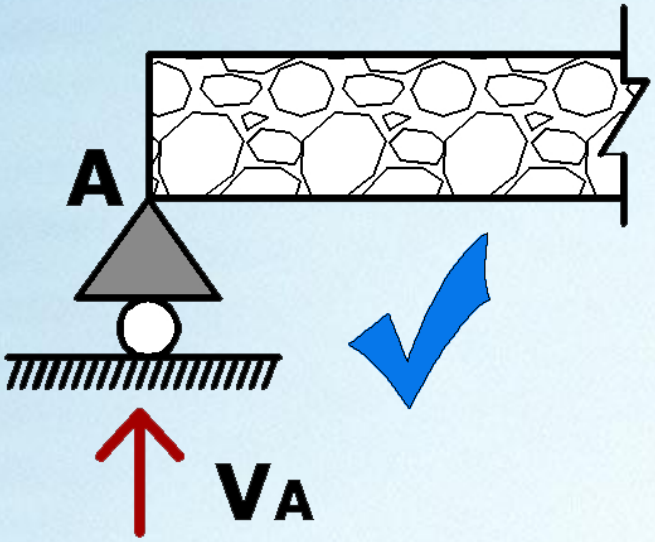
rol menghasilkan SATU ANU : VB





Tumpuan Sendi dan Rol

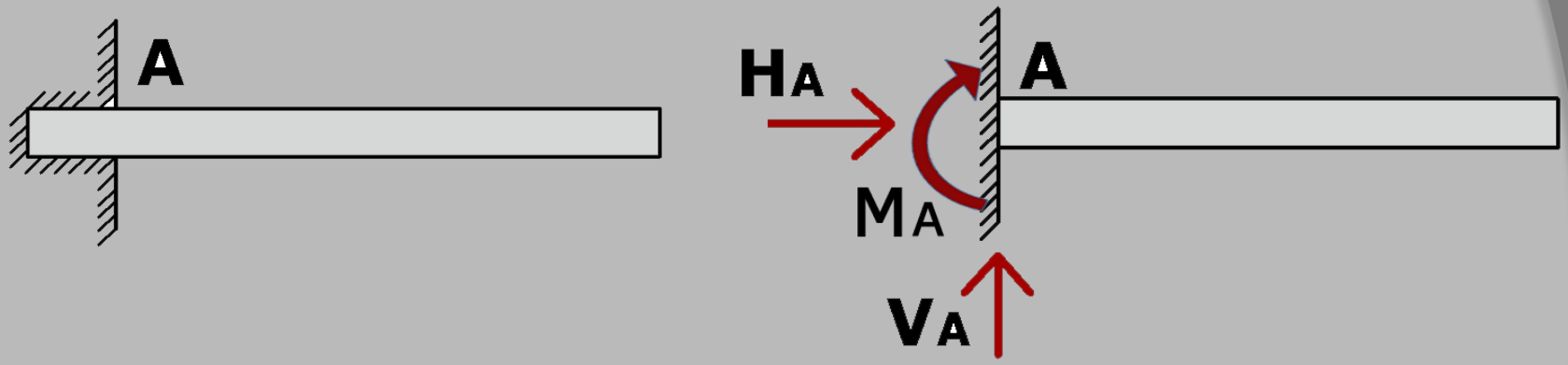




Tumpuan Jepit.

Balok yang tertanam didalam pasangan batu merah, balok dan kolom.
Jepit dapat mendukung **gaya vertikal, gaya horizontal dan momen**.

Jepit menghasilkan **TIGA ANU : VA, HA, MA**



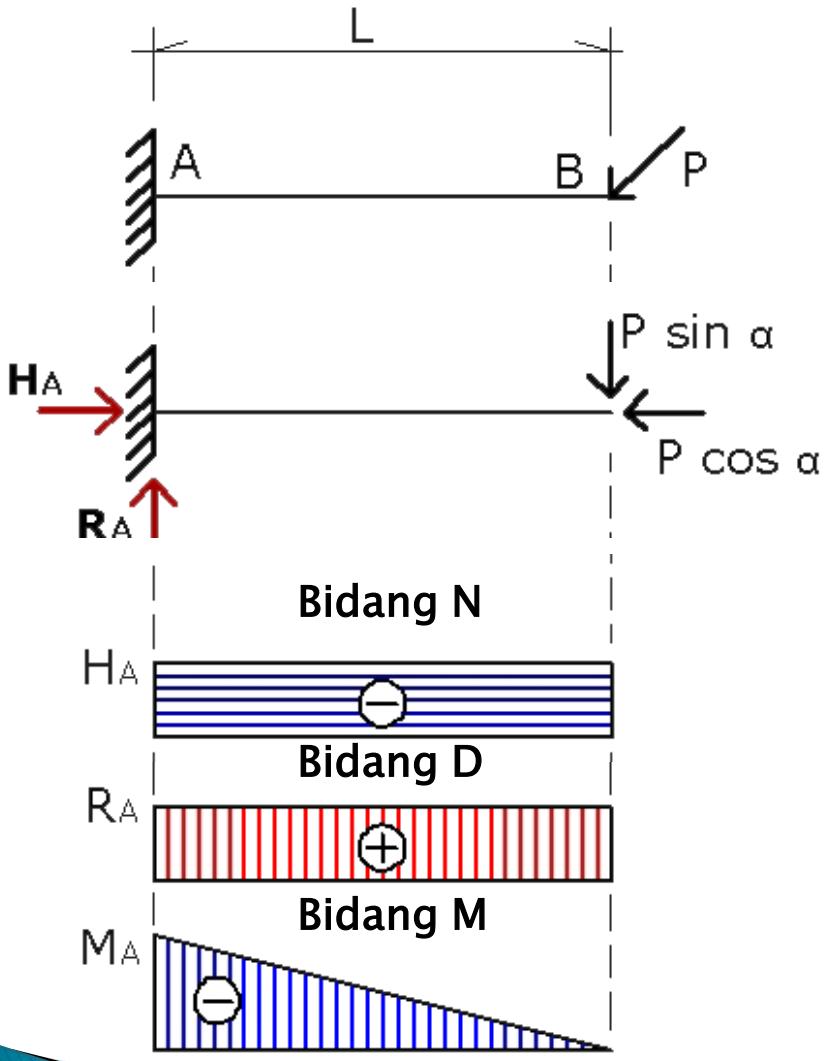
Tiga Syarat Kesetimbangan : $\Sigma H = 0$

$\Sigma V = 0$

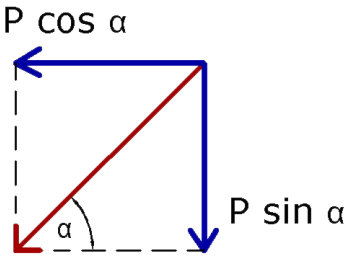
$\Sigma M = 0$

disebut : Struktur statis tertentu.

Balok Kantilever dengan Beban Terpusat



$\alpha = 45°$



ΣH = 0

HA – P cos α = 0

HA = P cos α

ΣV = 0

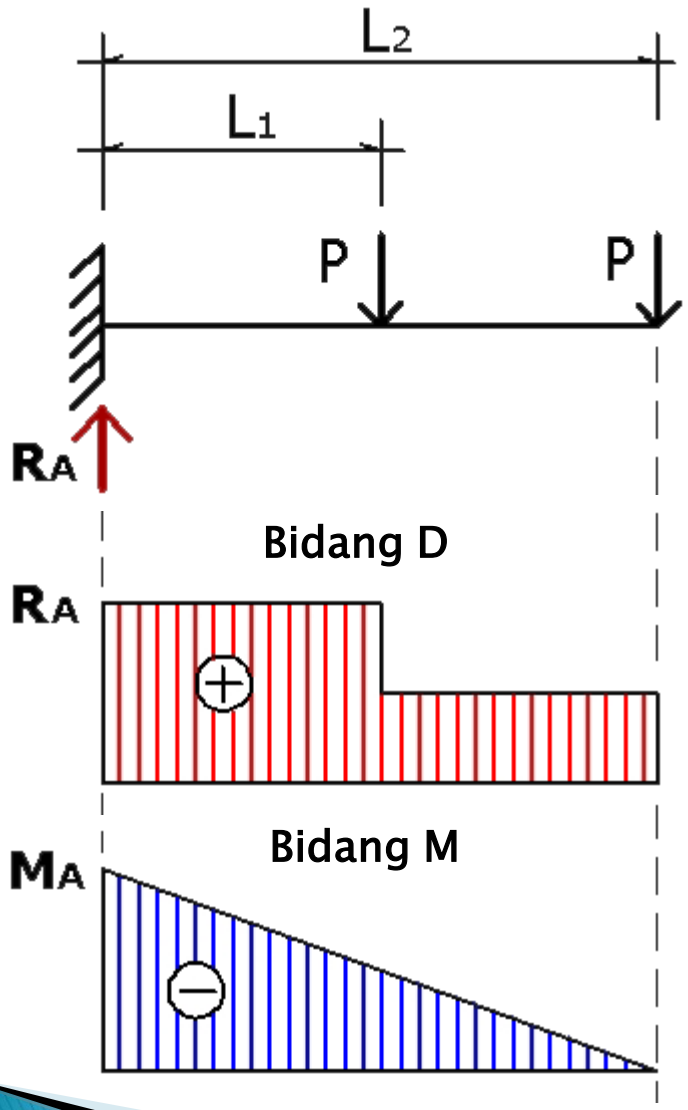
RA – P sin α = 0

RA = P sin α

ΣM = 0

MA = P sin α. L

Balok Kantilever dengan Beban Terpusat

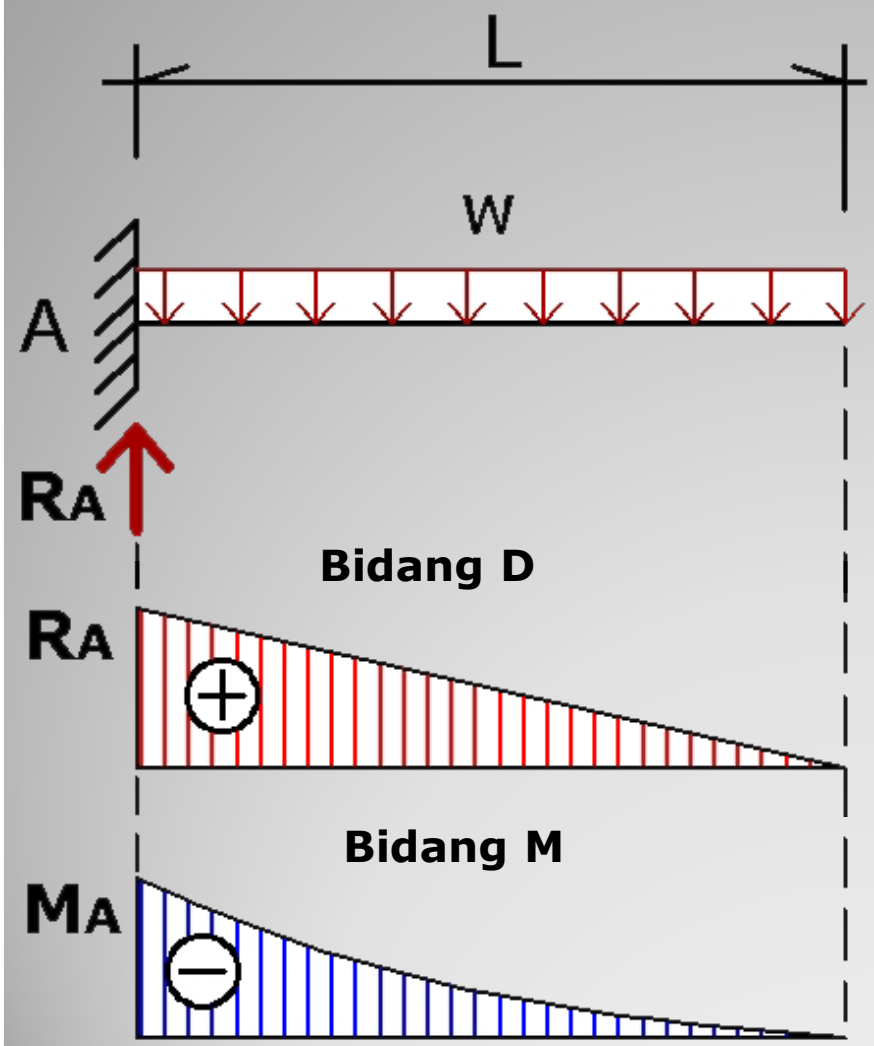


$\Sigma V = 0 \rightarrow RA - P - P = 0$

$RA = 2\,P$

$\Sigma M = 0 \rightarrow MA = P.\,L_1 + P.\,L_2$

Balok kantilever dengan Beban merata



ΣV = 0

$RA - WL = 0$

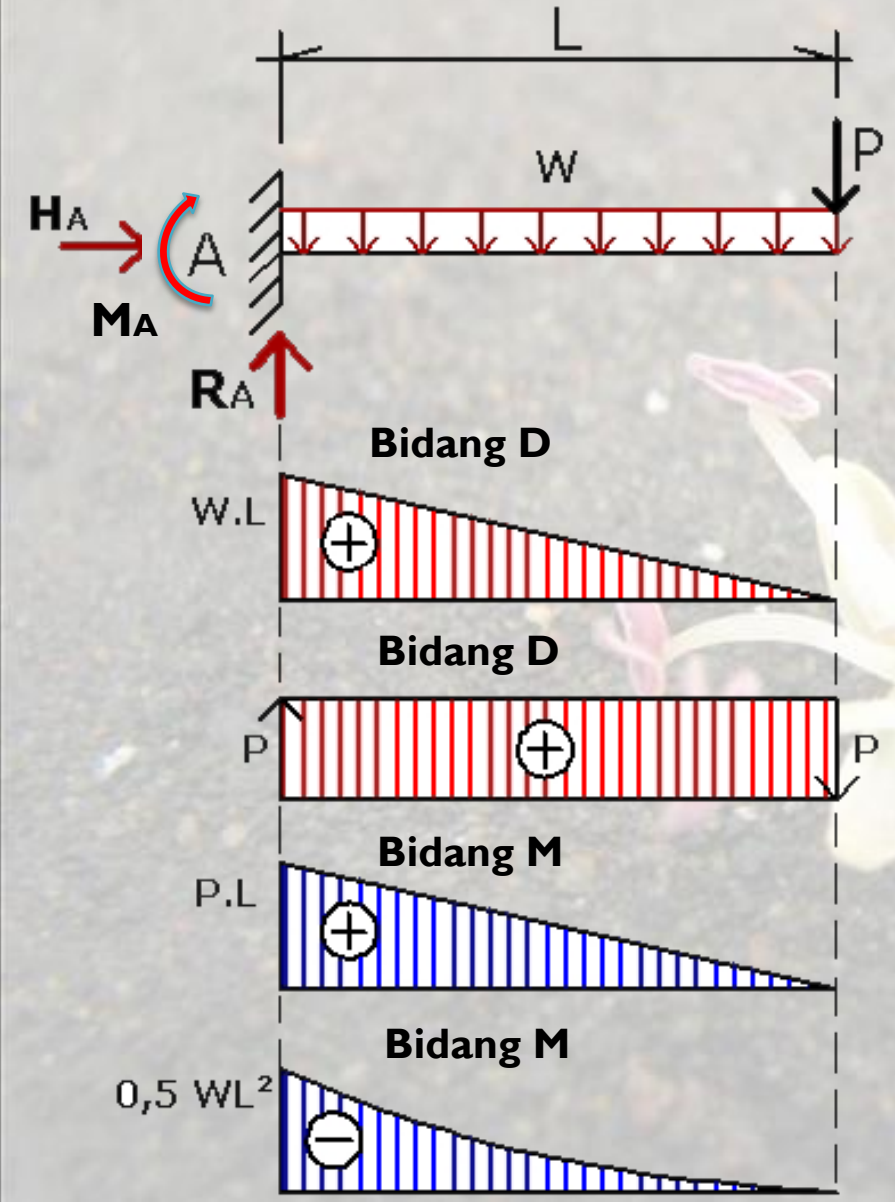
$RA = WL$

ΣM = 0

$MA = WL.\ 0{,}5\ L$

$= 0{,}5\ WL^2$

Balok kantilever dengan
Beban merata + Beban Terpusat



ΣV = 0

RA – WL – P = 0

RA = WL + P

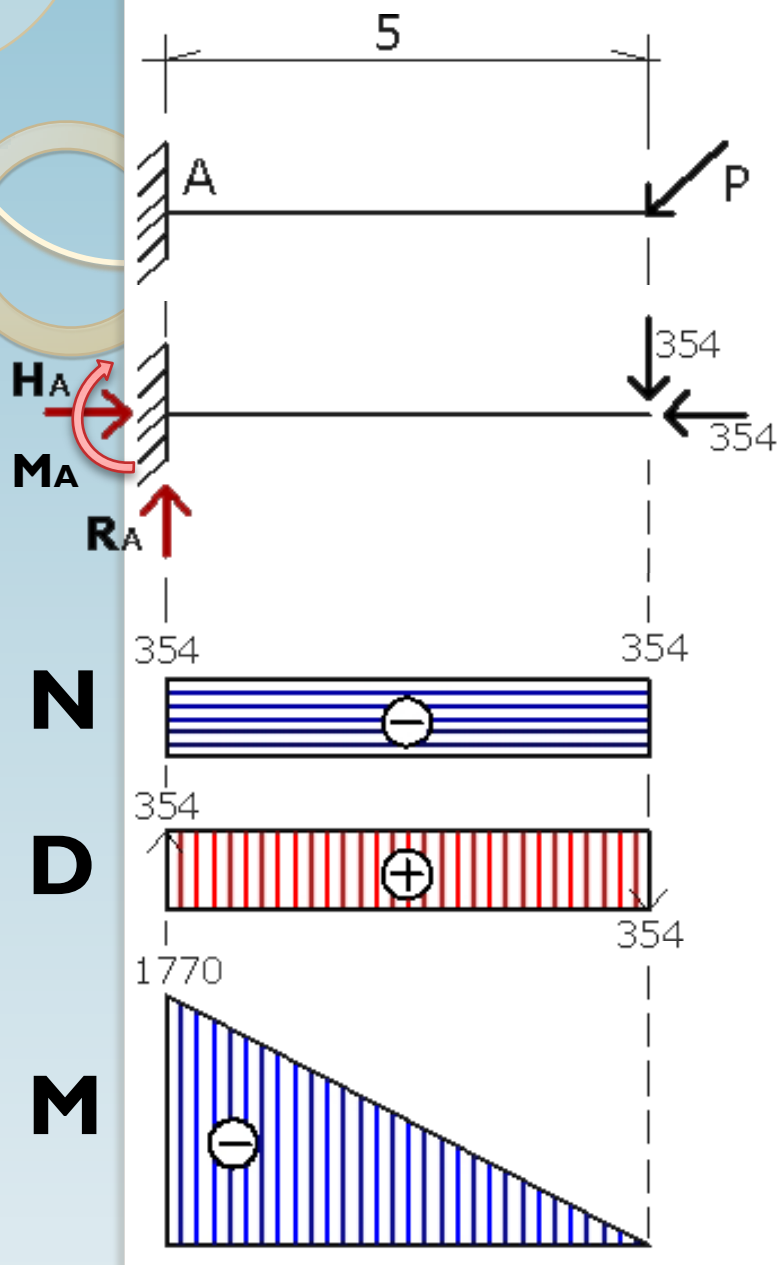
ΣM = 0

MA = P. L + WL. 0,5 L

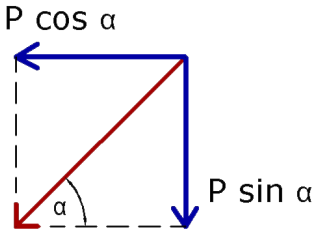
= PL + 0,5 WL^2

AYO LATIHAN SOAL...!!!





1) Gambar bidang momen, gaya lintang dan gaya aksial.
P = 500 kg, α = 45°



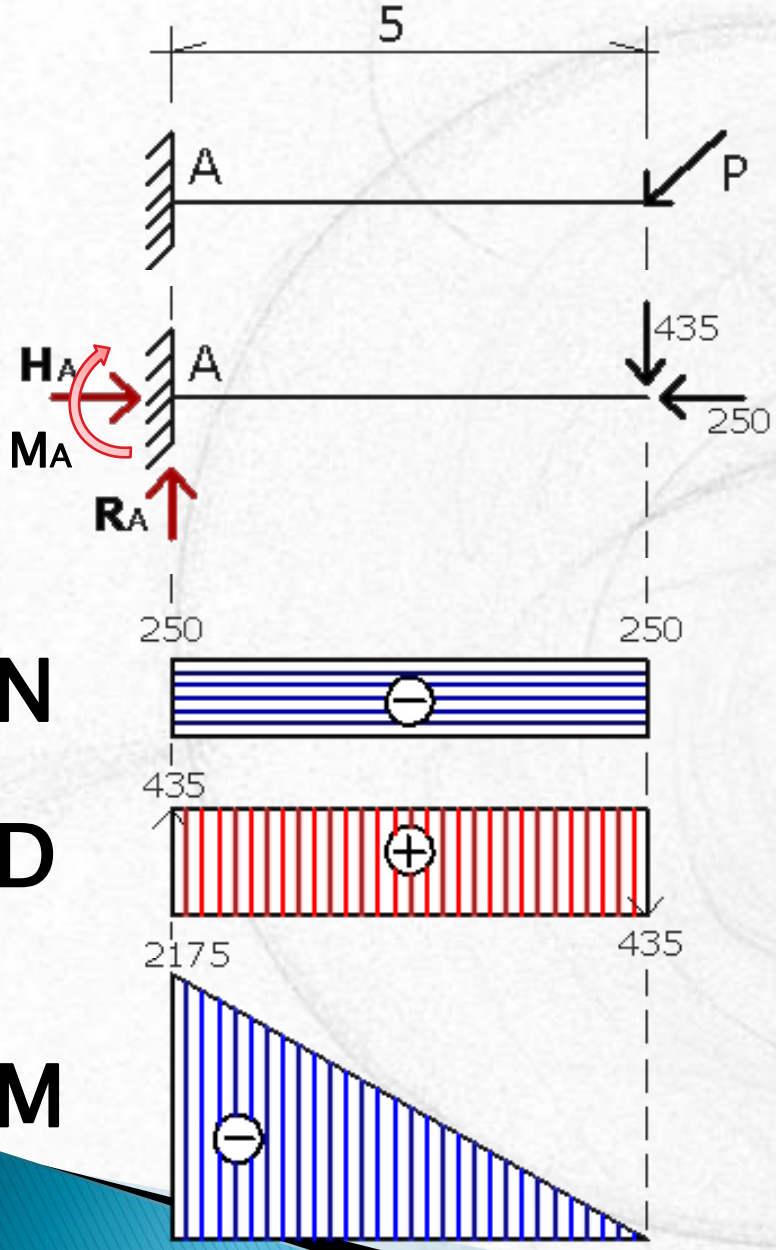
P cos 45° = 500. 0,707 = **354 kg** ←
P sin 45° = 500. 0,707 = **354 kg** ↑

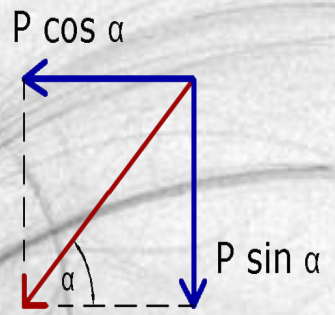
ΣH = 0
HA – 354 = 0
HA = **354 kg**

ΣV = 0
RA – 354 = 0
RA = **354 kg**

ΣM = 0
MA = 354. 5
= **1770 kgm**

2) Gambar bidang momen, gaya lintang dan gaya aksial.
P = 500 kg, α = 60°



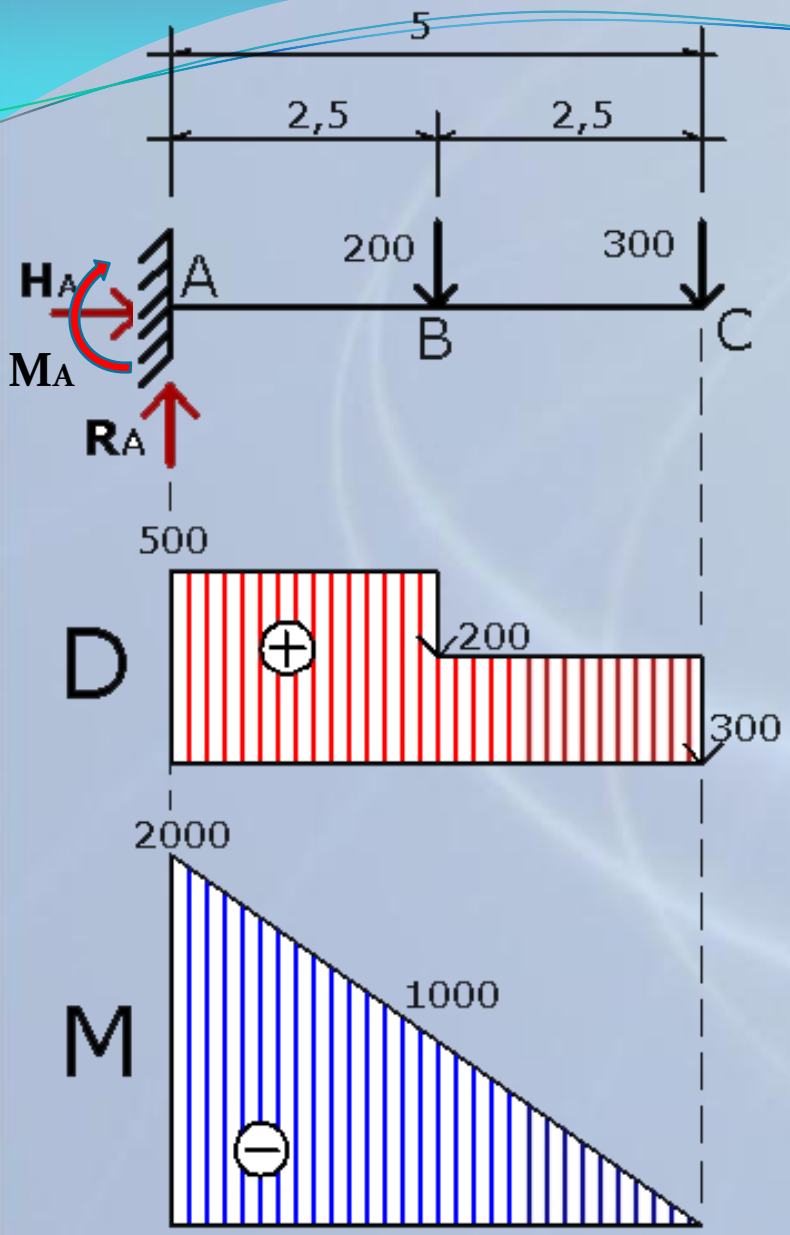


P cos 60° = 500. 0,5 = **250 kg**
P Sin 60° = 500. 0,87 = **435 kg**

ΣH = 0 →
HA – 250 = 0
HA = **250 kg**

ΣV = 0 →
RA – 435 = 0
RA = **435 kg**

ΣM = 0 →
MA = 435. 5
= **2175 kgm**



2) Gambar bidang momen, gaya lintang.
P1 = 200 kg, P2 = 300 kg,

ΣV = 0 →

$RA - P_1 - P_2 = 0$

$RA - 200 - 300 = 0$

$RA =$ **500 kg**

ΣM = 0 →

$MA = P_1 . 0{,}5 . 5 + P_2 . 5$

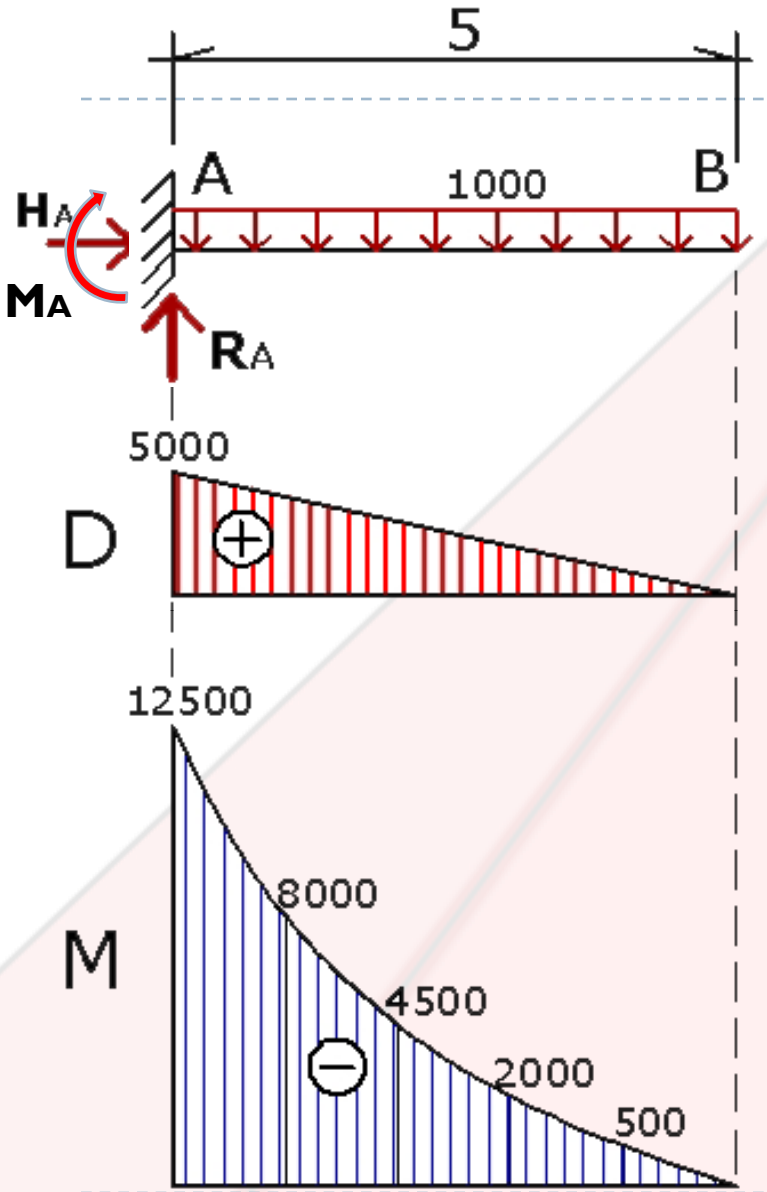
$= 200 . 2{,}5 + 300 . 5$

= **2000 kgm**

$MB = P_1 . 0 + P_2 . 2{,}5$

$= 200 . 0 + 300 . 2{,}5$

= **750 kgm**



2) Gambar bidang momen, gaya lintang.
W = 1000 Kg/m

$\Sigma V = 0 \rightarrow$
RA – W. 5 = 0
RA – 1000. 5 = 0
RA = **5000 kg**

$\Sigma M = 0 \rightarrow$
$MA = 0{,}5\ W.\ 5^2$
$= 0{,}5.\ 1000.\ 25$
= **12500 kgm**

x = 1 m (dari B) →
$Mx = 0{,}5\ Wx^2$
$= 0{,}5.\ 1000.\ 1^2$
= **500 kgm**

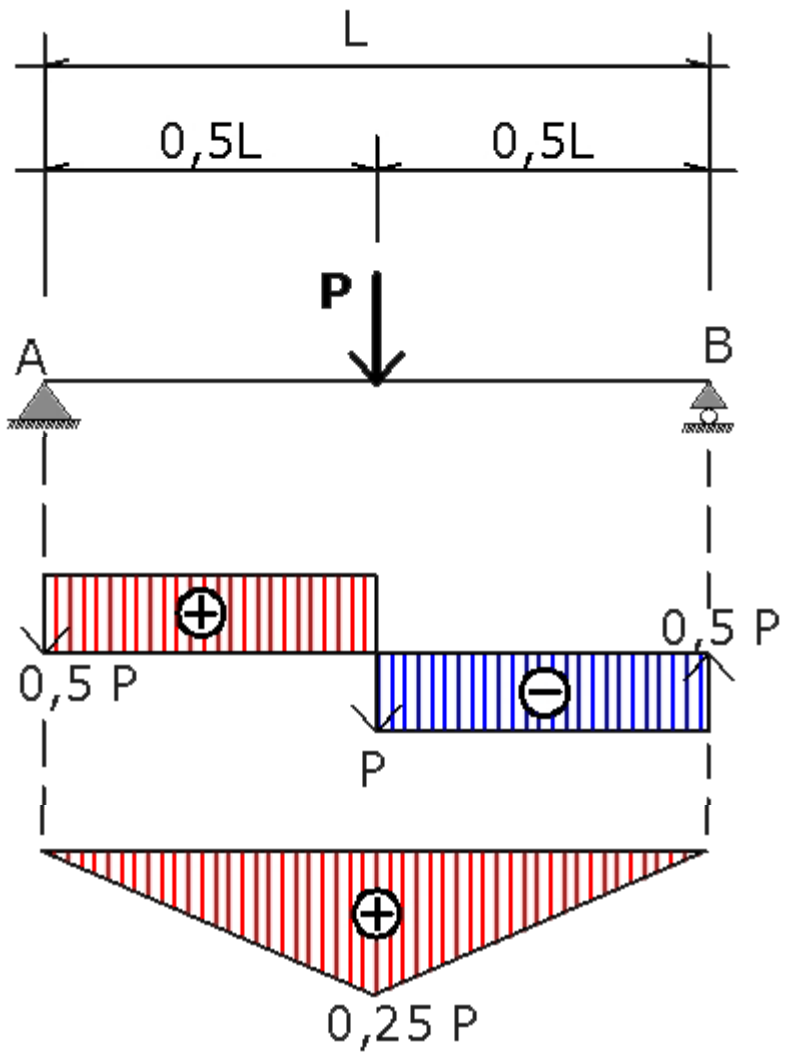
x = 2 m (dari B) →
$Mx = 0{,}5\ Wx^2$
$= 0{,}5.\ 1000.\ 2^2$
= **2000 kgm**

x = 3 m (dari B) →
$Mx = 0{,}5\ Wx^2$
$= 0{,}5.\ 1000.\ 3^2$
= **4500 kgm**

x = 4 m (dari B) →
$Mx = 0{,}5\ Wx^2$
$= 0{,}5.\ 1000.\ 4^2$
= **8000 kgm**

Balok Diatas Dua Perletakan (tumpuan).

Dengan Beban Terpusat



$\Sigma MB = 0 \rightarrow$

$RA.\ L - P.\ 0{,}5\ L = 0$

$RA = \dfrac{0{,}5PL}{L} = 0{,}5\ P$

$\Sigma MA = 0 \rightarrow$

$RB.\ L - P.\ 0{,}5\ L = 0$

$RB = \dfrac{0{,}5PL}{L} = 0{,}5\ P$

$\Sigma V = 0 \rightarrow$

$RA + RB = P$

$0{,}5\ P + 0{,}5\ P = P$

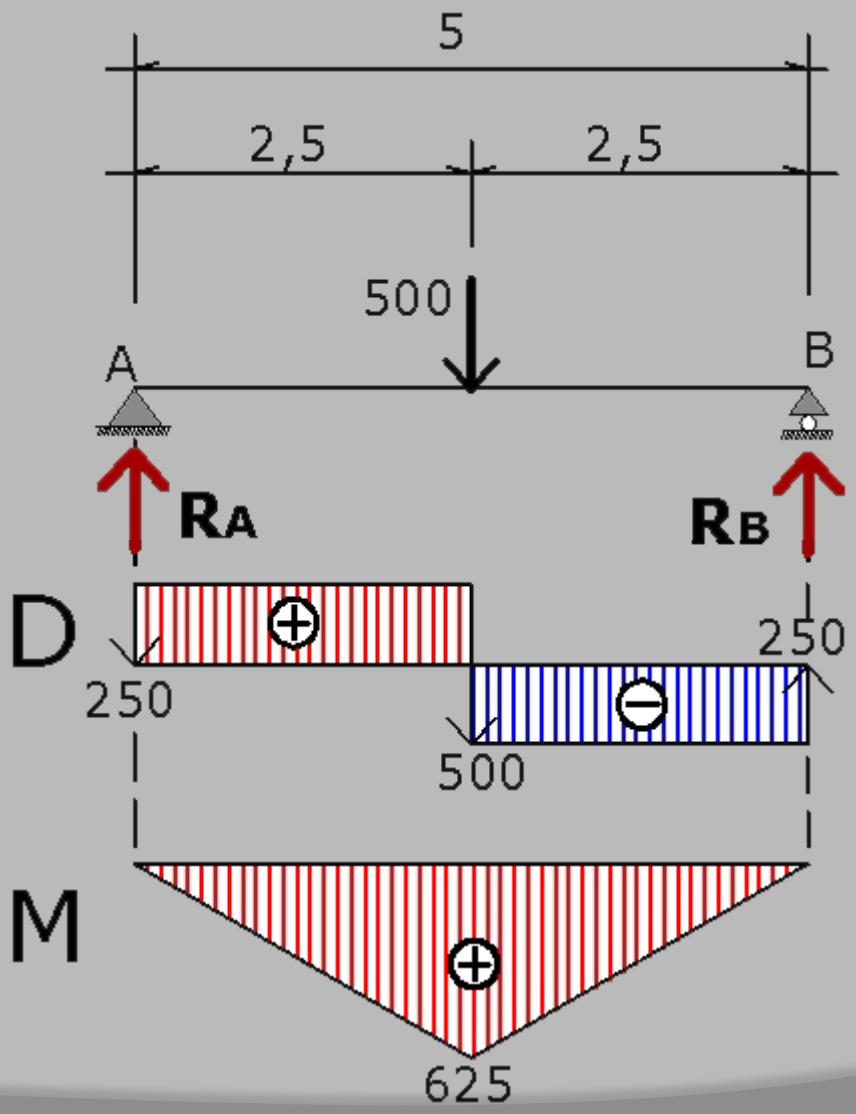
$P = P \rightarrow$ ok

$MC = RA.\ 0{,}5\ L$

$= 0{,}5\ P.\ 0{,}5\ L$

$= 0{,}25\ PL$

5) Gambar bidang momen, gaya lintang.
P = 500 Kg



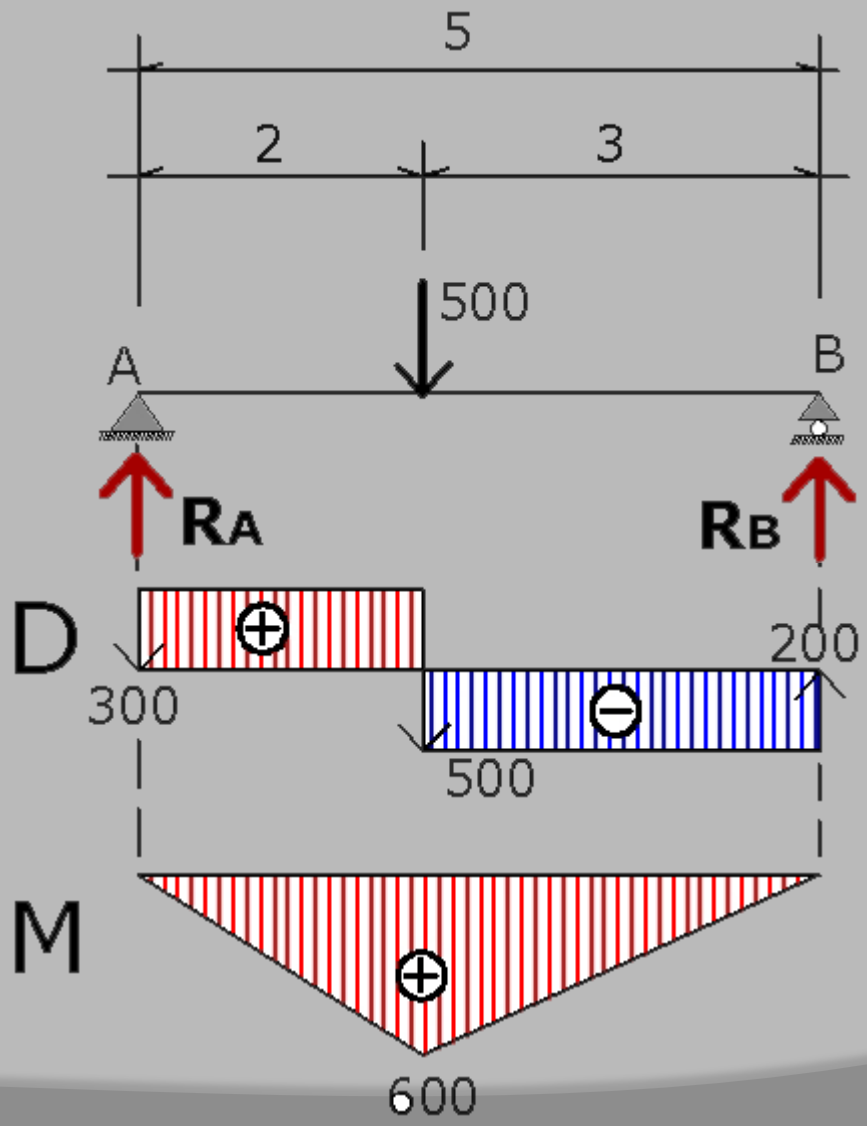
ΣMB = 0 →
RA. 5 – 500. 2,5 = 0
5 RA – 1250 = 0
RA = **250 kg**

ΣMA = 0 →
RB. 5 – 500. 2,5 = 0
5 RB – 1250 = 0
RB = **250 kg**

ΣV = 0 →
RA + RB = P
250 + 250 = 500
500 = 500 → **ok**

MC = RA. 2,5
= 250. 2,5
= **625 kgm**

6) Gambar bidang momen, gaya lintang.
P = 500 Kg



ΣMB = 0 →
RA. 5 – P. 3 = 0
RA. 5 – 500. 3 = 0
5 RA – 1500 = 0
RA = **300 kg**

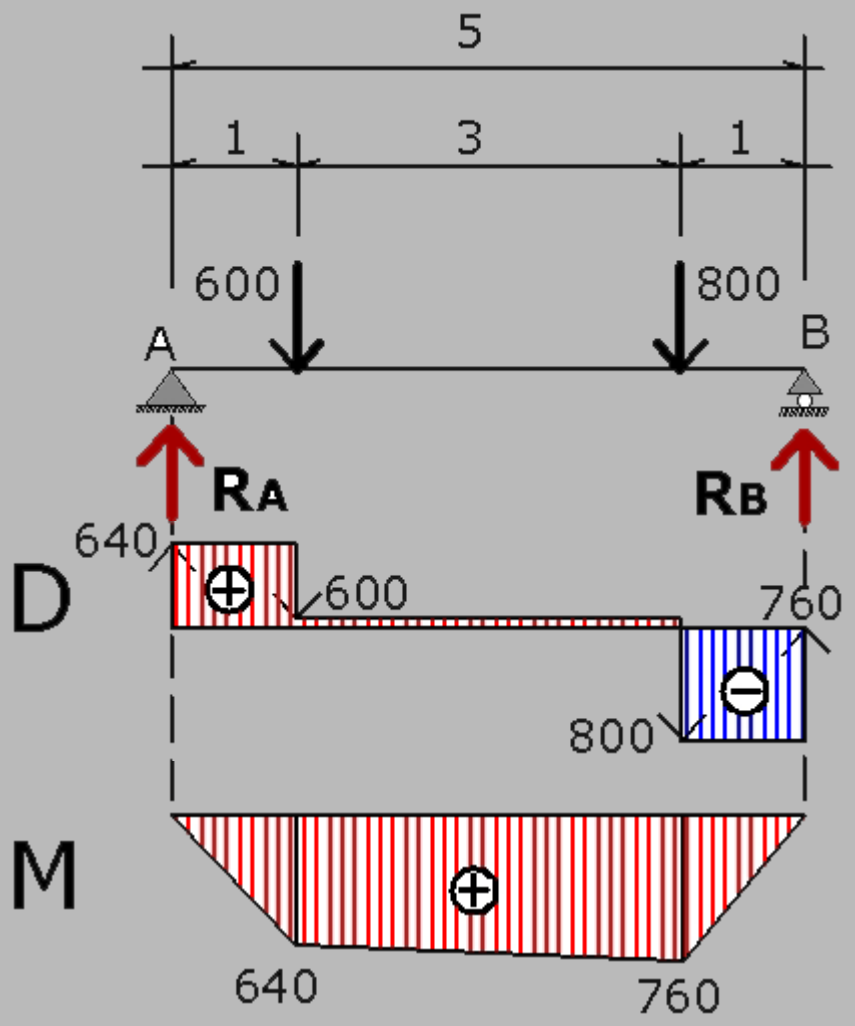
ΣMA = 0 →
RB. 5 – P. 2 = 0
RB. 5 – 500. 2 = 0
5 RB – 1000 = 0
RB = **200 kg**

ΣV = 0 →
RA + RB = P
300 + 200 = 500
500 = 500 → ok

MC = RA. 2
= 300. 2 = **600 kgm** atau

MC = RB. 3
= 200. 3 = **600 kgm**

7) Gambar bidang momen, gaya lintang.
P1 = 500 Kg, P2 = 800 Kg



$\Sigma MB = 0 \rightarrow$
$RA. 5 - P_1. 4 - P_2. 1$
$RA. 5 - 600. 4 - 800. 1 = 0$
$5\ RA - 2400 - 800 = 0$
$5\ RA - 3200 = 0$
$RA =$ **640 kg**

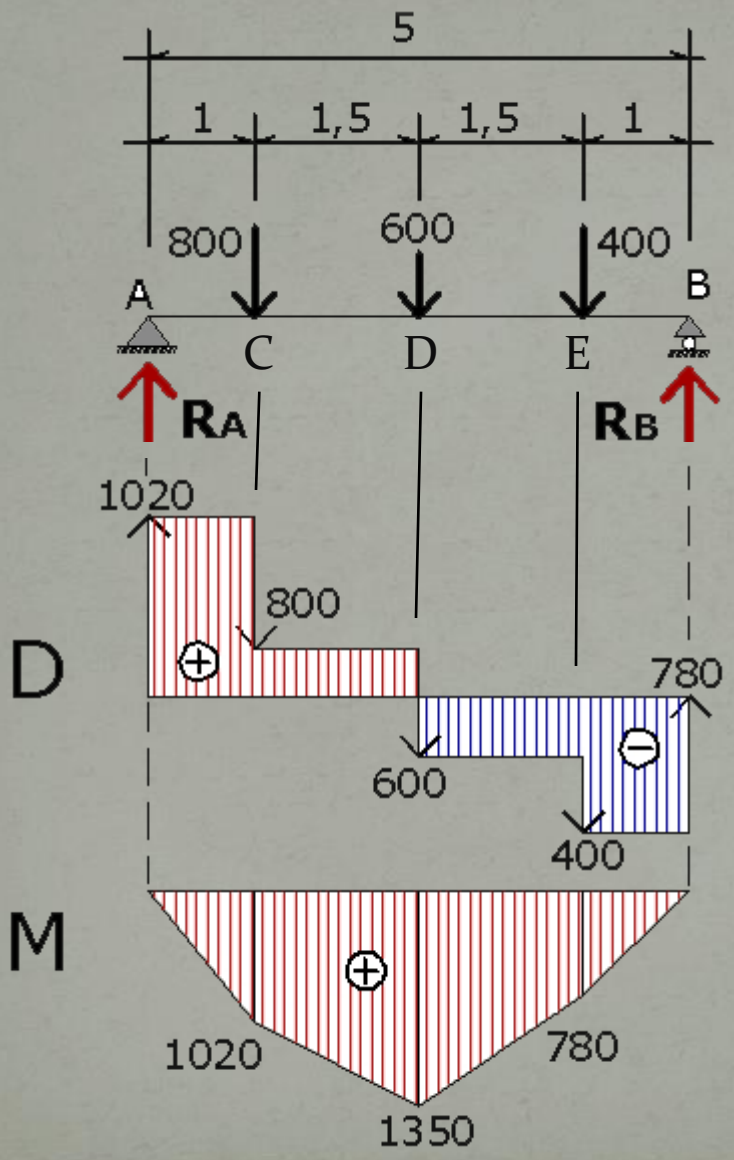
$\Sigma MA = 0 \rightarrow$
$RB. 5 - P_1. 1 - P_2. 4 = 0$
$RB. 5 - 600. 1 - 800. 4 = 0$
$5\ RB - 600 - 3200 = 0$
$5\ RB - 3800 = 0$
$RB =$ **760 kg**

$\Sigma V = 0 \rightarrow$
$RA + RB = P_1 + P_2$
$640 + 760 = 600 + 800$
$1400 = 1400 \rightarrow$ ok

$MC = RA. 1$
$= 640. 1$
$=$ **640 kgm**

$MD = RB. 1 = 760. 1$
$=$ **760 kgm**

8) Gambar bidang momen, gaya lintang.
P1 = 500 Kg, P2 = 800 Kg, P3 = 400 Kg



ΣMB = 0 →
RA. 5 – P_1. 4 – P_2. 2,5 – P_3. 1 = 0
RA. 5 – 800. 4 – 600. 2,5 –
400. 1 = 0
5 RA – 3200 – 1500 – 400 = 0
5 RA – 5100 = 0
RA = **1020 kg**

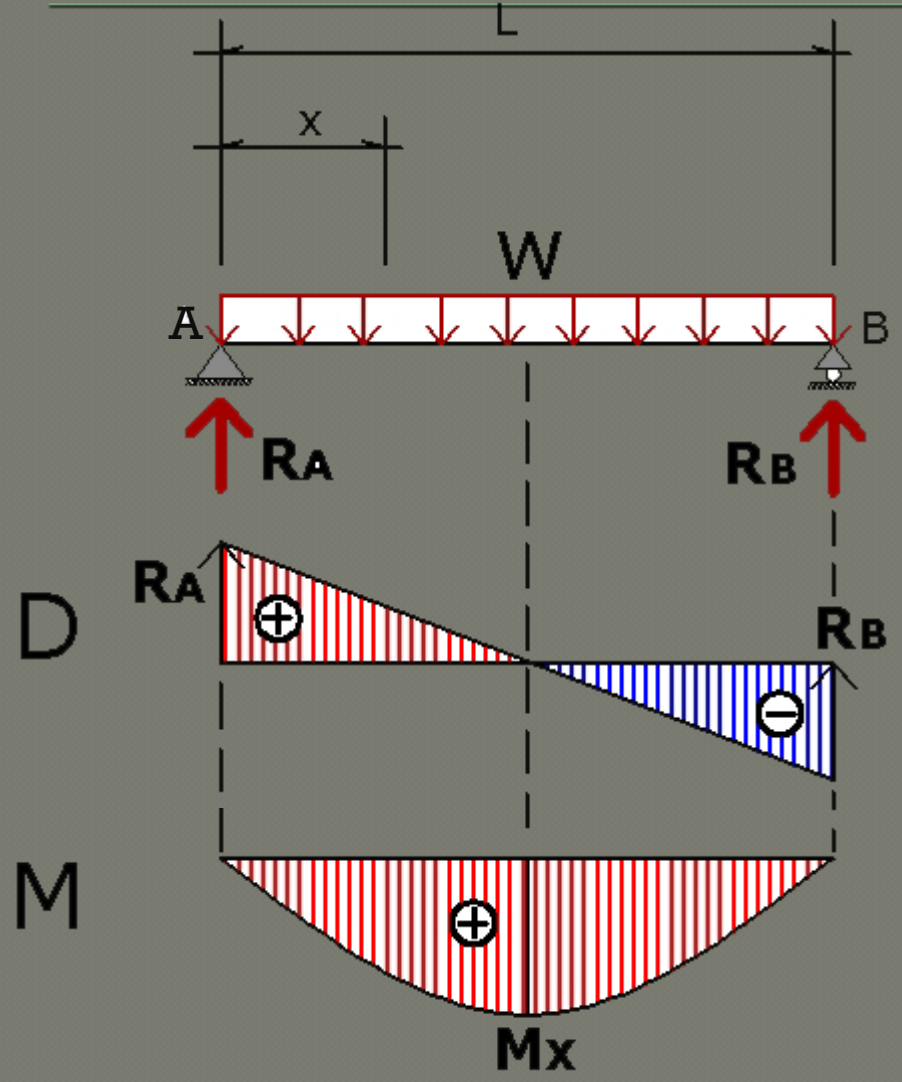
ΣMA = 0 →
RB. 5 – P_1. 1 – P_2. 2,5 – P_3. 4 = 0
RB. 5 – 800. 1 – 600. 2,5 – 400. 4 = 0
5 RB – 800 – 1500 – 1600 = 0
5 RB – 3900 = 0
RB = **780 kg**

ΣV = 0 →
RA + RB = P_1 + P_2 + P_3
1020 + 780 = 600 + 800 + 400
1800 = 1800 → ok
MC = RA. 1
= 1020. 1 = **1020 kgm**

MD = RA. 2,5 – P_1. 1,5
= 1020. 2,5 – 800. 1,5
= **1350 kgm**

ME = RB. 1
= 780. 1 = **780 kgm**

STATIKA BEBAN TERBAGI RATA



ΣMB = 0 →

RA. L – WL. 0,5 L = 0

RA. L – 0,5 WL^2 = 0

$$RA = \frac{0{,}5\,WL^2}{L} = 0{,}5\,WL$$

ΣMA = 0 →

RB. L – WL. 0,5 L = 0

RB. L – 0,5 WL^2 = 0

$$RB = \frac{0{,}5\,WL^2}{L} = 0{,}5\,WL$$

Mx = RA. X – WX. 0,5 X

= 0,5 WLX – 0,5 WX^2

$$\frac{dMX}{dX} = 0{,}5\,WL - WX \rightarrow \frac{dMX}{dX} = 0$$

WX = 0,5 WL

X = 0,5 L

MX = 0,5 WL. 0,5 L – 0,5 W $(0{,}5\,L)^2$

= 0,25 WL^2 – 0,125 WL^2

= 0,125 WL^2

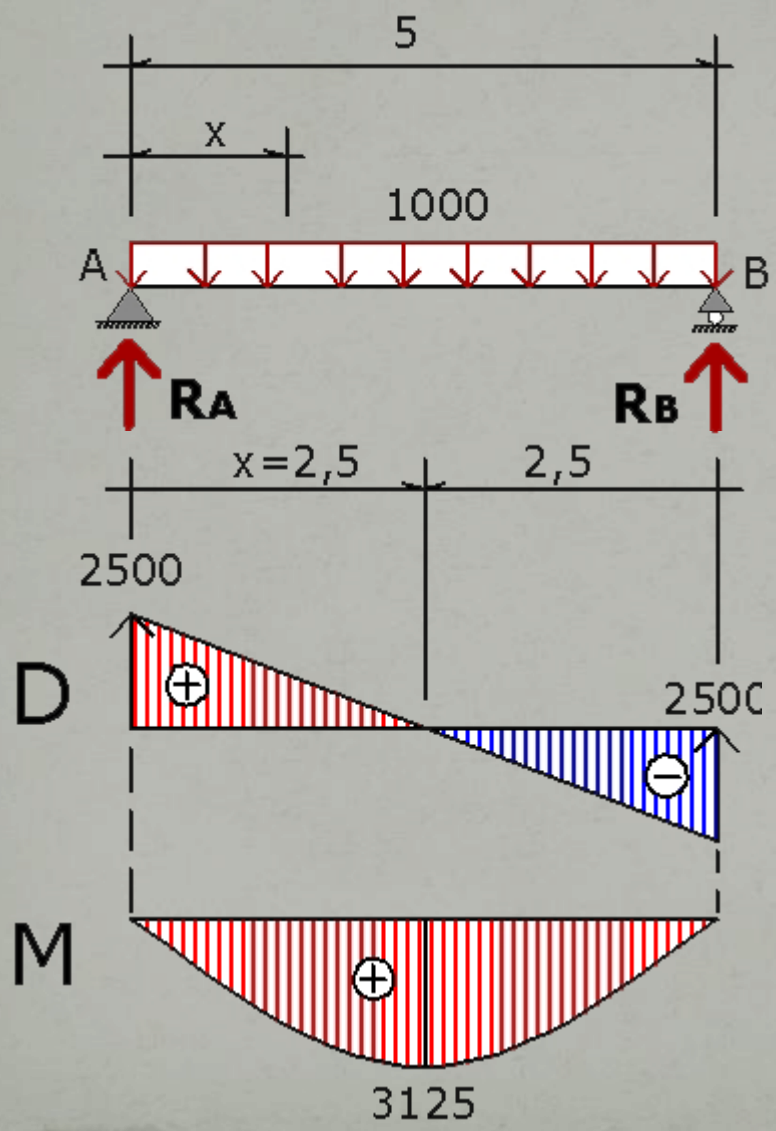
= 1/8 WL^2

DX = RA – WX → X = 0,5 L

= 0,5 WL – W. 0,5 L

= 0,5 WL – 0,5 WL = 0

9) Gambar bidang momen, gaya lintang.
W = 1000 Kg/m



ΣMB = 0 →
RA. 5 – W. 5. 2,5 = 0
RA. 5 – 1000. 12,5 = 0
5 RA – 12500 = 0
RA = **2500 kg**

ΣMA = 0 →
RB. 5 – W. 5. 2,5 = 0
RB. 5 – 1000. 12,5 = 0
5 RB – 12500 = 0
RB = **2500 kg**

ΣV = 0 →
RA + RB = W. 5
2500 + 2500 = 1000. 5
5000 = 5000 → ok

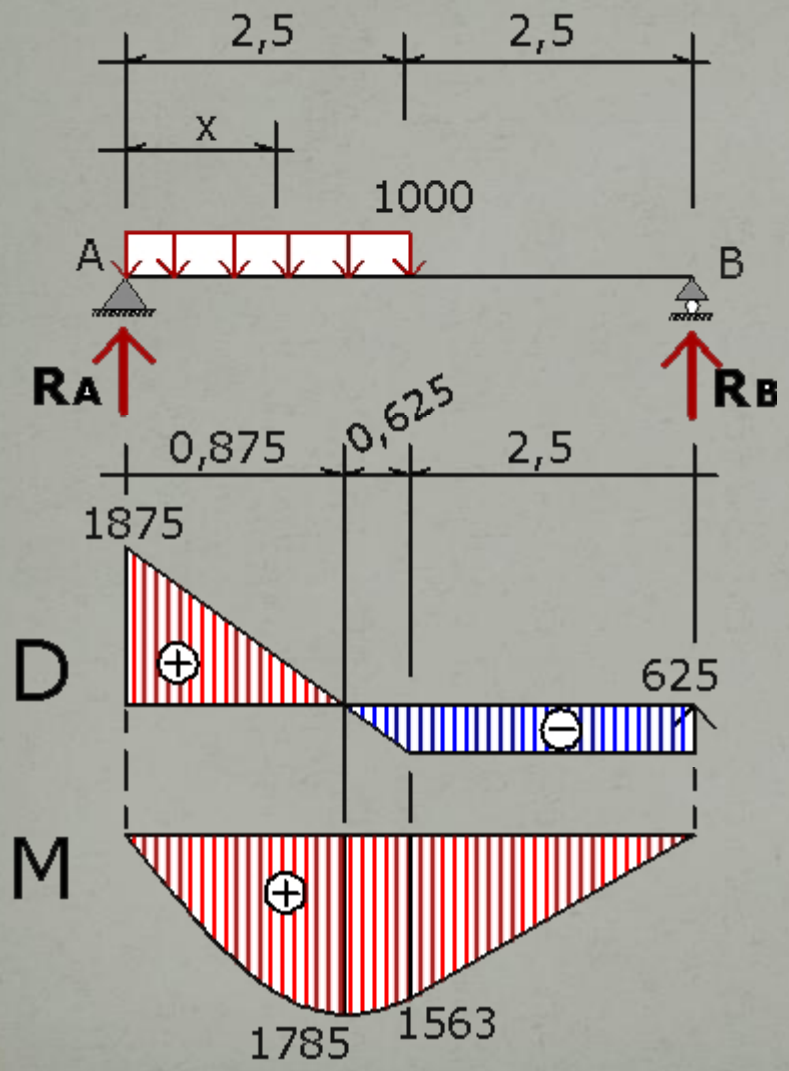
$MX = RA.\ X - WX.\ 0{,}5\ X$
$= 2500\ X - 0{,}5.\ 1000\ X^2$

$$\frac{dMX}{dX} = 2500 - 1000\ X \rightarrow \frac{dMX}{dX} = 0$$

1000 X = 2500
X = 2,5 m

M maks = $2500.\ 2{,}5 - 500.\ 2{,}5^2$
= 6250 – 3125
= **3125 kgm**

10) Gambar bidang momen, gaya lintang.
W = 1000 Kg/m



MB = 0 →
RA. 5 – W. 2,5. 3,75 = 0
5 RA – 1000. 9,375 = 0
5 RA – 9375 = 0 → RA = **1875 kg**

ΣMA = 0 →
RB. 5 – W. 2,5. 1,25 = 0
5 RB – 1000. 3,125 = 0
5 RB – 3125 = 0 → RB = **625 kg**

ΣV = 0 →
RA + RB = W. 2,5
1875 + 625 = 1000. 2,5
2500 = 2500 → **ok**

$MX = RA.\ X - WX.\ 0{,}5\ X$
$= 1875\ X - 0{,}5.\ 1000\ X^2$

$$\frac{dMX}{dX} = 1875 - 1000\ X$$

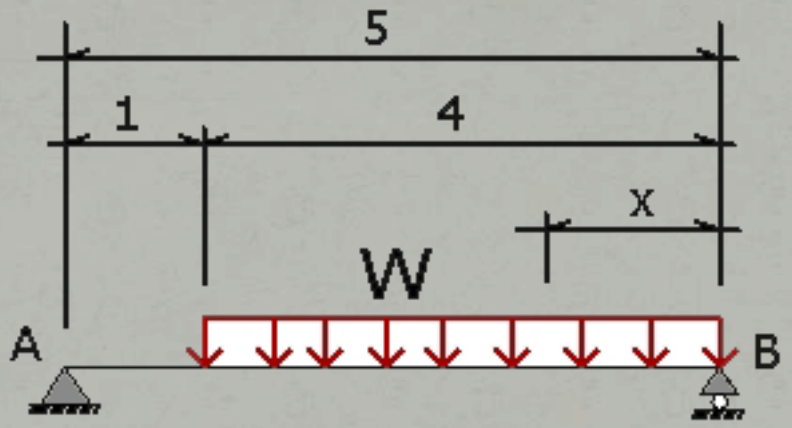
$$\frac{dMX}{dX} = 0 \rightarrow 1000\ X = 1875$$

$$X = 1{,}875\ \text{m}$$

M maks = 1875. 1,875 – 500. $1{,}875^2$
= 3516 – 1758 = **1758 kgm**

MC = RB. 2,5 = 625. 2,5
= 625. 2,5 = **1563 kgm**

11) Gambar bidang momen, gaya lintang.
W = 1000 Kg/m



ΣMB = 0 →

RA. 5 – W. 4. 2 = 0

RA. 5 – 1000. 8 = 0

5 RA – 8000 = 0

RA = **1600 kg**

ΣMA = 0 →

RB. 5 – W. 4. 3 = 0

5 RB – 12000 = 0

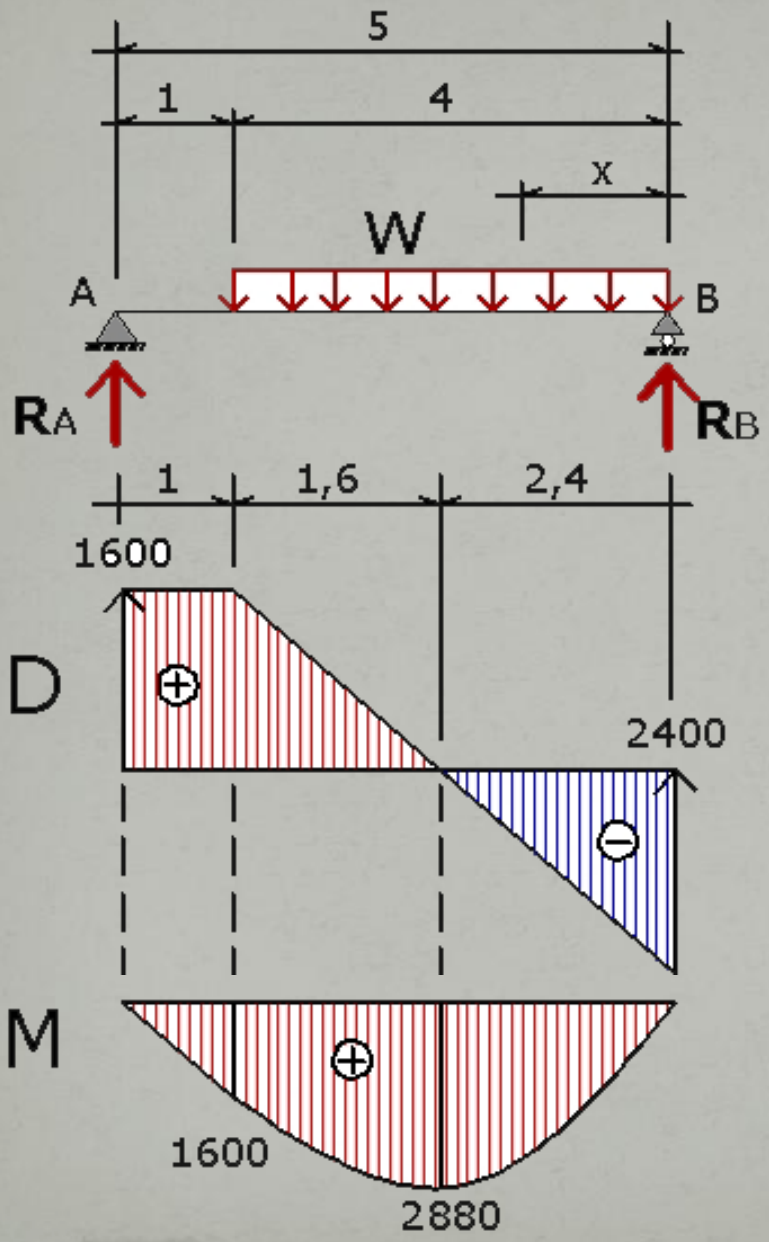
RB = **2400 kg**

ΣV = 0 →

RA + RB = W. 4

1600 + 2400 = 1000. 4

4000 = 4000 → **ok**



MX = RA. X – WX. 0,5 X

= 2400 X – 0,5. 1000 X^2

$$\frac{dMX}{dX} = 2400 - 1000\,X$$

$$\frac{dMX}{dX} = 0 \rightarrow 1000\,X = 2400$$

$$X = 2{,}4\ \text{m}$$

M maks = 2400. 2,4 – 500. $2{,}4^2$

= 5760 – 2880

= **2880 kgm**

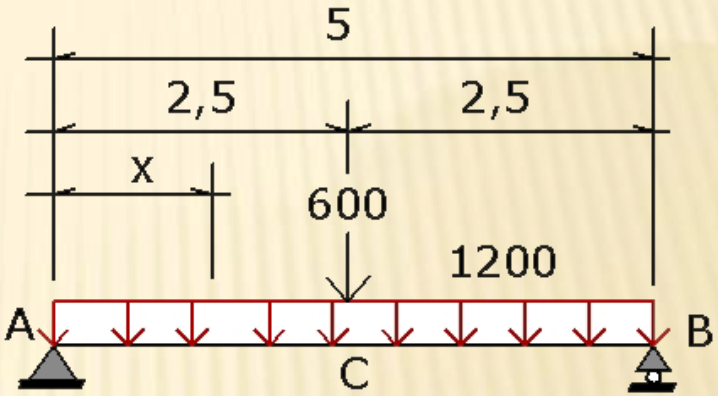
MC = RA. 1

= 1600. 1

= **1600 kgm**

KOMBINASI BEBAN TERPUSAT dengan BEBAN TERBAGI RATA

12) Gambar bidang momen, gaya lintang.
P = 600 Kg, W = 1000 Kg/m



ΣMB = 0 →
RA. 5 – P. 2,5 – W. 5. 2,5 = 0
5 RA – 600. 2,5 – 1200. 12,5
5 RA – 1500 – 15000 = 0
5 RA – 16500 = 0
RA = **3300 kg**

ΣMA = 0 →
RB. 5 – P. 2,5 – W. 5. 2,5 = 0
5 RB – 1500 – 15000 = 0
5 RB – 16500 = 0
RB = **3300 kg**

ΣV = 0 →
RA + RB = W. 5 + P
3300 + 3300 = 1200. 5 + 600
6600 = 6600 → **ok**

MX = RA. X – WX. 0,5 X

= 3300 X – 0,5. 1200 X^2

$\frac{dMX}{dX}$ = 3300 – 1200 X

$\frac{dMX}{dX}$ = 0 → 1200 X = 3300

X = 2,75 m > 2,5 m → tidak mungkin

M maks = MC = RA. 2,5 – W. 2,5. 1,25

= 3300. 2,5 – 1200. 3,125

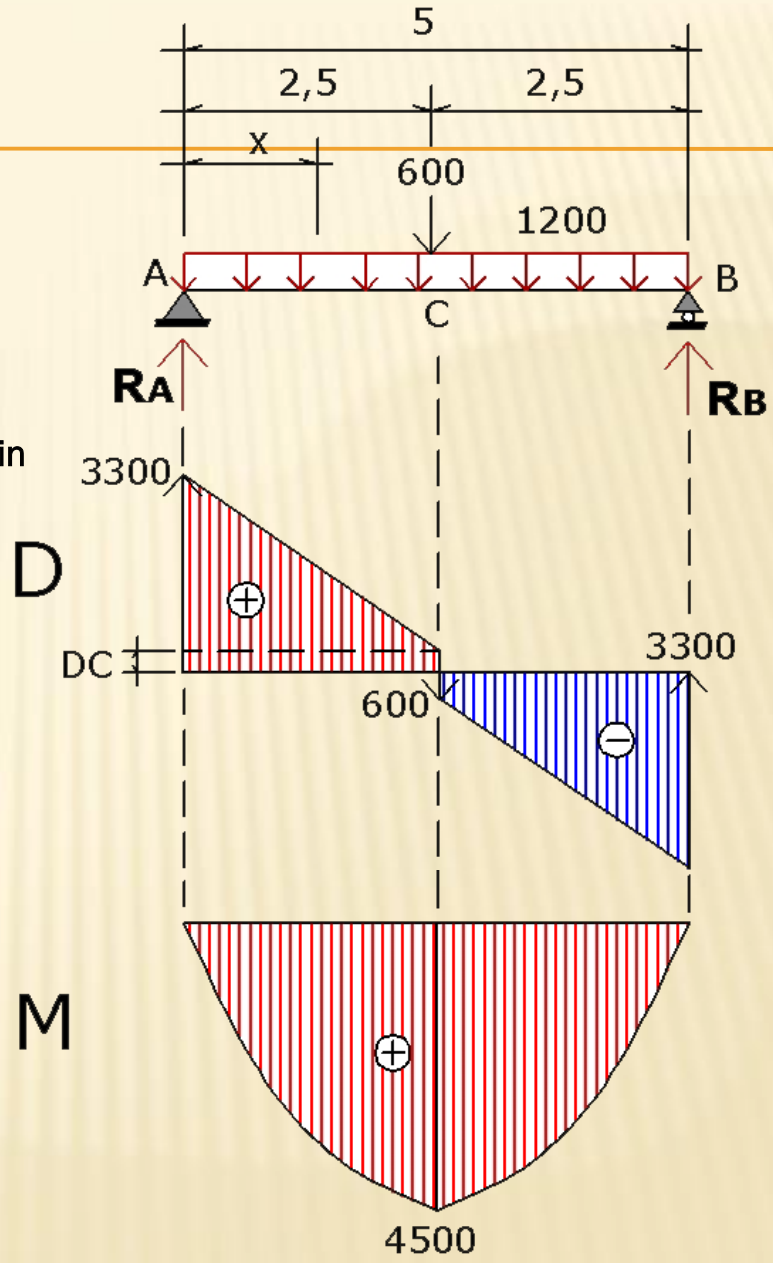
= 8250 – 3750

= **4500 kgm**

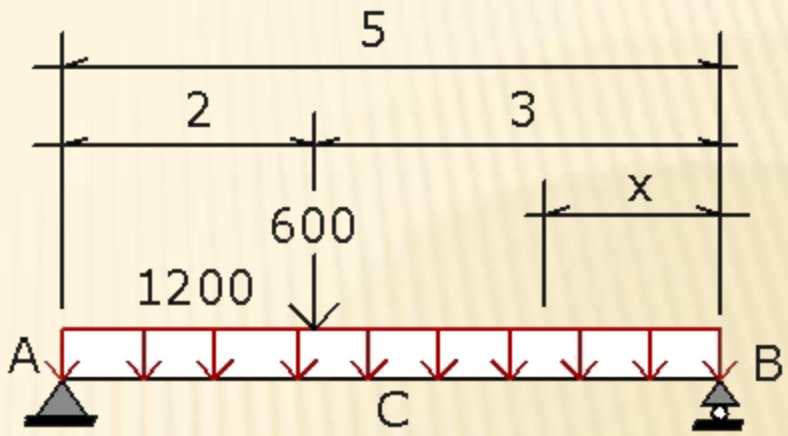
DC = RA – W. 2

= 3300 – 1200. 2,5

= **300 kg**



12) Gambar bidang momen, gaya lintang.
P = 600 Kg, W = 1000 Kg/m



ΣMB = 0 →

RA. 5 – P. 3 – W. 5. 2,5 = 0

5 RA – 600. 3 – 1200. 12,5 = 0

5 RA – 1800 – 15000 = 0

RA = **3360 kg**

ΣMA = 0 →

RB. 5 – P. 2 – W. 5. 2,5 = 0

5 RB – 600. 2 – 1200. 12,5 = 0

5 RB – 1200 – 15000 = 0

RB = **3240 kg**

ΣV = 0 →

RA + RB = W. 5 + P

3360 + 3240 = 1200. 5 + 600

6600 = 6600 → ok

DC = RA – W. 2
= 3360 – 1200. 2
= **960 kg**

MX = RB. X – WX. 0,5 X
= 3240 X – 0,5. 1200 X^2

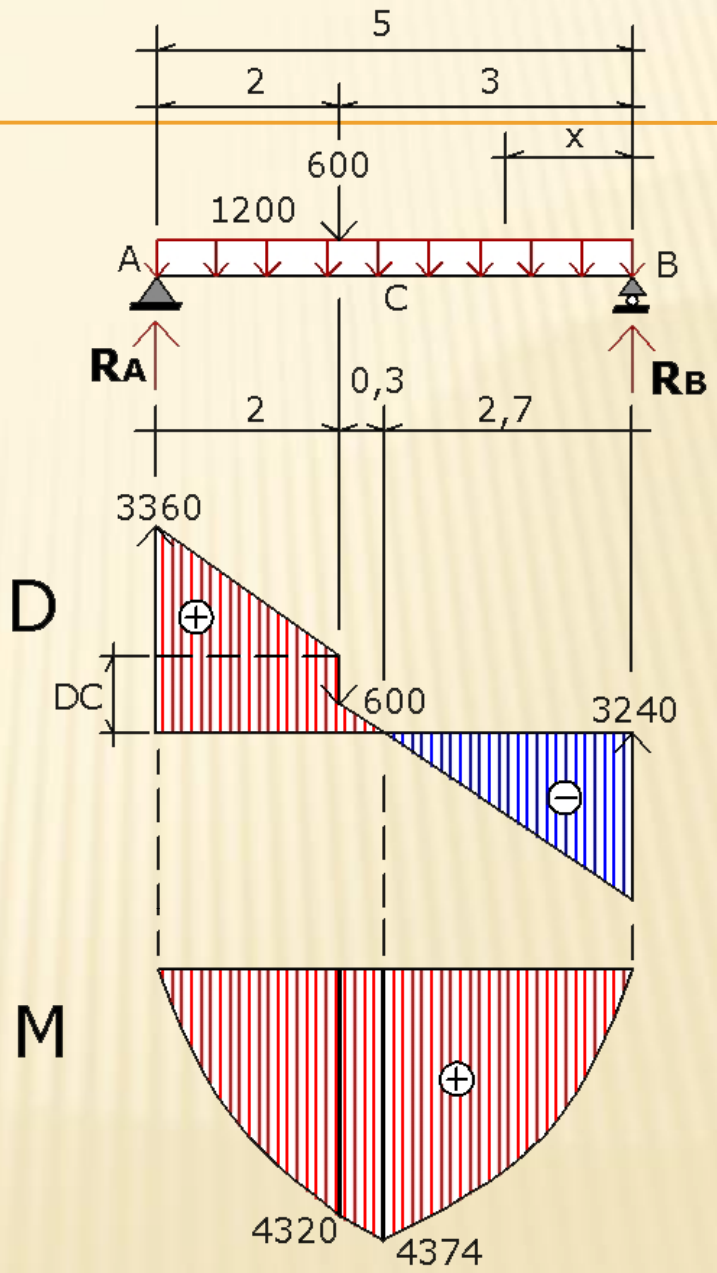
$$\frac{dMX}{dX} = 3240 - 1200\ X$$

$$\frac{dMX}{dX} = 0 \rightarrow 120\ X = 2{,}70\ m$$

X = 2,70 m

M maks = 3240. 2,70 – 600. $2{,}70^2$
= 8748 – 4374
= **4374 kgm**

MC = RA. 2 – W. 2. 1
= 3360. 2 – 1200. 2
= 6720 – 2400
= **4320 kgm**



15) Gambar bidang momen dan gaya lintang.
P = 600 kg, W = 1500 kg/m

ΣMB = 0

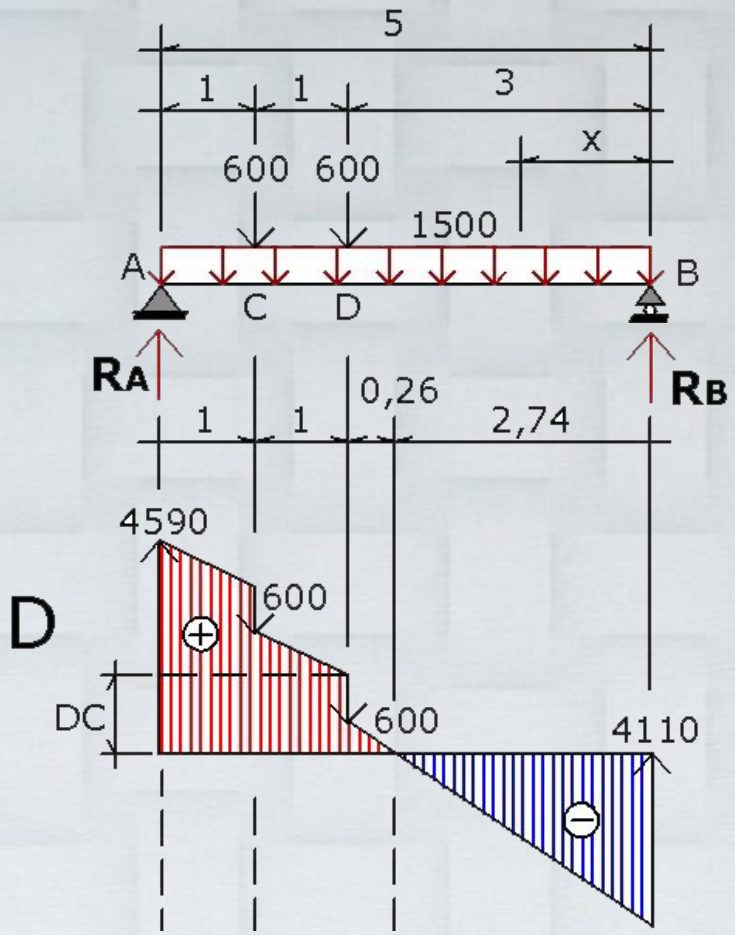
RA. 5 – P. 4 – P. 3 – W. 5. 0,5. 5 = 0
RA 5 – 600. 4 – 600. 3 – 1500. 5. 2,5 = 0
5 RA – 2400 – 1800 – 18750 = 0
5 RA – 22950 = 0
RA = 4590 kg

ΣMA = 0

RB. 5 – P. 1 – P. 2 – 0,5 W $(5)^2$ = 0
RB 5 – 600. 1 – 600. 2 – 0,5. 1500. 5^2 = 0
5 RB – 600 – 1200 – 18750 = 0
5 RB – 20550 = 0
RB = 4110 kg

ΣV = 0 →

RA + RB = 2P + W. 5
4590 + 4110 = 1200 + 1500. 5
8700 = 8700 → ok



$MX = RB.\ X - 0{,}5\ WX^2$

$= 4110\ X - 0{,}5.\ 1500\ X^2$

$\frac{dMX}{dX} = 4110 - 1500\ X$

$\frac{dMX}{dX} = 0 \rightarrow 1500\ X = 4110$

$X = 2{,}74\ \text{m}$

M maks = $4110.\ 2{,}74 - 750.\ 2{,}74^2$

$= 1126`1 - 5631$

$=$ **5630 kgm**

$MC = RA.\ 1 - 0{,}5\ W\ (1)^2$

$= 4590.\ 1 - 0{,}5\ .1500.\ 1$

$= 4590 - 750$

$=$ **3840 kgm**

$MD = RB.\ 3 - 0{,}5\ W\ (3)^2$

$= 4110.\ 3 - 0{,}5.1500.\ 9$

$= 12330 - 6750$

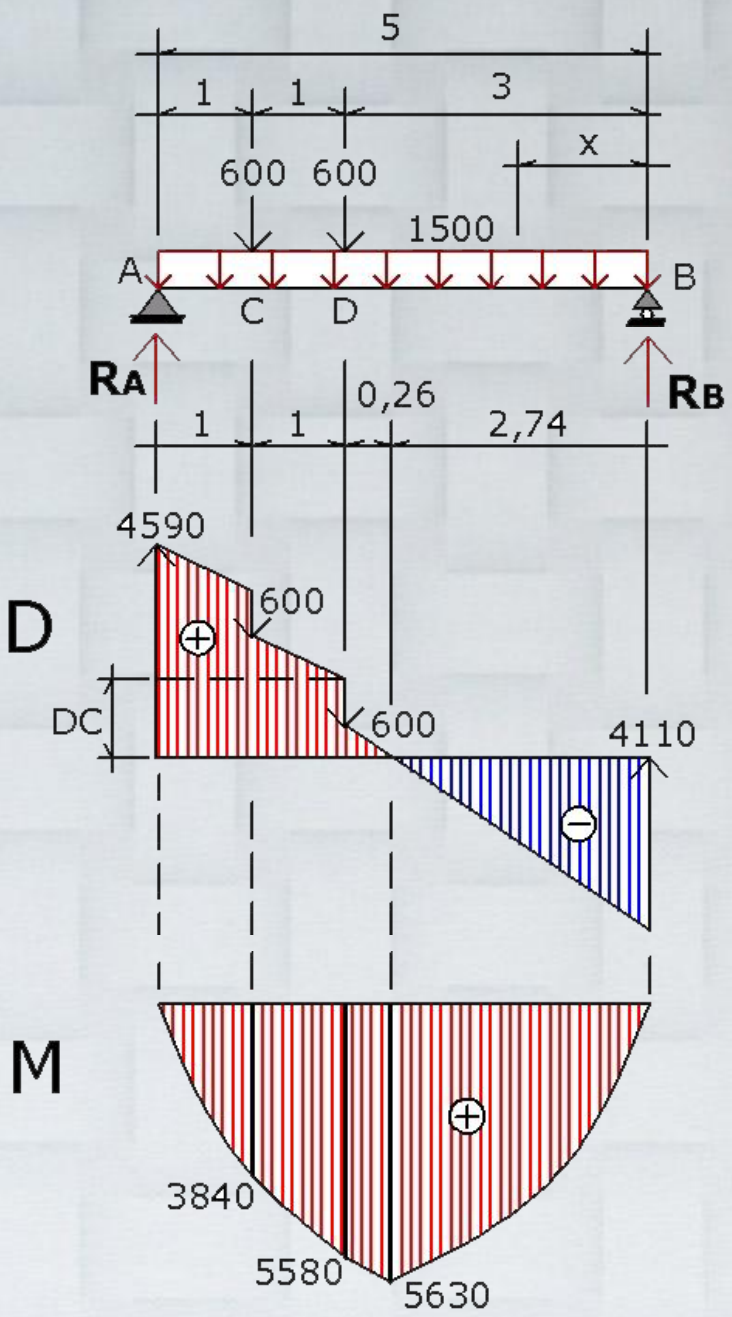
$=$ **5580 kgm**

DC = RA – 1 W

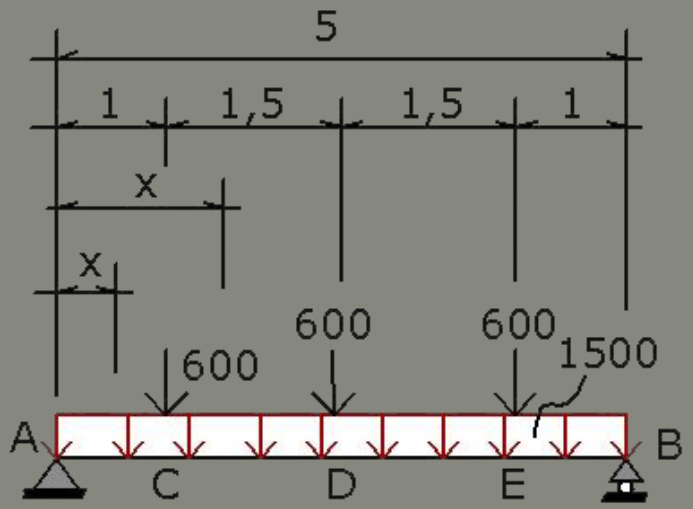
= 4590 – 1. 1500 = **3090 kg**

DD = RB – 3 W

= 4110 – 3. 1500 = **- 390 kg**



16) Gambar bidang momen dan gaya lintang.
P = 600 kg, W = 1500 kg/m



$\Sigma MB = 0 \rightarrow$

$RA.\ 5 - P.\ 4 - P.\ 2{,}5 - P.\ 1 - W.\ 5.\ 0{,}5.\ 5 = 0$

$RA\ 5 - 600.\ 4 - 600.\ 2{,}5 - 600.\ 1 - 1500.\ 5.\ 2{,}5 = 0$

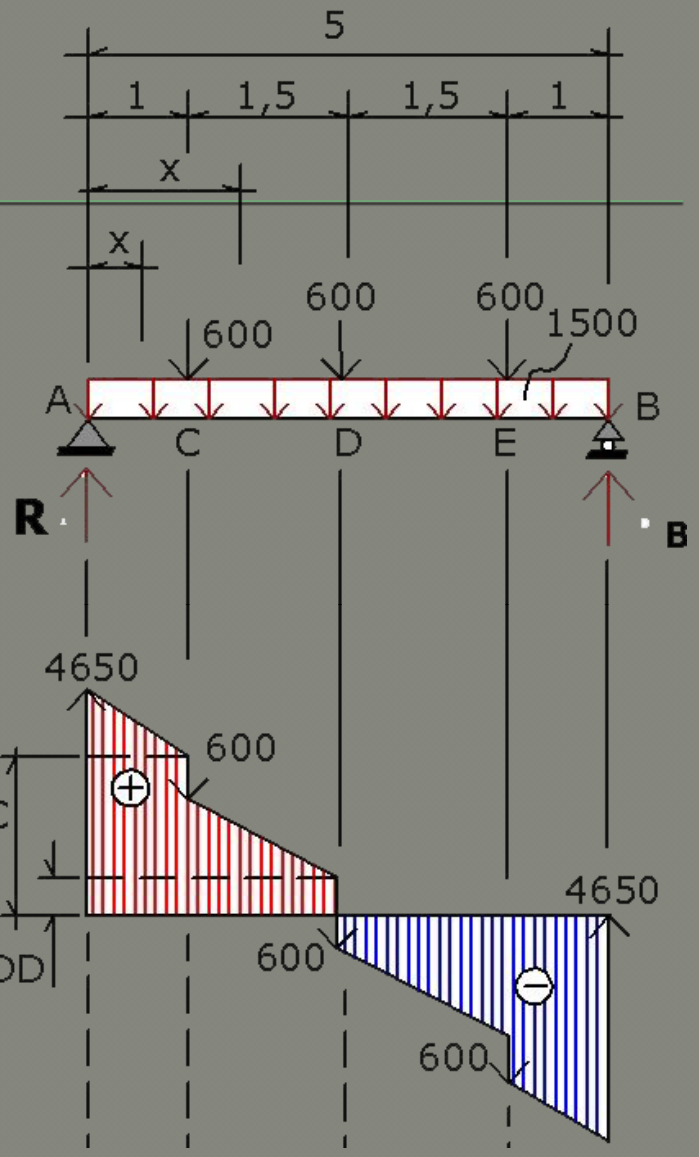
$5\ RA - 2400 - 1500 - 600 - 18750 = 0$

$5\ RA - 23250 = 0$

RA = 4650 kg

Struktur simetris → **RA = RB = 4650 kg**

Struktur simetris → **RA = RB = 4650 kg**



*** X = (0 – 1) m**

$MX = RA.\ X - 0{,}5\ W\ X^2$

$= 4650\ X - 0{,}5.\ 1500\ X^2$

$\frac{dMX}{dX} = 4650 - 1500\ X$

$\frac{dMX}{dX} = 0 \rightarrow 1500\ X = 4650$

X = 3,1 m > 1 m (Tidak Mungkin)

*** X = (0 – 2,5) m**

$MX = RA.\ X - P\ (X - 1) - 0{,}5\ W\ X^2$

$= 4650\ X - 600\ (X - 1) - 0{,}5.\ 1500\ X^2$

$= 4650\ X - 600\ X + 600 - 750\ X^2$

$= 4050\ X + 600 - 750\ X^2$

$\frac{dMX}{dX} = 4050 - 1500\ X$

$\frac{dMX}{dX} = 0 \rightarrow 1500\ X = 4050$

X = 2,7 m > 2,5 m (Tidak Mungkin)

M maks = MD

= RA. 2,5 – P. 1,5 -0,5 W. $2,5^2$

= 4650. 2,5 – 600. 1,5 – 0,5. 1500. 2,25

= 11625 – 800 – 4687

= **6138 kgm`**

MC = ME = RA. 1 – W.1.0,5

= 4650. 1 – 1500. 0,5

= **3900 kgm**

DC = RA – W. 1

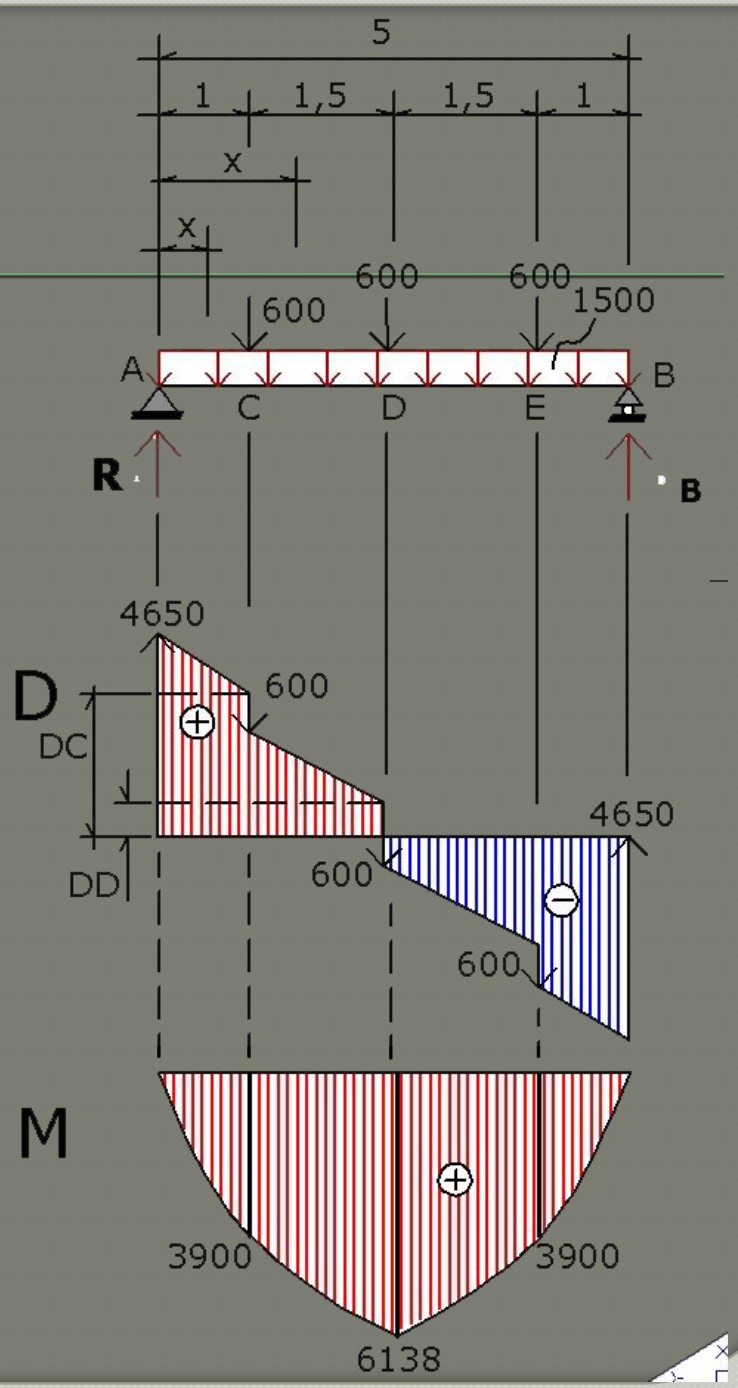
= 4650 – 1500. 1

= **3150 kg**

DD = RA – P – W. 2,5

= 4650 – 600 – 1500. 2,5

= **300 kg**



17) Gambar bidang momen dan gaya lintang.
W = 1000 kg/m

Resultante gaya : R = 0,5 W. 5
R = 0,5. 1000. 5
= **2500 kg**

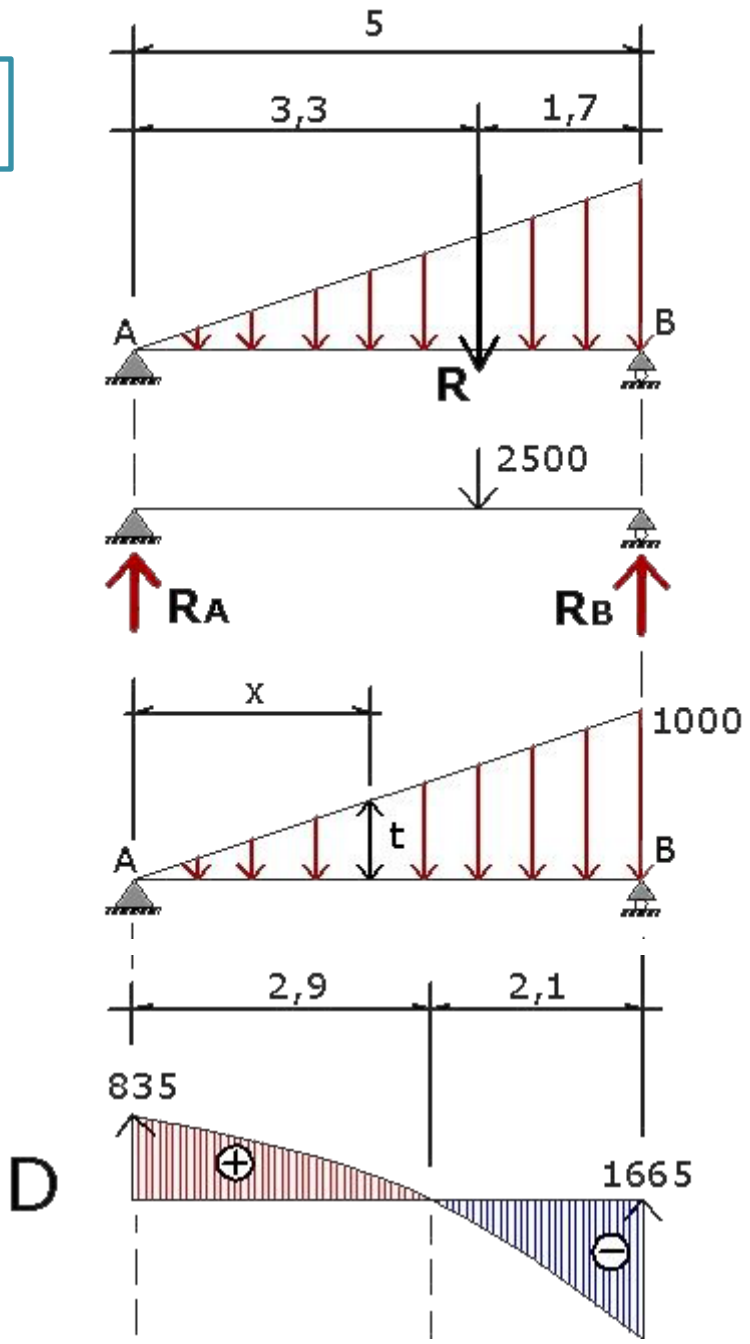
ΣMB = 0 →
RA. 5 – R 1/3. 5 = 0
RA 5 – 2500. 1,67 = 0
5 RA – 4175 = 0
RA = 835 kg

ΣMA = 0 →
RB. 5 – R 2/3. 5 = 0
RB 5 – 2500. 3,33 = 0
5 RB – 8325 = 0
RB = 1665 kg

ΣV = 0 →
RA + RB = R
835 + 1665 = 2500
2500 = 2500 → **ok**

$$t = \frac{W\,X}{L} = \frac{1000\,X}{5} = 200\ X$$

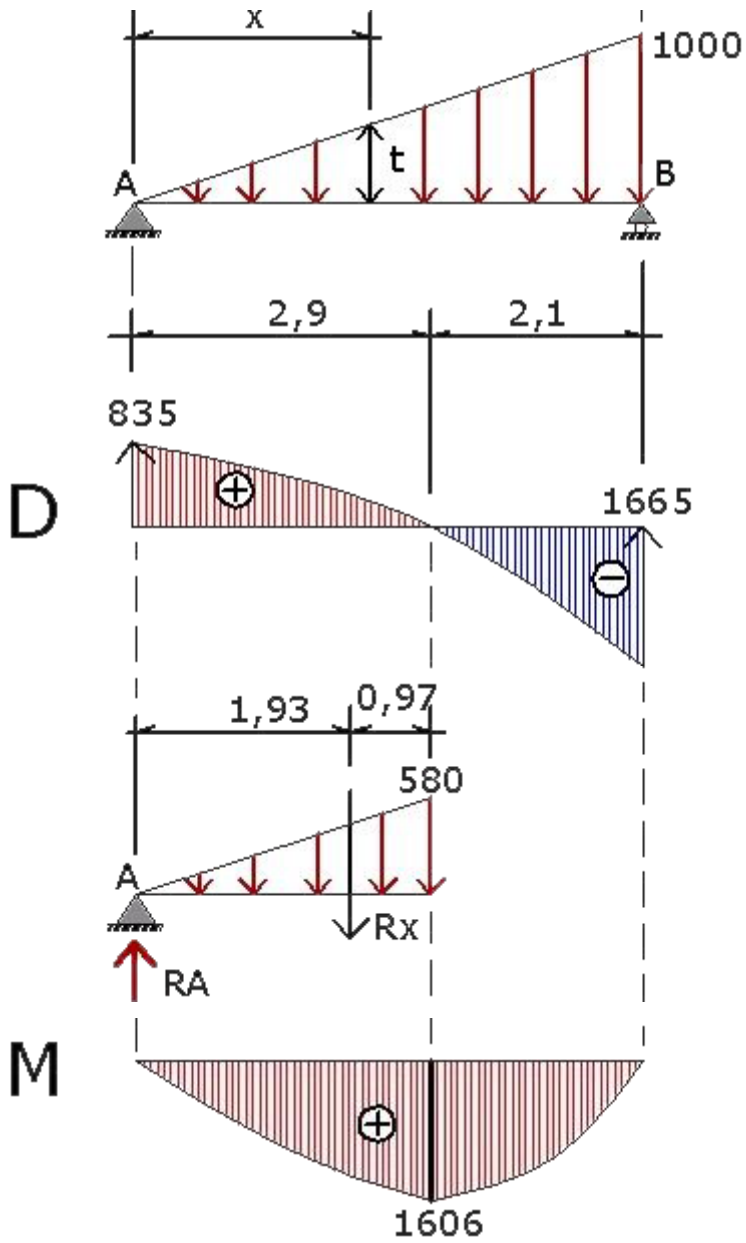
DX = RA – 0,5 t X
= 835 – 0,5. 200 X^2 = 835 – 100 X^2
DX = 0 →
100 X^2 = 835
X = 2,90 m



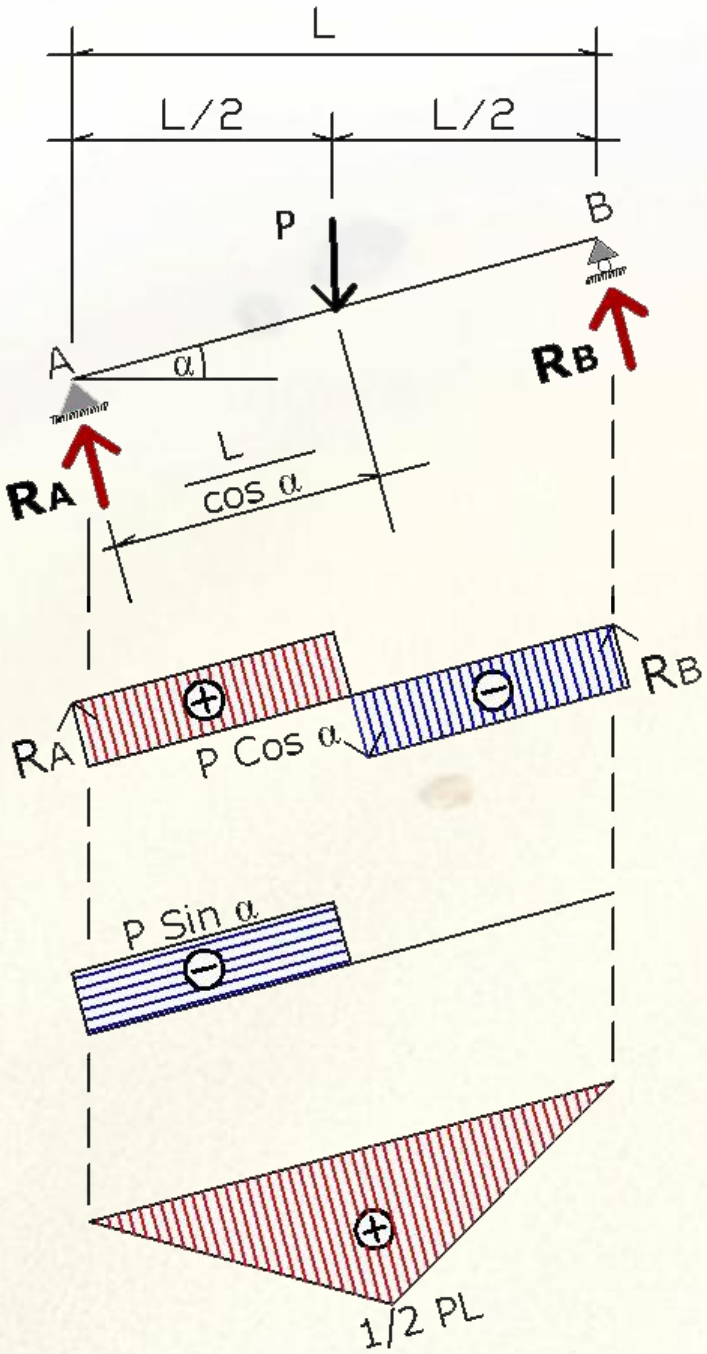
t = 200 X
= 200. 2,90
= **580 kg/m**

RX = 0,5 t X
= 0,5. 580. 2,90
= **841 kg**

M maks = RA. X – RX. 0,97
= 835. 2,90 – 841. 0,97
= **1606 kgm**



Balok Sederhana Dengan Perletakan Miring.



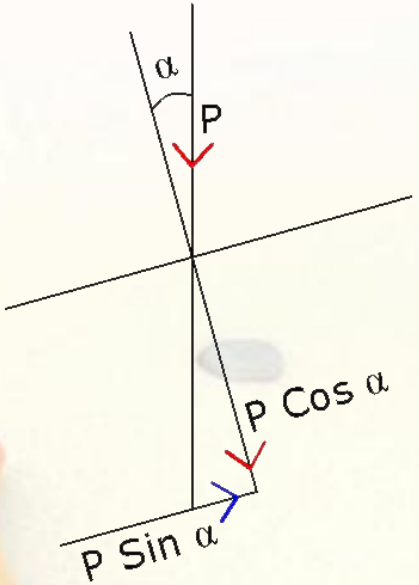
ΣV = 0 →

RA = RB

= 0,5 P cos α

ΣH = 0 →

RAH = P sin α



$$MC = RA\frac{1}{\cos\alpha}L$$

$$= 0{,}5.P.\cos\alpha\frac{1}{\cos\alpha}L$$

$$= 0{,}5.P.L$$

18) Gambar bidang momen, gaya lintang dan gaya aksial.
P = 800 kg, $\alpha = 30^o$

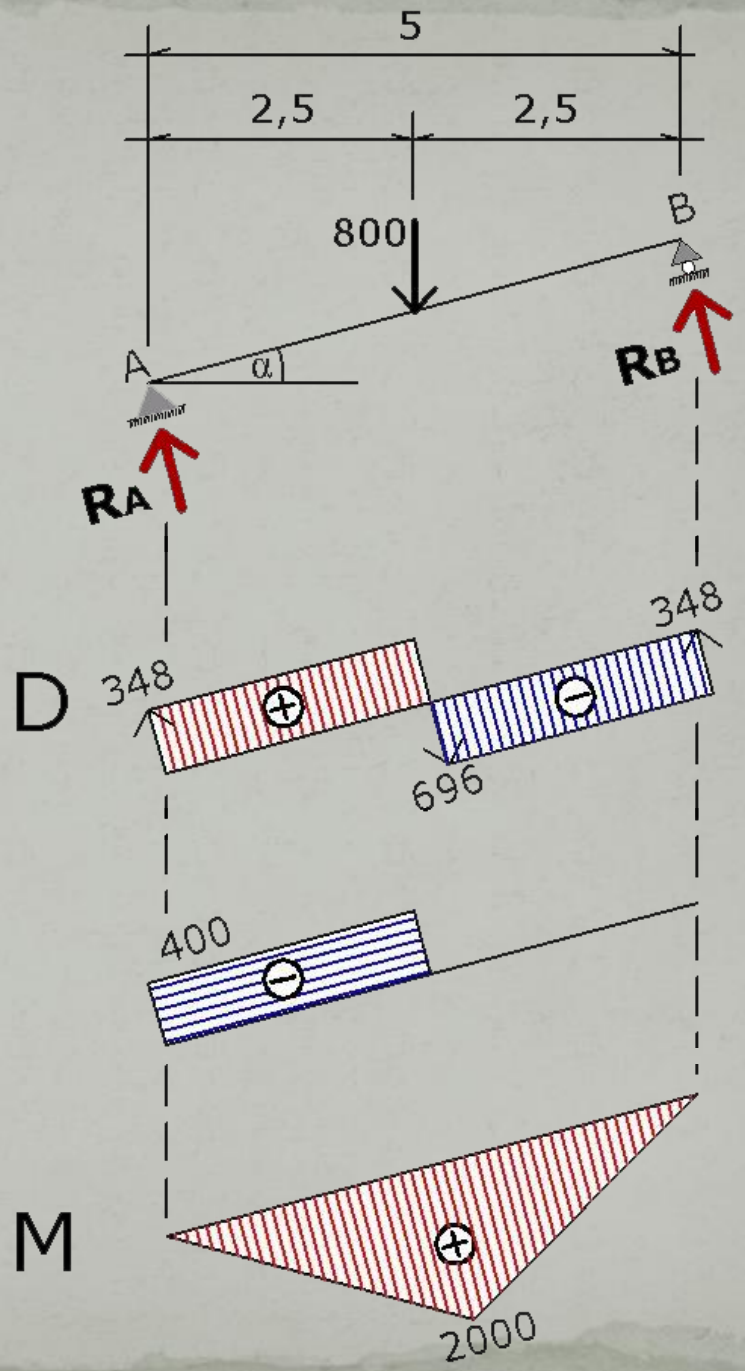
$\Sigma V = 0$ →

RA = RB = 0,5 P cos 30^o
= 0,5 . 800. 0,87
= **348 kg**

$\Sigma H = 0$ →

RAH = P sin 30^o
= 800. 0,5
= **400 kg**

MC = 0,25 P. 5
= 0,25. 800. 5
= **1000 kgm**



19) Gambar bidang momen, gaya lintang dan gaya aksial.
W = 1200 kg/m, $\alpha = 30^o$

$\Sigma V = 0 \rightarrow$

RA = RB = 0,5 Q cos 30^o

= 0,5. 1200. 5. 0,87

= **2610 kg**

$\Sigma H = 0 \rightarrow$

RAH = Q sin 30^o

= 1200. 5. 0,5

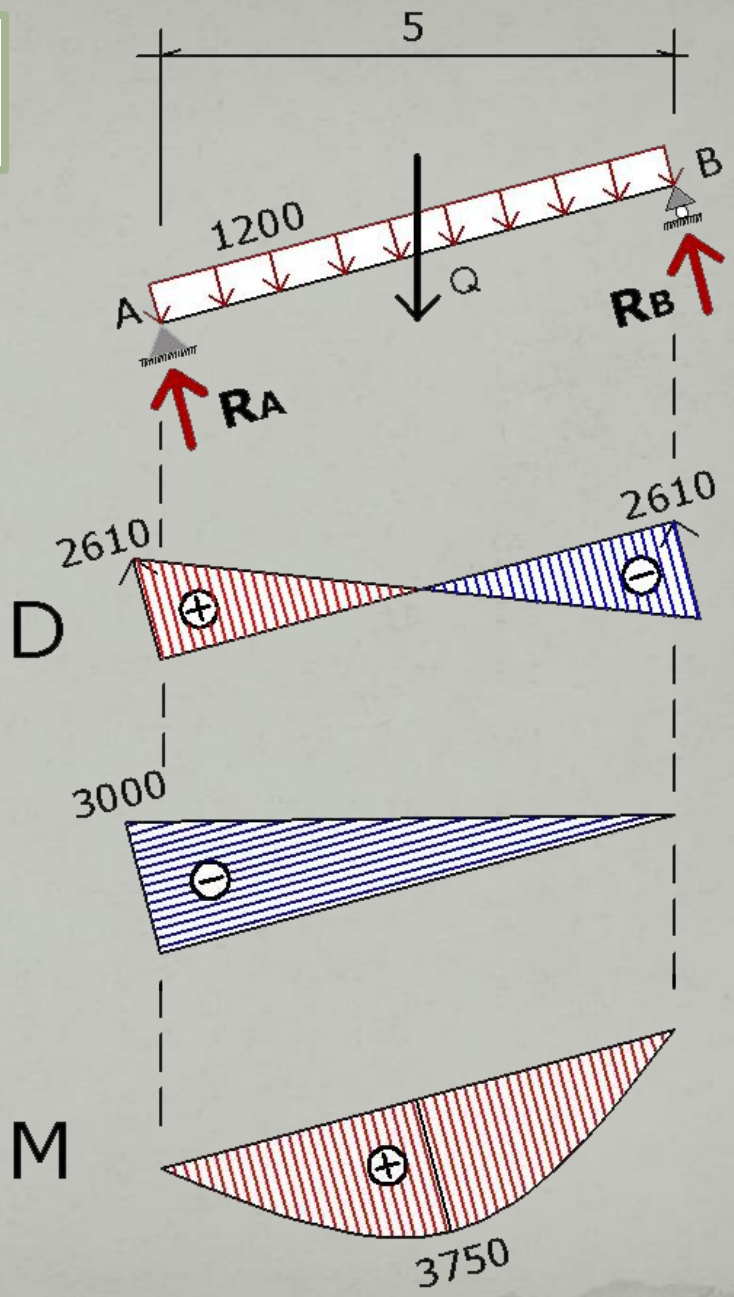
= **3000 kg**

* Miringnya balok tidak berpengaruh terhadap besarnya M Maks, pengaruhnya hanya pada D dan N.

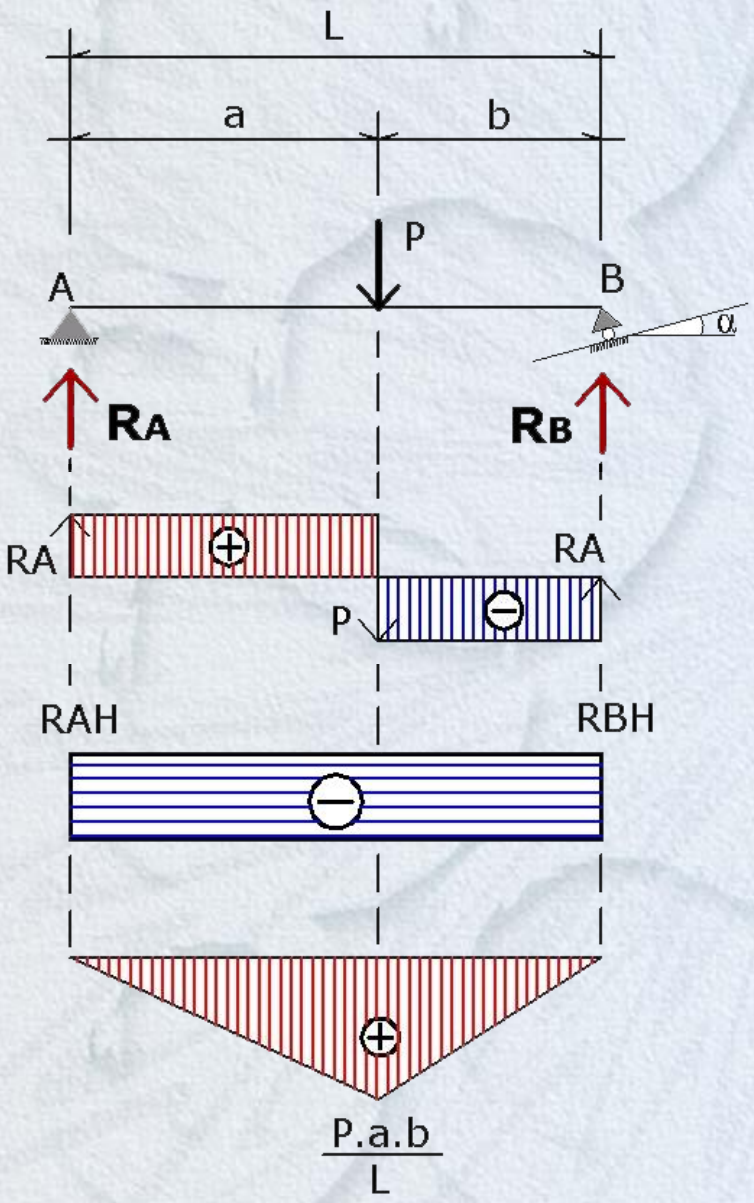
M maks = 1/8 W. 5^2

= 1/8. 1200. 25

= **3750 kgm**



Balok Sederhana Salah Satu Perletakannya Miring.



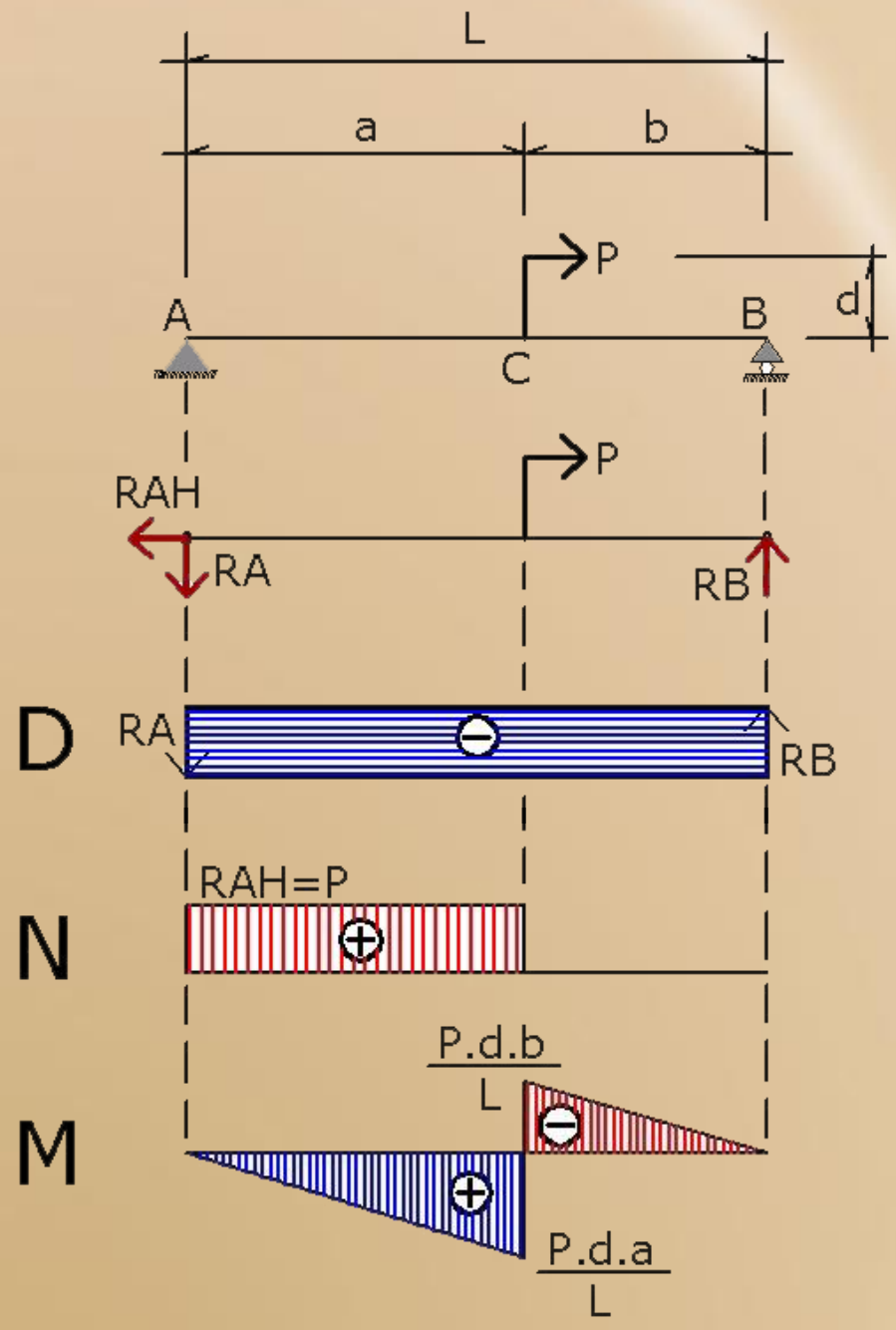
$$RA = \frac{b}{L} P$$

$$RB = \frac{a}{L} P$$

RAH = RBH = RB tan α

$$= \frac{a}{L} P.\tan \alpha$$

$$MC = \frac{P\,a\,b}{L}$$



Momen Sebagai Beban.

ΣMB = 0 →

RA. L + P. d = 0

$$RA = -\frac{Pd}{L} \downarrow$$

ΣMA = 0 →

RB. L – P. d = 0

$$RB = \frac{Pd}{L} \uparrow$$

ΣH = 0 →

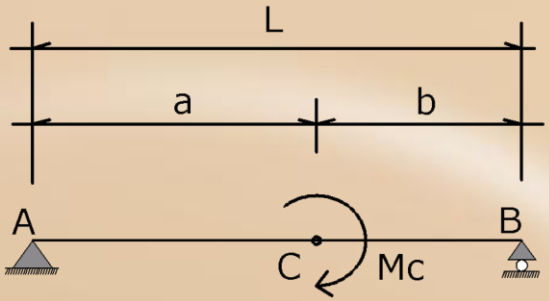
RAH = P (kekiri)

MC (kiri) = RA. a

$$= -\frac{Pd}{L} a$$

MC (kanan) = RB. b

$$= \frac{Pd}{L} b$$



Gambar Soal diatas dapat diganti dengan beban momen → MC
di titik C → MC = P d

ΣMB = 0 →

RA. L + M = 0

$$RA = -\frac{M}{L}$$

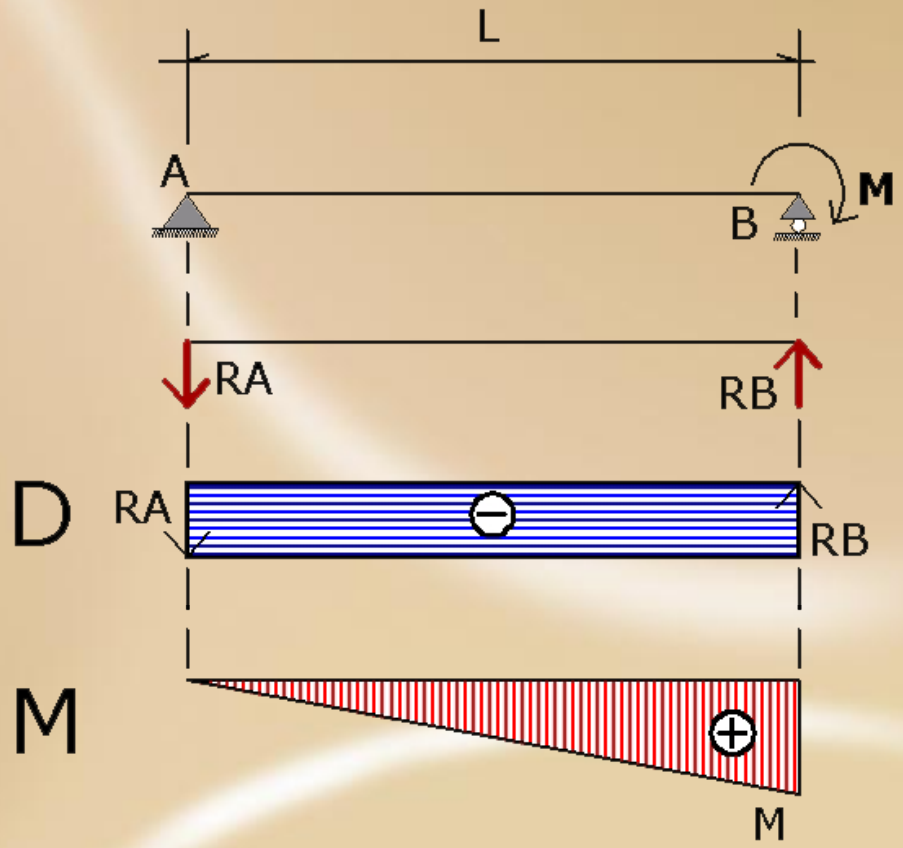
ΣMA = 0 →

RB. L – M = 0

$$RA = \frac{M}{L}$$

MA = 0

MB = - M



Balok Sederhana dengan Balok Kantilever.

ΣMB = 0 →

RA. L_1 + P L_2 = 0

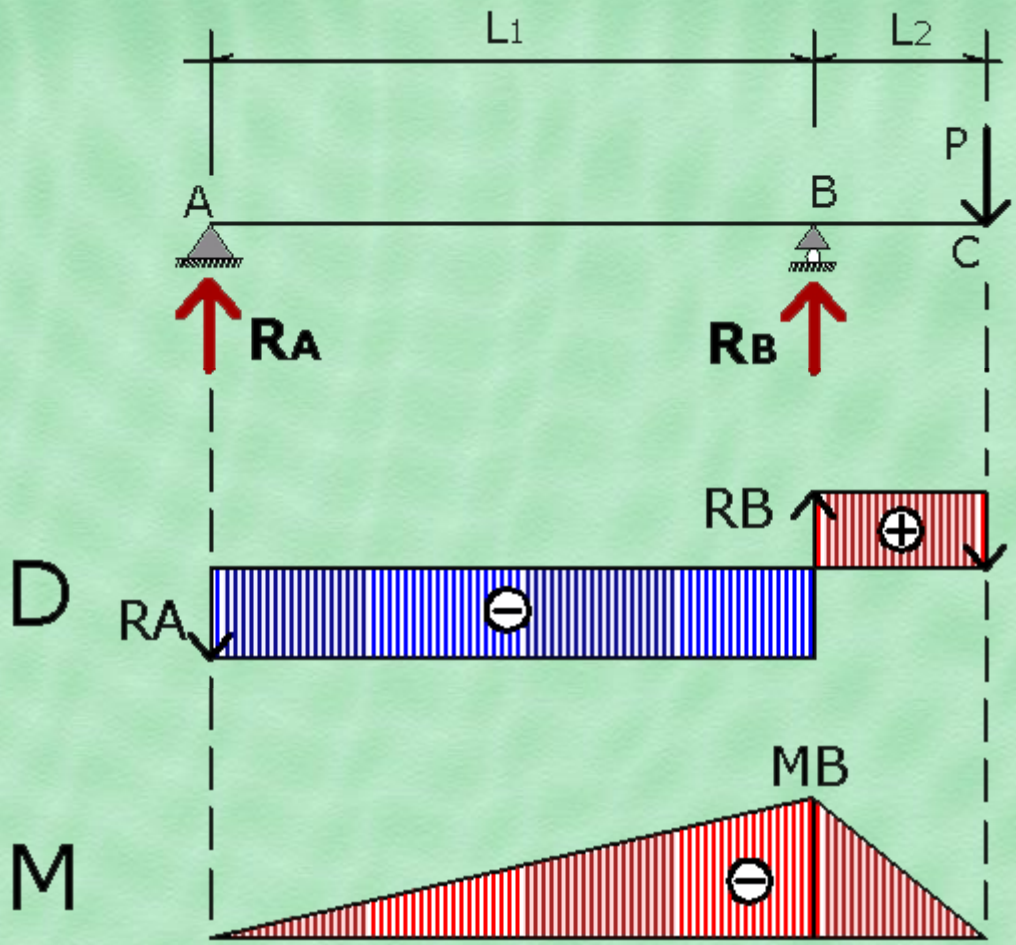
$$RA = -\frac{PL_2}{L_1} \downarrow$$

ΣMA = 0 →

RB. L_1 – P (L_1 + L_2) = 0

$$RB = \frac{P(L_1+L_2)}{L_1} \uparrow$$

MB = P L_2



20) Gambar bidang momen dan gaya lintang
P = 600 kg

ΣMB = 0 →
RA. 5 + P. 2 = 0
RA 5 + 600. 2 = 0
5 RA + 1200 = 0
RA = **- 240 kg**

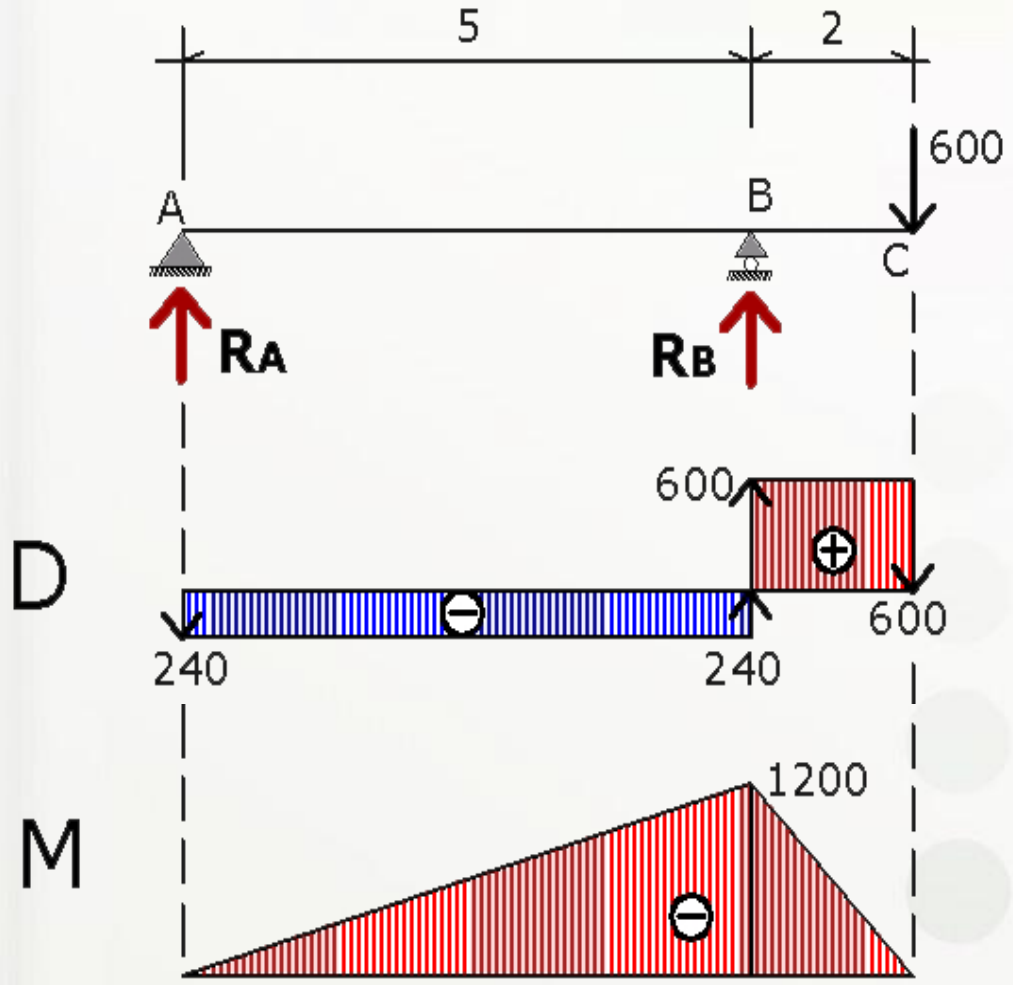
ΣMA = 0 →
RB. 5 – P. 7 = 0
RB 5 – 600. 7 = 0
5 RB – 4200 = 0
RB = **840 kg**

ΣV = 0 →
RA + RB = P
-240 + 840 = 600

600 = 600 → ok
RBC = P = **600 kg**

RBA = RB – RBC
= 840 – 600 = **240 kg**

MB = P. 3 = 600. 2
= **1200 kgm**

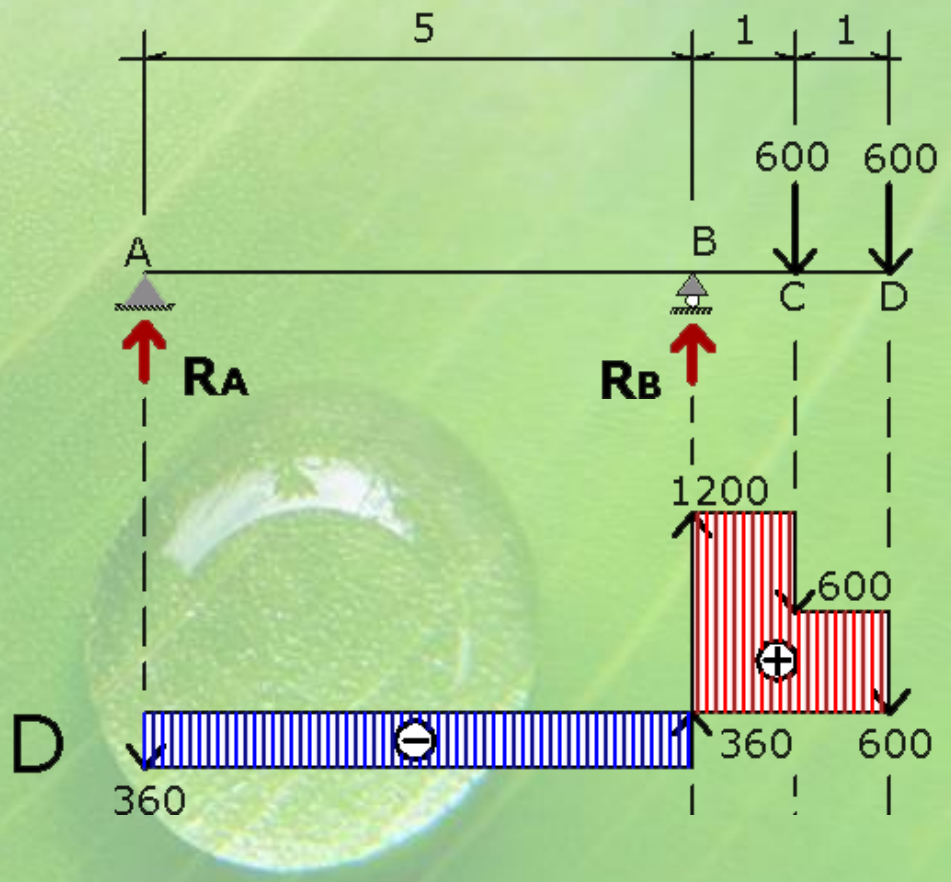


21) Gambar bidang momen dan gaya lintang
P = 600 kg

ΣMB = 0 →
RA. 5 + P.1 + P. 2 = 0
RA 5 + 600. 1 + 600. 2 = 0
5 RA + 600 + 1200 = 0
5 RA + 1800 = 0
RA = **- 360 kg**

ΣMA = 0 →
RB. 5 – P. 6 – P. 7 = 0
RB 5 – 600. 6 – 600. 7 = 0
5 RB – 3600 – 4200 = 0
5 RB – 7800 = 0
RB = **1560 kg**

ΣV = 0 →
RA + RB = 2 P
-360 + 1560 = 1200
-1200 = 1200 → **ok**

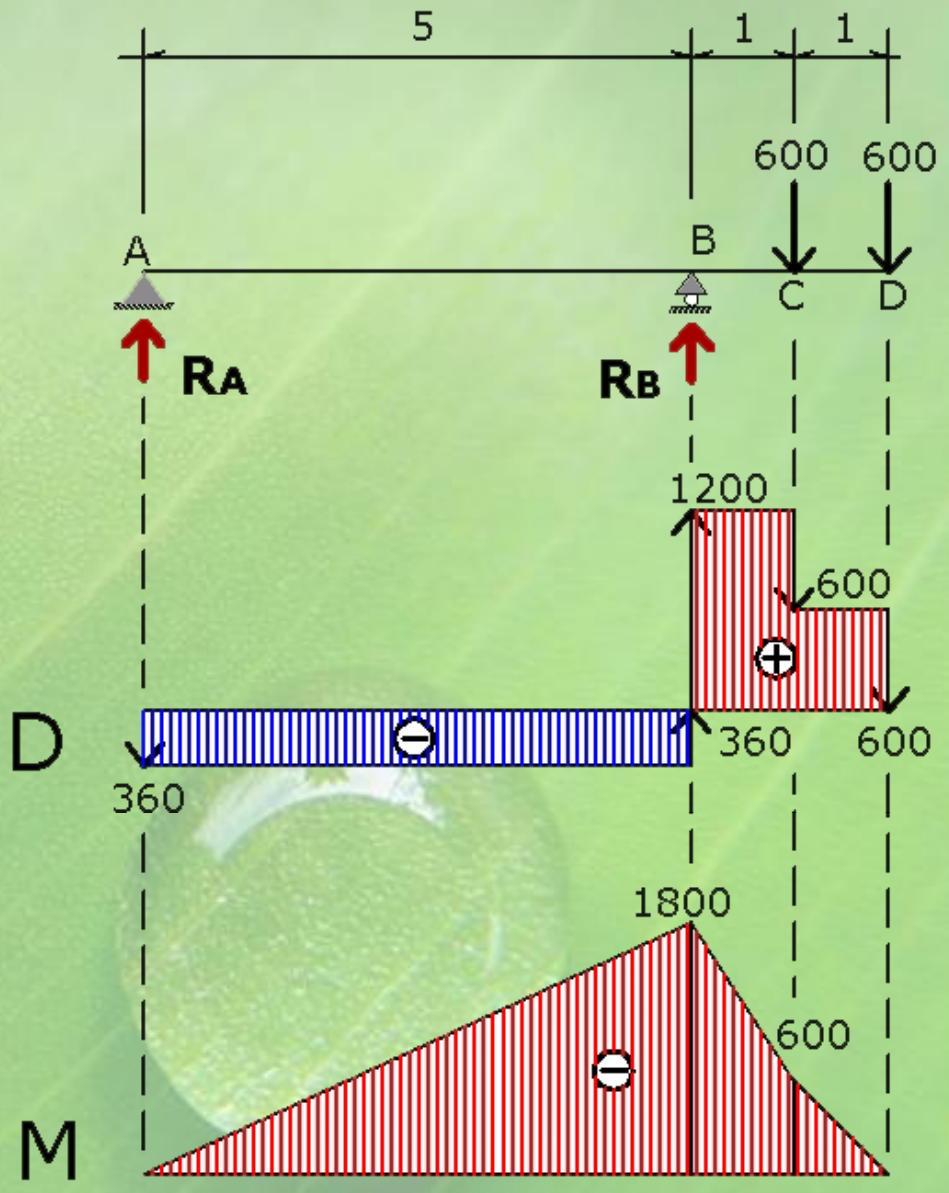


RBD = 2 P = 2. 600
= **1200 kg**

RBA = RB – RBD
= 1560 – 1200
= **360 kg**

MB = P. 1 + P. 2
= 600. 1 + 600. 2
= 600 + 1200
= **1800 kgm**

MC = P. 1
= 600. 1
= **600 kgm**



22) Gambar bidang momen dan gaya lintang
P_1 = 800 kg, P_2 = 600 kg

ΣMB = 0 →

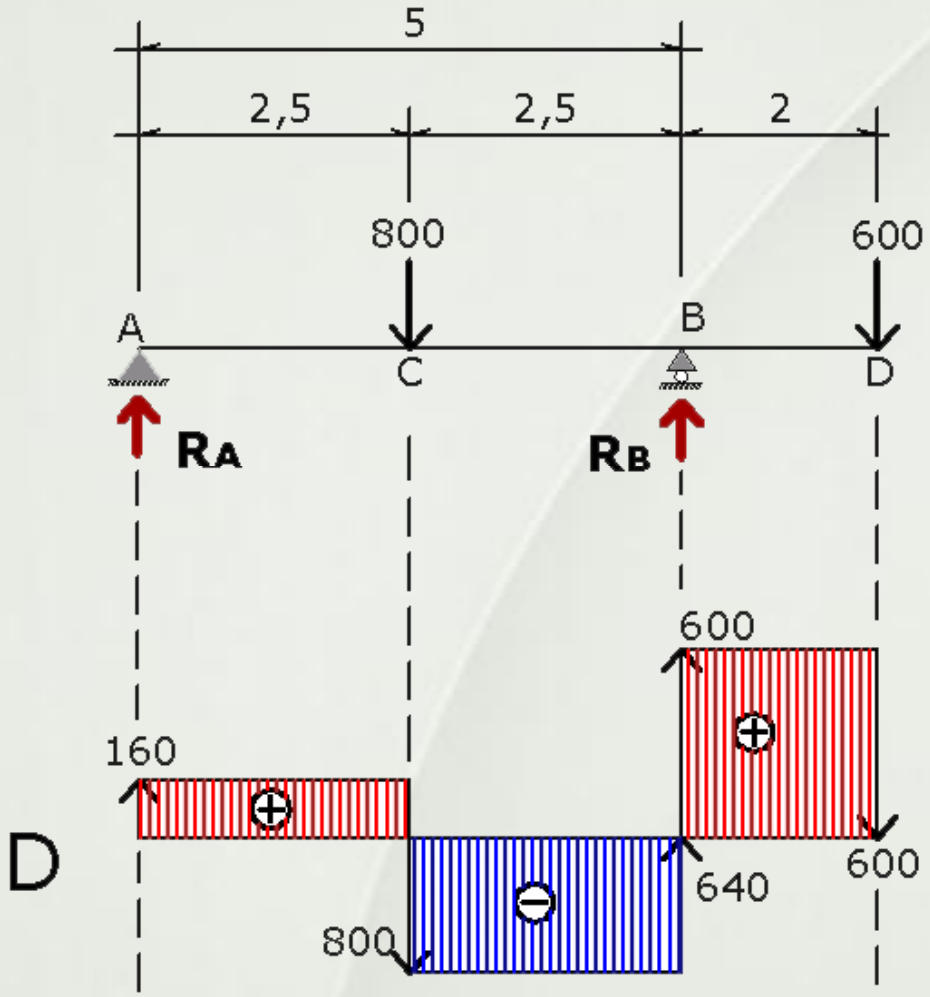
RA. 5 + P_2. 2 – P_1. 2,5 = 0
RA 5 + 600. 2 – 800. 2,5 = 0
5 RA + 1200 – 2000 = 0
5 RA – 800 = 0
RA = **160 kg**

ΣMA = 0 →

RB. 5 – P_1. 2,5 – P_2. 7 = 0
RB 5 – 800. 2,5 – 600. 7 = 0
5 RB – 2000 – 4200 = 0
5 RB – 6200 = 0
RB = **1240 kg**

ΣV = 0 →

RA + RB = P_1 + P_2
160 + 1240 = 800 + 600
1400 = 1400 → **ok**

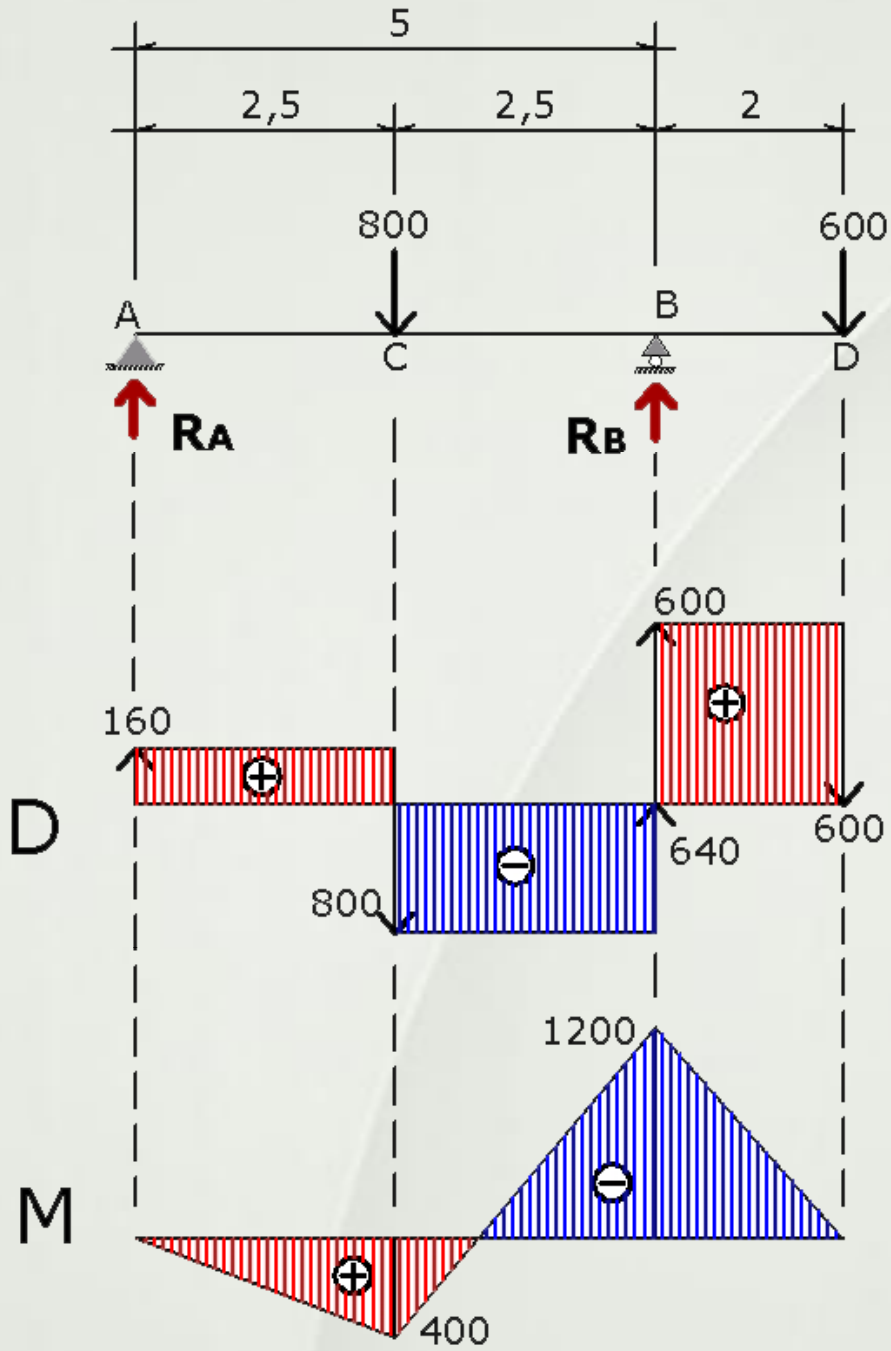


RBD = P_2 = **600 kg**

RBA = RB – RBD
= 1240 – 600
= **640 kg**

MB = P_2. 2
= 600. 2
= **1200 kgm**

MC = RA. 2,5
= 160. 2.5
= **400 kgm**



23) Gambar bidang momen dan gaya lintang
P_1 = 800 kg, P_2 = 600 kg

ΣMB = 0 →

RA. 5 + P_2 . 2 – P_1. 1,5 – P_1. 3,5 = 0

RA 5 + 600. 2 – 800. 3,5 – 800. 1,5 = 0

5 RA + 1200 – 2800 – 1200 = 0

5 RA – 2800 = 0

RA = **560 kg**

ΣMA = 0 →

RB. 5 – P_1. 1,5 – P_1. 3,5 – P_2. 7 = 0

RB 5 – 800. 1,5 – 800. 3,5 – 600. 7 = 0

5 RB – 1200 – 2800 – 4200 = 0

5 RB – 8200 = 0

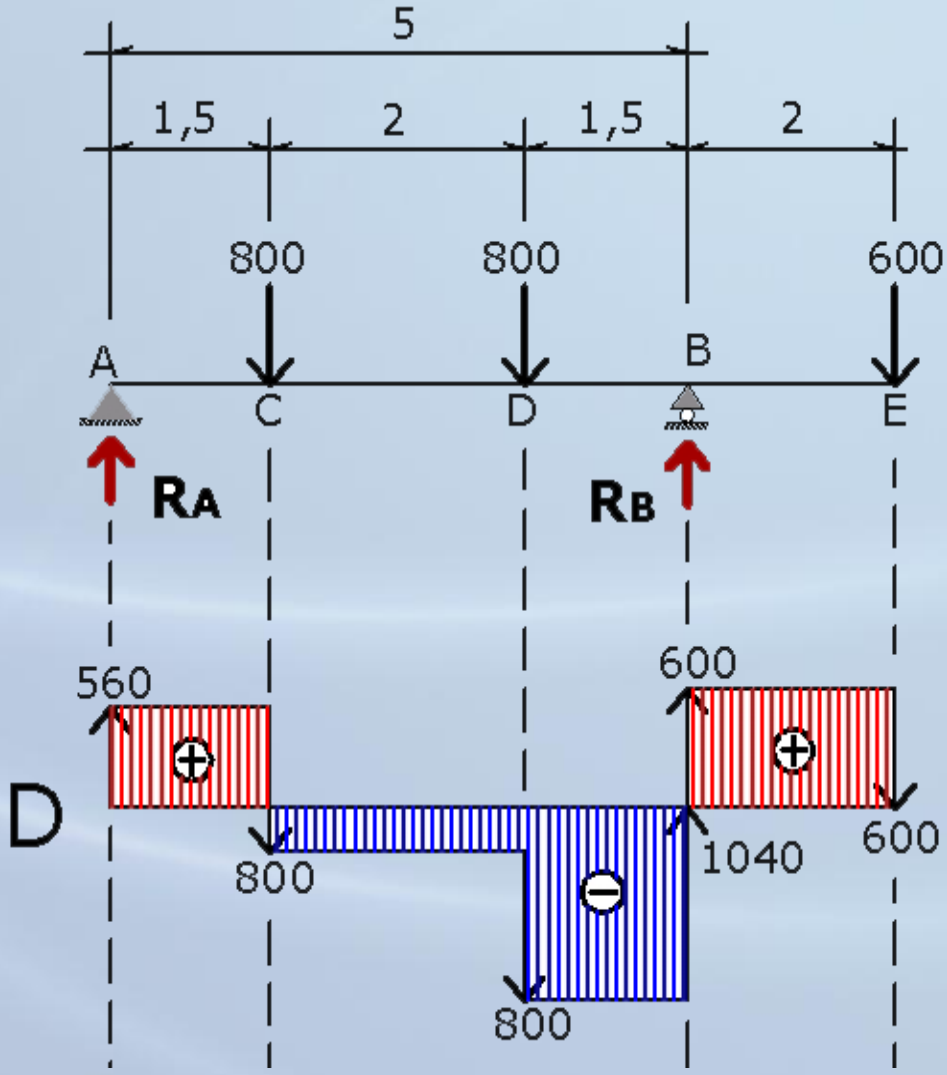
RB = **1640 kg**

ΣV = 0 →

RA + RB = 2 P_1 + P_2

560 + 1640 = 2. 800 + 600

2200 = 2200 → **ok**



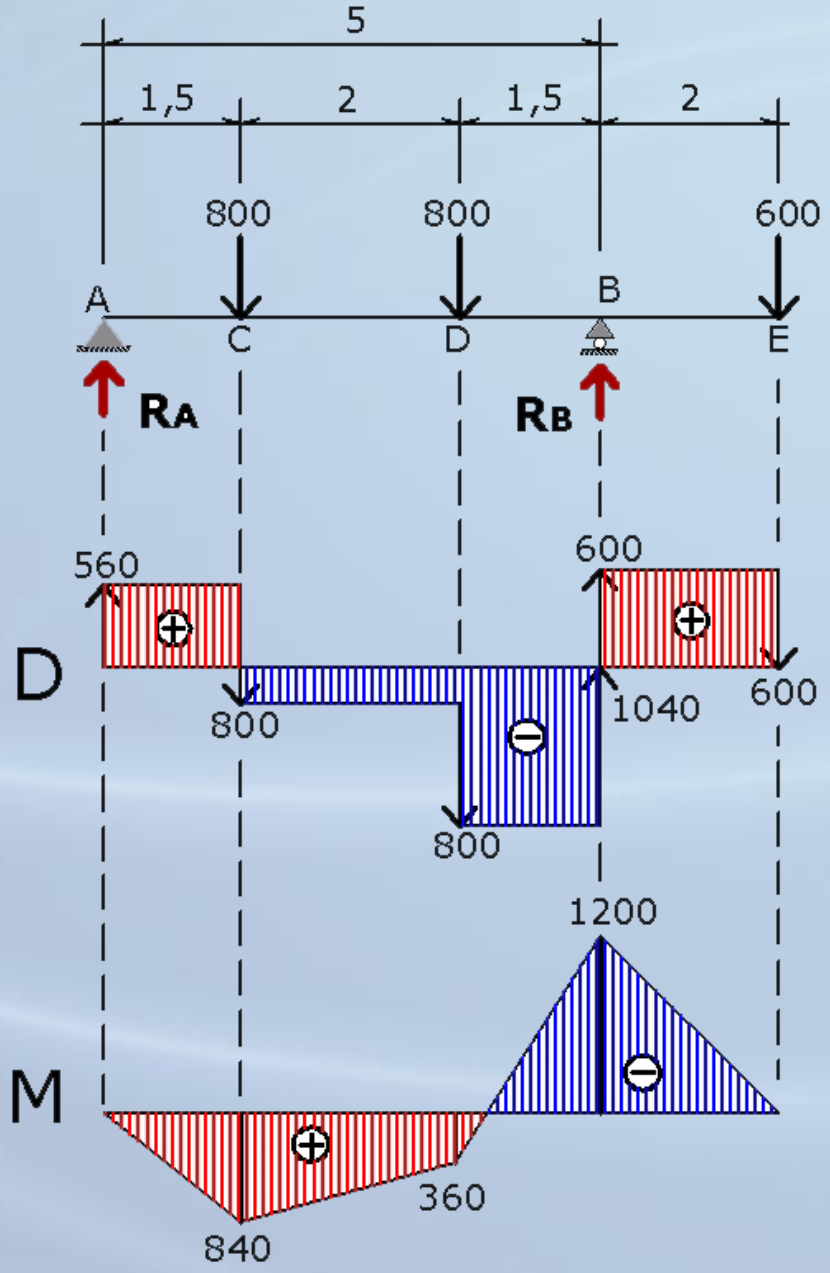
RBE = P_2 = **600 kg**

RBA = RB – RBE
= 1640 – 600
= **1040 kg**

MD = RB.1,5 – P_2. 3,5
= 1640. 1,5 – 600. 3,5
= 2460 – 2100
= **360 kgm**

MB = P_2. 2
= 600. 2
= **1200 kgm**

MC = RA. 1,5
= 560. 1.5
= **840 kgm**



24) Gambar bidang momen dan gaya lintang
W = 1000 kg/m

ΣMB = 0 →
RA. 5 + W. 2. 1 = 0
RA 5 + 1000. 2. 1 = 0
5 RA + 2000 = 0
RA **= - 400 kg**

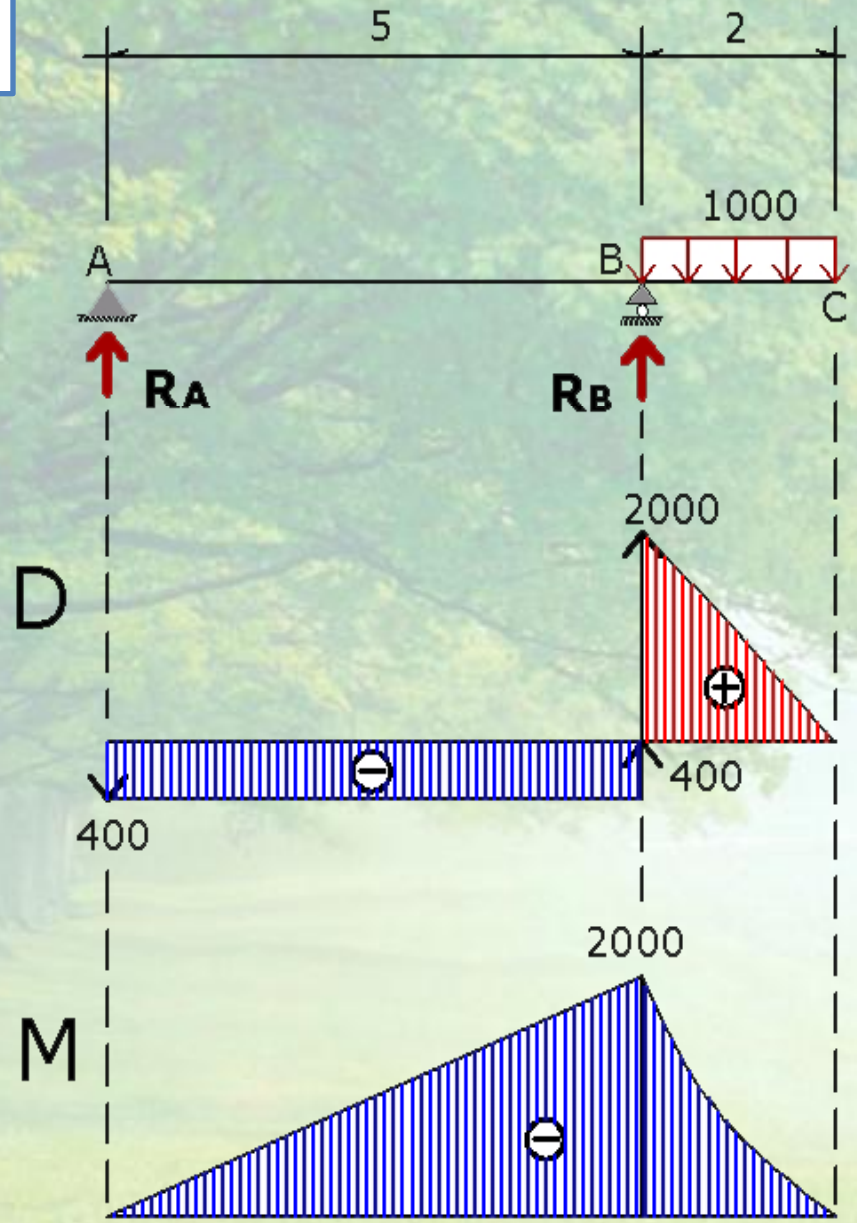
ΣMA = 0 →
RB. 5 – W. 2. 6 = 0
RB 5 – 1000. 2. 6= 0
5 RB – 12000 = 0
RB = **2400 kg**

ΣV = 0 →
RA + RB = W. 2
- 400 + 2400 = 1000. 2
2000 = 2000 → **ok**

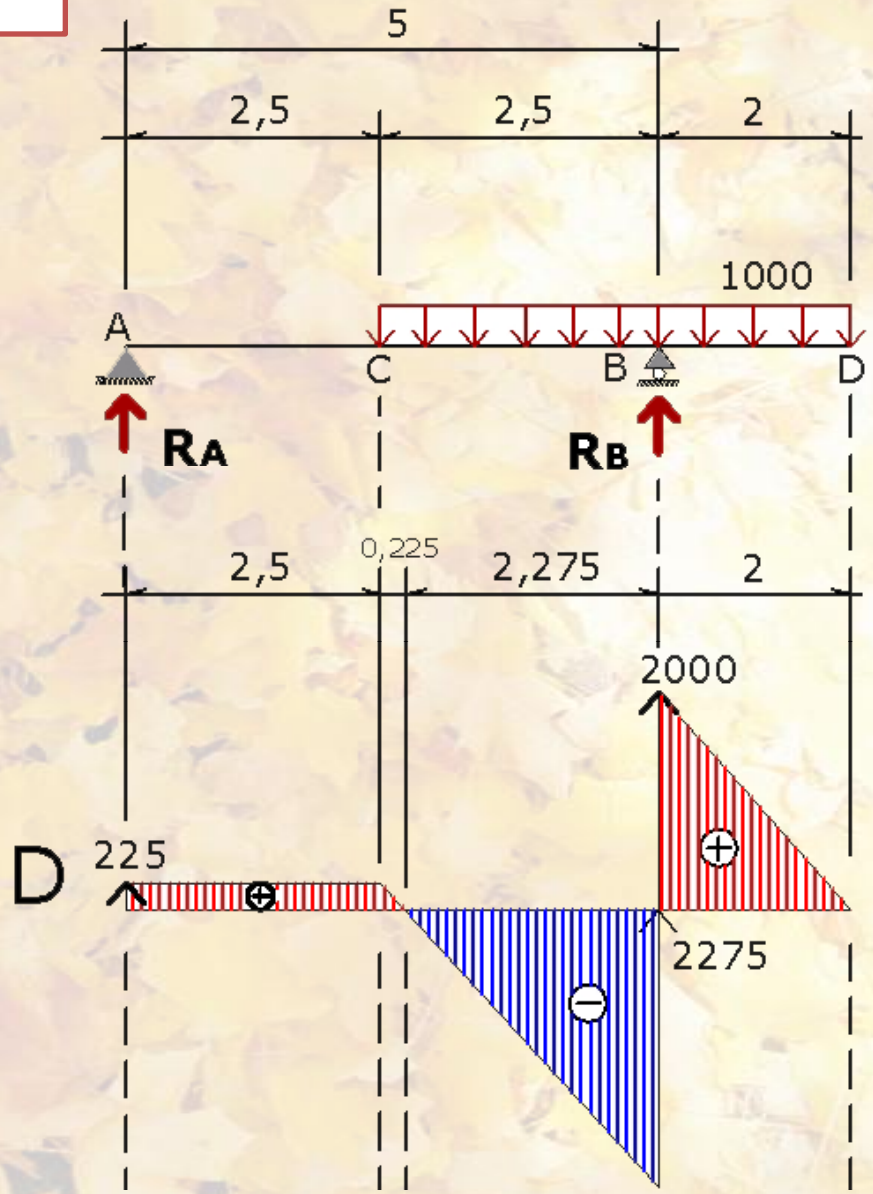
RBC = Q = 2. 1000
= 2000 kg

RBA = RB – RBC
= 2400 – 2000
= **400 kg**

MB = W. 2. 1
= 1000. 2. 1
= **2000 kgm**



25) Gambar bidang momen dan gaya lintang
W = 1000 kg/m



ΣMB = 0 →

RA. 5 + W. 2 .1 – W. 2,5. 1,25 = 0

RA 5 + 1000. 2 – 1000. 3,125 = 0

5 RA + 2000 – 3125 = 0

RA = **225 kg**

ΣMA = 0 →

RB. 5 – W. 2,5. 3,75 – W. 2. 6 = 0

RB 5 – 1000. 9,375 – 1000. 12 = 0

5 RB – 9375 – 12000 = 0

RB = **4275 kg**

ΣV = 0 →

$RA + RB = W L_1 + W L_2$

225 + 4275 = 1000. 2,5 + 1000. 2

4500 = 4500 → **ok**

RBD = Q = 2. 1000

= **2000 kg**

RBA = RB – RBD

= 4275 – 2000

= **2275 kg**

MX = RB. X – W. 2.(1 + X) – W X 0,5 X = 0

= 4275 X – 1000. 2 (X + 1) – 500 X^2

= 4275 X – 2000 X – 2000 – 500 X^2

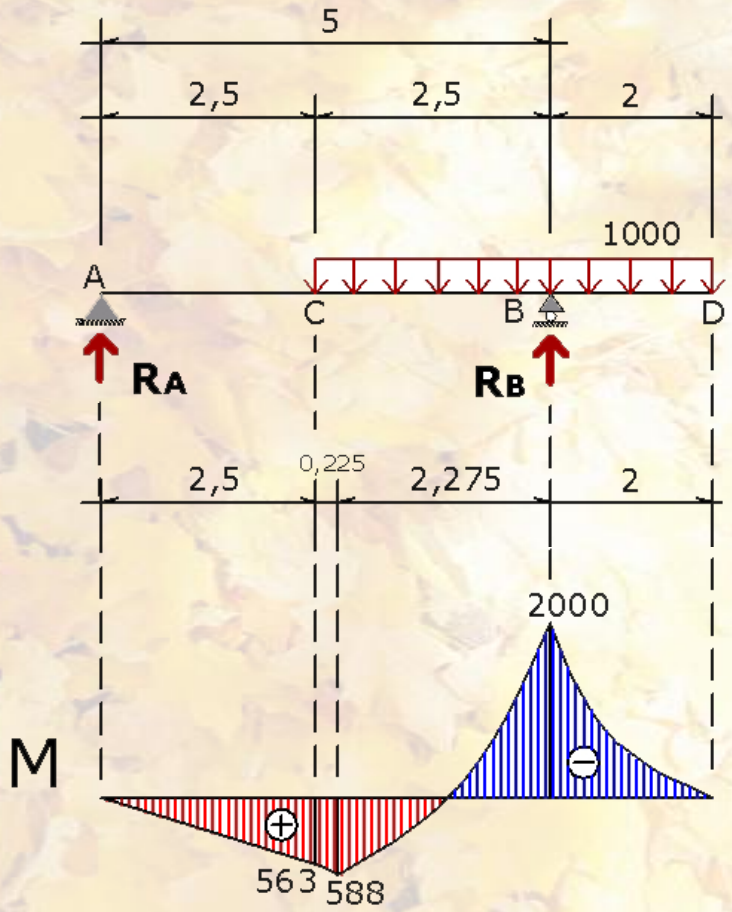
= 2275 X – 2000 – 500 X^2

$$\frac{dMX}{dX} = 2275 - 1000X$$

$$\frac{dMX}{dX} = 0$$

$$1000X = 2275$$

X = 2,275 m



M maks = 2275. 2,275 – 2000 – 500. $2,275^2$

= 5176 – 2000 – 2588

= **588 kgm**

MB = W 2. 0,5. 2

= 1000. 2

= **2000 kgm**

MC = RA. 2,5

= 225. 2,5

= **563 kgm**

26) Gambar bidang momen dan gaya lintang
W = 1000 kg/m

ΣMB = 0 →

RA. 5 + W. 2. 1 – W. 5. 2,5 = 0

RA 5 + 1000. 2 – 1000. 12,5 = 0

5 RA + 2000 – 12500 = 0

5 RA – 10500 = 0

RA = **2100 kg**

ΣMA = 0 →

RB. 5 – W. 5. 2,5 – W. 2. 6 = 0

RB. 5 – 1000. 12,5 – 1000. 12 = 0

5 RB – 12500 – 12000 = 0

5 RB – 24500 = 0

RB = **4900 kg**

ΣV = 0 →

RA + RB = W. 5 + W. 2

2100 + 4900 = 1000. 5 + 1000. 2

7000 = 7000 → **ok**

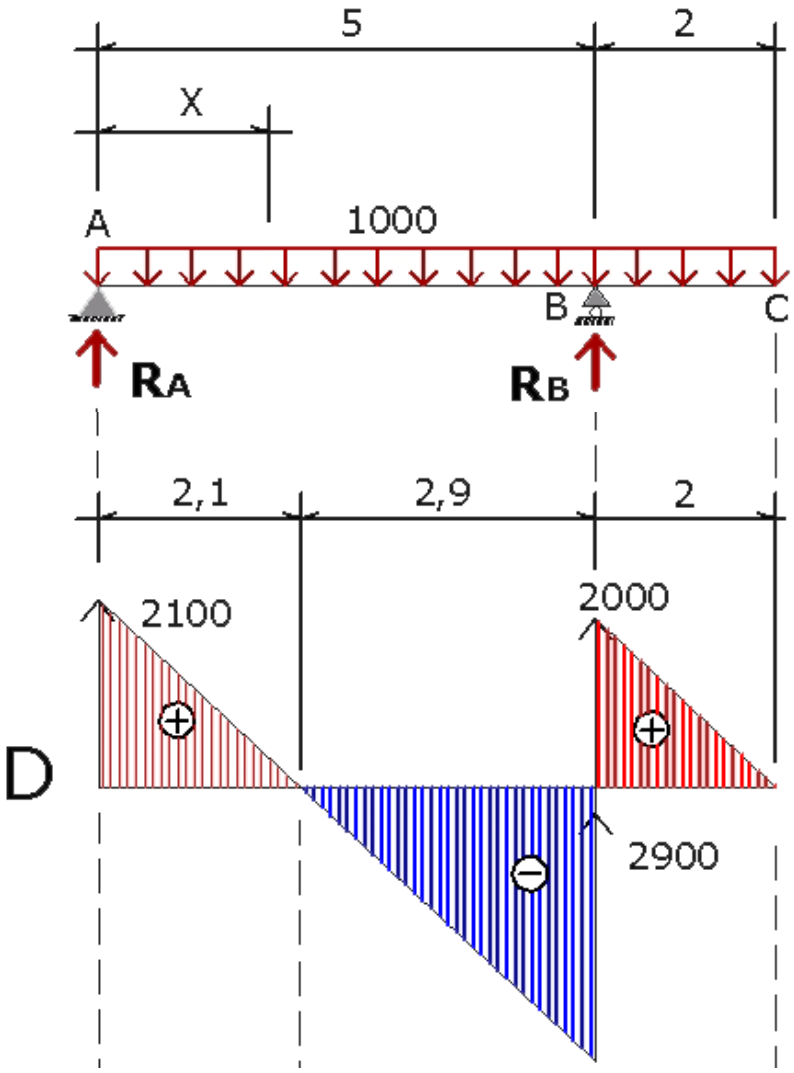
RBC = Q = 2. 1000

= **2000 kg**

RBA = RB – RBC

= 4900 – 2000

= **2900 kg**



MX = RA. X – 0,5 WX^2

= 2100 X – 0,5. 1000 X^2

$$\frac{dMX}{dX} = 2100 - 1000x$$

$$\frac{dMX}{dX} = 0$$

1000 X = 2100

X = 2,1 m

M maks = 2100. 2,1 – 500. $2,1^2$

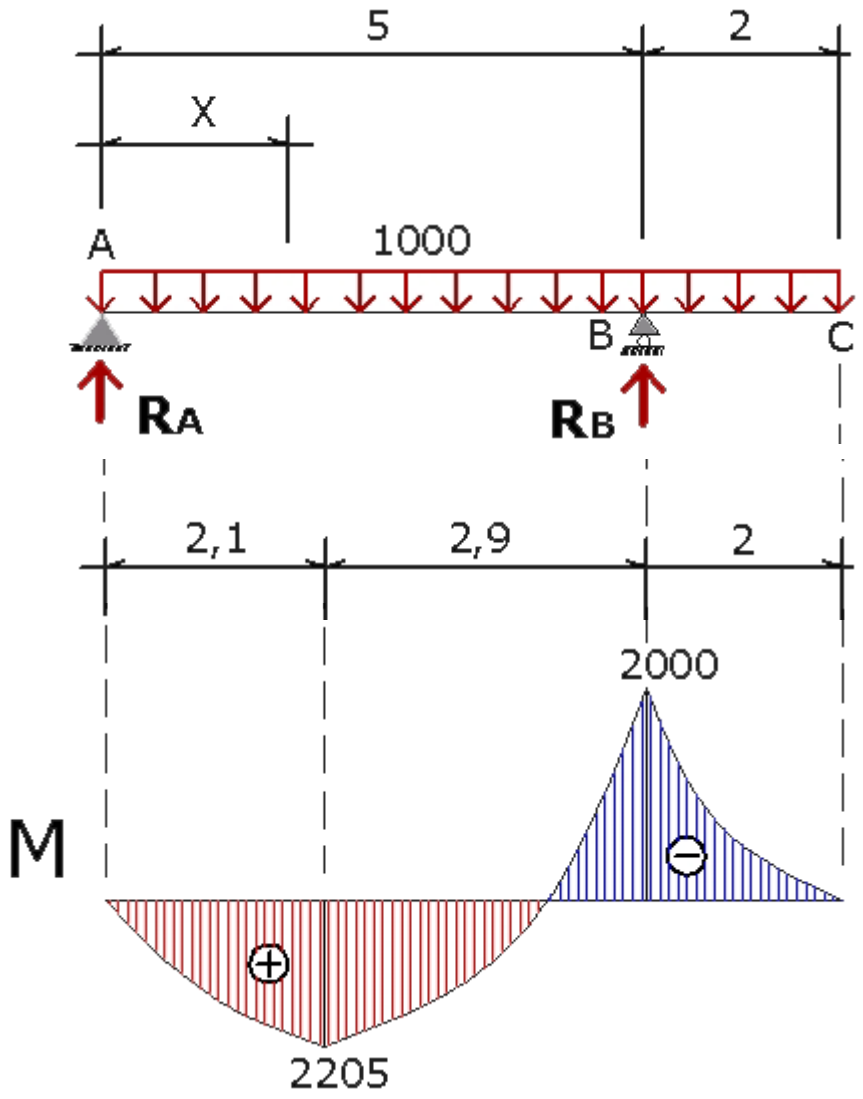
= 4410 – 2205

= **2205 kgm**

MB = W. 2. 1

= 1000. 2

= **2000 kgm**



27) Gambar bidang momen dan gaya lintang
W = 1000 kg/m, P = 600 kg

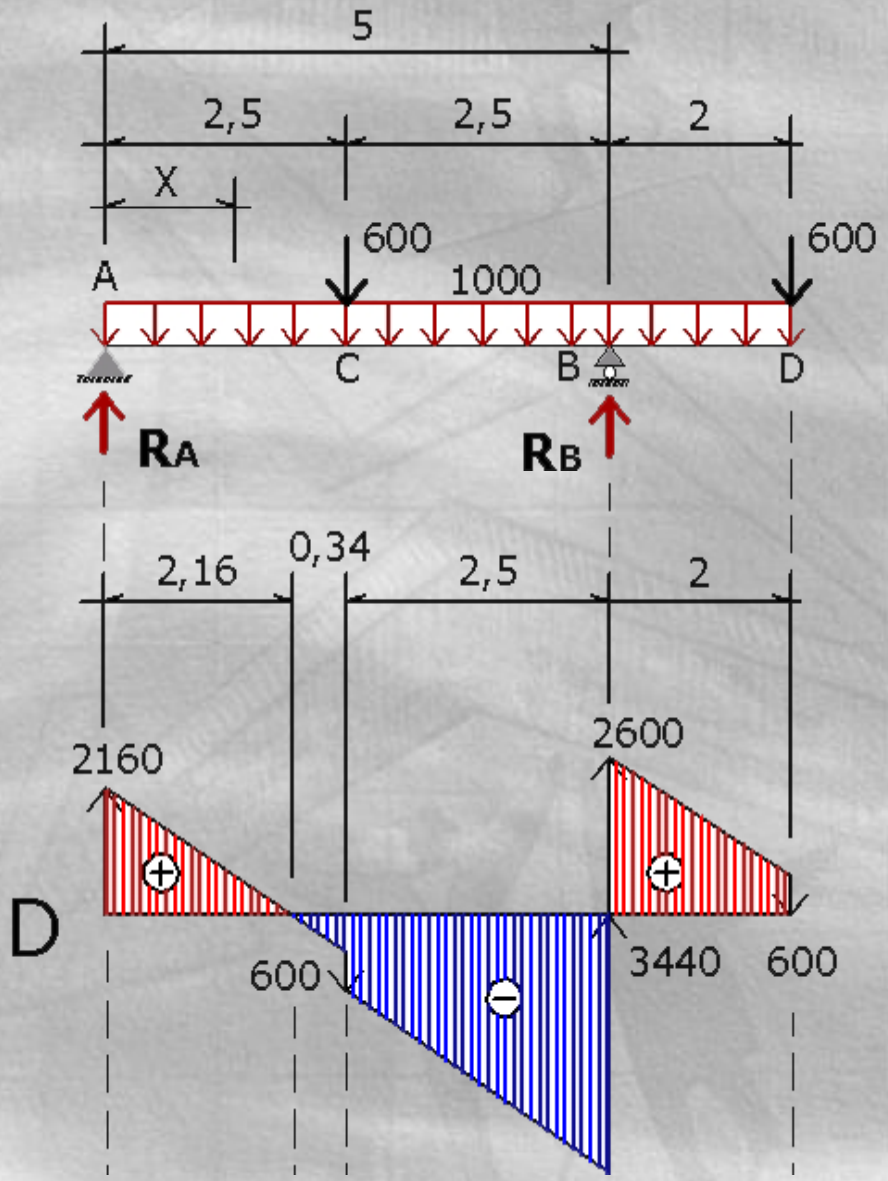
ΣMB = 0 →
RA. 5 + W 2. 1 – W. 5. 2,5 + P. 2 – P. 2,5 = 0
RA 5 + 1000. 2. 1 – 1000. 5. 2,5 + 600. 2 – 600. 2, 5 = 0
5 RA + 2000 – 12500 + 1200 – 1500 = 0
5 RA – 10800 = 0
RA = **2160 kg**

ΣMA = 0 →
RB. 5 – W 7. 3,5 – P. 2,5 – P. 7 = 0
RB 5 – 1000. 24,5 – 600. 2,5 – 600. 7 = 0
5 RB – 24500 – 1500 – 4200 = 0
5 RB – 30200 = 0
RB = **6040 kg**

ΣV = 0 →
RA + RB = W. 7 + 2 P
2160 + 6040 = 1000. 7 + 2. 600
8200 = 8200 → **ok**

RBD = Q + P
= 2. 1000 + 600
= 2600 kg

RBA = RB – RBD
= 6040 – 2600
= 3440 kg



$MX = RA.\ X - 0{,}5\ WX^2$

$= 2160\ X - 0{,}5.\ 1000\ X^2$

$$\frac{dMx}{dx} = 2160 - 1000x$$

$$\frac{dMx}{dx} = 0$$

$1000\ X = 2160$

X = 2,16 m

M maks $= 2160.\ 2{,}16 - 500.\ 2{,}16^2$

$= 4666 - 2333$

$=$ **2333 kgm**

MB $= W.\ 2.\ 1 + P.\ 2$

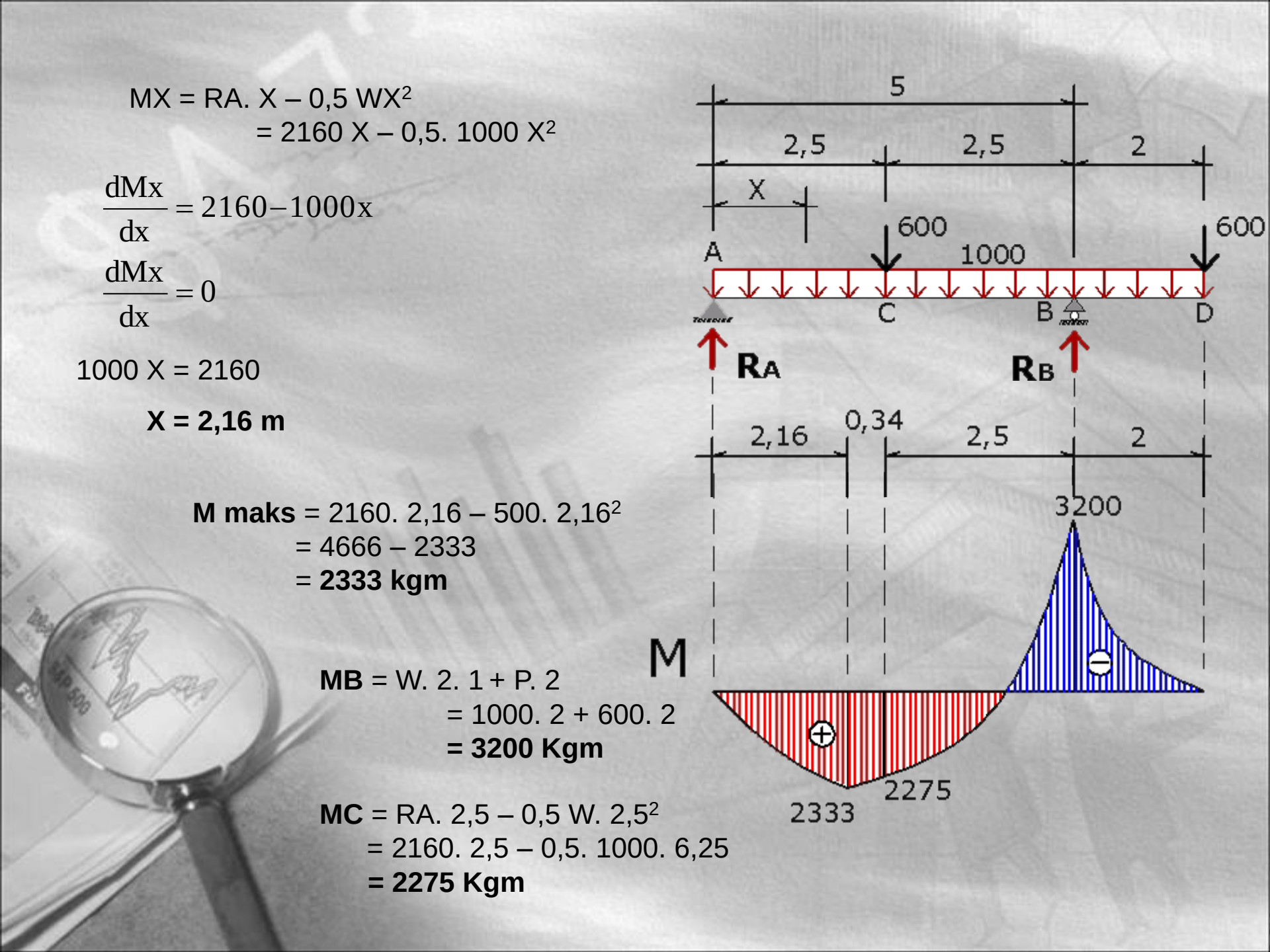
$= 1000.\ 2 + 600.\ 2$

= 3200 Kgm

MC $= RA.\ 2{,}5 - 0{,}5\ W.\ 2{,}5^2$

$= 2160.\ 2{,}5 - 0{,}5.\ 1000.\ 6{,}25$

= 2275 Kgm



28) Gambar bidang momen dan gaya lintang.
P = 600 kg, W = 1000 kg/m

ΣMB = 0 →

RA 5 + 600. 2 – 600. 2,5 + 1000. 2. 0,5. 2 – 1000. 5. 2,5 = 0

5 RA + 1200 – 1500 + 2000 – 12500 = 0

5 RA – 10800 = 0

RA = **2160 kg**

ΣMA = 0 →

RB 5 – 600. 2,5 – 600. 5 – 600. 7 – 1000. 7. 3,5 = 0

5 RB – 1500 – 3000 – 4200 – 24500 = 0

5 RB – 33200 = 0

RB = **6640 kg**

ΣV = 0 →

RA + RB = 3 P + W. 7

2160 + 6640 = 3. 600 + 1000. 7

8800 = 8800 → **ok**

RBD = Q + P

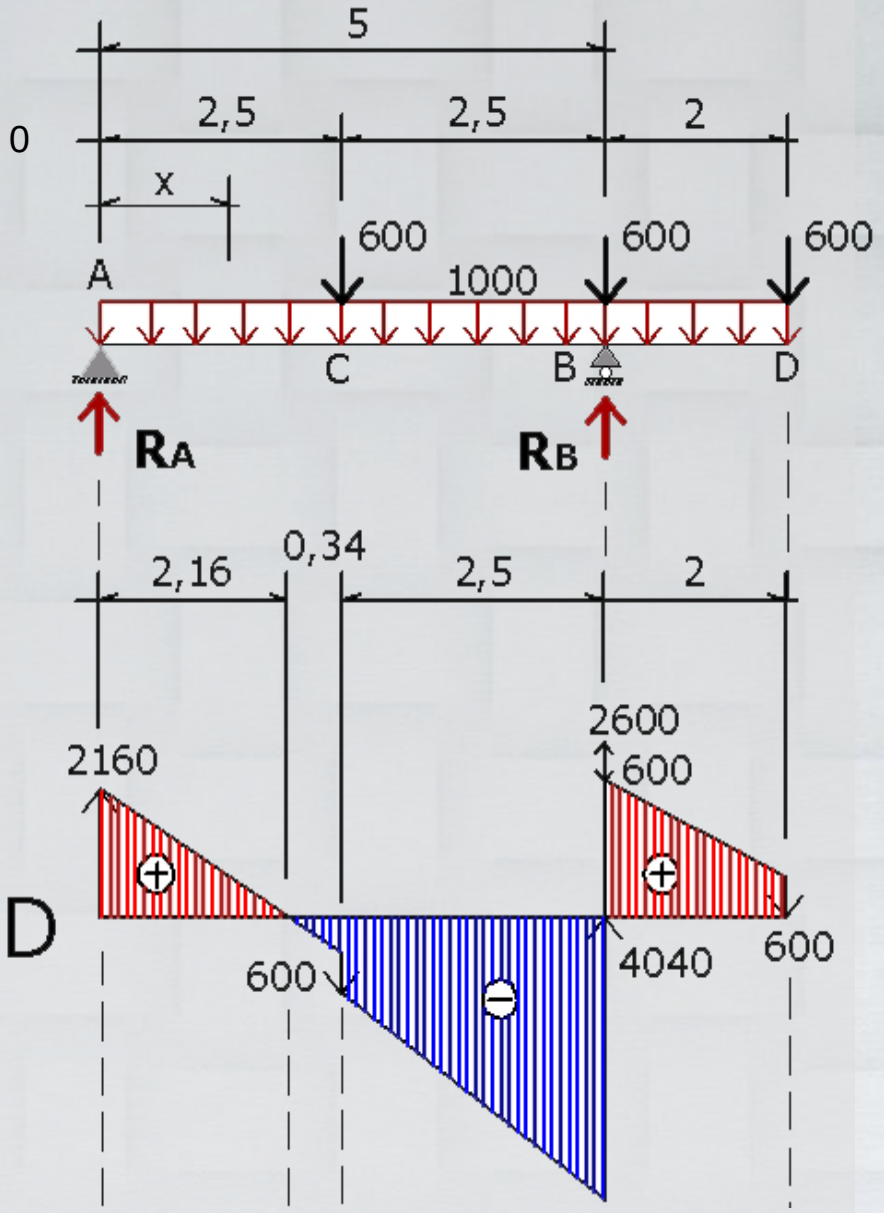
= 2. 1000 + 600

= **2600 kg**

RBA = RB – RBD

= 6640 – 2600

= **4040 kg**



$MX = RA.\ X - 0{,}5\ WX^2$

$= 2160\ X - 0{,}5.\ 1000\ X^2$

$$\frac{dMx}{dx} = 2160 - 1000x$$

$$\frac{dMx}{dx} = 0$$

$1000\ X = 2160$

X = 2,16 m

M maks $= 2160.\ 2{,}16 - 500.\ 2{,}16^2$

$= 4666 - 2333$

$=$ **2333 kgm**

MB $= W.\ 2.\ 1 + P.\ 2$

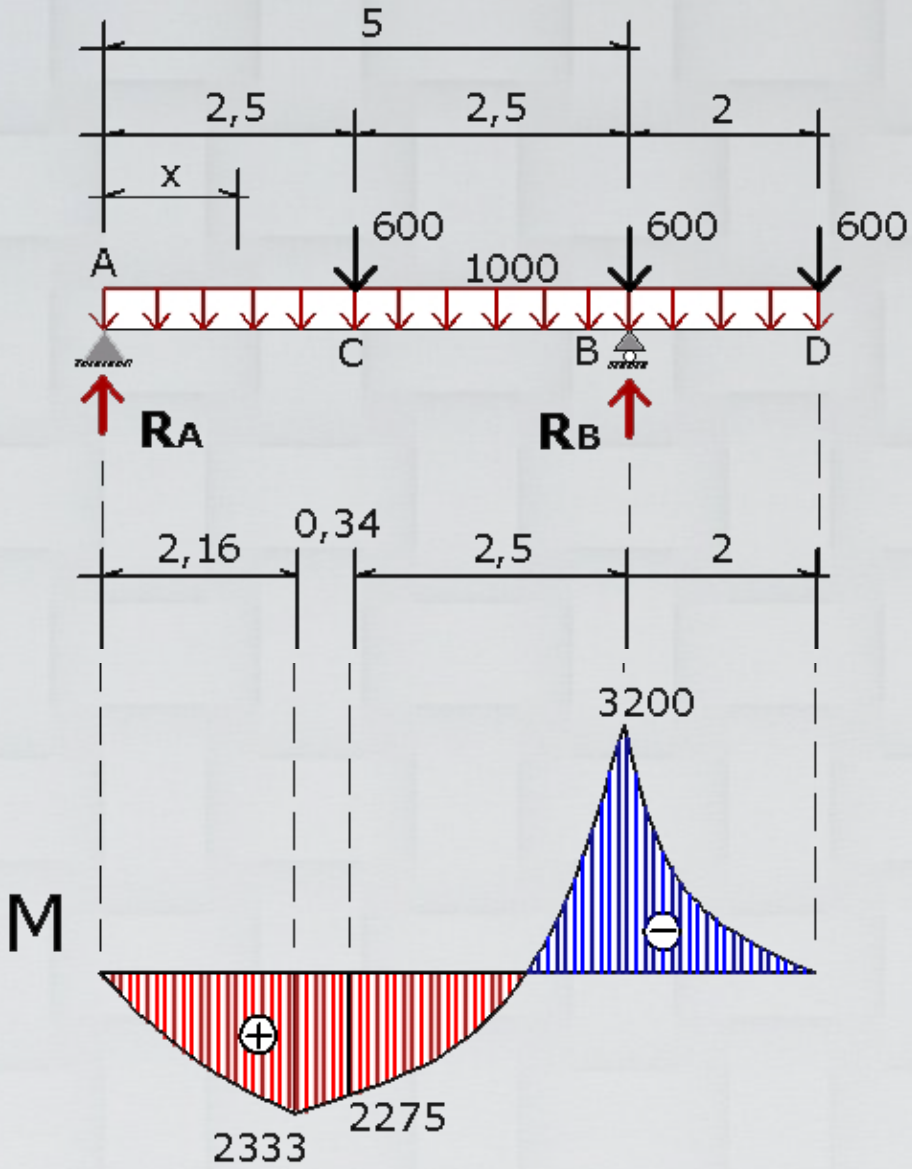
$= 1000.\ 2 + 600.\ 2$

= 3200 Kgm

MC $= RA.\ 2{,}5 - 0{,}5\ W.\ 2{,}5^2$

$= 2160.\ 2{,}5 - 0{,}5.\ 1000.\ 6{,}25$

= 2275 Kgm



29) Gambar bidang momen dan gaya lintang.
P = 400 kg, W_1 = 1000 kg/m, W_2 = 800 kg/m

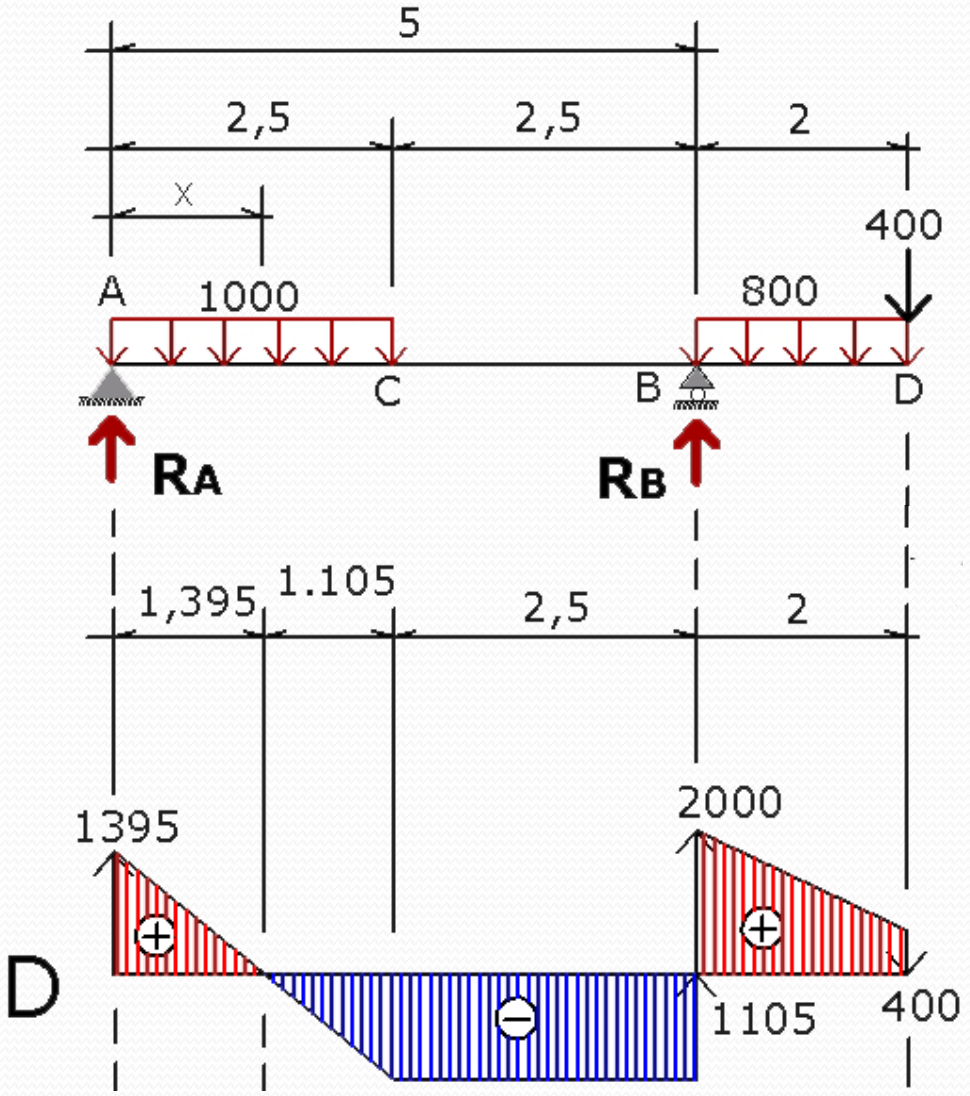
ΣMB = 0 →
RA. 5 + P. 2 + W_2. 2. 1 – W_1. 2,5. 3,75 = 0
RA 5 + 400. 2 + 800. 2. 1 – 1000. 9,375 = 0
5 RA + 800 + 1600 – 9375 = 0
5 RA – 6975 = 0
RA = **1395 kg**

ΣMA = 0 →
RB 5 – W_1. 2,5. 1,25 – W_2. 2. 6 – P. 7 = 0
RB. 5 - 1000. 3,125 – 800. 12 – 400. 7 = 0
5 RB - 3125 - 9600 – 2800 = 0
5 RB – 15525 = 0
RB = **3105 kg**

ΣV = 0 →
RA + RB = P + W_1. 2,5 + W_2. 2
1395 + 3105 = 400 + 1000. 2,5 + 800. 2
4500 = 4500 → **ok**

RBD = Q + P = 2. 800 + 400
= **2000 kg**

RBA = RB – RBD
= 3105 – 2000 = **1105 kg**



$MX = RA.\ X - 0{,}5\ W_1\ X^2$

$= 1395\ X - 0{,}5.\ 1000\ X^2$

$$\frac{dMx}{dx} = 1395 - 1000x$$

$$\frac{dMx}{dx} = 0$$

$1000\ X = 1395$

$X = 1{,}395\ m$

M maks $= 1395.\ 1{,}395 - 500.\ 1{,}395^2$

$=$ **973 kgm**

$MB = P.\ 2 + 0{,}5\ W_2.\ 2^2$

$= 400.\ 2 + 0{,}5.\ 800.\ 2^2$

$= 800 + 1600$

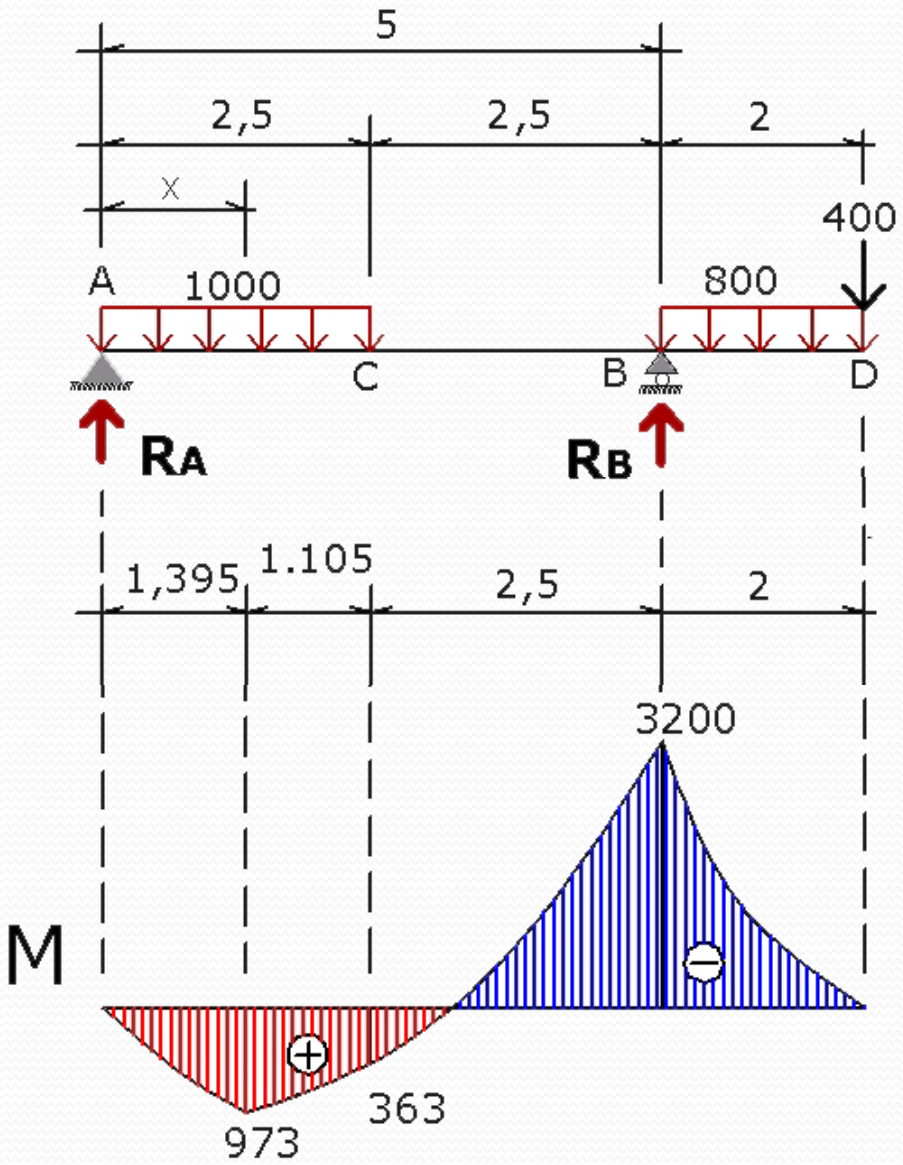
$=$ **2400 kgm**

$MC = RA.\ 2{,}5 - 0{,}5\ W_1.\ (2{,}5)^2$

$= 1395.\ 2{,}5 - 0{,}5.\ 1000.\ 2{,}5^2$

$= 3488 - 3125$

$=$ **363 kgm**



30) Gambar bidang momen dan gaya lintang.
P = 400 kg, W = 800 kg/m

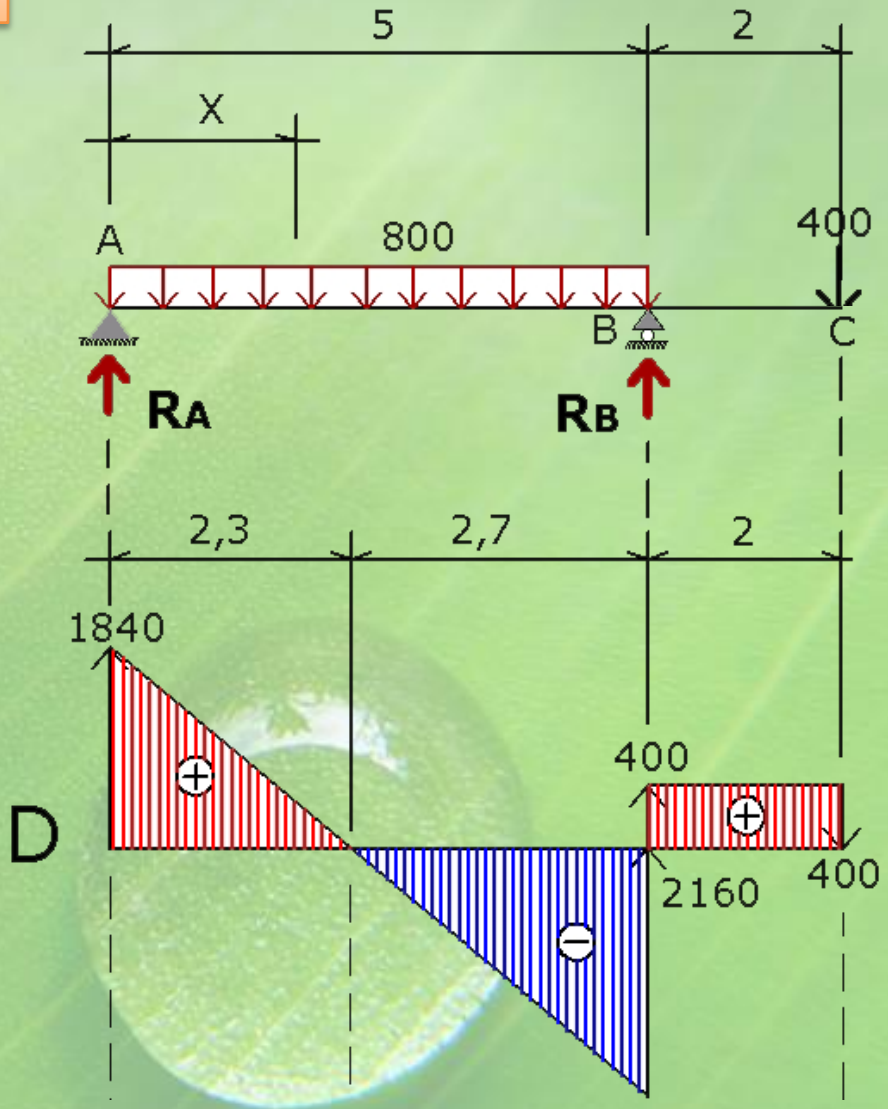
ΣMB = 0 →
RA. 5 + P. 2 – W. 5. 2,5 = 0
5 RA + 400. 2 – 800. 12,5 = 0
5 RA + 800 – 10000 = 0
RA = **1840 kg**

ΣMA = 0 →
RB. 5 – W. 5. 2,5 – P. 7 = 0
RB. 5 - 800. 12,5 – 400. 7 = 0
5 RB – 10000 – 2800 = 0
5 RB – 12800 = 0
RB = **2560 kg**

ΣV = 0 →
RA + RB = P + W 5
1840 + 2560 = 400 + 800. 5
4400 = 4400 → **ok**

RBC = P = **400 kg**

RBA = RB – RBC
= 2560 – 400
= **2160 kg**



MX = RA. X – 0,5 W. X^2

= 1840 X – 0,5. 800 X^2

$$\frac{dMx}{dx} = 1840 - 800x$$

$$\frac{dMx}{dx} = 0$$

800 X = 1840

X = 2,3 m

M maks = 1840. 2,3 – 400. $2,3^2$

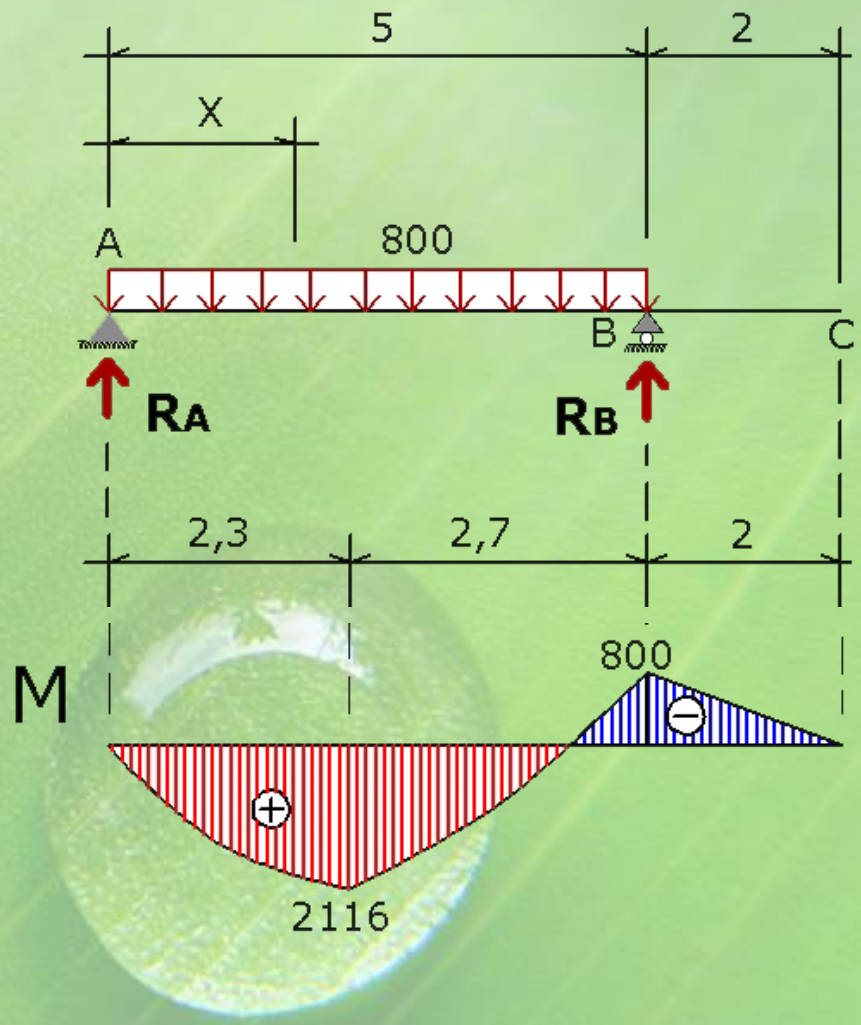
= 4232 - 2116

= **2116 kgm**

MB = P 2

= 400. 2

= **800 kgm**



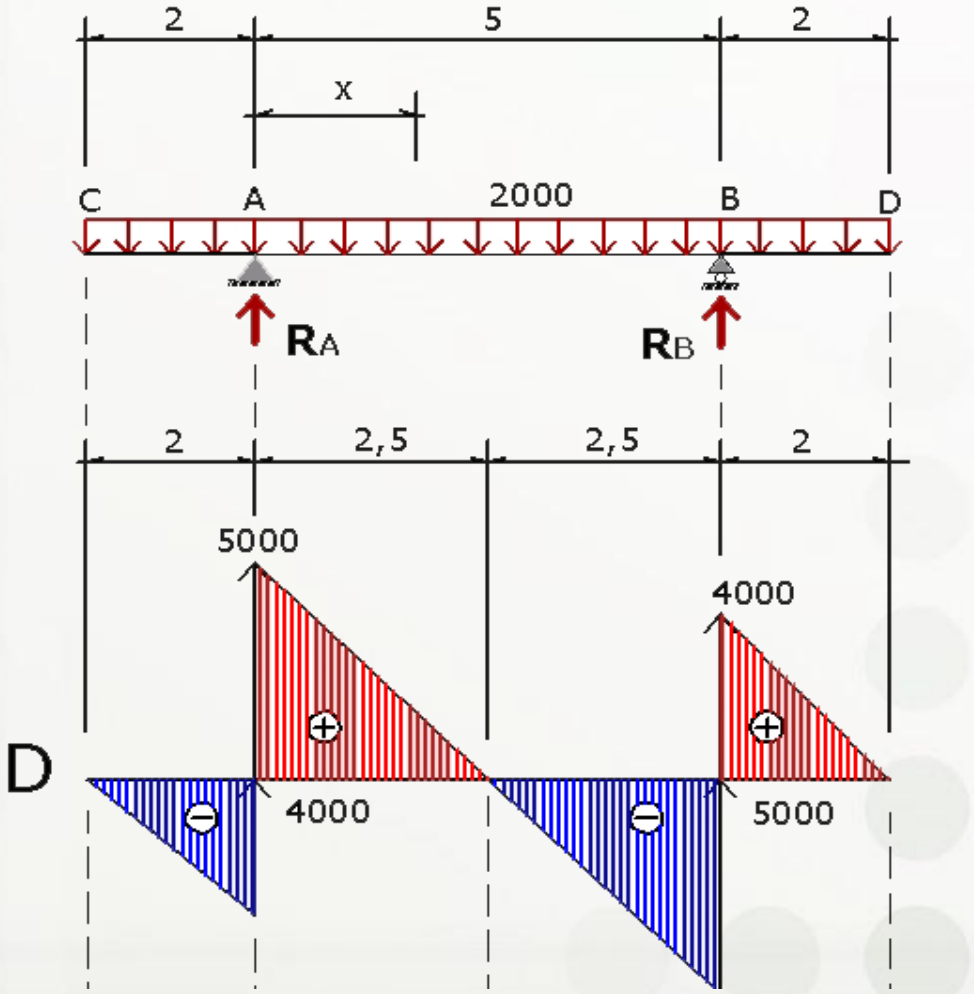
31) Gambar bidang momen dan gaya lintang.
W = 2000 kg/m

Struktur Simetris
RA = RB

$$\frac{W.9}{2} = \frac{2000.9}{2} = 9000Kg$$

RAC = RBD = W. 2
= 2000. 2
= 4000 kg

RAB = RBA = RA – RAC
= 9000 – 4000
= **5000 kg**



MX = RA. X – W 2 (1 + X) – 0,5 W X^2

= 9000 X – 2000. 2 (1 + X) – 0,5. 2000 X^2

= 9000 X – 4000 – 4000 X – 1000 X^2

= 5000 X – 4000 – 1000 X^2

$$\frac{dMx}{dx} = 5000 - 2000x$$

$$\frac{dMx}{dx} = 0$$

2000 X = 5000

X = 2,5 m

M maks = 5000. 2,5 – 4000 – 1000. $2{,}5^2$

= 12500 – 4000 – 6250

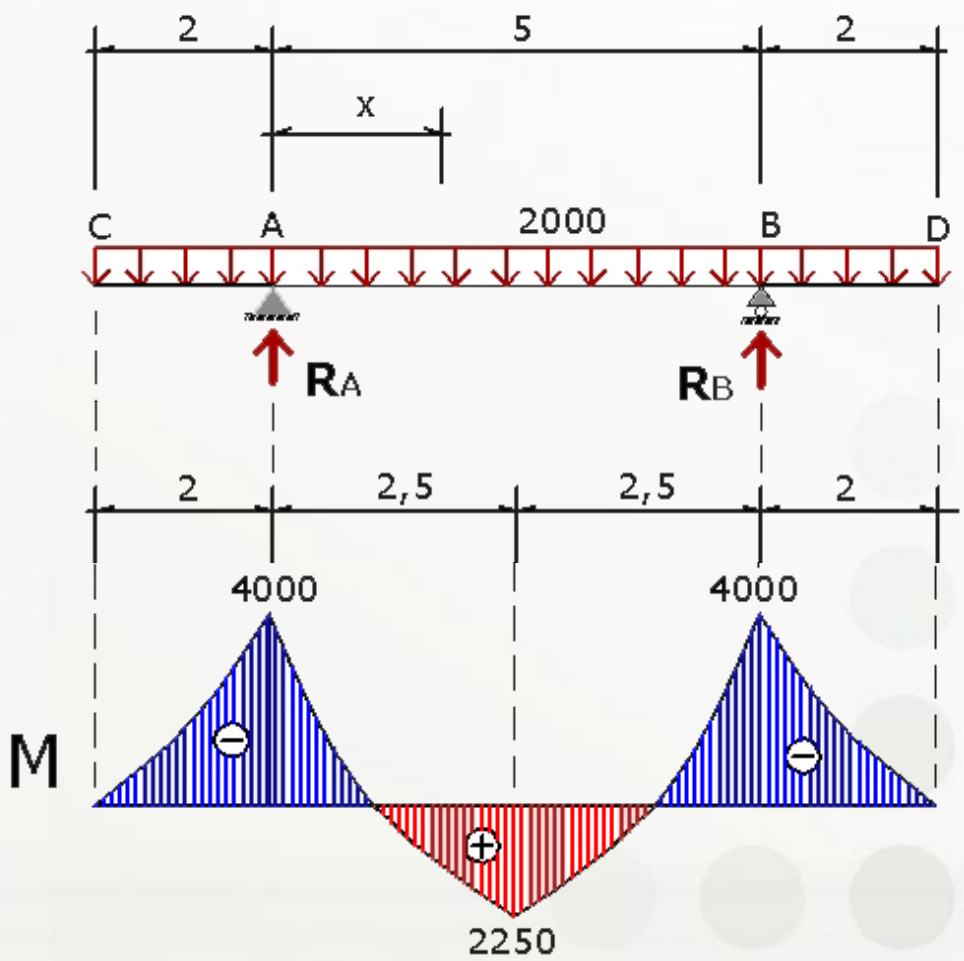
= **2250 kgm**

MA = MB

= W 2. 1

= 2000. 2. 1

= **4000 kgm**



32) Gambar bidang momen dan gaya lintang.
P_1 = 300 kg, P_2 = 2500 kg

Struktur Simetris
RA = RB

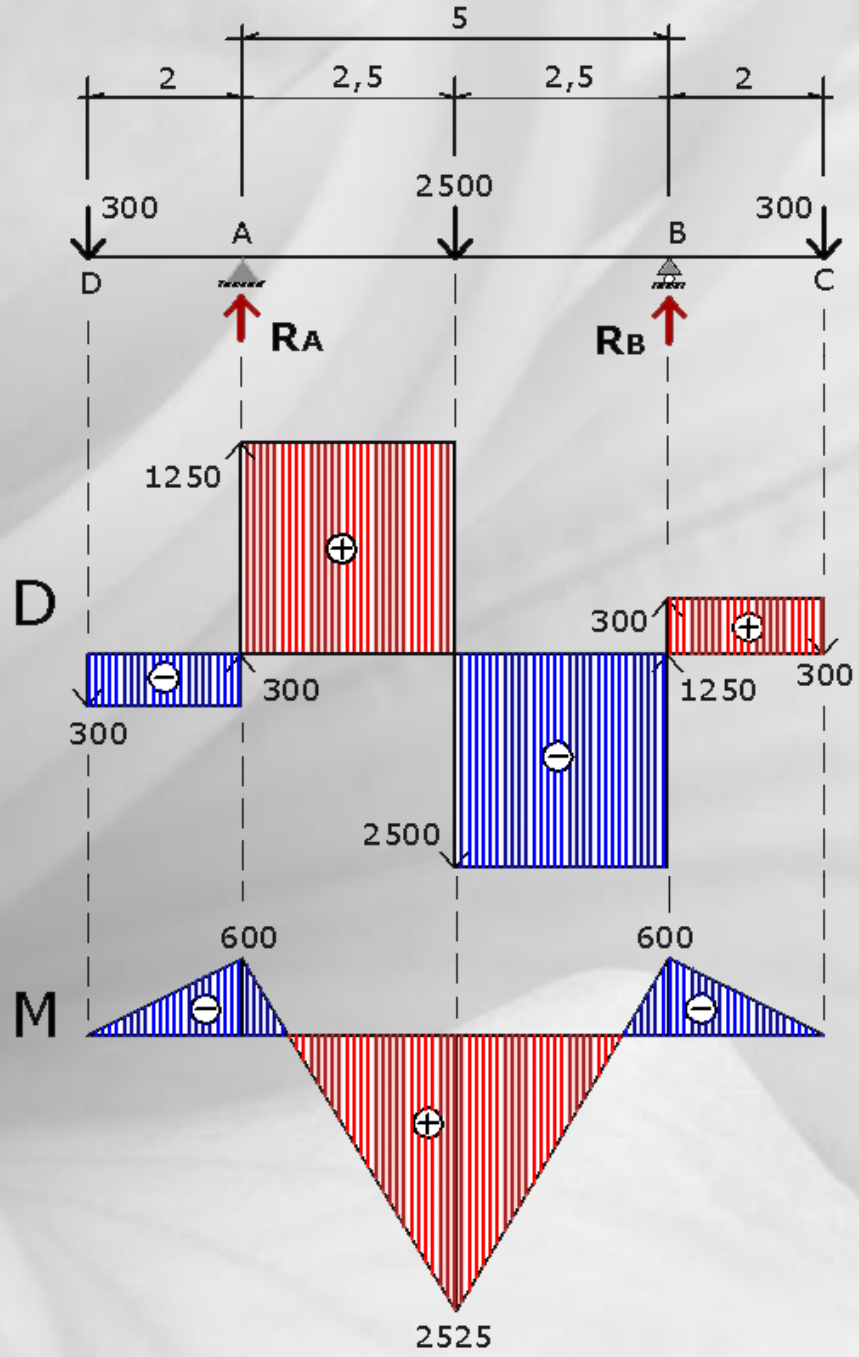
$RA = RB = P_1 + 0{,}5\ P_2$
$= 300 + 0{,}5.\ 2500$
$=$ **1550 kg**

$RAD = P_1 =$ **300 kg**

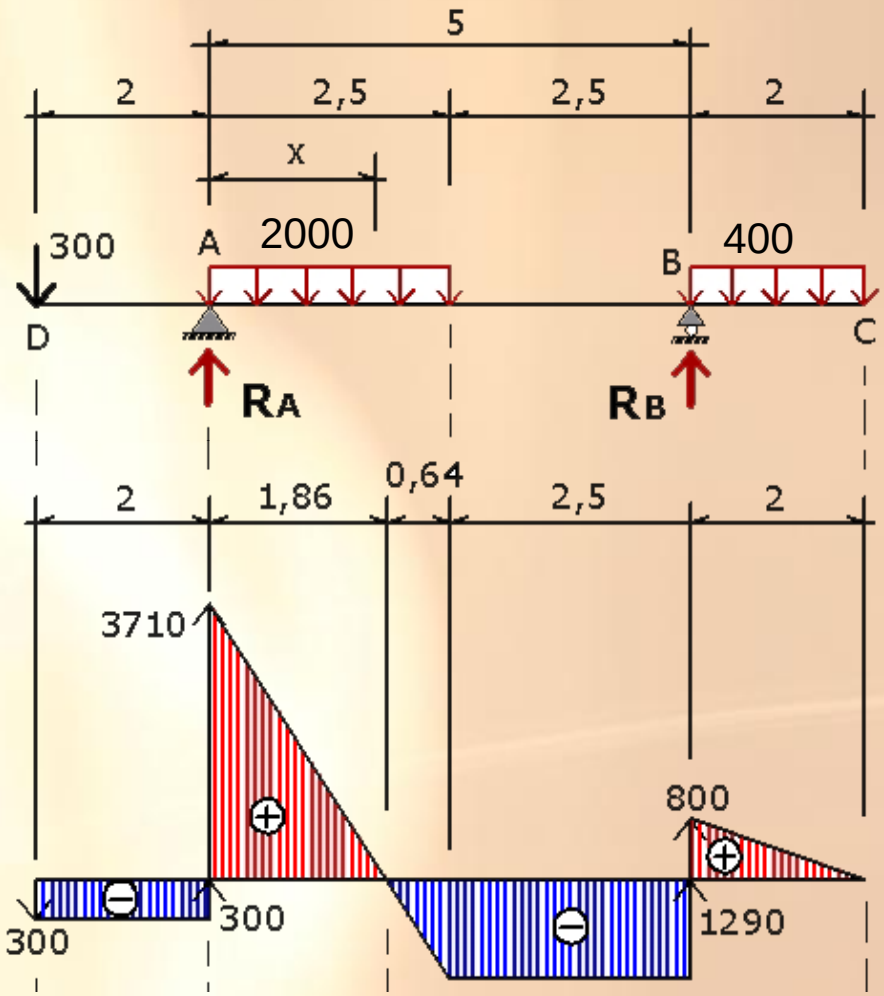
$RAB = RBA = RA - RAD$
$= 1550 - 300$
$=$ **1250 kg**

$MA = MB = P_1.\ 2$
$= 300.\ 2$
$=$ **600 kgm**

$ME = RA.\ 2{,}5 - P_1.\ 4{,}5$
$= 1550.\ 2{,}5 - 300.\ 4{,}5$
$= 3875 - 1350$
$=$ **2525 kgm**



33) Gambar bidang momen dan gaya lintang.
P = 300 kg, W_1 = 2000 kg/m, W_2 = 400 kg/m



D

ΣMB = 0

RA. 5 + W_2. 2. 1 – P. 7 – W_1. 2,5. 3,75 = 0
RA 5 + 400. 2 – 300. 7 – 2000. 9,375 = 0
5 RA + 800 – 2100 –18750 = 0
5 RA – 20030 = 0
RA = **4010 kg**

ΣMA = 0

RB. 5 + P. 2 – W_1. 2,5. 1,25 – W_2. 2. 6 = 0
RB 5 + 300. 2 – 2000. 3,125 – 400. 12 = 0
5 RB + 600 – 6250 – 4800 = 0
5 RB – 10450 = 0
RB = **2090 kg**

ΣV = 0

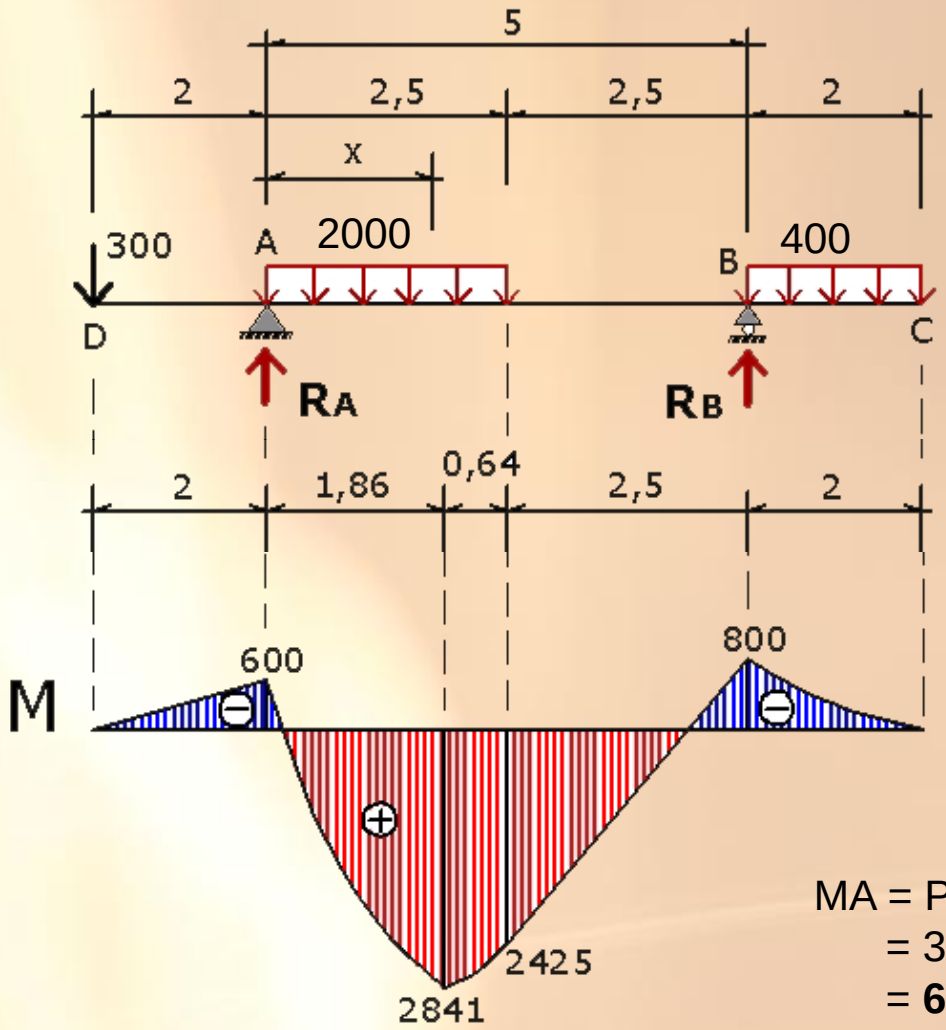
RA + RB = W_1. 2,5 + W_2. 2 + P
4010 + 2090 = 2000. 2,5 + 400. 2 + 300
6100 = 6100 → ok

RAC = P = 300 kg

RAB = RA – RAC
= 4010 – 300
= 3710 kg

RBE = Q = 2. 400
= 800 kg

RBA = RB – RBE
= 2090 – 800
= 1290 kg



$MX = RA.\ X - P\ (2 + X) - 0{,}5\ W_1.\ X^2$

$= 4010\ X - 300\ (2 + X) - 0{,}5.\ 2000\ X^2$

$= 4010\ X - 600 - 300\ X - 1000\ X^2$

$= 3710\ X - 600 - 1000\ X^2$

$$\frac{dMx}{dx} = 3170 - 2000x$$

$$\frac{dMx}{dx} = 0$$

$2000\ X = 3710$

$X = 1{,}86\ m$

$M\ maks = 3710.\ 1{,}86 - 600 - 1000.\ 1{,}86^2$

$= 6901 - 600 - 3460$

$=$ **2841 kgm**

$MA = P.\ 2$

$= 300.\ 2$

$=$ **600 kgm**

$MB = W_2.\ 2.\ 1$

$= 400.\ 2$

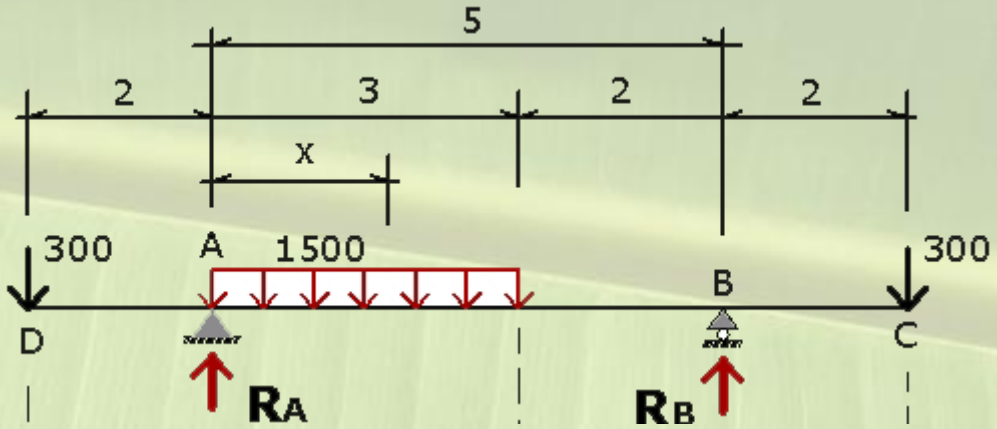
$=$ **800 kgm**

$MD = RB.\ 2{,}5 - W_2.\ 2.\ 3{,}5$

$= 2090.\ 2{,}5 - 400.\ 7$

$=$ **2425 kgm**

34) Gambar bidang momen dan gaya lintang.
P_1 = 300 kg, P_2 = 500 kg, W = 1500 kg/m



ΣMB = 0

RA. 5 + P_2. 2 – P_1. 7 – W. 3. 3,5 = 0
RA 5 + 500. 2 – 300. 7 – 1500. 10,5 = 0
5 RA + 1000 – 2100 – 15750 = 0
5 RA – 16850 = 0
RA = **3370 kg**

ΣMA = 0

RB. 5 + P_1. 2 – P_2. 7 – W. 3. 1,5 = 0
RB 5 + 300. 2 – 500. 7 – 1500. 4,5 = 0
5 RB + 600 – 3500 – 6750 = 0
5 RB – 9650 = 0
RB = **1930 kg**

RA = **3370 kg**

RB = **1930 kg**

ΣV = 0

RA + RB = W. 3 + P_1 + P_2

3370 + 1930 = 1500. 3 + 300 + 500

5300 = 5300 → **ok**

RAC = P_1 = **300 kg**

RAB = RA – RAC

= 3370 – 300

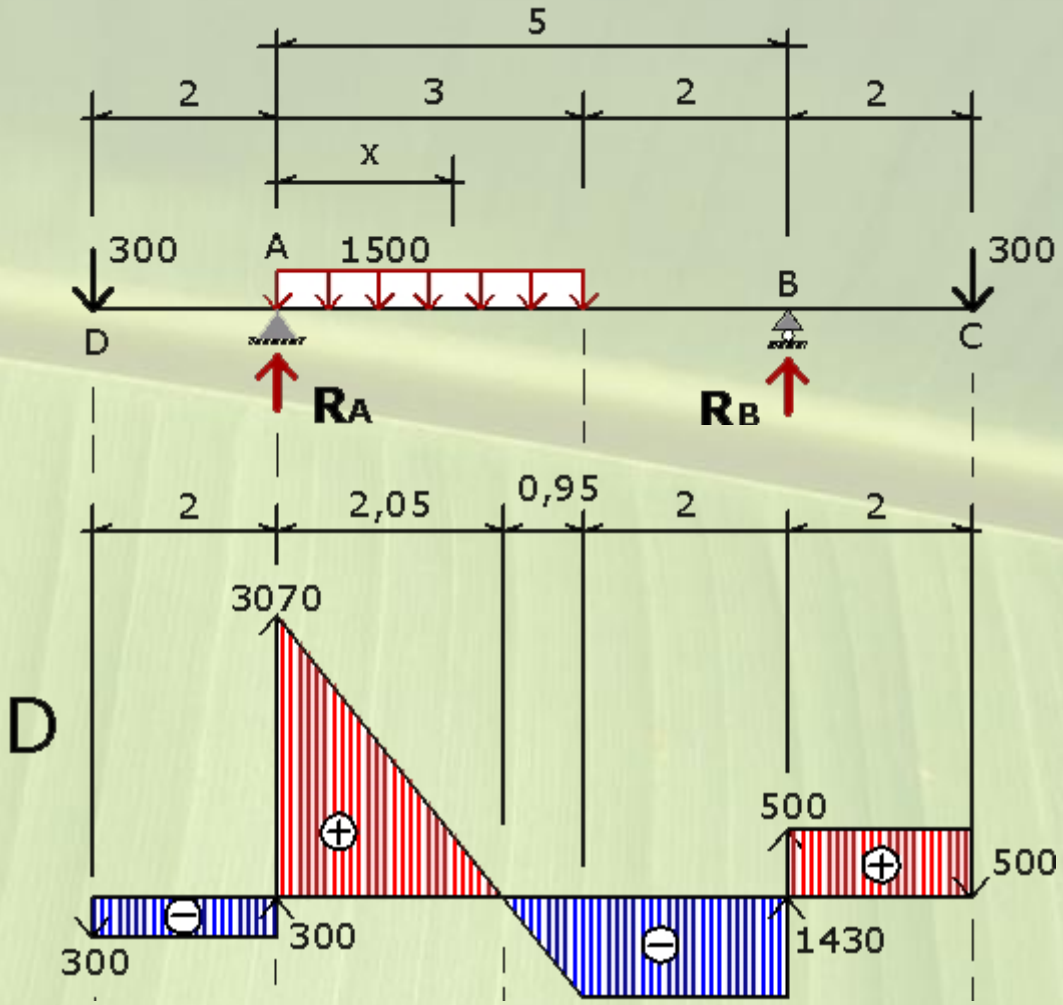
= **3070 kg**

RBE = P_2 = **500 kg**

RBA = RB – RBE

= 1930 – 500

= **1430 kg**



MX = RA. X – P_1 (2 + X) – 0,5 W X^2

= 3370 X – 300 (2 + X) – 0,5. 1500 X^2

= 3370 X – 600 – 300 X – 750 X^2

= 3070 X – 600 – 750 X^2

$$\frac{dMx}{dx} = 3070 - 1500x$$

$$\frac{dMx}{dx} = 0$$

1500 X = 3070

X = 2,05 m

M maks = 3070. 2,05 – 600 – 750. $2,05^2$

= 6294 – 600 – 3152

= **2542 kgm**

MA = P_1. 2

= 300. 2

= **600 kgm**

MB = P_2. 2

= 500. 2

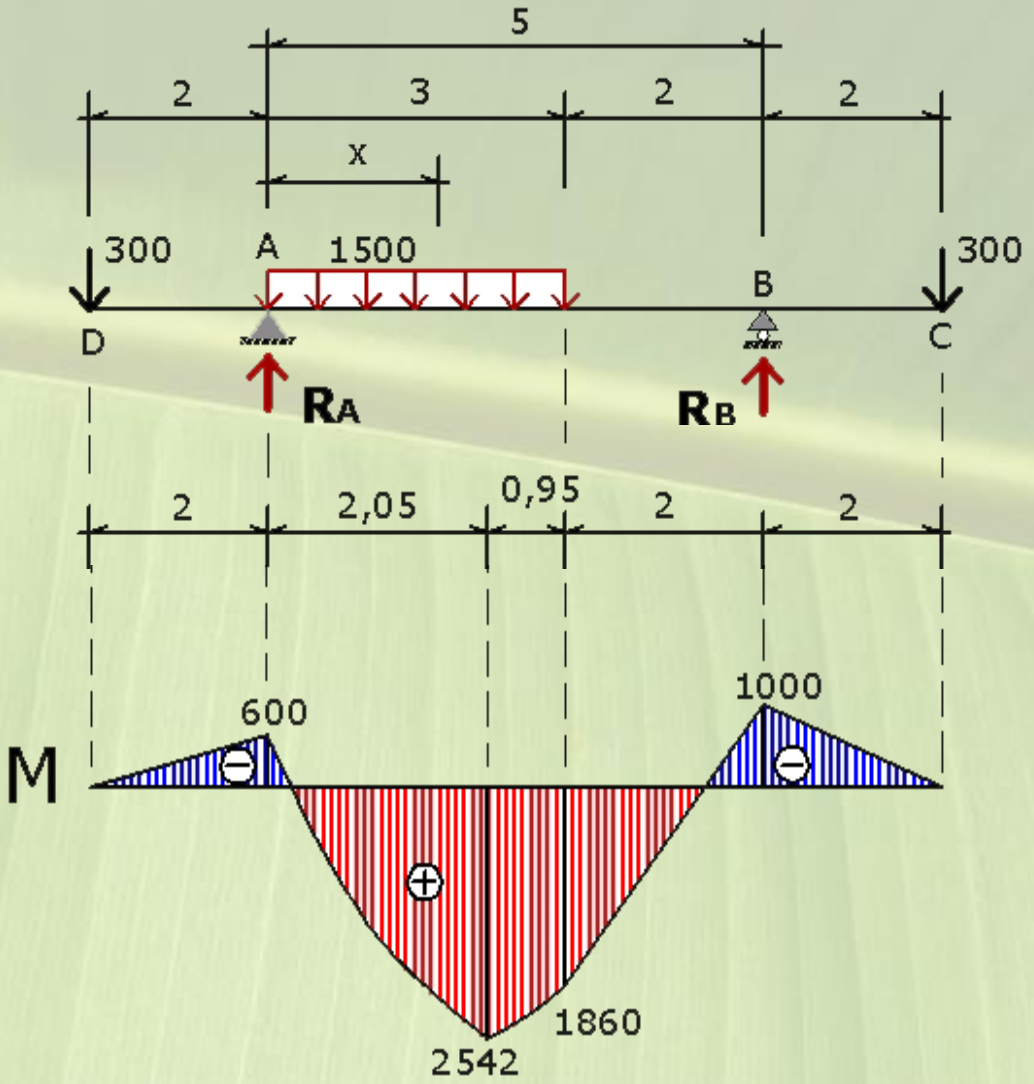
= **1000 kgm**

MD = RB. 2 – P_2. 4

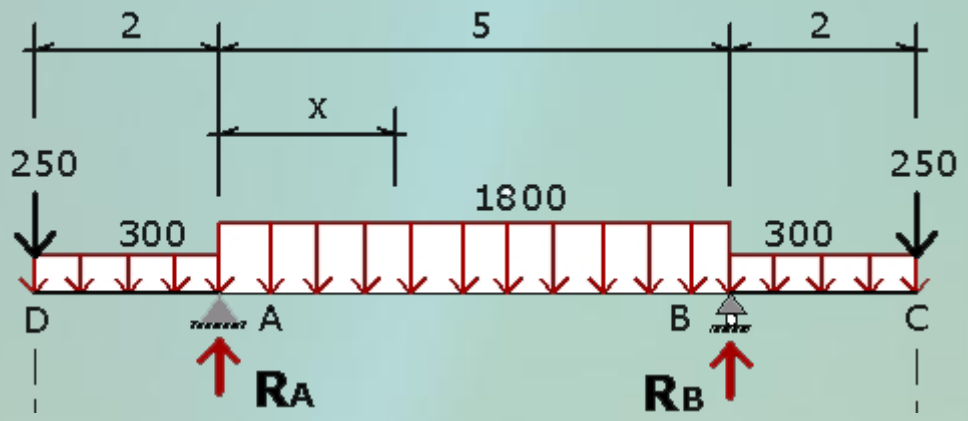
= 1930. 2 – 500. 4

= 3860 – 2000

= **1860 kgm**



35) Gambarkan bidang momen dan gaya lintang.
P = 250 kg, W_1 = 300 kg/m, W_2 = 1800 kg/m



Struktur Simetris
RA = RB

ΣMB = 0

$RA.\ 5 + P.\ 2 - P.\ 7 + W_1.\ 2.\ 1 - W_1.\ 2.\ 6 - W_2.\ 5.\ 2{,}5 = 0$

$RA\ 5 + 250.\ 2 - 250.\ 7 + 300.\ 2 - 300.\ 12 - 1800.\ 12{,}5 = 0$

$5\ RA + 500 - 1750 + 600 - 3600 - 22500 = 0$

$5\ RA - 26750 = 0$

RA = **5350 kg**

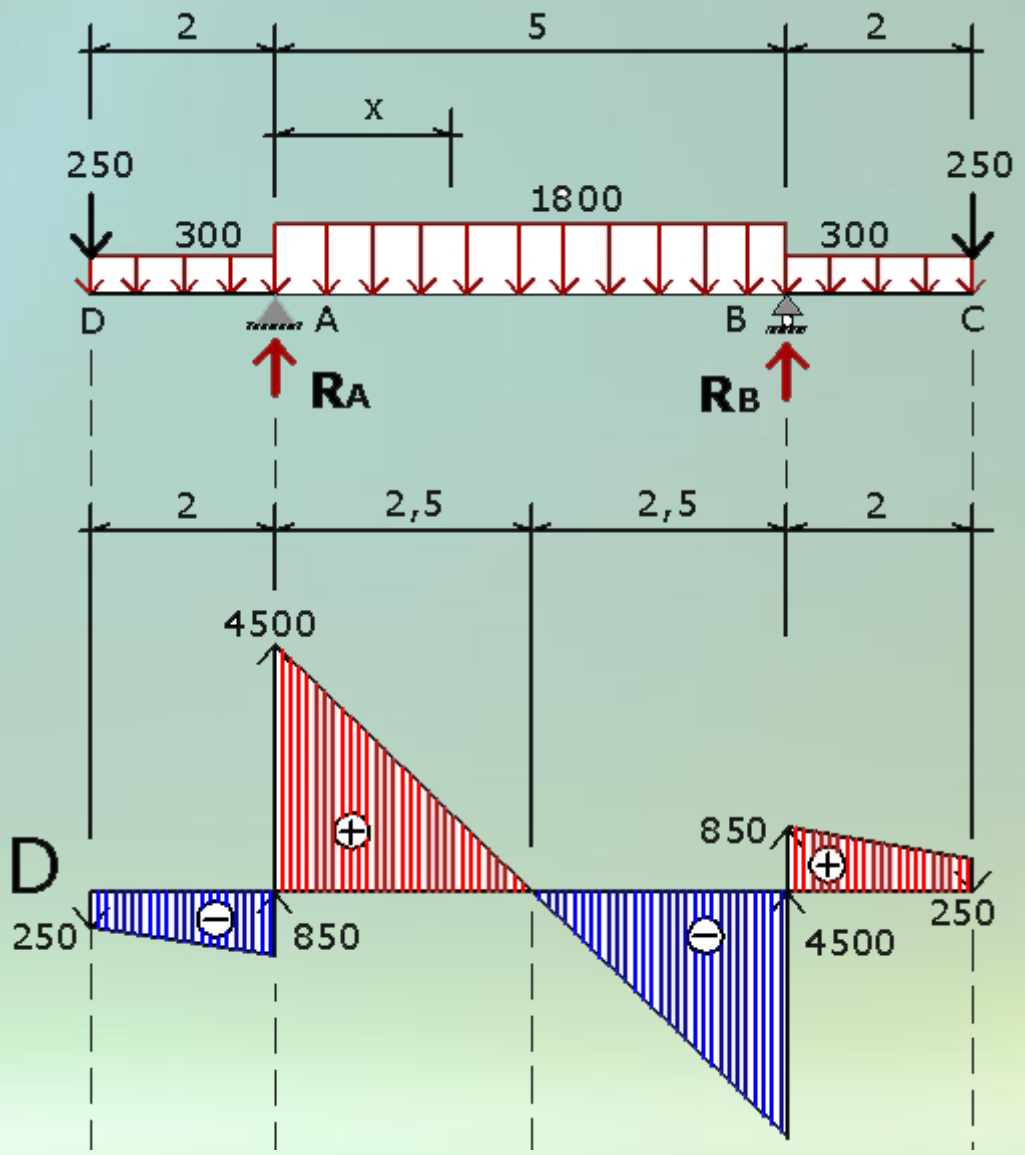
RA = RB = **5350 kg**

RA = RB = **5350 kg**

Struktur Simetris

RAC = RBD
= P + W_1. 2
= 250 + 300. 2
= **850 kg**

RAB = RBA
= RA – RAC
= 5350 – 850
= 4500 kg



M maks = RA. X – P (2 + X) – W_1. 2 (1 + X) – 0,5 W_2. X^2

= 5350 X – 250 (2 + X) – 300. 2 (1 + X) - 0,5. 1800 X^2

= 5350 X – 500 – 250 X – 600 – 600 X - 900 X^2

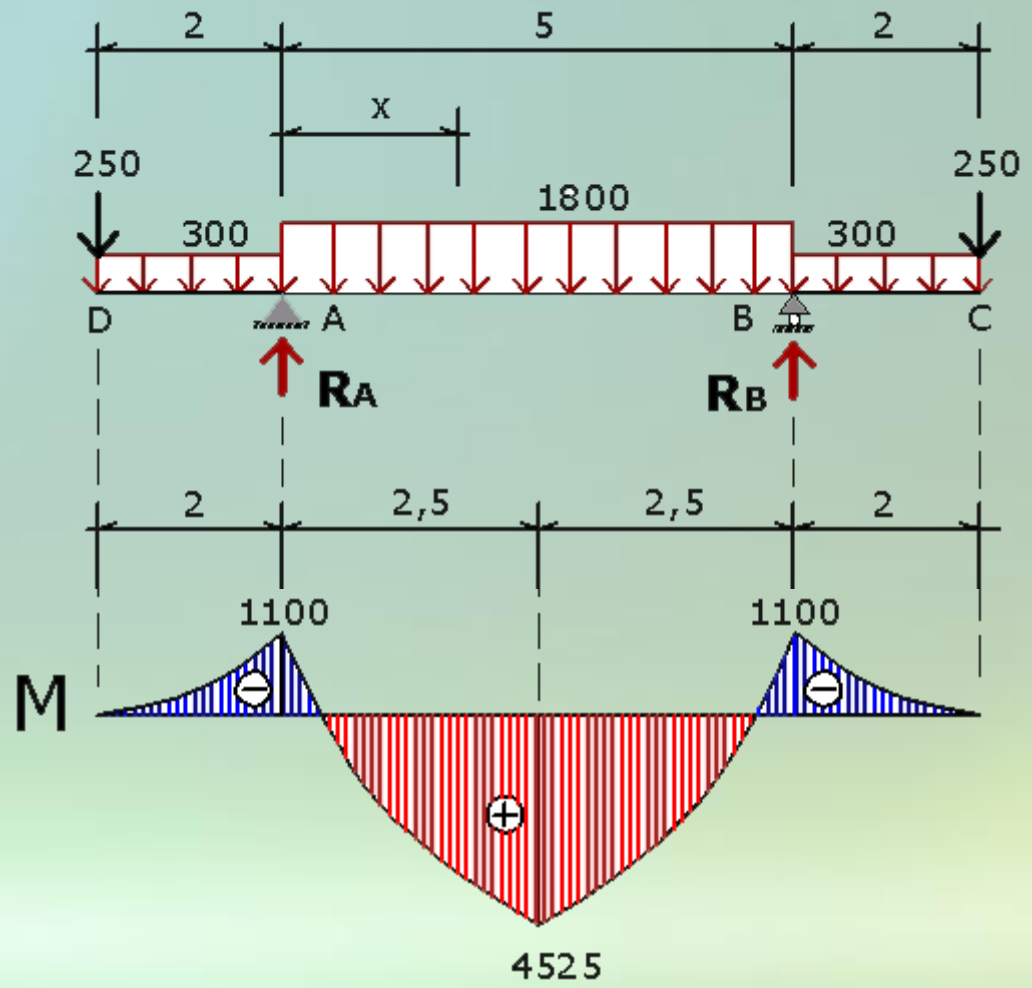
= 4500 X – 1100 – 900 X^2

$$\frac{dMx}{dx} = 4500 - 1800x$$

$$\frac{dMx}{dx} = 0$$

1800 X = 4500

X = 2,5 m



M maks = 4500. 2,5 – 1100 – 900. $2,5^2$

= 11250 – 1100 – 5625

= **4525 kgm**

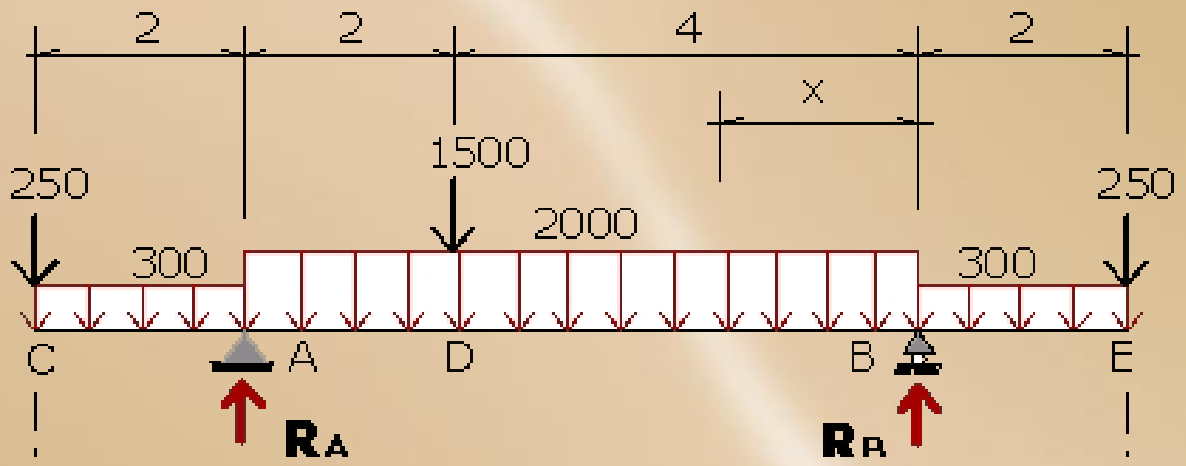
MA = MB

= P. 2 + W_1. 2. 1

= 250. 2 + 300. 2

= **1100 Kgm**

36) Gambar bidang momen dan gaya lintang.
P_1 = 250 kg, P_2 = 1500 kg, W_1 = 300 kg/m, W_2 = 2000 kg/m



ΣMB = 0

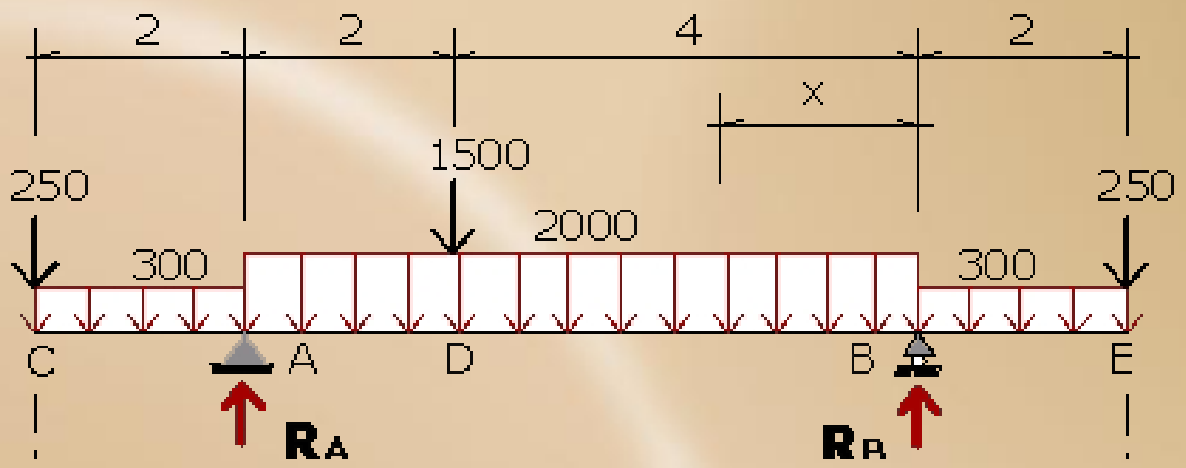
RA. 6 + P_1. 2 + W_1. 2. 1 – P_1. 8 – P_2. 4 – W_1. 2. 7 – W_2. 6. 3 = 0

RA. 6 + 250. 2 + 300. 2 – 250. 8 – 1500. 4 – 300. 14 – 2000. 18 = 0

6 RA + 500 + 600 – 2000 – 6000 – 4200 – 36000 = 0

6 RA – 47100 = 0

RA = **7850 kg**



ΣMA = 0

RB 6 + P_1. 2 + W_1. 2. 1 – P_2. 2 – P_1. 8 – W_2. 6. 3 – W_1. 2. 7 = 0

RB 6 + 250. 2 + 300. 2 – 1500. 2 – 250. 8 – 2000. 18 – 300. 14 = 0

6 RB + 500 + 600 – 3000 – 2000 – 36000 – 4200 = 0

6 RB – 44100 = 0

RB = **7350 kg**

ΣV = 0

RA + RB = W_1. 2. 2 + 2 P_1 + P_2 + W_2. 6

7850 + 7350 = 300. 4 + 2. 250 + 1500 + 2000. 6

15200 = 15200 → **ok**

RA = **7850 kg**

RB = **7350 kg**

RAC = RBE

= $P_1 + Q_1$

= 250 + 300. 2

= 850 kg

RAB = RA – RAC

= 7850 – 850

= 7000 kg

RBA = RB – RBE

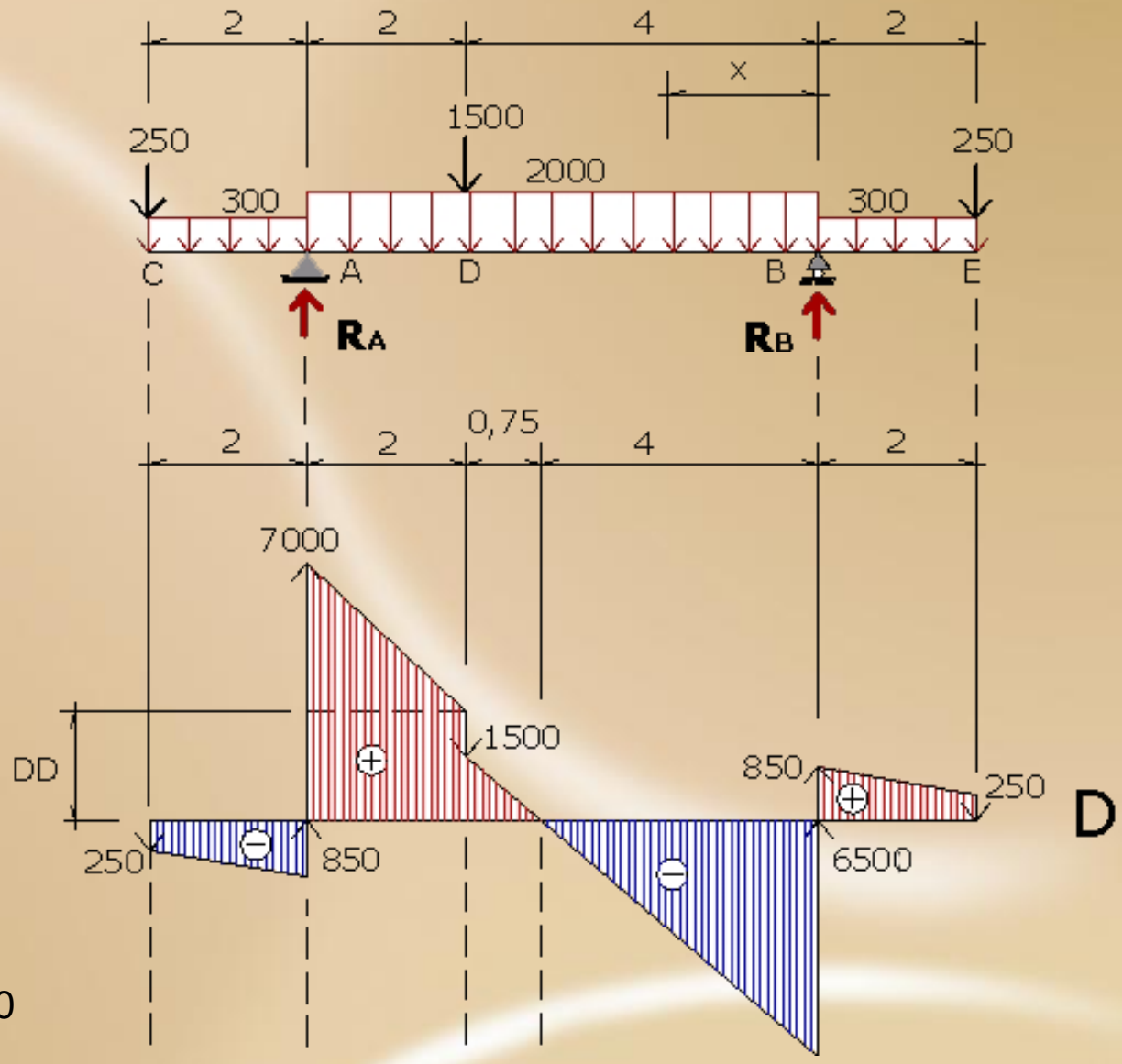
= 7350 – 850

= 6500 kg

DD = RAB – Q_2

= 7000 – 2. 2000

= 3000 kg`



$$MX = RB.\ X - P_1\ (2 + X) - W_1.\ 2\ (X + 1) - 0{,}5\ W_2\ X^2$$

$$= 7350\ X - 250\ (2 + X) - 300.\ 2\ (1 + X) - 0{,}5.\ 2000\ X^2$$

$$= 7350\ X - 500 - 250\ X - 600 - 600\ X - 1000\ X^2$$

$$= 6500\ X - 1100 - 1000\ X^2$$

$$\frac{dMx}{dx} = 6500 - 2000x$$

$$\frac{dMx}{dx} = 0$$

$$2000\ X = 6500$$

X = 3,25 m

M maks $= 6500.\ 3{,}25 - 1100 - 1000.\ 3{,}25^2$

$= 21125 - 1100 - 10563$

$=$ **9462 kgm**

$MA = MB = P_1.\ 2 + W_1.\ 2.\ 1$

$= 250.\ 2 + 300.\ 2$

$= 500 + 600$

$=$ **1100 kg**

$MD = RA.\ 2 - P_1.\ 4 - W_1.\ 2.\ 3 - W_2.\ 2.\ 1$

$= 7850.\ 2 - 250.\ 4 - 300.\ 6 - 2000.\ 2$

$= 15700 - 1000 - 1800 - 4000$

$=$ **8900 kgm**

