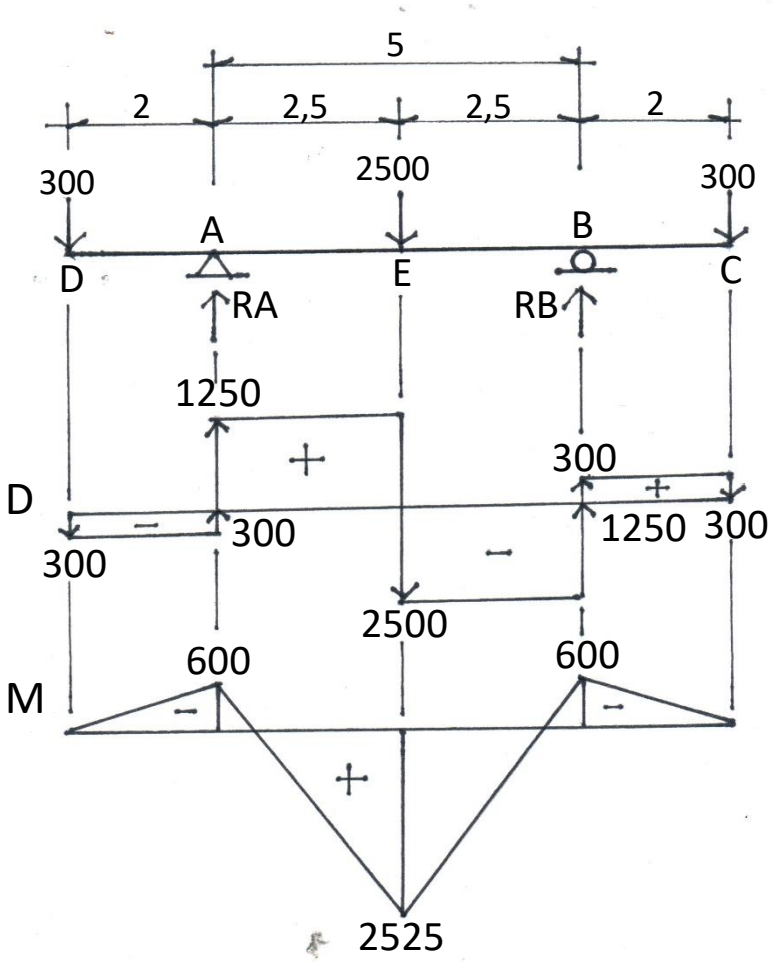
BAB 5 BALOK SEDERHANA DENGAN DUA KANTILEVEL

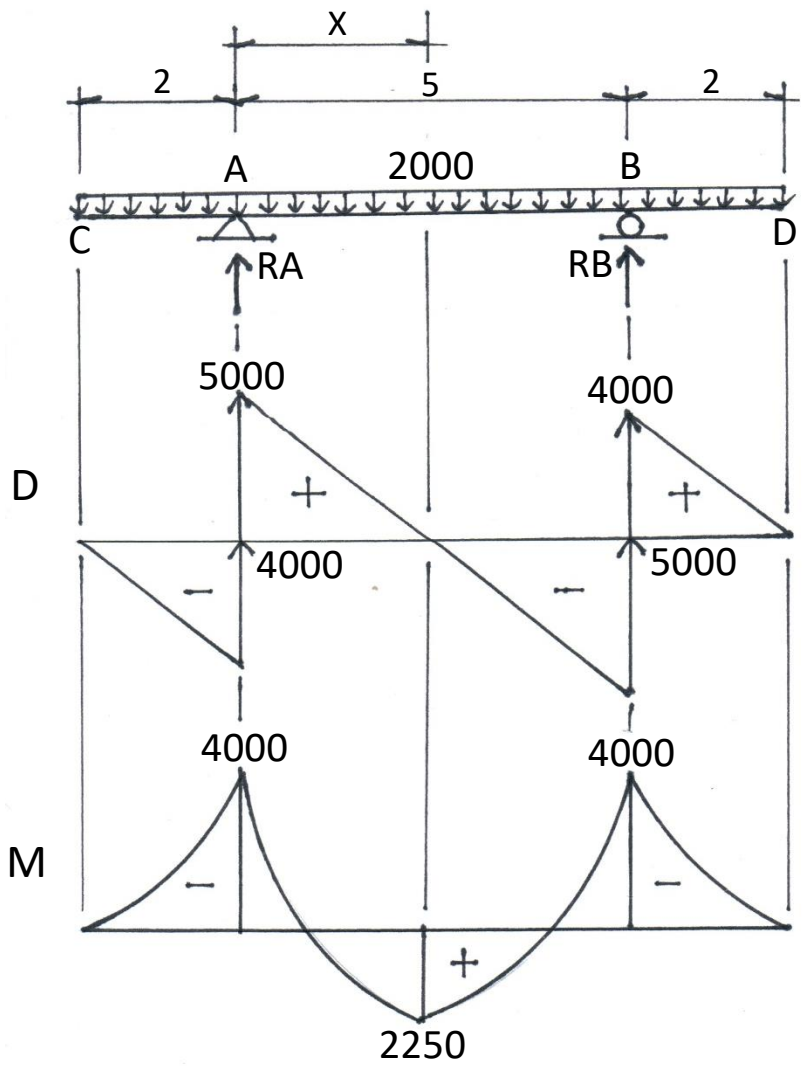
5.1 Gambar bidang : gaya lintang dan momen, P_1 = 300 kg ; P_2 = 2500 kg



RA = RB = 300 + 0,5. 2500 = **1550 kg** (simetris)
RAD = P_1 = 300 kg
RAB = RA – RAD = 1550 – 300 = 1250 kg
RBC = RAD = 300 kg
RBA = RAB = 1250 kg

MA = MB = 300. 2 = **600 kgm**
ME = RA. 2,5 – P_1. 4,5 = 1550. 2,5 – 300. 4,5
= 3875 – 1350 = **2525 kgm**

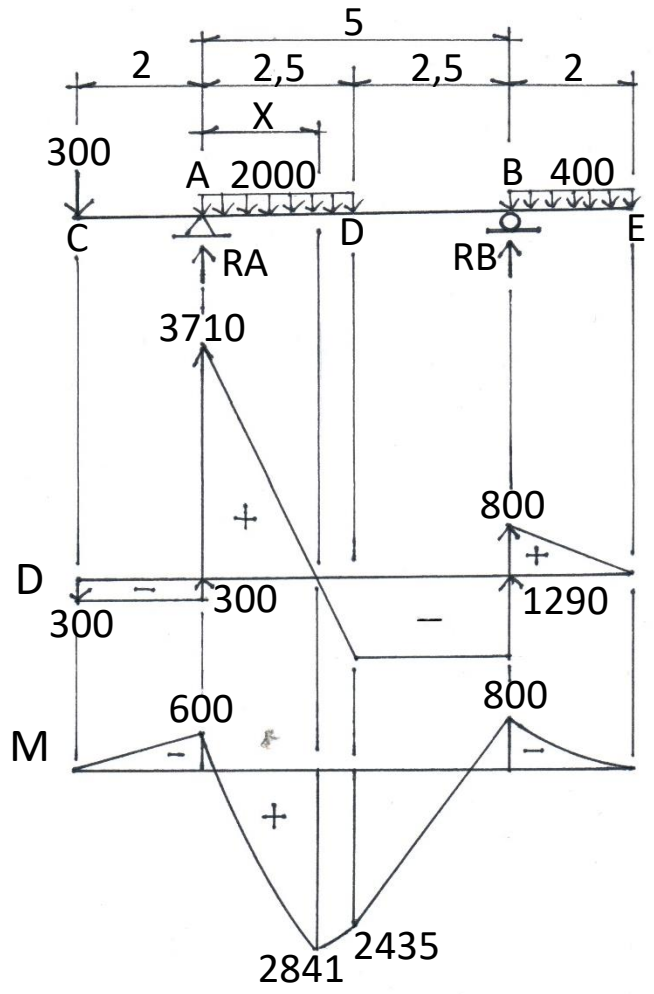
5.2 Gambar bidang : gaya lintang dan momen, W = 2000 kg/m



RA = RB = 0,5. 2000. 9 = **9000 kg** (simetris)
RAC = RBD = 2000. 2 = 4000 kg
RAB = RBA = 9000 – 4000 = 5000 kg

MX = 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
dMX/dX = 5000 – 2000 X → dMX/dX = 0 → 2000 X = 5000 →
X = 2,5 m
M maks = M lap = 5000. 2,5 – 4000 – 1000. $2,5^2$
= 12500 – 4000 – 6250 = **2250 kgm**
MA = MB = 2000. 2. 1 = **4000 kgm**

5.3 Gambar bidang : gaya lintang dan momen, W_1 = 2000 kg/m , W_2 = 400 kg/m , P = 300 kg



$\Sigma MB = 0 \rightarrow RA\ 5 + W_2.\ 2.\ 1 - P\ 7 - W_1.\ 2{,}5.\ 3{,}75 = 0$
$5\ RA + 400.\ 2 - 300.\ 7 - 2000.\ 9{,}375 = 0 \rightarrow 5\ RA + 800 - 2100 - 18750 = 0$
$5\ RA - 20030 = 0 \rightarrow 5\ RA = 20030 \rightarrow$ **RA = 4010 kg**

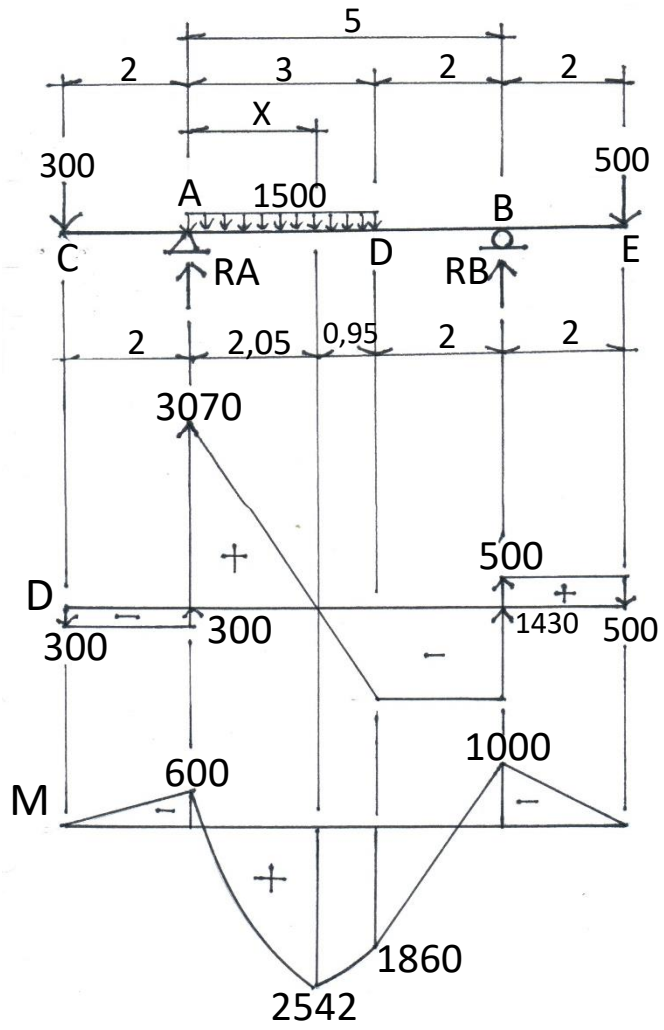
$\Sigma MA = 0 \rightarrow RB\ 5 + P.\ 2 - W_1.\ 2{,}5.\ 1{,}25 - W_2.\ 2.\ 6 = 0$
$5\ RB + 300.\ 2 - 2000.\ 3.125 - 400.\ 12 = 0 \rightarrow 5\ RB + 600 - 6250 - 4800 = 0$
$5\ RB - 10450 = 0 \rightarrow 5\ RB = 10450 \rightarrow$ **RB = 2090 kg**

$\Sigma V = 0 \rightarrow RA + RB = Q_1 + Q_2 + P \rightarrow 4010 + 2090 = 2000.\ 2{,}5 + 400.\ 2 + 300$
$4010 + 2090 = 5000 + 800 + 300 \rightarrow 6010 = 6010 \rightarrow$ ok
RAC = P = 300 kg ; RAB = 4010 – 300 = 3710 kg
$RBE = Q_2 = 400.\ 2 = 800$ kg ; RBA = 2090 – 800 = 1290 kg

$MX = 4010\ X - 300\ (2 + X) - 0{,}5.\ 2000\ X^2 = 4010\ X - 600 - 300\ X - 1000\ X^2$
$= 3710\ X - 600 - 1000\ X^2 \rightarrow dMX/dX = 3710 - 2000\ X$
$dMX/dX = 0 \rightarrow 2000\ X = 3710 \rightarrow X = 1{,}86$ m
$M\ maks = 3710.\ 1{,}86 - 600 - 1000.\ 1{,}86^2 = 6901 - 600 - 3460 =$ **2841 kgm**
$MA = 300.\ 2 = 600$ kgm ; $MB = 400.\ 2.\ 1 =$ **800 kgm**
$MD = 2090.\ 2{,}5 - 400.\ 2.\ 3{,}5 = 5225 - 2800 =$ **2425 kgm**

5.4 Gambar bidang : gaya lintang dan momen, W = 1500 kg/m,

P_1 = 300 kg ; P_2 = 500 kg



$\Sigma MB = 0 \rightarrow RA\ 5 + P_2.\ 2 - P_1.\ 7 - W.\ 3.\ 3{,}5 = 0$

$5\ RA + 500.\ 2 - 300.\ 7 - 1500.\ 10{,}5 = 0 \rightarrow 5\ RA + 1000 - 2100 - 15750 = 0$

$5\ RA - 16850 = 0 \rightarrow 5\ RA = 16850 \rightarrow$ **RA = 3370 kg**

$\Sigma MA = 0 \rightarrow RB\ 5 + P_1.\ 2 - P_2.\ 7 - W.\ 3.\ 1{,}5 = 0$

$5\ RB + 300.\ 2 - 500.\ 7 - 1500.\ 4{,}5 = 0 \rightarrow 5\ RB + 600 - 3500 - 6750 = 0$

$5\ RB - 9650 = 0 \rightarrow 5\ RB = 9650 \rightarrow$ **RB = 1930 kg**

$\Sigma V = 0 \rightarrow RA + RB = P_1 + P_2 + Q \rightarrow 3370 + 1930 = 300 + 500 + 1500.\ 3$

$3370 + 1930 = 800 + 4500 \rightarrow 5300 = 5300 \rightarrow$ ok

RAC = 300 kg → RAB = 3370 – 300 = 3070 kg

RBE = 500 kg → RBA = 1930 – 500 = 1430 kg

$MX = 3370\ X - 300\ (2 + X) - 0{,}5.\ 1500\ X^2 = 3370\ X - 600 - 300\ X - 750\ X^2$

$= 3070\ X - 600 - 750\ X^2 \rightarrow dMX/dX = 3070 - 1500\ X \rightarrow dMX/dX = 0$

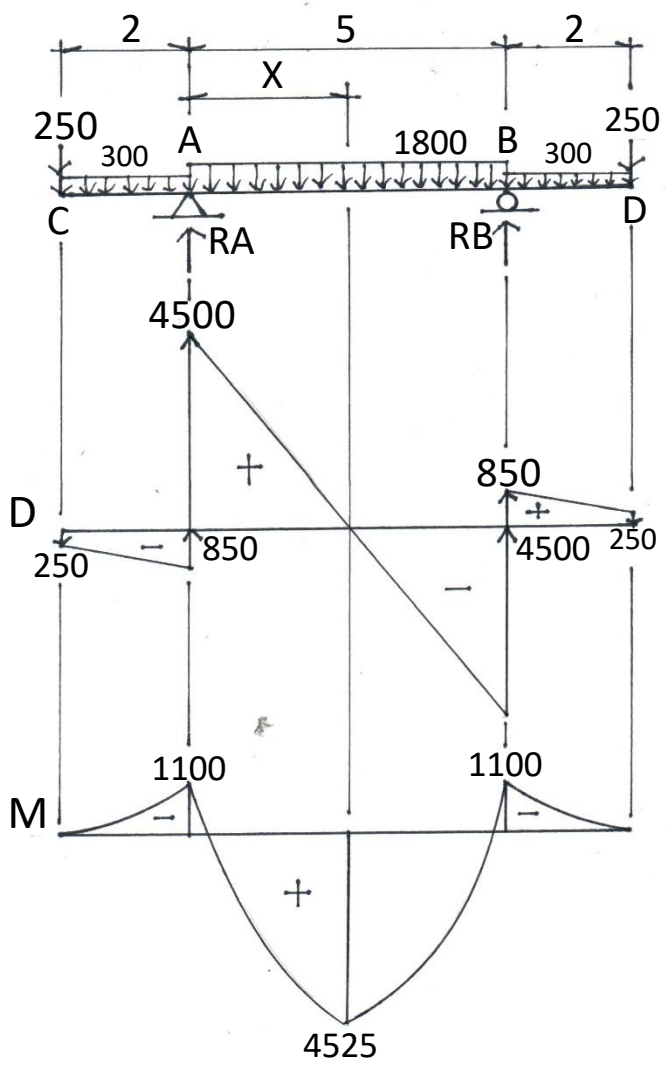
$1500\ X = 3070 \rightarrow X = 2{,}05$ m

M maks = $3070.\ 2{,}05 - 600 - 750.\ 2{,}05^2 = 6294 - 600 - 3152 =$ **2542 kgm**

MA = 300. 2 = 600 kgm ; MB = 500. 2 = **1000 kgm**

MD = 1930. 2 – 500. 4 = 3860 – 2000 = **1860 kgm**

5.5 Gambar bidang : gaya lintang dan momen, W_1 = 300 kg/m, W_2 = 1800 kg/m ; P = 250 kg



ΣMB = 0 → RA. 5 + 250. 2 – 250. 7 + 300. 2. 1 – 300. 2. 6 – 1800. 5. 2,5 = 0

5 RA + 500 – 1750 + 600 – 3600 – 22500 = 0

5 RA – 26750 = 0 → 5 RA = 26750 → **RA = 5350 kg**

RB = RA = 5350 kg (simetris)

RAC = RBD = 250 + 300. 2 = 850 kg ; RAB = RBA = 5350 – 850 = 4500 kg

MX = 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

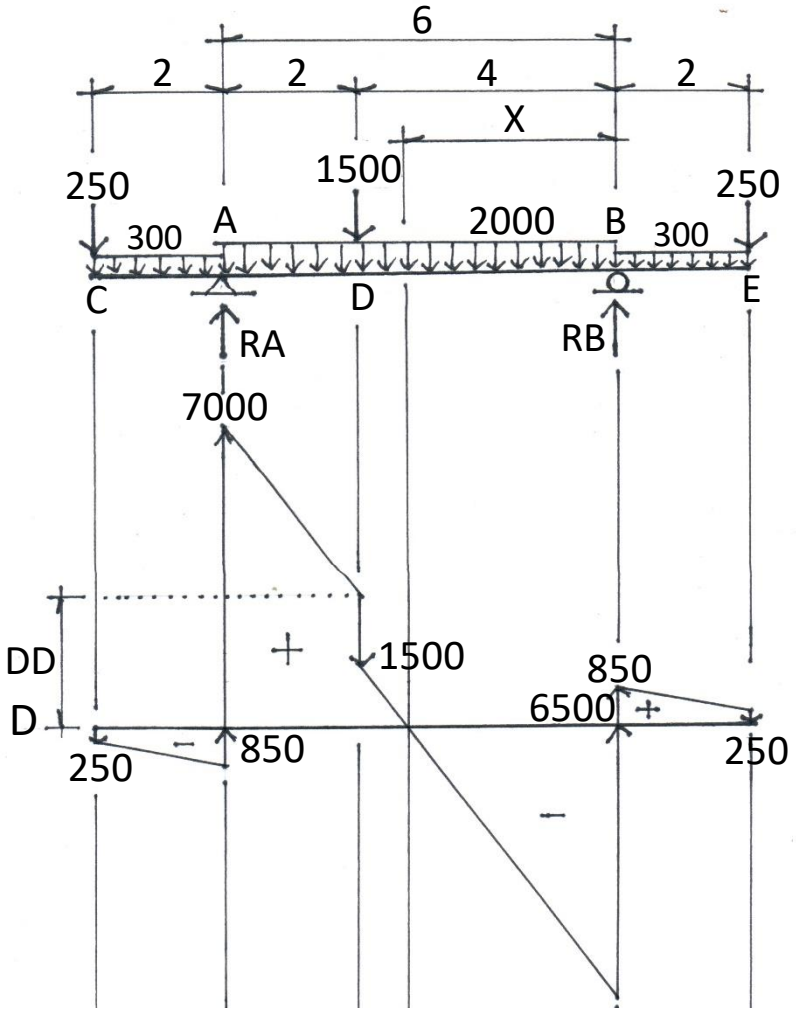
= 4500 X – 1100 – 900 X^2 → dMX/dX = 4500 – 1800 X

dMX/dX = 0 → 1800 X = 4500 → X = 2,5 m

M maks = 4500. $2,5^2$ – 1100 – 900. $2,5^2$ = 11250 – 1100 – 5625 = **4525 kgm**

MA = MB = 250. 2 + 300.2. 1 = 500 + 600 = **1100 kgm**

5.6 Gambar bidang : gaya lintang dan momen, W_1 = 300 kg/m, W_2 = 2000 kg/m, P_1 = 250 kg, P_2 = 1500 kg



ΣM B = 0 → RA. 6 + 250. 2 + 300. 2. 1 – 250. 8 – 300. 2. 7 - 2000. 6. 3 – 1500. 4 = 0 → 6 RA + 500 + 600 – 2000 – 4200 – 36000 - 6000 = 0 → 6 RA – 47100 = 0 → 6 RA = 47100

RA = 7850 kg

ΣMA = 0 → RB. 6 + 250. 2 + 300. 2. 1 – 2000. 6. 3 – 300. 2 .7 – 1500. 2 - 250. 8 = 0 → 6 RB + 500 + 600 – 36000 – 4200 – 3000 2000 → 6 RB – 44100 = 0 → **RB = 7350 kg**

RAC = 250 + 300.2 = 850 kg ; RAB = 7850 – 850 = 7000 kg

RBE = 250 + 300.2 = 850 kg ; RBA = 7350 – 850 = 6500 kg

$MX = 7350\,X – 250\,(2 + X) – 300.2\,(1 + X) – 0{,}5.\,2000\,X^2$

$= 7350\,X – 500 – 250\,X – 600 – 600\,X – 1000\,X^2$

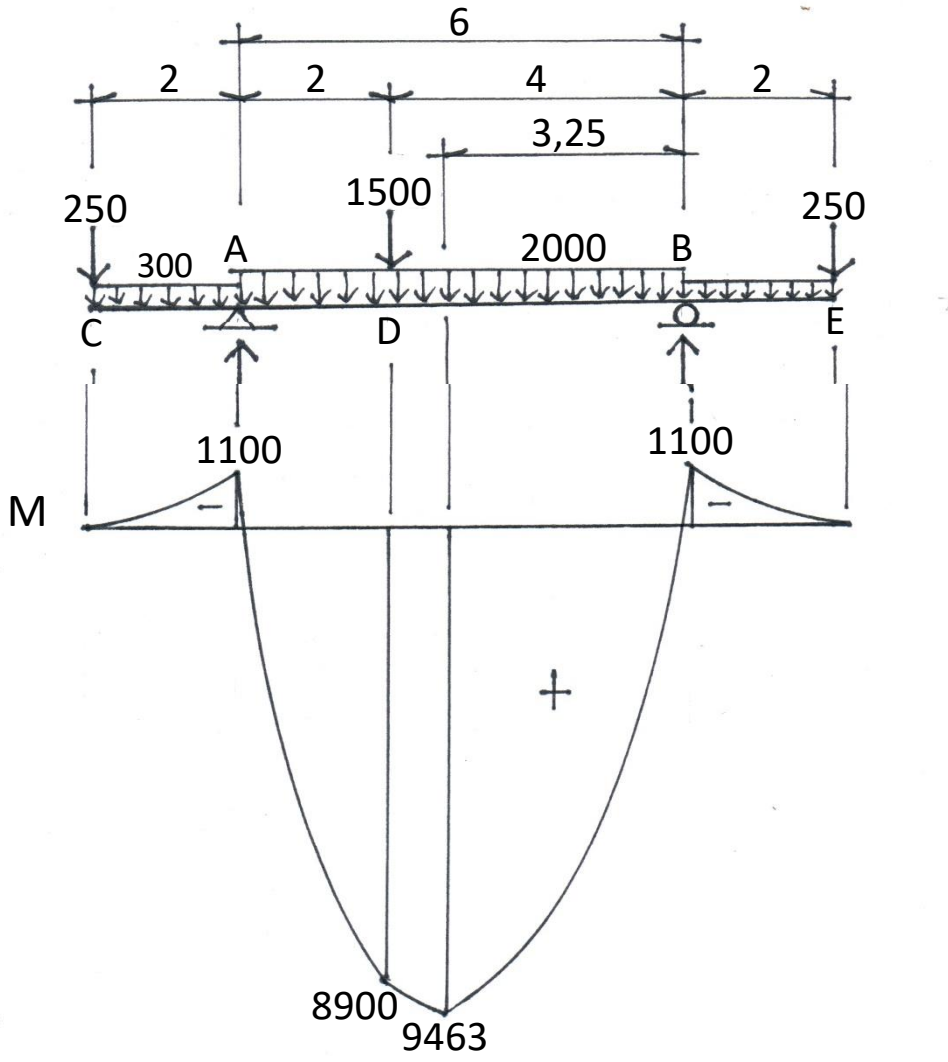
$= 6500\,X – 1100 – 1000\,X^2 \rightarrow dMX/dX = 6500 – 2000\,X$

dMX/dX = 0 → 2000 X = 6500 → X = 3,25 m

M maks = $6500.\,3{,}25 – 1100 – 1000.\,3{,}25^2$ = **9462 kgm**

MA = MB = 250. 2 + 300.2.1 = **1100 kgm**

MD = 7850. 2 – 250. 4 – 300. 2. 3 – 2000. 2. 1 = **8900 kgm**


6
2
2
4
2
3,25
250
1500
250
300
A
2000
B
C
D
E
1100
1100
M
8900
9463