STATIKA

(TUGAS SEMESTER)

Oleh

GALIH ABIE SADEWA

2315011042

JURUSAN TEKNIK SIPIL

FAKULTAS TEKNIK

UNIVERSITAS LAMPUNG

2023

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN, RISET, DAN TEKNOLOGI
FAKULTAS TEKNIK-JURUSAN TEKNIK SIPIL
UNIVERSITAS LAMPUNG
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LEMBAR ASISTENSI TUGAS SEMESTER

NAMA : **GALIH ABIE SADEWA**
NPM : **2315011042**
SEMESTER : **1 (SATU)**
MATA KULIAH : **STATIKA**

NO	TANGGAL	KETERANGAN	PARAF
1.	13-9-2023	Perbaiki skala, Reaksi Perletakan	✓
		OK Lanjutkan !!	
2	25-9-2023	Perbaiki gambar bidang Momen	✓
3.	2-10-2023	Perbaiki gambar	✓
4	23-10-2023	Lanjutkan 1b	✓
5.	30-10-2023	ACC !!!	✓

Bandar Lampung, 2023
Asisten Dosen

MUHAMMAD FATIH NABAN
NPM. 2015011030

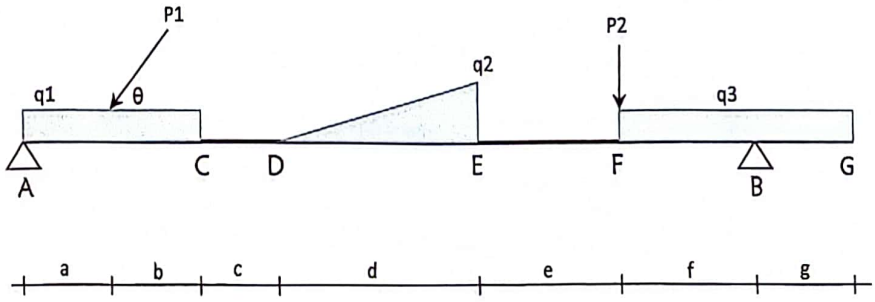
KEMENTRIAN PENDIDIKAN, KEBUDAYAAN,
RISET DAN TEKNOLOGI
UNIVERSITAS LAMPUNG
FAKULTAS TEKNIK
JURUSAN TEKNIK SIPIL

TUGAS BESAR **STATIKA (SIP 620104)**
SEMESTER GANJIL 2023/2024

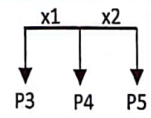
NAMA : GALIH ABIE SADEWA
NPM : 2315011042

SOAL NO. 1

Diketahui struktur *simple beam* dengan beban seperti tergambar.



Data-data sebagai berikut:

Perletakan		Beban		Jarak		Beban berjalan	
A	Rol	P1	13 kN	a	1,5 m	P3	28 kN
B	Sendi	P2	11 kN	b	2,9 m	P4	25 kN
		q1	28 kN/m'	c	1,3 m	P5	16 kN
		q2	46 kN/m'	d	4,6 m		
		q3	36 kN/m'	e	1,4 m		
				f	2,0 m		
				g	1,9 m		
				Sudut θ	35 °	x1	1,5 m
						x2	1,4 m

Pertanyaan:

a. Hitung dan gambarkan bidang momen, lintang dan normal akibat beban tetap (seperti tergambar).
b. Hitung dan gambar garis pengaruh momen dan lintang akibat beban jika P = 1 kN bergerak dari tumpuan A ke B pada potongan C, D, E dan F.
c. Hitung nilai momen ekstrim dan lintang ekstrim pada potongan C, D, E, dan F akibat rangkaian beban berjalan (P3, P4, P5) dari A ke B.

Asisten Responsi,

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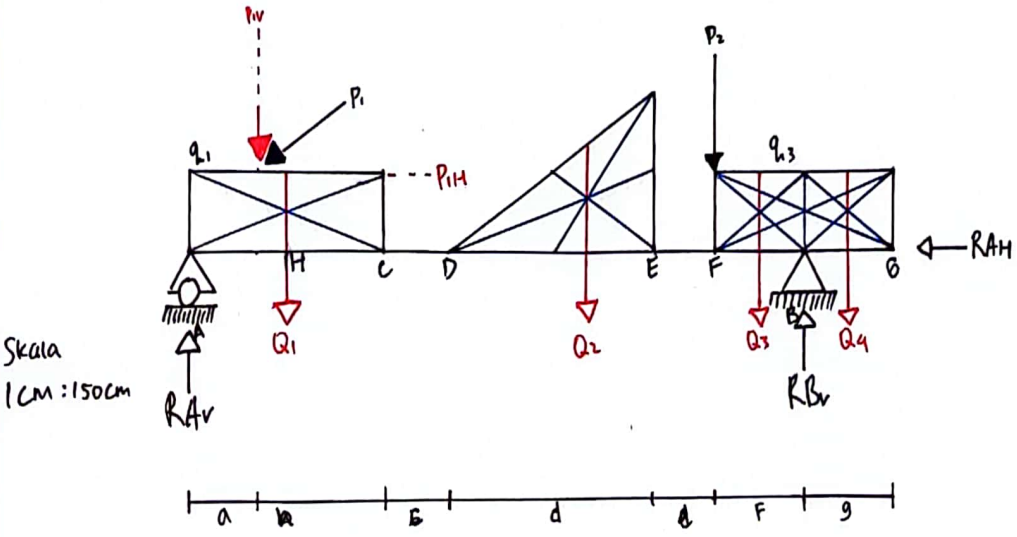

Data Soal :

- Perletakan :
  - A : Rol
  - B : Sendi
- Beban :
  - P_1 : 13 kN
  - P_2 : 11 kN
  - q_{n1} : 28 kN/m
  - q_{n2} : 96 kN/m
  - q_{n3} : 36 kN/m
- Jarak :
  - a : 1.5 m
  - b : 2,9 m
  - c : 1,3 m
  - d : 4,6 m
  - e : 1,4 m
  - F : 2,0 m
  - g : 1,9 m
- Sudut :
  - θ : 35°

Uraian :

- $P_{1V} = P_1 . \sin\theta$
  $= 13 . \sin 35°$
  $= 7,4565$ kN
- $P_{1H} = P_1 . \cos\theta$
  $= 13 . \cos 35°$
  $= 10,649$ kN
- $Q_1 = q_{n1} . (a+b)$
  $= 28 . (1,5+2,9)$
  $= 123,2$
- $Q_2 = q_{n2} . (\frac{1}{2} . d)$
  $= 96 . (\frac{1}{2} . 4,6)$
  $= 105,8$ kN
- $Q_3 = q_{n3} . (F)$
  $= 36 . (2,0)$
  $= 72$ kN
- $Q_4 = q_{n3} . (g)$
  $= 36 . (1,9)$
  $= 68,4$ kN

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*Reaksi Peletakan

• $\Sigma MA = 0$

$-(P_{1V} \cdot a) - (Q_1 \cdot (\frac{1}{2} \cdot (a+b))) - (Q_2 \cdot (\frac{2}{3} \cdot d) + (a+b+c)) - (P_2 \cdot (a+b+c+d+e))$
$-(Q_3 \cdot (\frac{1}{2} \cdot F) + (a+b+c+d+e)) - (Q_4 \cdot (\frac{1}{2} \cdot g) + (a+b+c+d+e+F)) +$
$R_{BV} \cdot (a+b+c+d+e+F)$

$-(7,4565 \cdot 1,5) - (123,2 \cdot (\frac{1}{2} \cdot (1,5+2,9))) - (105,8 \cdot (\frac{2}{3} \cdot 4,6) + (1,5+2,9+1,3))$
$-(11 \cdot (1,5+2,9+1,3+4,6+1,4)) - (72 \cdot (\frac{1}{2} \cdot 2,0) + (1,5+2,9+1,3+4,6+1,4))$
$-(68,4 \cdot (\frac{1}{2} \cdot 1,9) + (1,5+2,9+1,3+4,6+1,4+2,0)) + R_{BV} \cdot (1,5+2,9+1,3+4,6+1,4+2,0))$
$-(11,1898) - (271,09) - (927,5169) - (128,7) - (919,4) - (1002,06) + R_{BV} \cdot 13,7$

$-3259,9017 + R_{BV} \cdot 13,7$

$R_{BV} = \frac{3259,9017}{13,7}$

$R_{BV} = 237,5841$

• $MB = 0$

$(Q_4 \cdot (\frac{1}{2} \cdot g)) - (Q_3 \cdot (\frac{1}{2} \cdot F)) - (P_2 \cdot F) - (Q_2 \cdot (\frac{1}{3} \cdot d) + (F+c)) - (Q_1 \cdot (\frac{1}{2} \cdot (a+b)) + (F+c+d+c))$
$-(P_{1V} \cdot (F+e+d+c+b)) + R_{AV} \cdot (F+c+d+c+b+a)$
$(68,4 \cdot (\frac{1}{2} \cdot 1,9)) - (72 \cdot (\frac{1}{2} \cdot 2,0)) - (11 \cdot 2,0) - (105,8 \cdot (\frac{2}{3} \cdot 4,6) + (2,0+1,4)) - (123,2 \cdot (\frac{1}{2} \cdot$
$(1,5+2,9)) + (2,0+1,4+4,6+1,3)) - (7,4565 \cdot (2,0+1,4+4,6+1,3+2,9)) + R_{AV} \cdot (2,0+1,4+4,6+1,3+2,9+1,5))$

$+(64,98) - (72) - (22) - (521,9431) - (1916,8) - (90,9693 + R_{AV} \cdot 13,7$

$-2059,0324 + R_{AV} \cdot 13,7$

$R_{AV} = \frac{2058,0324}{13,7}$

$R_{AV} = 150,2724$

• $\Sigma V = 0$

$R_{AV} + R_{BV} = P_{1V} + Q_1 + Q_2 + P_2 + Q_3 + Q_4$

$150,2724 + 237,5841 = 7,4565 + 123,2 + 105,8 + 11 + 72 + 68,4$

$387,8565 = 387,8565$

(OK!!)

*Gaya Normal

$\Sigma H = 0$

$R_{AH} - P_{1H} = 0$

$R_{AH} = P_{1H}$

$R_{AH} = 10,649$ kN

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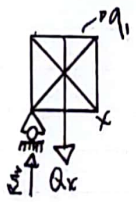
*Gaya Lintang

~ $0 \le x \le 1{,}5$ (A - Hkiri)

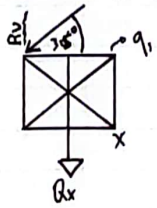


$D_x = R_{Av} - q_1 \cdot x$

$= 150{,}2729 - 28 \cdot x$

x	0	1	1,5
Dx(kN)	150,2729	122,2729	108,2729

~ $1{,}5 \le x \le 4{,}4$ (Hkanan - C)



$D_x = R_{Av} - P_{1V} - q_1 \cdot x$

$= 150{,}2729 - 7{,}4565 - 28 \cdot x$

$= 142{,}8159 - 28 \cdot x$

x	Dx (kN)
1,5	100,8159
2	86,8159
3	58,8159
4	30,8159
4,4	19,6159

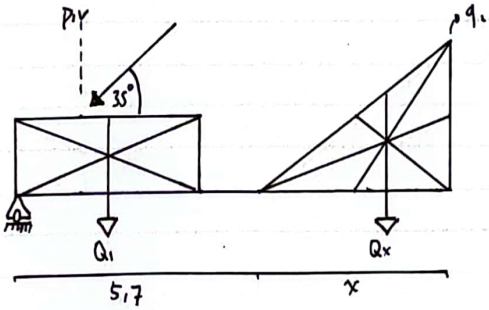
~ $4{,}4 \le x \le 5{,}7$ (C - D)

$D_{4,4-5,7} = R_{Av} - P_{1V} - Q_1$

$= 150{,}2729 - 7{,}4565 - 123{,}2$

$= 19{,}6159$ kN

~ $5{,}7 \le x \le 10{,}3$ (D - E)



$\frac{q_x}{q} = \frac{x}{4{,}6}$; $q_x = \frac{q \cdot x}{4{,}6}$

$\frac{q_x}{46} = \frac{x}{4{,}6}$; $q_x = \frac{46x}{4{,}6}$

$Q_x = \frac{q_x \cdot x}{2}$; $Q_x = \frac{\frac{46x}{4{,}6} \cdot x}{2}$; $Q_x = 5x^2$

$D_x = R_{Av} - Q_1 - P_{1V} - Q_x$

$= 150{,}2729 - 123{,}2 - 7{,}4565 - 5x^2$

$= 19{,}6159 - 5(x - 5{,}7)^2$

x	Dx (kN)
5,7	19,6159
6	19,1659
7	11,1659
8	-6,8341
9	-34,8341
10	-72,8341
10,3	-86,1841

~ $10{,}3 \le x \le 11{,}7$ (E - Fkiri)

$D_{10,3-11,7} = R_{Av} - P_{1V} - Q_1 - Q_2$

$= 150{,}2729 - 7{,}4565 - 123{,}2 - 105{,}8$

$= -86{,}1841$

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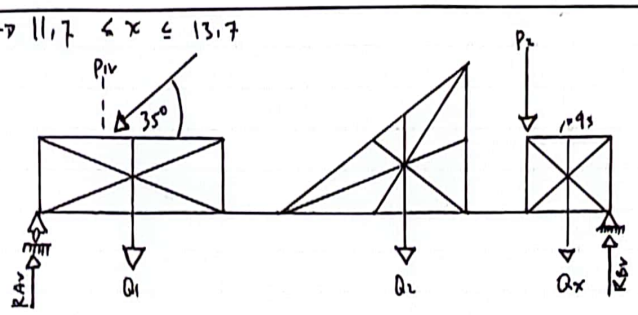
~> 11,7 ≤ x ≤ 13,7



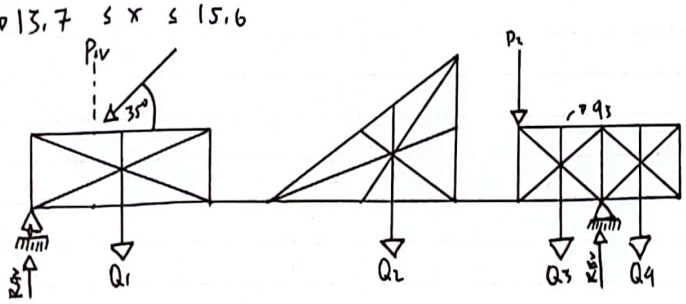
$D_x = R_{Av} - P_{1v} - Q_1 - Q_2 - P_2 - q_3 \cdot (x - 11{,}7)$

$= 150{,}2729 - 7{,}4565 - 123{,}2 - 105{,}8 - 11 - 36 \cdot (x - 11{,}7)$

$= -97{,}1841 - 36 \cdot (x - 11{,}7)$

x	11,7	12	13	13,7
Dx(kN)	-97,1841	-107,9841	-143,9841	-169,1841

~> 13,7 ≤ x ≤ 15,6



$D_x = R_{Av} - P_{1v} - Q_1 - Q_2 - P_2 - Q_3 + R_{Bv} - q_3 \cdot (x - 13{,}7)$

$= 150{,}2729 - 7{,}4565 - 123{,}2 - 105{,}8 - 11 - 72 + 237{,}5841 - 36(x - 13{,}7)$

$= 140{,}4 - 36 \cdot (x - 13{,}7)$

x	13,7	14	15	16
Dx(kN)	68,4	57,6	21,6	0

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* Gaya Momen

2. $0 \leq x \leq 1,5$

$M_x = RA_V \cdot x - \frac{1}{2} \cdot q_1 \cdot x^2$

$= 150,2724 \cdot x - \frac{1}{2} \cdot 28 \cdot x^2$

$= 150,2724 \cdot x - 14 \cdot x^2$

$M_1 = 150,2724 \cdot x - 14 \cdot x^2$

$= 150,2724 - 14$

$= 136,2724$ kN.m

x	Mx (kN.M)
0	0
1	136,2724
1,5	193,9086

2. $1,5 \leq x \leq 4,4$

$M_x = RA_V \cdot x - P_{1V} \cdot (x-a) - \frac{1}{2} \cdot q \cdot x^2$

$= 150,2724 \cdot x - 7,4565 \cdot (x-1,5) - \frac{1}{2} \cdot 28 \cdot x^2$

$= 150,2724 \cdot x - 7,4565 \cdot (x-1,5) - 14 \cdot x^2$

$M_{1,5} = 150,2724 \cdot 1,5 - 7,4565 \cdot (1,5-1,5) - 14 \cdot 1,5^2$

$= 150,2724 \cdot 1,5 - 7,4565 \cdot (1,5-1,5) - 14 \cdot 2,25$

$= 193,9086$ kN.m

x	Mx (kN.M)
1,5	193,9086
2	240,8166
3	313,6325
4	358,4984
4,4	368,5347

2. $4,4 \leq x \leq 5,7$

$M_x = RA_V \cdot x - P_{1V} \cdot (x-a) - Q_1 \cdot (x - \frac{1}{2} \cdot (a+b)$

$= 150,2724 \cdot x - 7,4565 \cdot (x-1,5) - 123,2 \cdot (x - \frac{1}{2} \cdot (1,5+2,9)$

$= 150,2724 \cdot x - 7,4565 \cdot (x-1,5) - 123,2 \cdot (x-2,2)$

$M_{4,4} = 150,2724 \cdot x - 7,4565 \cdot (x-1,5) - 123,2 \cdot (x-2,2)$

$= 150,2724 \cdot 4,4 - 7,4565 \cdot (4,4-1,5) - 123,2 \cdot (4,4-2,2)$

$= 368,5347$ kN.m

x	Mx (kN.M)
4,4	368,5347
5	380,3043
5,7	394,0354

2. $5,7 \leq x \leq 10,3$

$M_x = RA_V \cdot x - P_{1V} \cdot (x-a) - Q_1 \cdot (x - \frac{1}{2} \cdot (a+b) - \frac{1}{6} \cdot \frac{q_2}{a} \cdot (x-(a+b+c))^3$

$= 150,2724 \cdot x - 7,4565 \cdot (x-a) - 123,2 \cdot (x - \frac{1}{2} \cdot (1,5+2,9) - \frac{1}{6} \cdot \frac{96}{4,6} \cdot (x-(1,5+2,9+1,3))^3$

$= 150,2724 \cdot x - 7,4565 \cdot (x-1,5) - 123,2 \cdot (x-2,2) - 1,6667 \cdot (x-5,7)^3$

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$M_{5,7} = 150,2724.x - 7,4565.(x-1,5) - 123,2.(x-2,2) - 1,6667.(x-5,7)^3$

$= 150,2724.4,4 - 7,4565.(4,4-1,5) - 123,2.(4,4-2,2) - 1,6667.(4,4-5,7)^3$

$= 394,0359$ kN.M

x	Mx (kN.M)
5,7	394,0359
6	399,8751
7	415,8743
8	418,8732
9	398,8717
10	395,8694
10,3	322,0389

2. $10,3 \leq x \leq 11,7$

$M_x = RAv.x - P_{1v}.(x-a) - Q_1.(x-\frac{1}{2}.(a+b)) - Q_2.(\frac{2}{3}d + (x - a+b+c)$

$M_x = 150,2724.x - 7,4565.(x-1,5) - 123,2.(x-2,2) - 105,8\,(3,0667 + (x-1,5+2,9+1,3)$

$= 150,2724.x - 7,4565.(x-1,5) - 123,2.(x-2,2) - 105,8\,(x-8,7667)$

$M_{10,3} = 150,2724.10,3 - 7,4565.(10,3-1,5) - 123,2.(10,3-2,2) - 105,8\,(10,3-8,7667)$

$= 322,0389$ kN.M

x	Mx (kN.M)
10,3	322,0389
11	261,71
11,7	201,3876

2. $11,7 \leq x \leq 13,7$

$M_x = RAv.x - P_{1v}.(x-a) - Q_1.(x-\frac{1}{2}.(a+b)) - Q_2.(\frac{2}{3}d + x - a+b+c) - P_2.(x-a+b+c+d+e) - q_3.\frac{1}{2}.(x-(a+b+c+d+e))^2$

$= 150,2724.x - 7,4565\,(x-1,5) - 123,2\,(x-2,2) - 105,8.(x-8,7667) - 11\,(x-11,7) - 18\,(x-11,7)^2$

$M_{11,7} = 150,2724.11,7 - 7,4565\,(11,7-1,5) - 123,2\,(11,7-2,2) - 105,8.(11,7-8,7667) - 11\,(11,7-11,7) - 18\,(11,7-11,7)^2$

$= 201,3876$ kN.M

x	Mx (kN.M)
11,7	201,3876
12	170,6124
13	94,6283
13,7	-64,98

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~> $13,7 \leq x \leq 15,6$

$M_x = -\frac{1}{2} \cdot 9_3 (9 - (x - 13,7))^2$

$= -\frac{1}{2} \cdot 36 (1,9 - (x - 13,7))^2$

$= -18 \cdot (x - (x - 13,7))^2$

x	M_x (kN.M)
13,7	-69,98
19	-96,08
15	-6,48
15,6	0

* Mencari Momen Maksimum

~> $5,7 \leq x \leq 10,3$

$M_x = R_{AV} \cdot (x + (a+b+c)) - Q_1 \cdot (x + (c + \frac{1}{2} \cdot a+b)) - P_{1V} \cdot (x + b + c)) - Q_x \cdot \frac{1}{3} x$

$= R_{AV} \cdot x + R_{AV} \cdot (a+b+c) - Q_1 \cdot x - Q_1 \cdot (c + \frac{1}{2} \cdot a+b) - P_{1V} \cdot x - P_{1V} \cdot (b+c) - \frac{46}{9,2} \cdot x^2 \cdot \frac{1}{3} \cdot x$

$Q_x = \frac{1}{2} \cdot \frac{46}{4,6} \cdot x^2 = \frac{46}{9,2} \cdot x^2$

$= R_{AV} \cdot x + R_{AV} \cdot (a+b+c) - Q_1 \cdot x - Q_1 \cdot (c + \frac{1}{2} \cdot a+b) - P_{1V} \cdot x - P_{1V} (b+c) - \frac{46}{27,6} x^3$

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

$= R_{AV} - Q_1 - P_{1V} - 3 \cdot \frac{46}{27,6} \cdot x^2 = 0 \longrightarrow Dx = 0$

$150,2724 - 123,2 - 7,4565 - 5x^2 = 0$

$-5x^2 = -19,6159$

$x^2 = \frac{-19,6159}{-5}$

$x = \sqrt{3,9232} = 1,9807$

$x = 1,9807$ dari titik D

$M_{max} = R_{AV} \cdot x + R_{AV} \cdot (1,5 + 2,9 + 1,3) - Q_1 \cdot x - Q_1 (1,3 + \frac{1}{2} \cdot 1,9 + 2,9) - P_{1V} \cdot x - P_{1V} (2,9 + 1,3) - \frac{46}{27,6} x^3$

$= 150,2729 \cdot x + 150,2729 \cdot (5,7) - 123,2 \cdot x - 123,2 (3,5) - 7,4565 \cdot x - 7,4565 (9,2) - \frac{46}{27,6} x^3$

$= 19,6159 \cdot x + 394,0359 - \frac{46}{27,6} \cdot x^3$

$= 19,6159 \cdot (1,9807) + 394,0359 - \frac{46}{27,6} \cdot (1,9807)^3$

$= 38,8532 + 394,0359 - 12,951$

$= 419,9376$ kN.M

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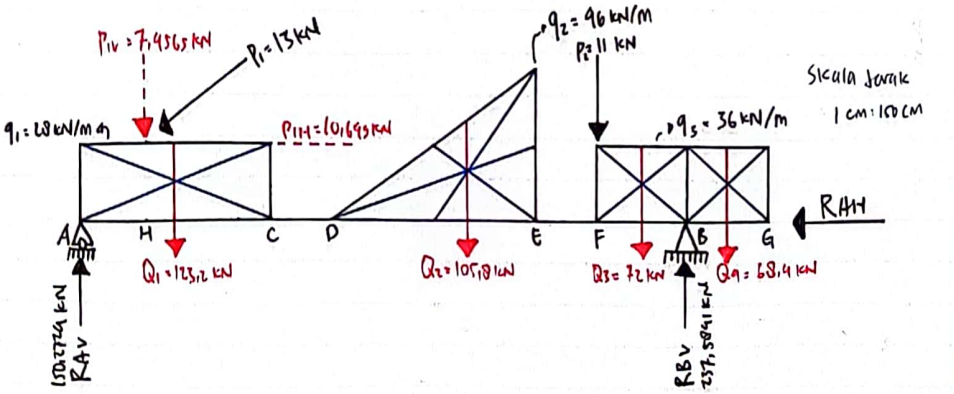
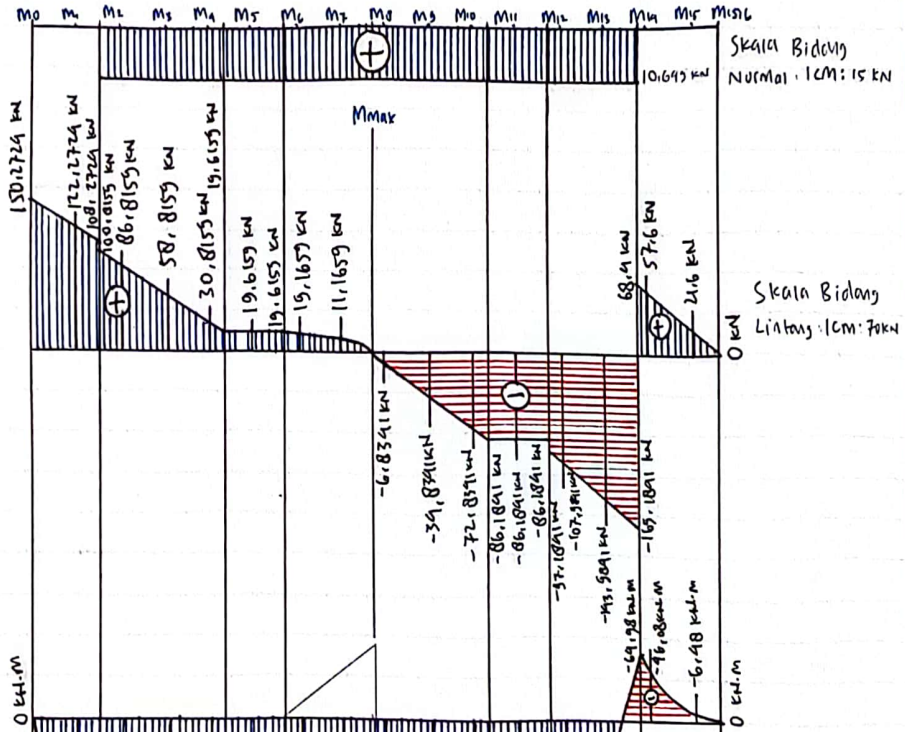
*Gambar Bidang Normal, Lintang, dan Momen.





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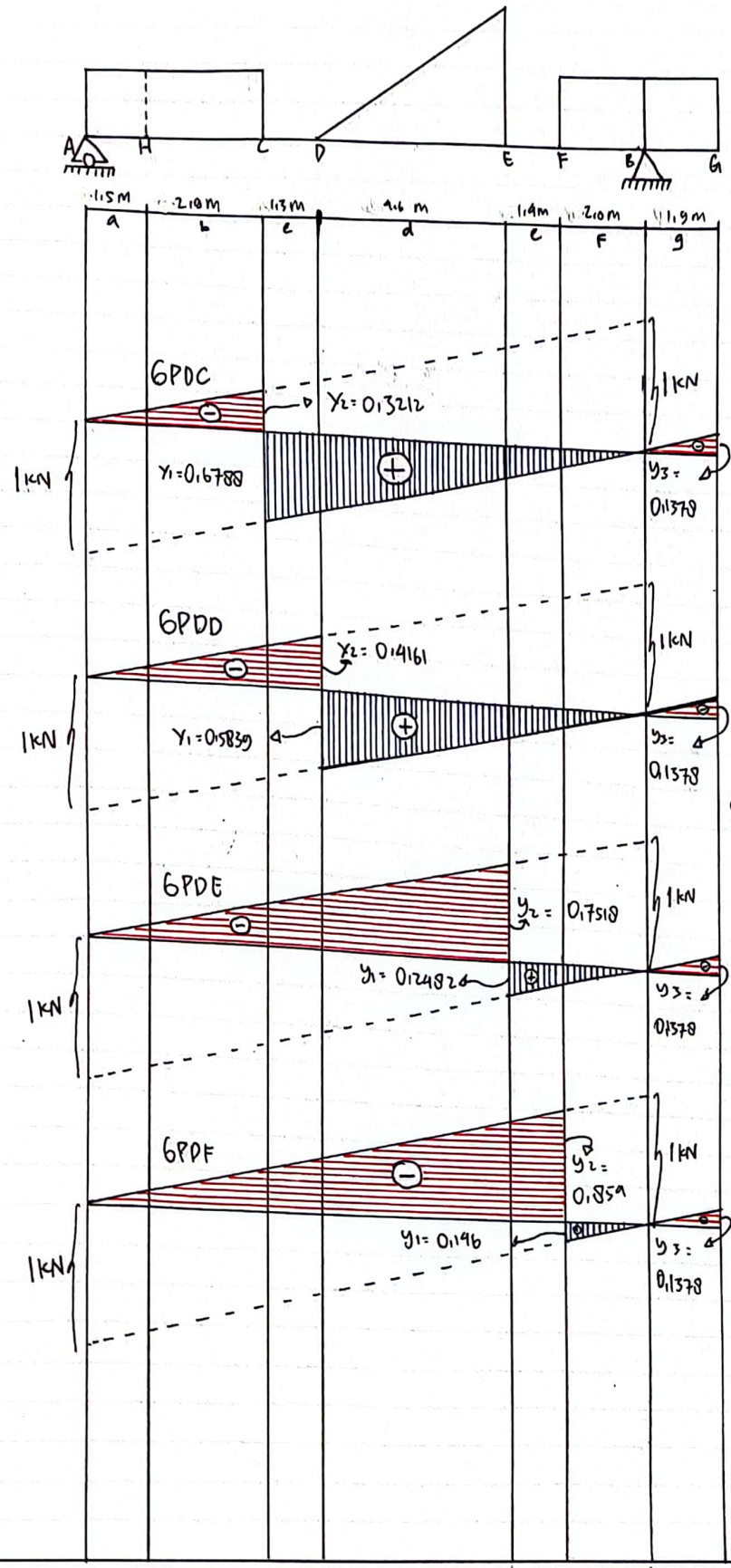
*Gambar Garis Pengaruh Lintang.



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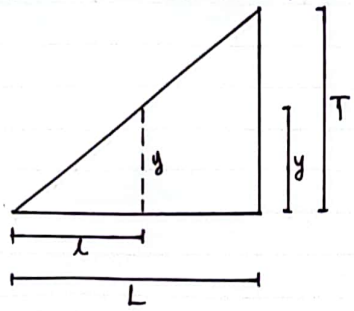
b. Hitung dan Gambar Garis Pengaruh Momen dan lintang akibat beban jika P = 1kN bergerak dari tumpuan A ke B pada Potongan C, D, E, dan F.



$$\frac{y}{T} = \frac{x}{L}$$

$$y = \frac{x.T}{L}$$

* Garis Pengaruh Lintang

~> Titik C

· y_1 Positif : $y_1 = \frac{(c+d+e+F).1}{(a+b+c+d+e+F)}$

$y_1 = \frac{9,3.1}{13,7} = 0,6788$

· y_2 Negatif : $y_2 = \frac{(a+b).1}{(a+b+c+d+e+F)}$

$y_2 = \frac{4,4.1}{13,7} = 0,3212$

· y_3 Negatif : $y_3 = \frac{(9).1}{13,7}$

$y_3 = \frac{1,9.1}{13,7} = 0,1387$

~> Titik D

· y_1 Positif : $y_1 = \frac{(d+e+F).1}{(a+b+c+d+e+F)}$

$y_1 = \frac{8.1}{13,7} = 0,5839$

· y_2 Negatif : $y_2 = \frac{(a+b+c).1}{(a+b+c+d+e+F)}$

$y_2 = \frac{5,7.1}{13,7} = 0,4161$

· y_3 Negatif : $y_3 = \frac{(9).1}{(a+b+c+d+e+F)}$

$y_3 = \frac{1,9.1}{13,7} = 0,1387$

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~▷ Titik E

· y_1 Positif : $y_1 = \frac{(e+F)\cdot 1}{(a+b+c+d+e+F)}$

$y_1 = \frac{3,9\cdot 1}{13,7} = 0,2902$

· y_2 Negatif : $y_2 = \frac{(a+b+c+d)\cdot 1}{(a+b+c+d+e+F)}$

$y_2 = \frac{10,3\cdot 1}{13,7} = 0,7518$

· y_3 Negatif : $y_3 = \frac{(g)\cdot 1}{(a+b+c+d+e+F)}$

$y_3 = \frac{1,9\cdot 1}{13,7} = 0,1387$

~▷ Titik F

· y_1 Positif : $y_1 = \frac{(F)\cdot 1}{(a+b+c+d+e+F)}$

$y_1 = \frac{2\cdot 1}{13,7} = 0,146$

· y_2 Negatif : $y_2 = \frac{(a+b+c+d+e)\cdot 1}{(a+b+c+d+e+F)}$

$y_2 = \frac{11,7\cdot 1}{13,7} = 0,854$

· y_3 Negatif : $y_3 = \frac{(g)\cdot 1}{(a+b+c+d+e+F)}$

$y_3 = \frac{1,9\cdot 1}{13,7} = 0,1387$

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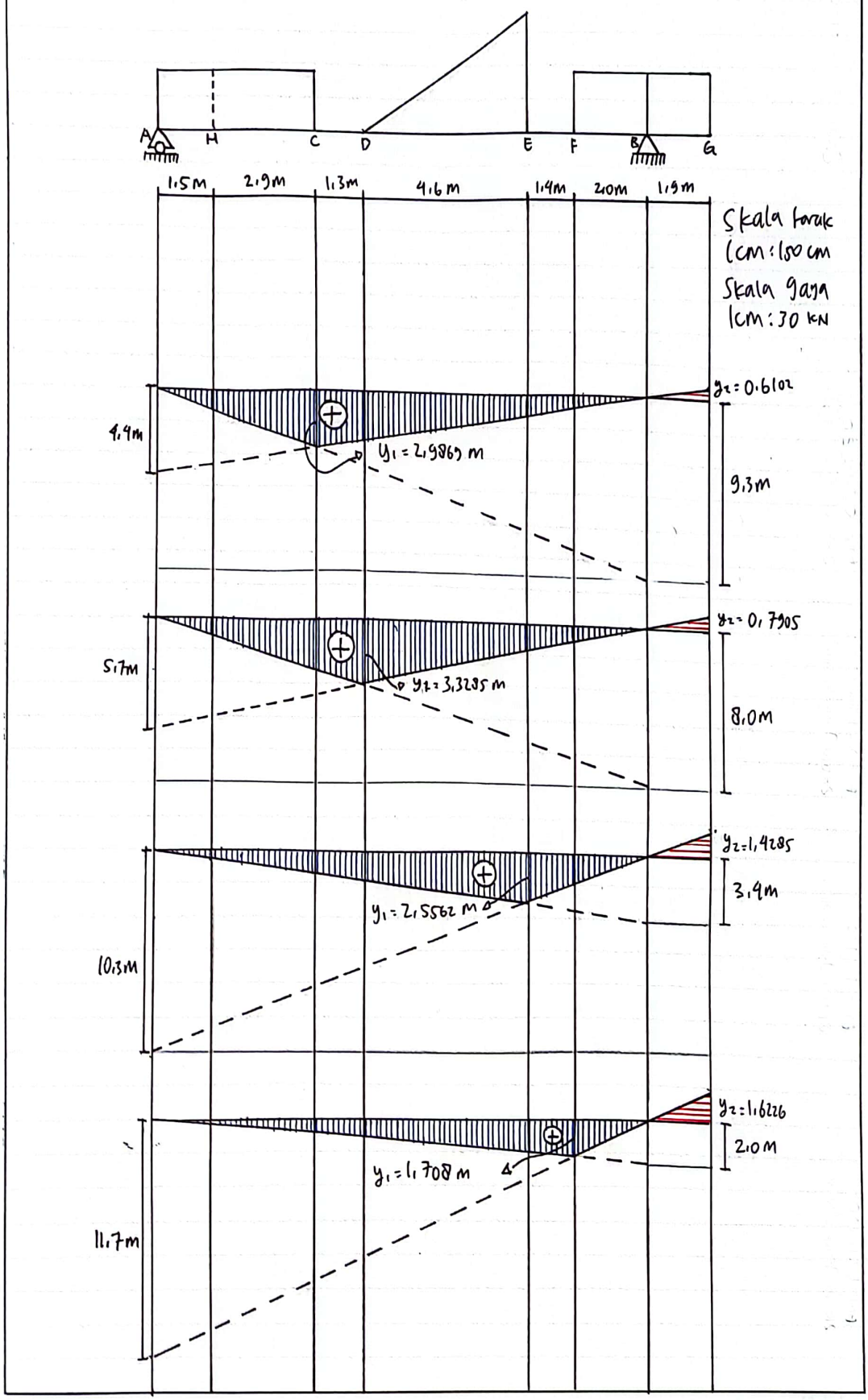
*Gambar Garis Pengaruh Momen.



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* Garis Pengaruh Momen C

~> Titik C =

· Y Positif = $\frac{(a+b)(c+d+e+f)}{a+b+c+d+e+f} = \frac{(1,5+2,9)(1,3+4,6+1,4+2,0)}{(1,5+2,9+1,3+4,6+1,4+2,0)} = \frac{(4,4)(9,3)}{13,7} = 2,9869$

= $y^+C \cdot P$ = 2,9869 . 1 = 2,9869 m

· Y Negatif = $\frac{(a+b)(g)}{(a+b+c+d+e+f)} = \frac{(1,5+2,9)(1,9)}{(1,5+2,9+1,3+4,6+1,4+2,0)} = \frac{(4,4)(1,9)}{13,7} = 0,6102$

= $y^-C \cdot P$ = 0,6102 . 1 = 0,6102 m

~> Titik D =

· Y Positif = $\frac{(a+b+c)(d+e+f)}{(a+b+c+d+e+f)} = \frac{(5,7)(8)}{13,7} = 3,3285$

= $y^+D \cdot P$ = 3,3285 . 1 = 3,3285 m

· Y Negatif = $\frac{(a+b+c)(g)}{(a+b+c+d+e+f)} = \frac{(5,7)(1,9)}{13,7} = 0,7905$

= $y^-D \cdot P$ = 0,7905 . 1 = 0,7905 m

~> Titik E =

· Y Positif = $\frac{(a+b+c+d)(e+f)}{(a+b+c+d+e+f)} = \frac{(10,3)(3,4)}{13,7} = 2,5562$

= $y^+E \cdot P$ = 2,5562 . 1 = 2,5562 m

· Y Negatif = $\frac{(a+b+c+d)(g)}{(a+b+c+d+e+f)} = \frac{(10,3)(1,9)}{13,7} = 1,4285$

= $y^-E \cdot P$ = 1,4285 . 1 = 1,4285 m

~> Titik F : Y Positif = $\frac{(a+b+c+d+e)(f)}{(a+b+c+d+e+f)} = \frac{(11,7)(2)}{13,7} = 1,708$

= $y^+F \cdot P$ = 1,708 . 1 = 1,708 m

· Y negatif = $\frac{(a+b+c+d+e)(g)}{(a+b+c+d+e+f)} = \frac{(11,7)(1,9)}{13,7} = 1,6226$

= $y^-F \cdot P$ = 1,6226 . 1 = 1,6226 m

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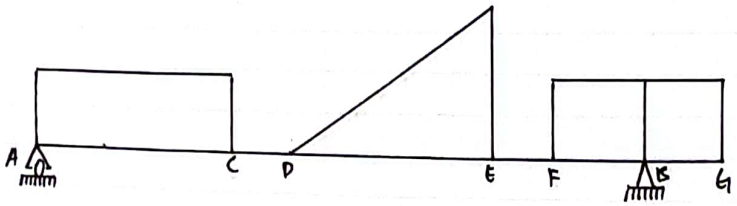
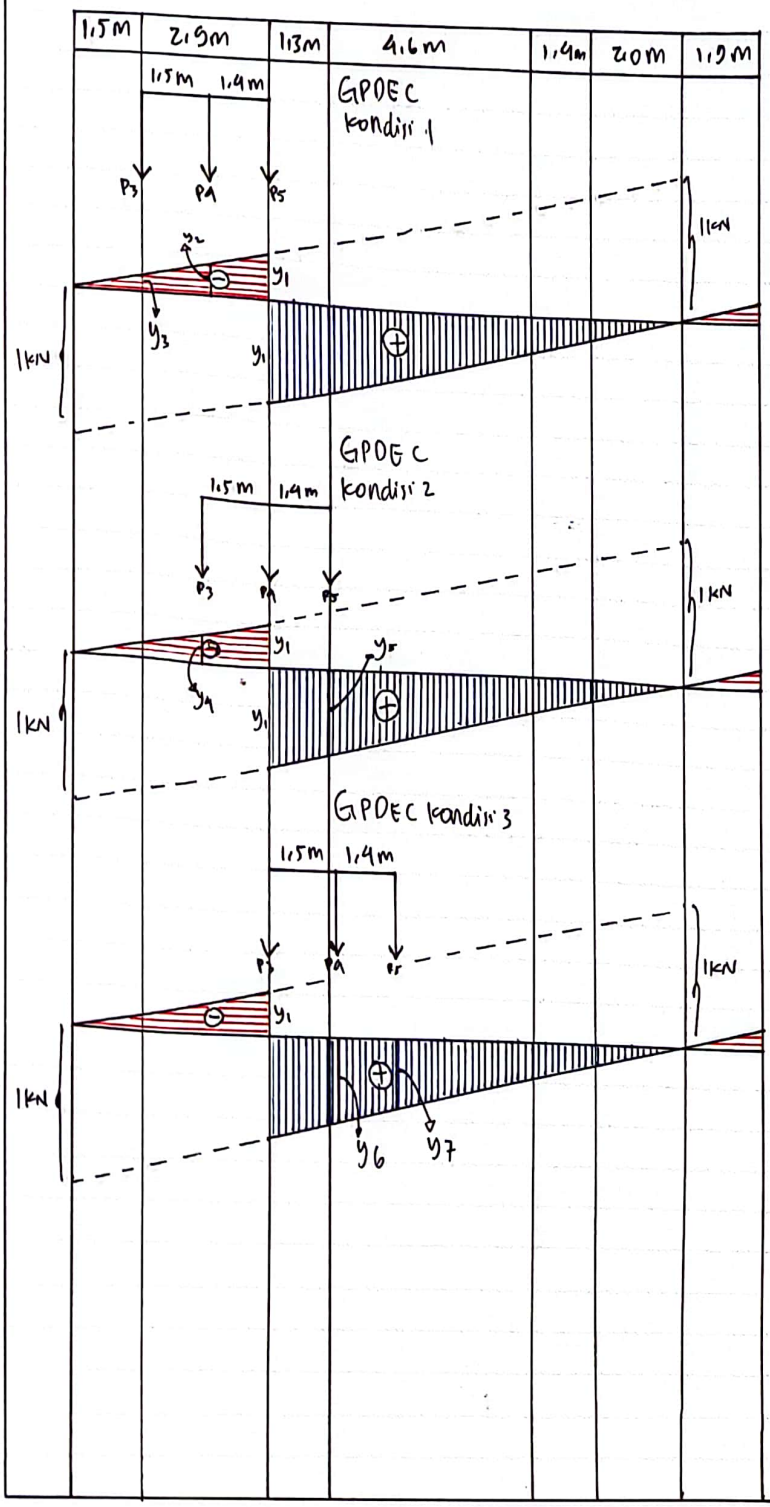
C. Hitung Nilai Momen elastrim dan Lintang elastrim Pada Potongan C, D, E, dan F akibat rangkaian beban berjalan (P_3, P_4, P_5) dari A ke B.

→ Lintang elastrim di titik C akibat beban berjalan





Skala jarak
1 cm : 150 cm
skala gaya
2 cm : 1 kN

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=> Kondisi 1

- Lintang Negatif

$y_1 = \frac{4,4}{13,7} = 0,3212$

$y_2 = \frac{3}{13,7} = 0,2190$

$y_3 = \frac{1,5}{13,7} = 0,1095$

$Dc = -P_3(y_3) - P_4(y_2) - P_5(y_1)$
$= -28(0,1095) - 25(0,2190) - 16(0,3212)$
$= -3,066 - 5,475 - 5,1392$
$= -13,6802$ kN.

- Lintang Positif

$y_1 = \frac{9,3}{13,7} = 0,6788$

$Dc = P_5(y_1)$
$= 16(0,6788) = 10,8608$ kN.

=> Kondisi 2

- Lintang Negatif

$y_1 = \frac{4,4}{13,7} = 0,3212$

$y_4 = \frac{2,9}{13,7} = 0,2117$

$Dc = -P_3(y_4) - P_4(y_1)$
$= -28(0,2117) - 25(0,3212)$
$= -5,9276 - 8,0300$
$= -13,9576$ kN.

- Lintang Positif

$y_1 = \frac{9,3}{13,7} = 0,6788$

$y_5 = \frac{7,9}{13,7} = 0,5766$

$Dc = P_4(y_1) + P_5(y_5)$
$= 25(0,6788) + 16(0,5766)$
$= 16,9700 + 9,2256$
$= 26,1956$ kN.

=> Kondisi 3

- Lintang Negatif

$y_1 = \frac{4,4}{13,7} = 0,3212$

$Dc = -P_3(y_1)$
$= -28(0,3212)$
$= -8,9936$ kN.

- Lintang Positif

$y_1 = \frac{9,3}{13,7} = 0,6788$

$y_6 = \frac{7,8}{13,7} = 0,5693$

$y_7 = \frac{6,9}{13,7} = 0,4672$

$Dc = P_3(y_1) + P_4(y_6) + P_5(y_7)$
$= 28(0,6788) + 25(0,5693) + 16(0,4672)$
$= 19,0064 + 19,2325 + 7,4752$
$= 40,7141$ kN.

* Lintang Positif (Dc Max) terjadi pada kondisi 3 = 40,7141 kN.
* Lintang Negatif (Dc Min) terjadi pada kondisi 2 = -13,9576 kN.

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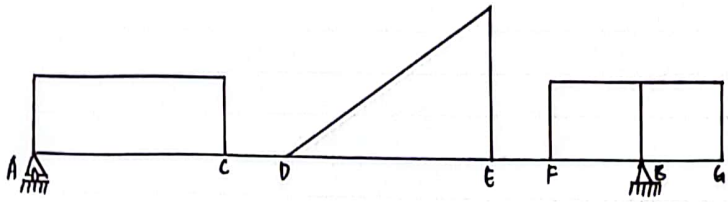
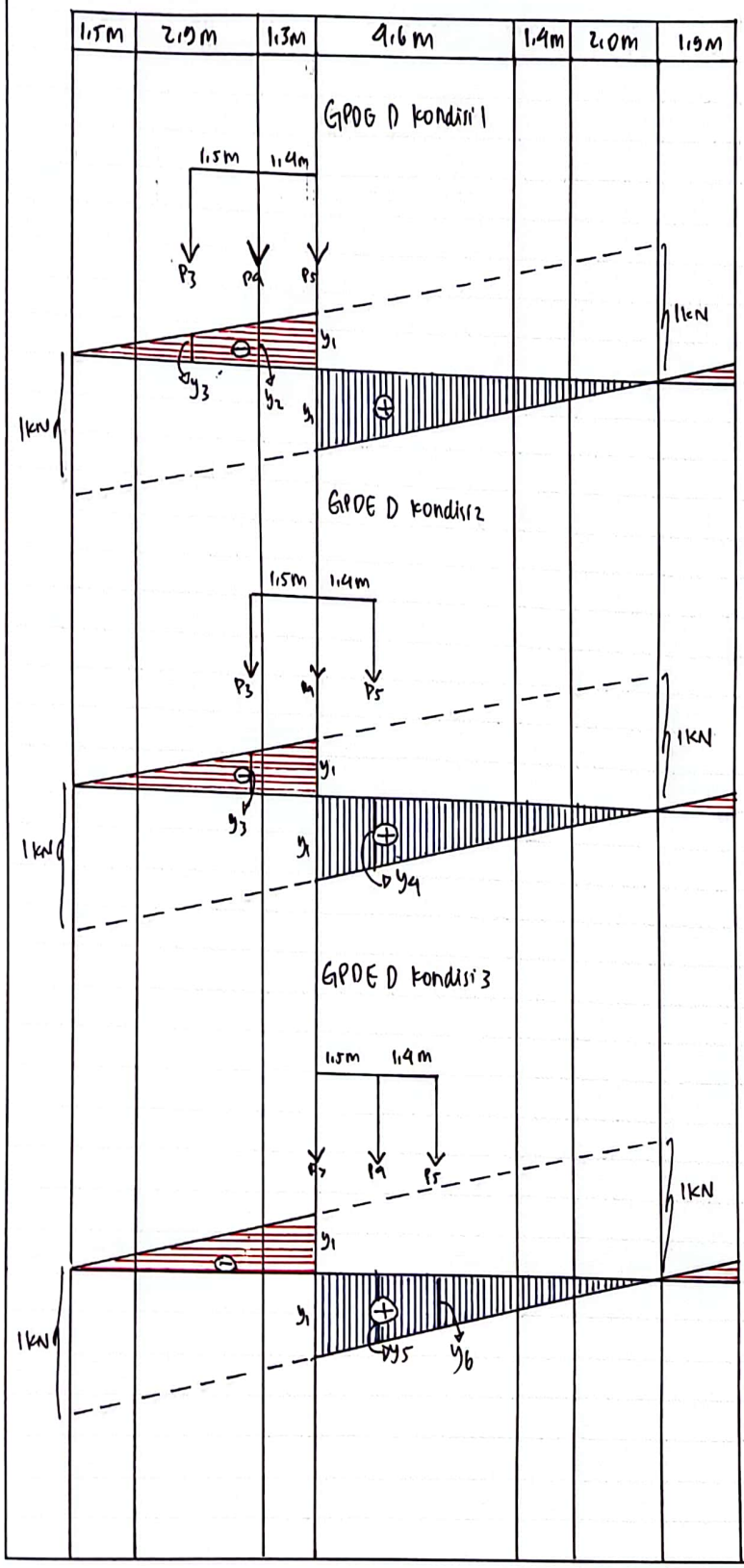
→ Lintasan elastisitas di titik D akibat beban berjalan.





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=> Kondisi 1

- Lintang Negatif

$y_1 = \frac{5,7}{13,7} = 0,4161$

$y_2 = \frac{4,3}{13,7} = 0,3139$

$y_3 = \frac{2,8}{13,7} = 0,2044$

$D_0 = -P_3(y_3) - P_4(y_2) - P_5(y_1)$
$= -28(0,2044) - 25(0,3139) - 16(0,4161)$
$= -5,7232 - 7,8475 - 6,6576$
$= -20,2283$ kN.

- Lintang Positif

$y' = \frac{8}{13,7} = 0,5839$

$D_0 = P_5(y_1)$
$= 16(0,5839)$
$= 9,3424$ kN.

=> Kondisi 2

- Lintang Negatif

$y_1 = \frac{5,7}{13,7} = 0,4161$

$y_3 = \frac{4,2}{13,7} = 0,3066$

$D_0 = -P_3(y_3) - P_4(y_1)$
$= -28(0,3066) - 25(0,4161)$
$= -8,5848 - 10,4025$
$= -18,9873$ kN.

- Lintang Positif

$y' = \frac{8}{13,7} = 0,5839$

$y_4 = \frac{6,6}{13,7} = 0,4818$

$D_0 = P_4(y_1) + P_5(y_4)$
$= 25(0,5839) + 16(0,4818)$
$= 14,5975 + 7,7088$
$= 22,3063$ kN.

=> Kondisi 3

- Lintang Negatif

$y_1 = \frac{5,7}{13,7} = 0,4161$

$D_0 = -P_3(y_1)$
$= -28(0,4161)$
$= -11,6508$ kN.

- Lintang Positif

$y_1 = \frac{8}{13,7} = 0,5839$

$y_5 = \frac{6,5}{13,7} = 0,4745$

$y_6 = \frac{5,1}{13,7} = 0,3723$

$D_0 = P_3(y_1) + P_4(y_5) + P_5(y_6)$
$= 28(0,5839) + 25(0,4745) + 16(0,3723)$
$= 16,3492 + 11,8625 + 5,9568$
$= 34,1685$ kN.

* Lintang Positif (D0 Max) terjadi pada Kondisi 3 = 34,1685 kN.
* Lintang Negatif (D0 Min) terjadi pada kondisi 1 = -20,2283 kN.

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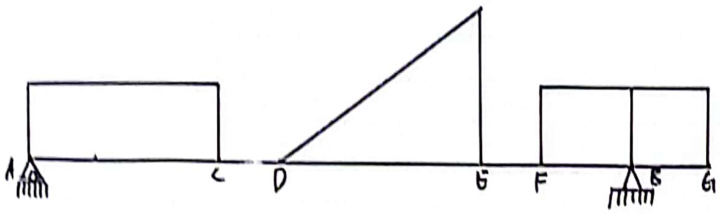
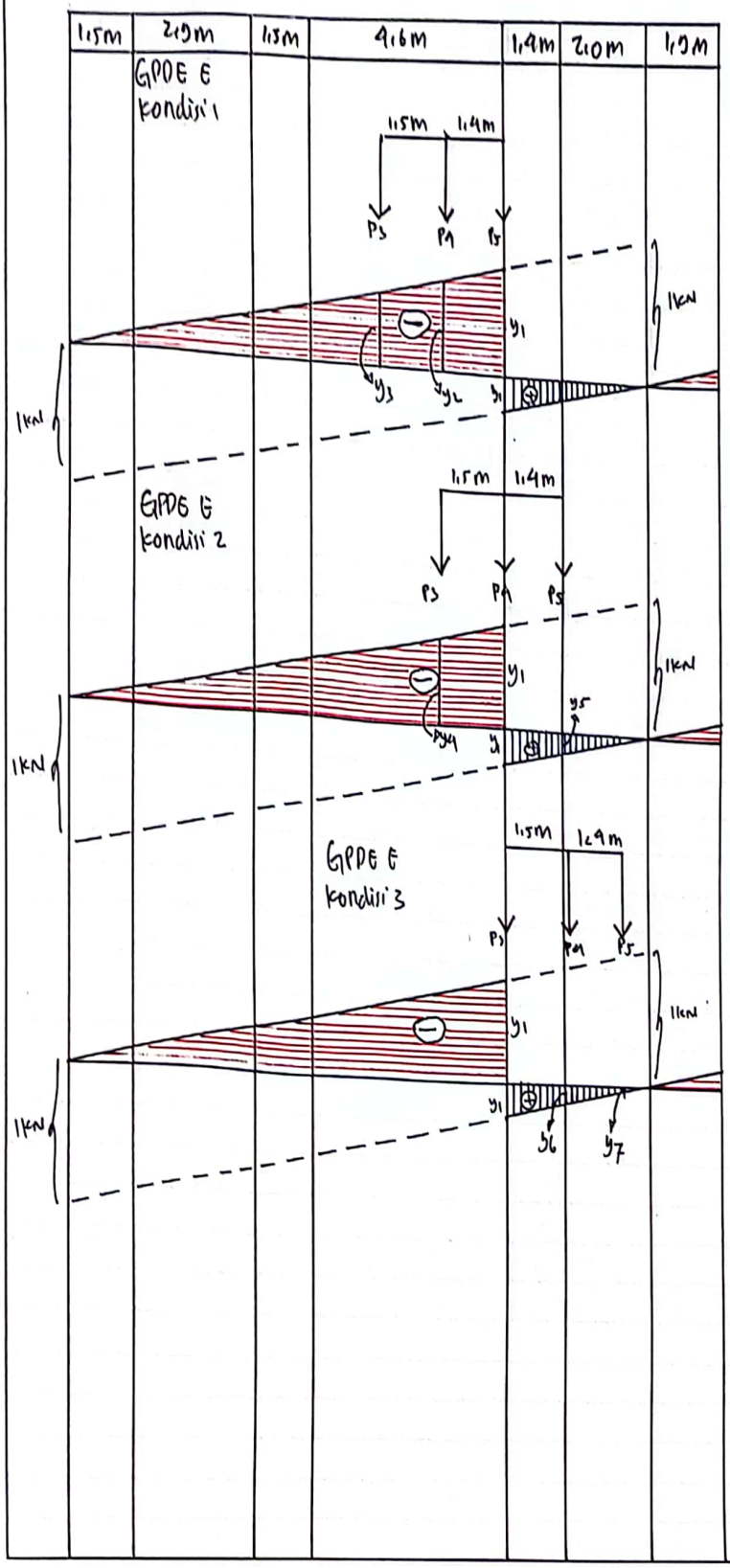
– Lintang ekstrim di titik G akibat beban bergalan.





Skala jarak
1 cm : 150 cm
Skala gaya
2 cm : 1 kN

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=> Kondisi 1

- Lintang Negatif

$y_1 = \frac{10,3}{13,7} = 0,7518$

$y_2 = \frac{8,9}{13,7} = 0,6496$

$y_3 = \frac{7,9}{13,7} = 0,5401$

$D_E = -P_3(y_3) - P_4(y_2) - P_5(y_1)$

$= -28(0,5401) - 25(0,6496) - 16(0,7518)$

$= -15,1228 - 16,2400 - 12,0288$

$= -43,3916$ kN.

- Lintang Positif

$y_1 = \frac{3,9}{13,7} = 0,2482$

$D_E = P_5(y_1)$

$= 16(0,2482)$

$= 3,9712$ kN.

=> Kondisi 2

- Lintang Negatif

$y_1 = \frac{10,3}{13,7} = 0,7518$

$y_4 = \frac{8,8}{13,7} = 0,6423$

$D_E = -P_3(y_4) - P_4(y_1)$

$= -28(0,6423) - 25(0,7518)$

$= -17,9844 - 18,7950$

$= -36,7794$ kN.

- Lintang Positif

$y_1 = \frac{3,9}{13,7} = 0,2482$

$y_5 = \frac{2}{13,7} = 0,1460$

$D_E = P_4(y_1) + P_5(y_5)$

$= 25(0,2482) + 16(0,1460)$

$= 6,2050 + 2,3360$

$= 8,5410$ kN.

=> Kondisi 3

- Lintang Negatif

$y_1 = \frac{10,3}{13,7} = 0,7518$

$D_E = -P_3(y_1) =$

$= -28(0,7518)$

$= -21,0504$ kN.

- Lintang Positif

$y_1 = \frac{3,9}{13,7} = 0,2482$

$y_6 = \frac{1,9}{13,7} = 0,1387$

$y_7 = \frac{0,5}{13,7} = 0,0365$

$D_E = P_3(y_1) + P_4(y_6) + P_5(y_7)$

$= 28(0,2482) + 25(0,1387) + 16(0,0365)$

$= 6,9496 + 3,4675 + 0,5840$

$= 11,0011$ kN.

* Lintang Positif (D_E Max) terjadi pada kondisi 3: 11,0011 kN.
* Lintang Negatif (D_E min) terjadi pada kondisi 1: -93,3916 kN.

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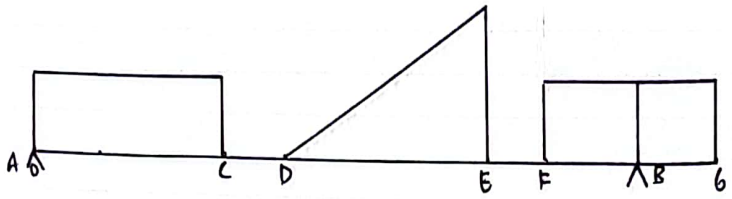
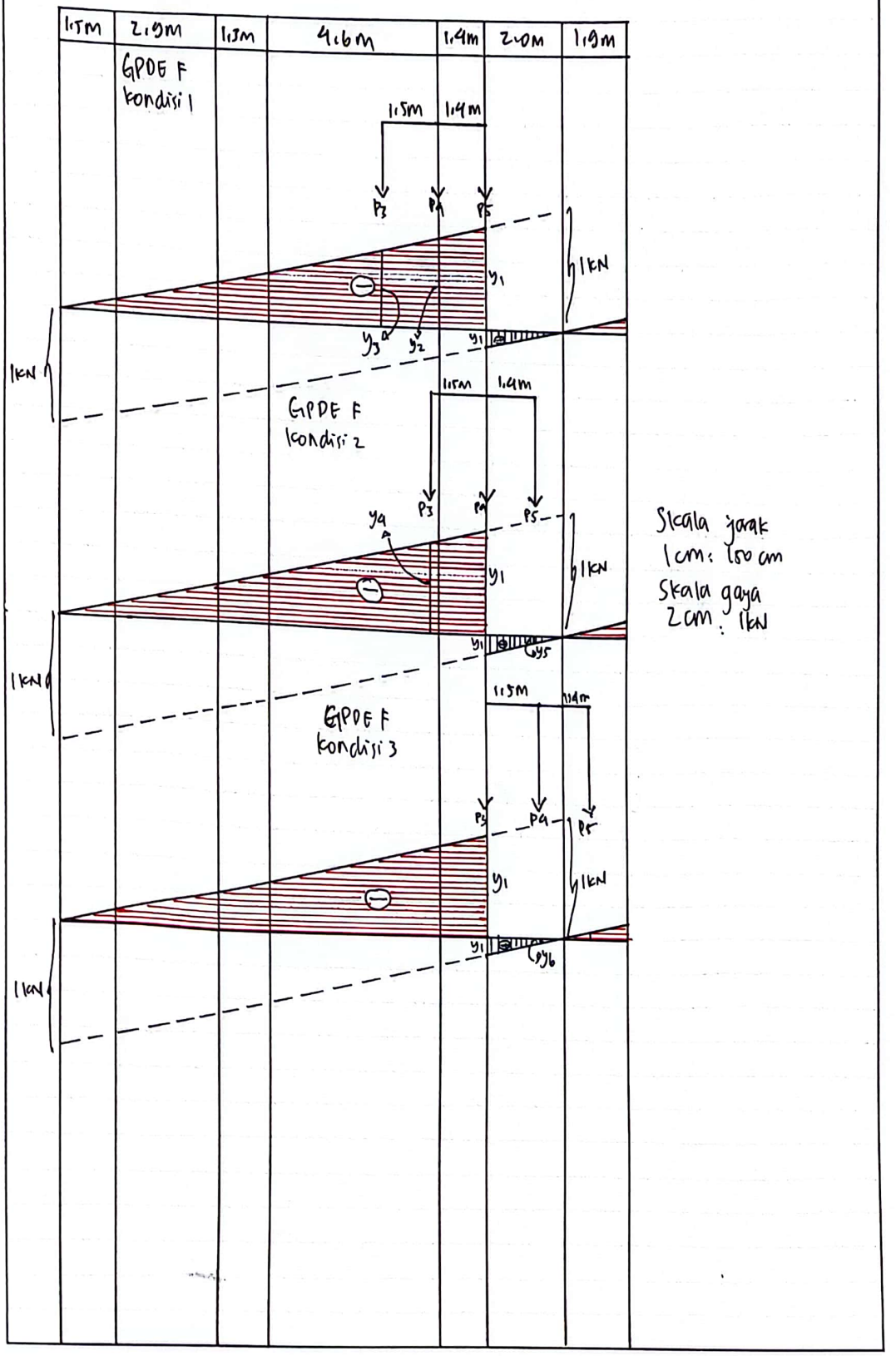
→ Lintang ekstrim di titik F akibat beban berjalan.





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=> kondisi 1

- Lintang Negatif

$y_1 = \frac{11,7}{13,7} = 0,8540$

$y_2 = \frac{10,3}{13,7} = 0,7518$

$y_3 = \frac{8,8}{13,7} = 0,6423$

$D_F = -P_3(y_3) - P_4(y_2) - P_5(y_1)$
$= -28(0,6423) - 25(0,7518) - 16(0,8540)$
$= -17,9894 - 18,7950 - 13,6640$
$= -50,4484$ kN.

- Lintang Positif

$y_1 = \frac{2}{13,7} = 0,1460$

$D_F = P_5(y_1)$
$= 16(0,1460)$
$= 2,336$ kN.

=> kondisi 2

- Lintang Negatif

$y_1 = \frac{11,7}{13,7} = 0,8540$

$y_4 = \frac{10,2}{13,7} = 0,7445$

$D_F = -P_3(y_4) - P_4(y_1)$
$= -28(0,7445) - 25(0,8540)$
$= -20,8460 - 21,3500$
$= -42,1960$ kN.

- Lintang Positif

$y_1 = \frac{2}{13,7} = 0,1460$

$y_5 = \frac{0,6}{13,7} = 0,0438$

$D_F = P_4(y_1) + P_5(y_5)$
$= 25(0,1460) + 16(0,0438)$
$= 3,6500 + 0,7008$
$= 4,3508$ kN.

=> kondisi 3

- Lintang Negatif

$y_1 = \frac{11,7}{13,7} = 0,8540$

$D_F = -P_3(y_1)$
$= -28(0,8540)$
$= -23,9120$ kN.

- Lintang Positif

$y_1 = \frac{2}{13,7} = 0,1460$

$y_6 = \frac{0,5}{13,7} = 0,0365$

$D_F = P_3(y_1) + P_4(y_6) +$
$= 28(0,1460) + 25(0,0365)$
$= 4,0880 + 0,9125$
$= 5,0005$ kN.

* Lintang Positif (D_F Max) terjadi pada kondisi 3 = 5,0005 kN.
* Lintang Negatif (D_F Min) terjadi pada kondisi 1 = -50,4434 kN

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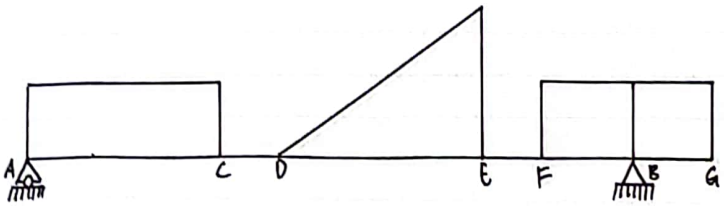
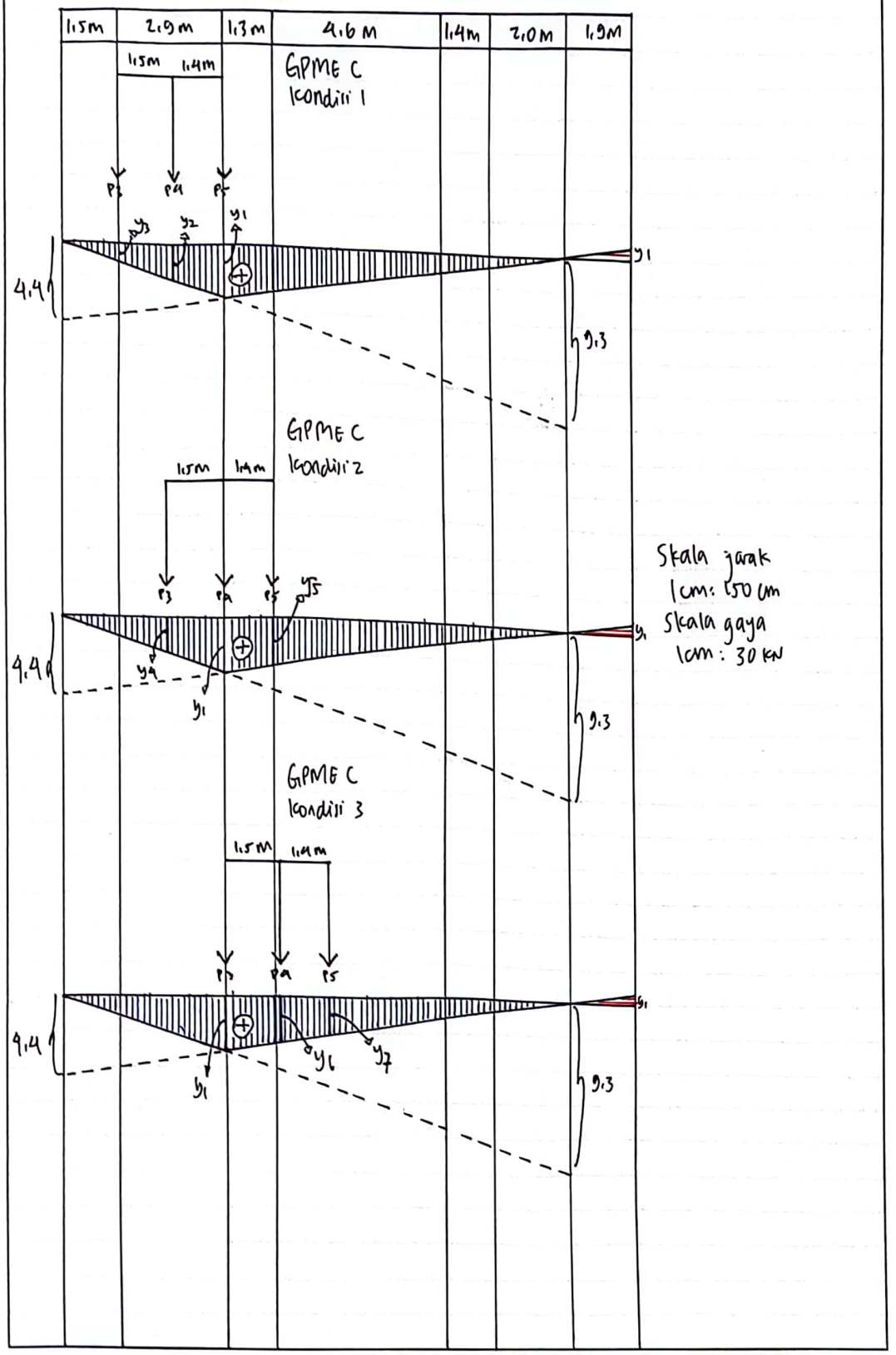
– D Momen ekstrim Pada titik C akibat beban berjalan.





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=D Kondisi 1

- Momen Positif

$y_1 = \frac{9,9 \cdot 9,3}{13,7} = 2,9869$

$y_2 = \frac{3 \cdot 9,3}{13,7} = 2,0365$

$y_3 = \frac{1,5 \cdot 9,3}{13,7} = 1,0182$

$Mc = P_3(y_3) + P_4(y_2) + P_5(y_1)$
$= 28(1,0182) + 25(2,0365) + 16(2,9869)$
$= 28,5096 + 50,9125 + 47,7904$
$= 127,2125$ KN.m

- Momen Negatif

$y_8 = \frac{1,9 \cdot 9,9}{13,7} = 0,6102$

$Mc = -P_5(y_8)$
$= -16(0,6102)$
$= -9,7632$ KN.m

=D Kondisi 2

- Momen Positif

$y_1 = \frac{9,9 \cdot 9,3}{13,7} = 2,9869$

$y_4 = \frac{2,9 \cdot 9,3}{13,7} = 1,9686$

$y_5 = \frac{9,9 \cdot 7,9}{13,7} = 2,5372$

$Mc = P_3(y_4) + P_4(y_1) + P_5(y_5)$
$= 28(1,9686) + 25(2,9869) + 16(2,5372)$
$= 55,1208 + 74,6725 + 40,5952$
$= 170,3885$ KN.m

- Momen Negatif

$y_8 = \frac{1,9 \cdot 9,9}{13,7} = 0,6102$

$Mc = -P_4(y_8)$
$= -25(0,6102)$
$= -15,2550$ KN.m

=D Kondisi 3

- Momen Positif

$y_1 = \frac{9,9 \cdot 9,3}{13,7} = 2,9869$

$y_6 = \frac{9,9 \cdot 7,8}{13,7} = 2,5051$

$y_7 = \frac{9,9 \cdot 6,9}{13,7} = 2,0555$

$Mc = P_3(y_1) + P_4(y_6) + P_5(y_7)$
$= 28(2,9869) + 25(2,5051) + 16(2,0555)$
$= 83,6332 + 62,6275 + 32,8880$
$= 179,1487$ KN.m

- Momen Negatif

$y_8 = \frac{1,9 \cdot 9,9}{13,7} = 0,6102$

$Mc = -P_3(y_8)$
$= -28(0,6102)$
$= -17,0856$ KN.m

* Momen Positif (Mc Max) terjadi pada kondisi 3 = 179,1487 KN
* Momen Negatif (Mc Mm) terjadi pada kondisi 3 = -17,0856 KN

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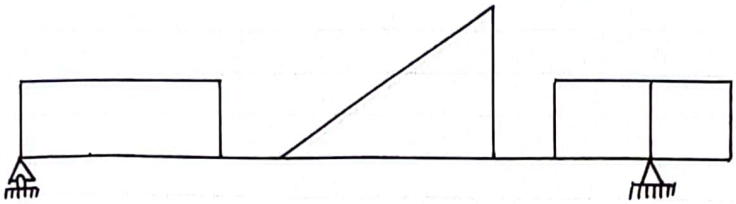
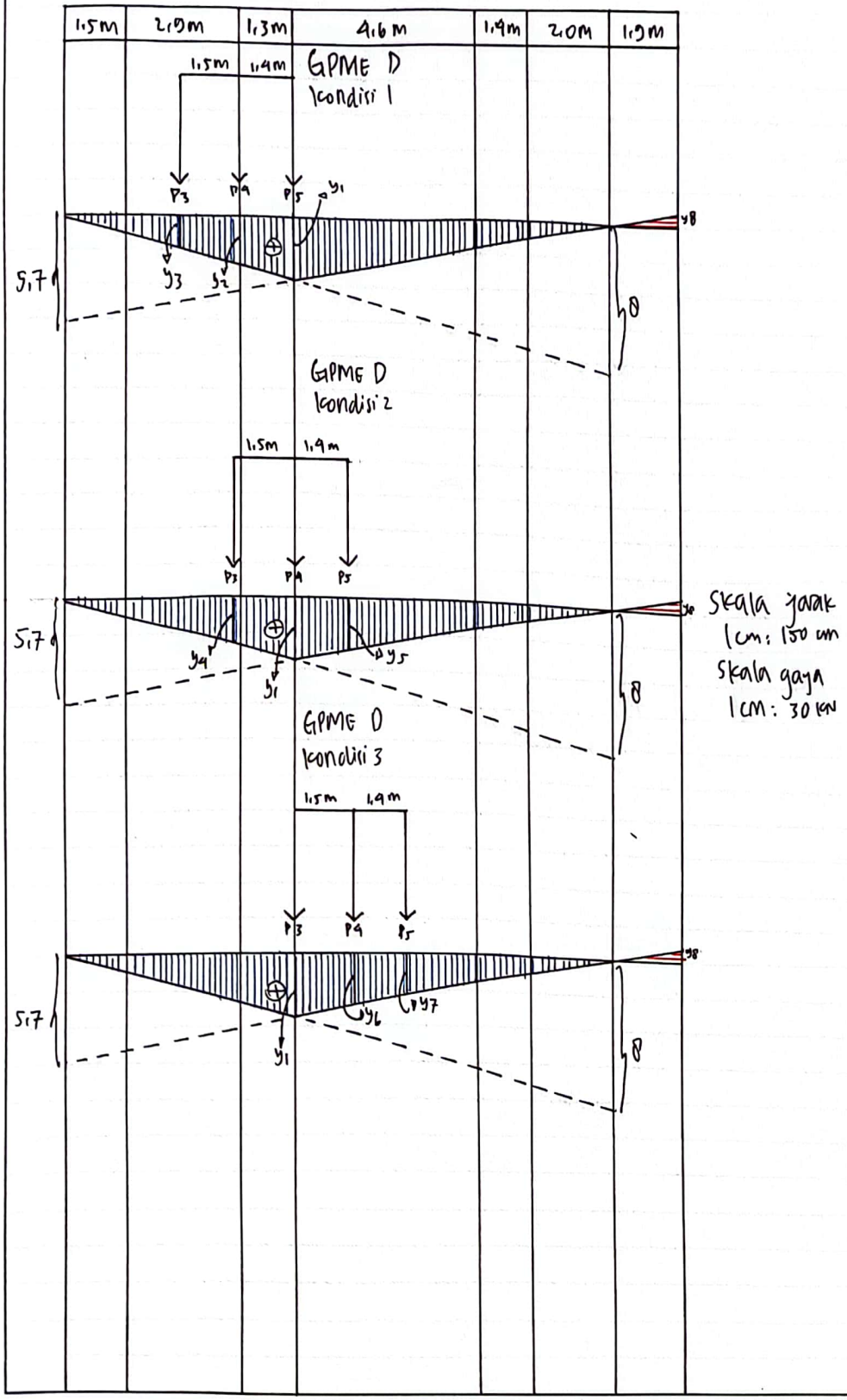
– Momen elastrim pada titik D akibat beban berjalan.





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=> Kondisi 1

- Momen Positif

$y_1 = \frac{5{,}17 \cdot 8}{13{,}7} = 3{,}3285$

$y_2 = \frac{9{,}13 \cdot 8}{13{,}7} = 2{,}5109$

$y_3 = \frac{2{,}8 \cdot 8}{13{,}7} = 1{,}6350$

$M_D = P_3(y_3) + P_4(y_2) + P_5(y_1)$
$= 28(1{,}6350) + 25(2{,}5109) + 16(3{,}3285)$
$= 45{,}7800 + 62{,}7725 + 53{,}2560$
$= 161{,}8085$ kN

- Momen Negatif

$y_0 = \frac{1{,}9 \cdot 5{,}17}{13{,}7} = 0{,}7905$

$M_D = -P_5(y_0)$
$= -16(0{,}7905)$
$= -12{,}6480$ kN

=> Kondisi 2

- Momen Positif

$y_1 = \frac{5{,}17 \cdot 8}{13{,}7} = 3{,}3285$

$y_4 = \frac{4{,}2 \cdot 8}{13{,}7} = 2{,}4526$

$y_5 = \frac{5{,}17 \cdot 6{,}6}{13{,}7} = 2{,}7460$

$M_D = P_3(y_4) + P_4(y_1) + P_5(y_5)$
$= 28(2{,}4526) + 25(3{,}3285) + 16(2{,}7460)$
$= 68{,}6728 + 83{,}2125 + 43{,}9360$
$= 195{,}8213$ kN

- Momen Negatif

$y_0 = \frac{1{,}9 \cdot 5{,}17}{13{,}7} = 0{,}7905$

$M_D = -P_4(y_0)$
$= -25(0{,}7905)$
$= -19{,}7625$ kN

=> Kondisi 3

- Momen Positif

$y_1 = \frac{5{,}17 \cdot 8}{13{,}7} = 3{,}3285$

$y_6 = \frac{6{,}5 \cdot 4{,}9}{13{,}7} = 2{,}0876$

$y_7 = \frac{5{,}11 \cdot 4{,}9}{13{,}7} = 1{,}6380$

$M_D = P_3(y_1) + P_4(y_6) + P_5(y_7)$
$= 28(3{,}3285) + 25(2{,}0876) + 16(1{,}6380)$
$= 93{,}1980 + 52{,}1900 + 26{,}2080$
$= 171{,}5960$ kN

- Momen Negatif

$y_8 = \frac{1{,}9 \cdot 5{,}17}{13{,}7} = 0{,}7905$

$M_D = -P_3(y_8)$
$= -28(0{,}7905)$
$= -22{,}1340$ kN

* Momen Positif (M_D Max) terjadi Pada kondisi 2 = 195,8213 kN
* Momen Negatif (M_D Min) terjadi pada kondisi 3 = -22,1340 kN

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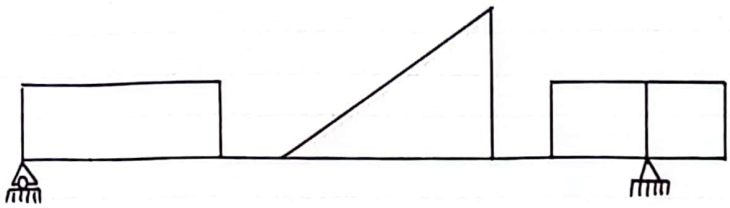
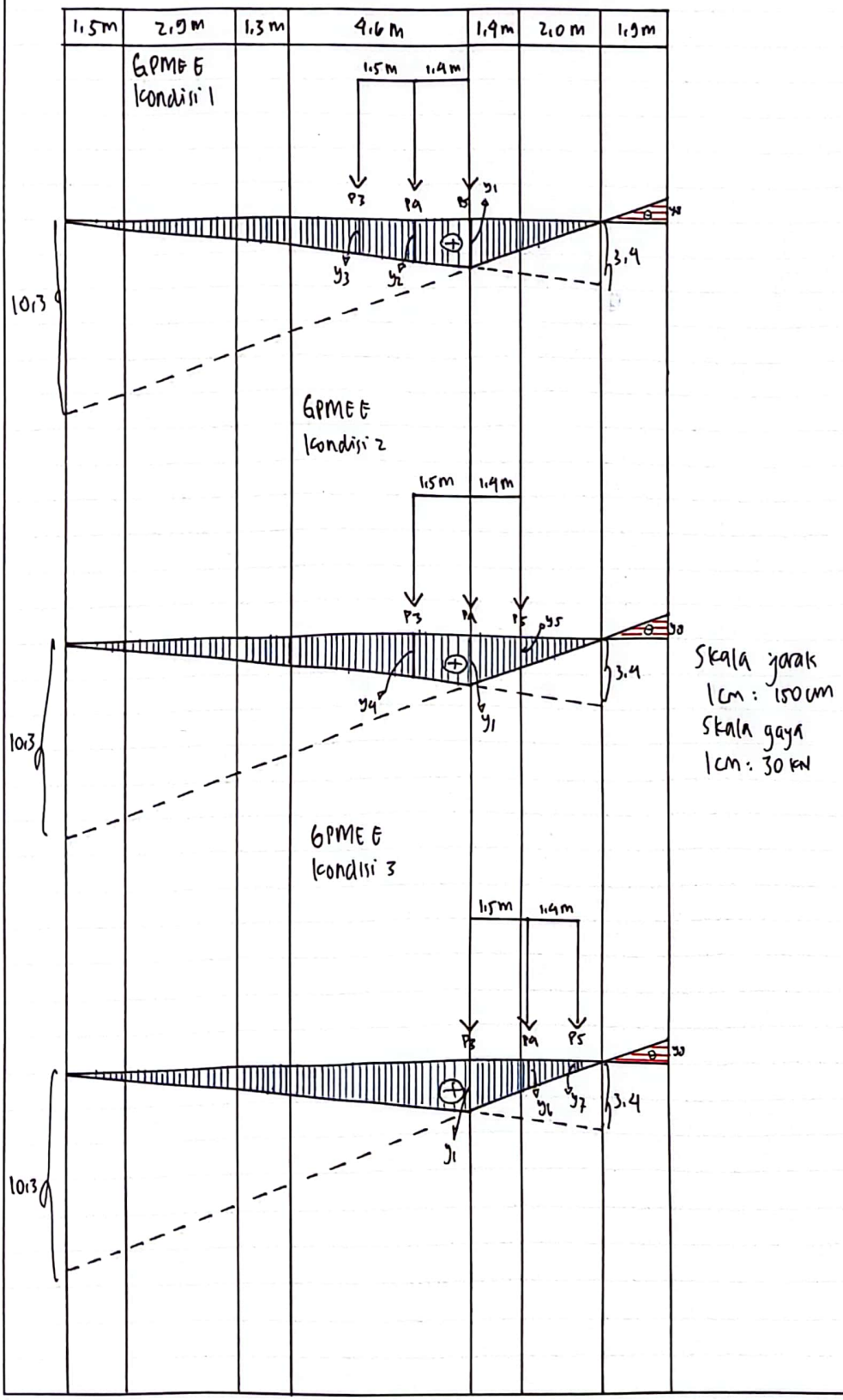
→ Momen ekstrim Pada titik E akibat beban berjalan.





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=> Kondisi 1

- Momen Positif

$y_1 = \frac{10{,}3 \cdot 3{,}4}{13{,}7} = 2{,}5562$

$y_2 = \frac{8{,}9 \cdot 3{,}4}{13{,}7} = 2{,}2088$

$y_3 = \frac{7{,}9 \cdot 3{,}4}{13{,}7} = 1{,}8365$

$ME = P_3(y_3) + P_4(y_2) + P_5(y_1)$
$= 28(1{,}8365) + 25(2{,}2088) + 16(2{,}5562)$
$= 51{,}4220 + 55{,}2200 + 40{,}8992$
$= 147{,}5412$ kN

- Momen Negatif

$y_8 = \frac{1{,}9 \cdot 10{,}3}{13{,}7} = 1{,}4285$

$ME = -P_5(y_8)$
$= -16(1{,}4285)$
$= -22{,}8560$ kN

=> Kondisi 2

- Momen Positif

$y_1 = \frac{10{,}3 \cdot 3{,}4}{13{,}7} = 2{,}5562$

$y_4 = \frac{8{,}8 \cdot 3{,}4}{13{,}7} = 2{,}1839$

$y_5 = \frac{2 \cdot 10{,}3}{13{,}7} = 1{,}5036$

$ME = P_3(y_4) + P_4(y_1) + P_5(y_5)$
$= 28(2{,}1839) + 25(2{,}5562) + 16(1{,}5036)$
$= 61{,}1492 + 63{,}9050 + 24{,}0576$
$= 149{,}1118$ kN

- Momen Negatif

$y_8 = \frac{1{,}9 \cdot 10{,}3}{13{,}7} = 1{,}4285$

$ME = -P_4(y_8)$
$= -25(1{,}4285)$
$= -35{,}7125$ kN

=> Kondisi 3

- Momen Positif

$y_1 = \frac{10{,}3 \cdot 3{,}4}{13{,}7} = 2{,}5562$

$y_6 = \frac{10{,}3 \cdot 1{,}9}{13{,}7} = 1{,}4285$

$y_7 = \frac{0{,}5 \cdot 10{,}3}{13{,}7} = 0{,}3759$

$ME = P_3(y_1) + P_4(y_6) + P_5(y_7)$
$= 28(2{,}5562) + 25(1{,}4285) + 16(0{,}3759)$
$= 71{,}5736 + 35{,}7125 + 6{,}0149$
$= 113{,}3005$ kN

- Momen Negatif

$y_8 = \frac{1{,}9 \cdot 10{,}3}{13{,}7} = 1{,}4285$

$ME = -P_3(y_8) =$
$= -28(1{,}4285)$
$= -39{,}9980$

* Momen Positif (ME Max) terjadi pada kondisi 2 : 149,1118 kN
* Momen Negatif (ME Min) terjadi pada kondisi 3 : -39,9980 kN

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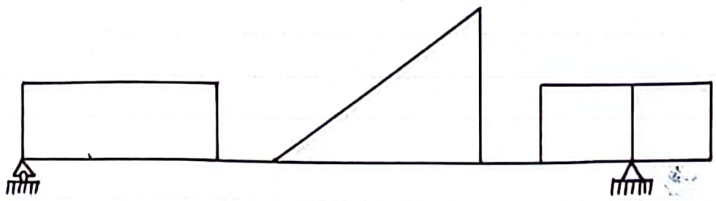
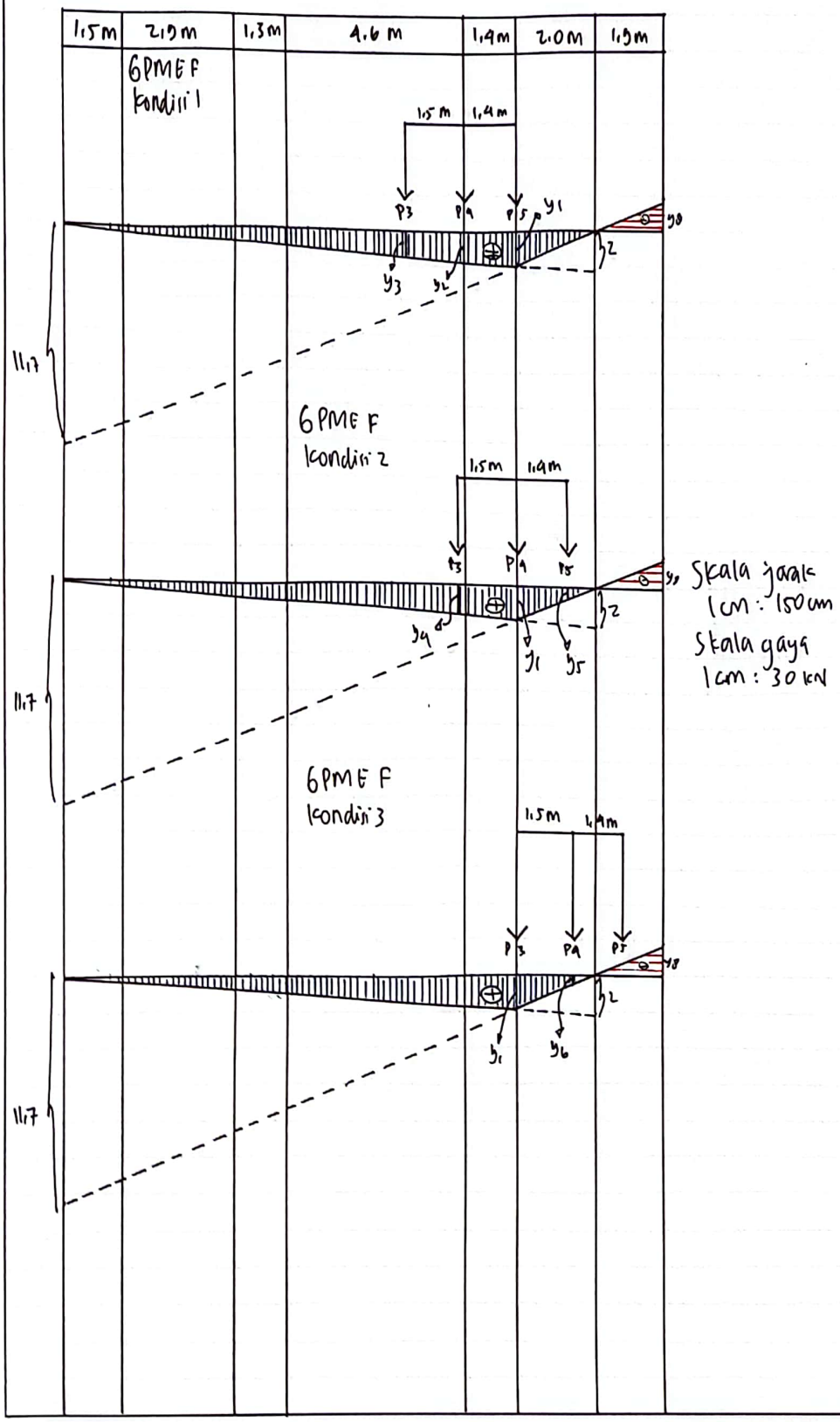
→ Momen ekstrim pada titik F akibat beban berjalan.





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=> Kondisi 1

- Momen Positif

$y_1 = \frac{11{,}7 \cdot 2}{13{,}7} = 1{,}7080$

$y_2 = \frac{10{,}3 \cdot 2}{13{,}7} = 1{,}5036$

$y_3 = \frac{8{,}8 \cdot 2}{13{,}7} = 1{,}2847$

$M_F = P_3(y_3) + P_4(y_2) + P_5(y_1)$
$= 28(1{,}2847) + 25(1{,}5036) + 16(1{,}7080)$
$= 35{,}9716 + 37{,}5900 + 27{,}3280$
$= 100{,}8896$ kN

- Momen Negatif

$y_8 = \frac{1{,}9 \cdot 11{,}7}{13{,}7} = 1{,}6226$

$M_F = -P_5(y_8)$
$= -16(1{,}6226)$
$= -25{,}9616$ kN

=> Kondisi 2

- Momen Positif

$y_1 = \frac{11{,}7 \cdot 2}{13{,}7} = 1{,}7080$

$y_4 = \frac{10{,}2 \cdot 2}{13{,}7} = 1{,}4891$

$y_5 = \frac{0{,}6 \cdot 11{,}7}{13{,}7} = 0{,}5129$

$M_F = P_3(y_4) + P_4(y_1) + P_5(y_5)$
$= 28(1{,}4891) + 25(1{,}7080) + 16(0{,}5129)$
$= 41{,}6948 + 42{,}7000 + 8{,}1989$
$= 92{,}5932$ kN

- Momen Negatif

$y_8 = \frac{1{,}9 \cdot 11{,}7}{13{,}7} = 1{,}6226$

$M_F = -P_4(y_8)$
$= -25(1{,}6226)$
$= -40{,}5650$ kN

=> Kondisi 3

- Momen Positif

$y_1 = \frac{2 \cdot 11{,}7}{13{,}7} = 1{,}7080$

$y_6 = \frac{0{,}5 \cdot 11{,}7}{13{,}7} = 0{,}9270$

$M_F = P_3(y_1) + P_4(y_6) +$
$= 28(1{,}7080) + 25(0{,}9270)$
$= 47{,}8240 + 10{,}6750$
$= 58{,}4990$ kN

- Momen Negatif

$y_8 = \frac{1{,}9 \cdot 11{,}7}{13{,}7} = 1{,}6226$

$M_F = -P_3(y_8)$
$= -28(1{,}6226)$
$= -45{,}4328$

* Momen Positif (M_F Max) terjadi pada kondisi 1 = 100,8896 kN
* Momen Negatif (M_F Min) terjadi pada kondisi 3 = -45,4328 kN

GALIH ABIE SADEWA
2315011042

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN, RISET,
DAN TEKNOLOGI
FAKULTAS TEKNIK-JURUSAN TEKNIK SIPIL
UNIVERSITAS LAMPUNG
Jl. Prof. Dr. Sumantri Brojonegoro No. 1 Bandar Lampung
Telp./fax.(0721) 704947 http: eng.unila.ac.id

LEMBAR ASISTENSI TUGAS SEMESTER

NAMA : **GALIH ABIE SADEWA**
NPM : **2315011042**
SEMESTER : **1 (SATU)**
MATA KULIAH : **STATIKA**

NO	TANGGAL	KETERANGAN	PARAF
	23-10-2023	Lanjutkan 2b	
	31-10-2023	Tambahkan satuan	
		Cek hitungan Y	
	3-11-2023	ACC !!!	

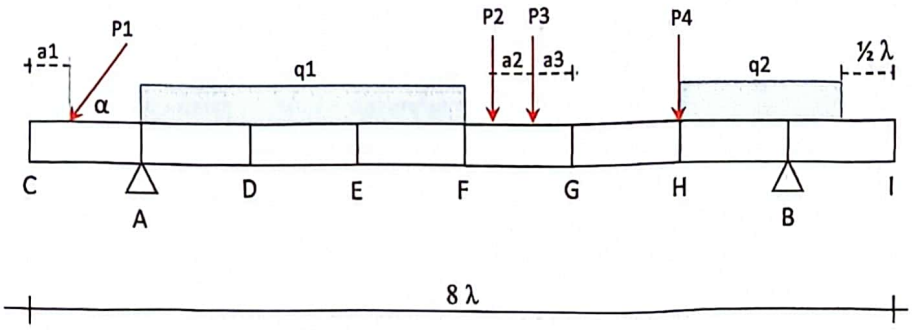
Bandar Lampung, 2023
Asisten Dosen

MUHAMMAD FATIH NABAN
NPM. 2015011030

NAMA : GALIH ABIE SADEWA
NPM : 2315011042

SOAL NO. 2

Diketahui struktur *simple beam* dengan beban tak langsung seperti tergambar.



Data-data sebagai berikut:

Perletakan		Beban		Jarak		Beban berjalan	
A	Sendi	q_1	2 kN/m'	λ	3,3 m	P_5	3 kN
B	Rol	q_2	1 kN/m'	a_1	1,8 m	P_6	5 kN
		P_1	4 kN	a_2	1,5 m		
		P_2	6 kN	a_3	1,1 m	x1	
		P_3	7 kN	Sudut α	31 °	P5 P6	
		P_4	3 kN				
						x_1	3,0 m

Pertanyaan:

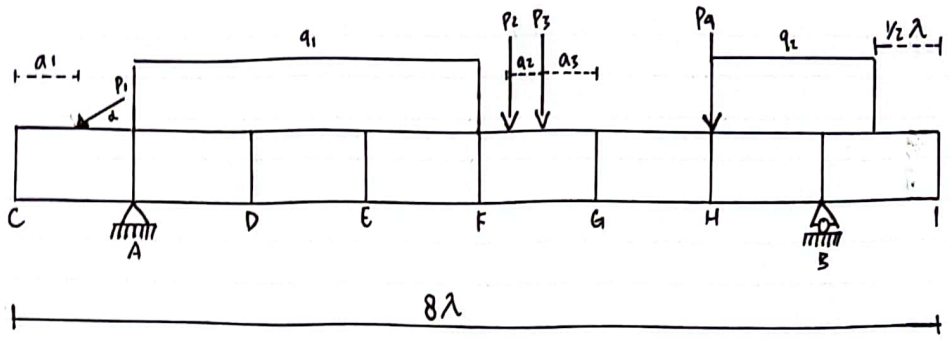
a. Hitung dan gambarkan bidang momen, lintang dan normal secara analitis akibat beban yang bekerja (seperti tergambar).
b. Hitung dan gambar garis pengaruh momen dan lintang akibat beban jika P = 1 kN bergerak dari tumpuan A ke B pada potongan/titik E, G, dan **0,7 m** ke kanan dari titik F
c. Hitung besar momen ekstrim dan lintang ekstrim pada point (b) akibat rangkaian beban berjalan (P5, P6) dari A ke B.

Asisten Responsi,

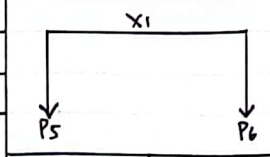
MUHAMMAD FATIH NABAN
NPM. 2015011030

Soal No 2

Diketahui struktur simple beam dengan beban tak langsung seperti tergambar.



Data-data sebagai berikut :

Perletakan		Beban		Jarak		Beban berjalan	
A	Sendi	q_1	2 kN/m'	λ	3.3 m	P_5	3 kN
B	Rol	q_2	1 kN/m'	a_1	1.8 m	P_6	5 kN
		P_1	4 kN	a_2	1.5 m		
		P_2	6 kN	a_3	1.1 m		
		P_3	7 kN	Sudut α	31°		
		P_4	3 kN				
						X_1	3.0 m

Pertanyaan :

a.) Hitung dan Gambarkan bidang Momen, lintang dan normal secara analitis akibat beban yang bekerja (seperti tergambar).

b.) Hitung dan gambar garis Pengaruh momen dan lintang akibat beban jika P = 1 kN bergerak dari tumpuan A ke B pada Potongan/titik dan 0,7 m ke kanan dari titik

c.) Hitung besar momen ekstrim dan lintang ekstrim pada Point (b) akibat rangkaian beban berjalan (P_5, P_6) dari A ke B.

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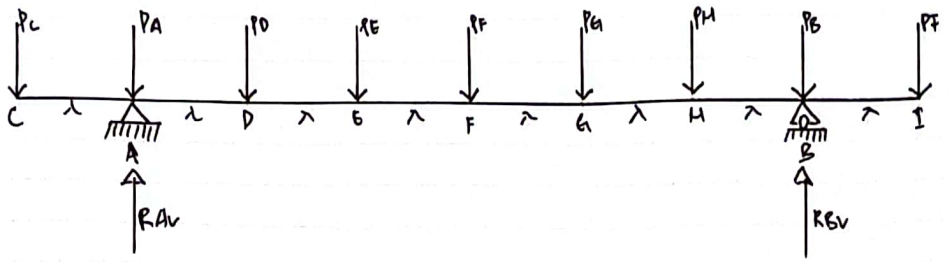
a.) Hitung dan gambarkan bidang momen, lintang dan normal secara analitis akibat beban yang bekerja (seperti tergambar)



a.) $P_{IV} = P_1 \cdot \sin\beta$
$= 4 \cdot \sin 31$
$= 2{,}0602$ kN

b.) $P_{IH} = P_1 \cdot \cos\beta$
$= 4 \cdot \cos 31$
$= 3{,}4287$ kN

c) $P_C = \frac{\lambda - a_1}{\lambda} \cdot P_{IV}$
$= \frac{3{,}3 - 1{,}8}{3{,}3} \cdot 2{,}0602$
$= 0{,}9365$ kN

d.) $P_A = \frac{a_1 \cdot P_{IV}}{\lambda} + \frac{\lambda \cdot q_1}{2}$
$= \frac{1{,}8 \cdot 2{,}0602}{3{,}3} + \frac{3{,}3 \cdot 2}{2}$
$= 4{,}4237$ kN

e.) $P_D = \frac{\lambda \cdot q_1}{2} + \frac{\lambda \cdot q_1}{2}$
$= \frac{3{,}3 \cdot 2}{2} + \frac{3{,}3 \cdot 2}{2}$
$= 6{,}6$ kN

F.) $P_E = \frac{\lambda \cdot q_1}{2} + \frac{\lambda \cdot q_1}{2}$
$= \frac{3{,}3 \cdot 2}{2} + \frac{3{,}3 \cdot 2}{2}$
$= 6{,}6$ kN

g.) $P_F = \frac{\lambda \cdot q_1}{2} + \frac{a_2 + a_3}{\lambda} \cdot P_2 + \frac{a_3}{\lambda} \cdot P_3$
$= \frac{3{,}3 \cdot 2}{2} + \frac{1{,}5 + 1{,}1}{3{,}3} \cdot 6 + \frac{1{,}1}{3{,}3} \cdot 7$
$= 10{,}3606$ kN

h.) $P_G = \frac{\lambda - a_2 - a_3}{\lambda} \cdot P_2 + \frac{\lambda - a_3}{\lambda} \cdot P_3$
$= \frac{3{,}3 - 1{,}5 - 1{,}1}{3{,}3} \cdot 6 + \frac{3{,}3 - 1{,}1}{3{,}3} \cdot 7$
$= 5{,}9394$ kN

i) $P_H = P_A + \frac{\lambda \cdot q_2}{2}$
$= 3 + \frac{3{,}3 \cdot 1}{2}$
$= 4{,}65$ kN

j.) $P_B = \frac{\lambda \cdot q_2}{2} + \frac{3}{4} \cdot \left(\frac{\lambda \cdot q_2}{2}\right)$
$= \frac{3{,}3 \cdot 1}{2} + \frac{3}{4} \cdot \left(\frac{3{,}3 \cdot 1}{2}\right)$
$= 2{,}8875$ kN

k.) $P_I = \frac{1}{4} \cdot \left(\frac{\lambda \cdot q_2}{2}\right)$
$= \frac{1}{4} \cdot \left(\frac{3{,}3 \cdot 1}{2}\right)$
$= 0{,}4125$ kN

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→ Reaksi Perletakan

• $\Sigma MB = 0$

$RAv.(6\lambda) - PC.(7\lambda) - PA.(6\lambda) - PD(5\lambda) - PE(4\lambda) - PF.(3\lambda) - PG.(2\lambda) - PH.(\lambda) + PI.(\lambda) = 0$

$(RAv.6)\lambda = \lambda(7PC + 6PH + 5PD + 4PE + 3PF + 2PG + PH - PI)$

$RAv.6 = 7.(0,9365) + 6.(4,9237) + 5(6,6) + 4(6,6) + 3(10,3606) + 2.(5,9394) + 4,65 - 0,4125$

$RAv.6 = 6,5555 + 26,5422 + 33 + 26,4 + 31,0818 + 11,8788 + 4,65 - 0,4125$

$RAv = \frac{139,6958}{6}$

$RAv = 23,2826 \text{ kN } (\uparrow)$

• $\Sigma MA = 0$

$-RBv.(6\lambda) - PC(\lambda) + PD(\lambda) + PE(2\lambda) + PF(3\lambda) + PG(4\lambda) + PH(5\lambda) + PB(6\lambda) + PI(7\lambda) = 0$

$-RBv.(6\lambda) = -PC(\lambda) + PD(\lambda) + PG(2\lambda) + PF(3\lambda) + PG(4\lambda) + PH(5\lambda) + PB(6\lambda) + PI(7\lambda)$

$\lambda(RBv.6) = \lambda(-PC + PD + 2PE + 3PF + 4PG + 5PH + 6PB + 7PI$

$RBv.6 = -0,9365 + 6,6 + 2.(6,6) + 3.(10,3606) + 4.(5,9394) + 5.(4,65) + 6.(2,8875) + 7.(0,4125)$

$RBv.6 = -0,9365 + 6,6 + 13,2 + 31,0810 + 23,7576 + 23,25 + 17,325 + 2,8875$

$RBv = \frac{117,1659}{6}$

$RBv = 19,5276 \text{ kN } (\uparrow)$

→ Checking

• $\Sigma V = 0$

$RAv + RBv = PA + PB + PC + PD + PE + PF + PG + PH + PI$

$23,2826 + 19,5276 = 4,9237 + 2,8875 + 0,9365 + 6,6 + 6,6 + 10,3606 + 5,9394 + 4,65 + 0,4125$

$42,8102 = 42,8102$ (✓)

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• $\Sigma H = 0$

$H_B - P_{1H} = 0$

$H_B = P_{1H}$

$H_B = 3.4287$ kN

→ Bidang Normal

$N_{P_{1H}-B} = 3.4287$ kN

→ Bidang Lintang

1.) $D_{C\text{-}Akiri} = -P_C = -0.9365$

2.) $D_{A\text{-}Dkiri} = -P_C - P_A + R_{AV}$

$= -0.9365 - 4.4237 + 23.2826 = 17.9224$ kN

3.) $D_{D\text{-}Ekiri} = -P_C - P_A + R_{AV} - P_D$

$= -0.9365 - 4.4237 + 23.2826 - 6.6 = 11.3224$ kN

4.) $D_{E\text{-}Fkiri} = -P_C - P_A + R_{AV} - P_D - P_E$

$= -0.9365 - 4.4237 + 23.2826 - 6.6 - 6.6 = 4.7224$ kN

5.) $D_{F\text{-}Gkiri} = -P_C - P_A + R_{AV} - P_D - P_E - P_F$

$= -0.9365 - 4.4237 + 23.2826 - 6.6 - 6.6 - 10.3606 = -5.6382$ kN

6.) $D_{G\text{-}Hkiri} = -P_C - P_A + R_{AV} - P_D - P_E - P_F - P_G$

$= -0.9365 - 4.4237 + 23.2826 - 6.6 - 6.6 - 10.3606 - 5.9394 = -11.5776$ kN

7.) $D_{H\text{-}Bkiri} = -P_C - P_A + R_{AV} - P_D - P_E - P_F - P_G - P_H$

$= -0.9365 - 4.4237 + 23.2826 - 6.6 - 6.6 - 10.3606 - 5.9394 - 4.65$

$= -16.2276$ kN

8.) $D_{B\text{-}Ikiri} = -P_C - P_A + R_{AV} - P_D - P_E - P_F - P_G - P_H - P_B + R_{BV}$

$= -0.9365 - 4.4237 + 23.2826 - 6.6 - 6.6 - 10.3606 - 5.9394$

$- 2.8875 + 19.5276 = 0.4125$ kN

9.) $D_I = -P_C - P_A + R_{AV} - P_D - P_E - P_F - P_G - P_H - P_B + R_{BV} - P_I$

$= -0.9365 - 4.4237 + 23.2826 - 6.6 - 6.6 - 10.3606 - 5.9394$

$- 2.8875 + 19.5276 - 0.4125$

$= 0$ kN

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→ Bidang Momen

- MC = 0 KN.m

- MA = -PC . λ
  = - 0,9365 . 3,3 = -3,0905 KN.m

- MD = - PC (2λ) + RAV (λ) - PA (λ)
  = -0,9365 (6,6) + 23,2826 (3,3) - 4,4237 (3,3)
  = - 6,1809 + 76,8326 - 14,5982 = 56,0535 KN.m

- ME = -PC (3λ) + RAV (2λ) - PA (2λ) - PD (λ)
  = -0,9365 (9,9) + 23,2826 (6,6) - 4,4237 (6,6) - 6,6 (3,3)
  = - 9,2714 + 153,6652 - 29,1964 - 21,78
  = 93,4174 KN.m

- MF = - PC (4λ) + RAV (3λ) - PA (3λ) - PD (2λ) - PE (λ)
  = - 0,9365 (13,2) + 23,2826 (9,9) - 4,4237 (9,9) - 6,6 (6,6) - 6,6 (3,3)
  = - 12,3618 + 230,4977 - 43,7946 - 43,56 - 21,78
  = 109,0013 KN.m

- MG = -PC (5λ) + RAV (4λ) - PA (4λ) - PD (3λ) - PE (2λ) - PF (λ)
  = -0,9365 (16,5) + 23,2826 (13,2) - 4,4237 (13,2) - 6,6 (9,9) - 6,6 (6,6) - 10,3606 (3,3)
  = -15,4523 + 307,3303 - 58,3928 - 65,34 - 43,56 - 34,19
  = 90,3952 KN.m

- MH = - PC (6λ) + RAV (5λ) - PA (5λ) - PD (4λ) - PE (3λ) - PF (2λ) - PG (λ)
  = -0,9365 (19,8) + 23,2826 (16,5) - 4,4237 (16,5) - 6,6 (13,2) - 6,6 (9,9) - 10,3606 (6,6) - 5,9394 (3,3)
  = - 18,5427 + 384,1629 - 72,9911 - 87,12 - 65,34 - 68,38 - 19,6
  = 52,1891 KN.m

- MB = - P7 . λ
  = - 0,4125 . 3,3
  = - 1,3613 KN.m

- MI = 0 KN.m

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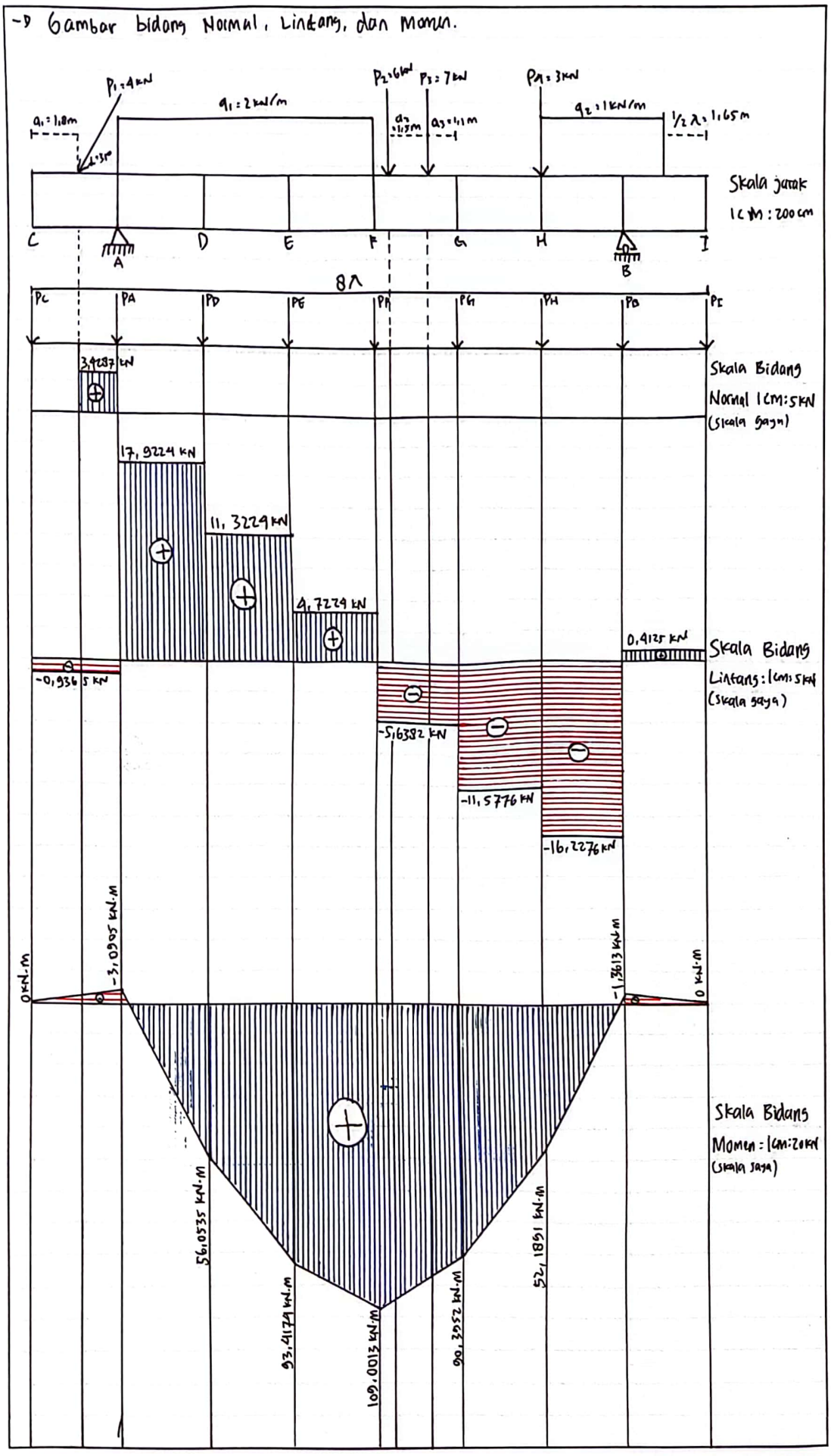
-D Gambar bidang Normal, Lintang, dan Momen.



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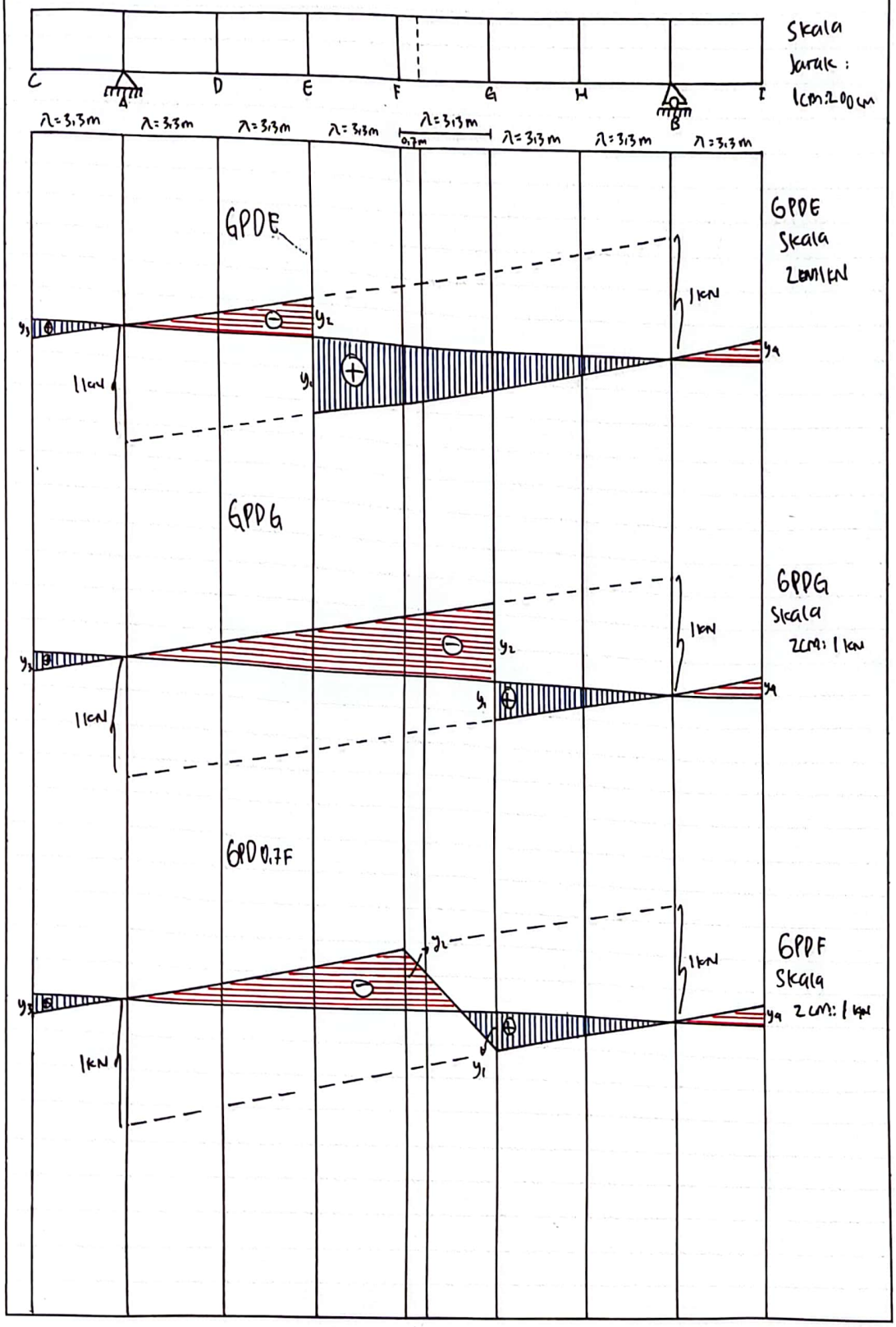
b. Hitung dan gambar garis pengaruh momen dan lintang akibat beban jika P = 1 kN bergerak dari tumpuan A ke B pada potongan / titik E, G, dan 0,7 m kekanan dari titik F

* Gambar garis pengaruh lintang.



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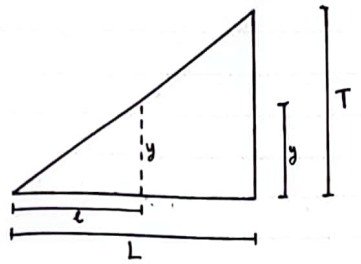
* Perhitungan Garis Pengaruh Lintang



$$\frac{y}{T} = \frac{l}{L}$$

$$y = \frac{l \cdot T}{L}$$

~> Titik E

- y_1 Positif : $y_1 = \frac{4\lambda \cdot 1}{6\lambda} = \frac{13,2 \cdot 1}{19,8} = 0,6667$
- y_2 Negatif : $y_2 = \frac{2\lambda \cdot 1}{6\lambda} = \frac{6,6 \cdot 1}{19,8} = 0,3333$
- y_3 Positif : $y_3 = \frac{\lambda \cdot}{6\lambda} = \frac{3,3}{19,8} = 0,1667$
- y_4 Negatif : $y_4 = \frac{\lambda}{6\lambda} = \frac{3,3}{19,8} = 0,1667$

~> Titik G

- y_1 Positif : $y_1 = \frac{2\lambda \cdot 1}{6\lambda} = \frac{6,6 \cdot 1}{19,8} = 0,3333$
- y_2 Negatif : $y_2 = \frac{4\lambda \cdot 1}{6\lambda} = \frac{13,2 \cdot 1}{19,8} = 0,6667$
- y_3 Positif : $y_3 = \frac{\lambda}{6\lambda} = \frac{3,3}{19,8} = 0,1667$
- y_4 Negatif : $y_4 = \frac{\lambda}{6\lambda} = \frac{3,3}{19,8} = 0,1667$

~> Titik F

- y_1 Positif : $y_1 = \frac{2\lambda \cdot 1}{6\lambda} = \frac{6,6 \cdot 1}{19,8} = 0,3333$
- y_2 Negatif : $y_2 = \frac{3\lambda \cdot 1}{6\lambda} = \frac{9,9 \cdot 1}{19,8} = 0,5$
- y_3 Positif : $y_3 = \frac{\lambda}{6\lambda} = \frac{3,3}{19,8} = 0,1667$
- y_4 Negatif : $y_4 = \frac{\lambda}{6\lambda} = \frac{3,3}{19,8} = 0,1667$

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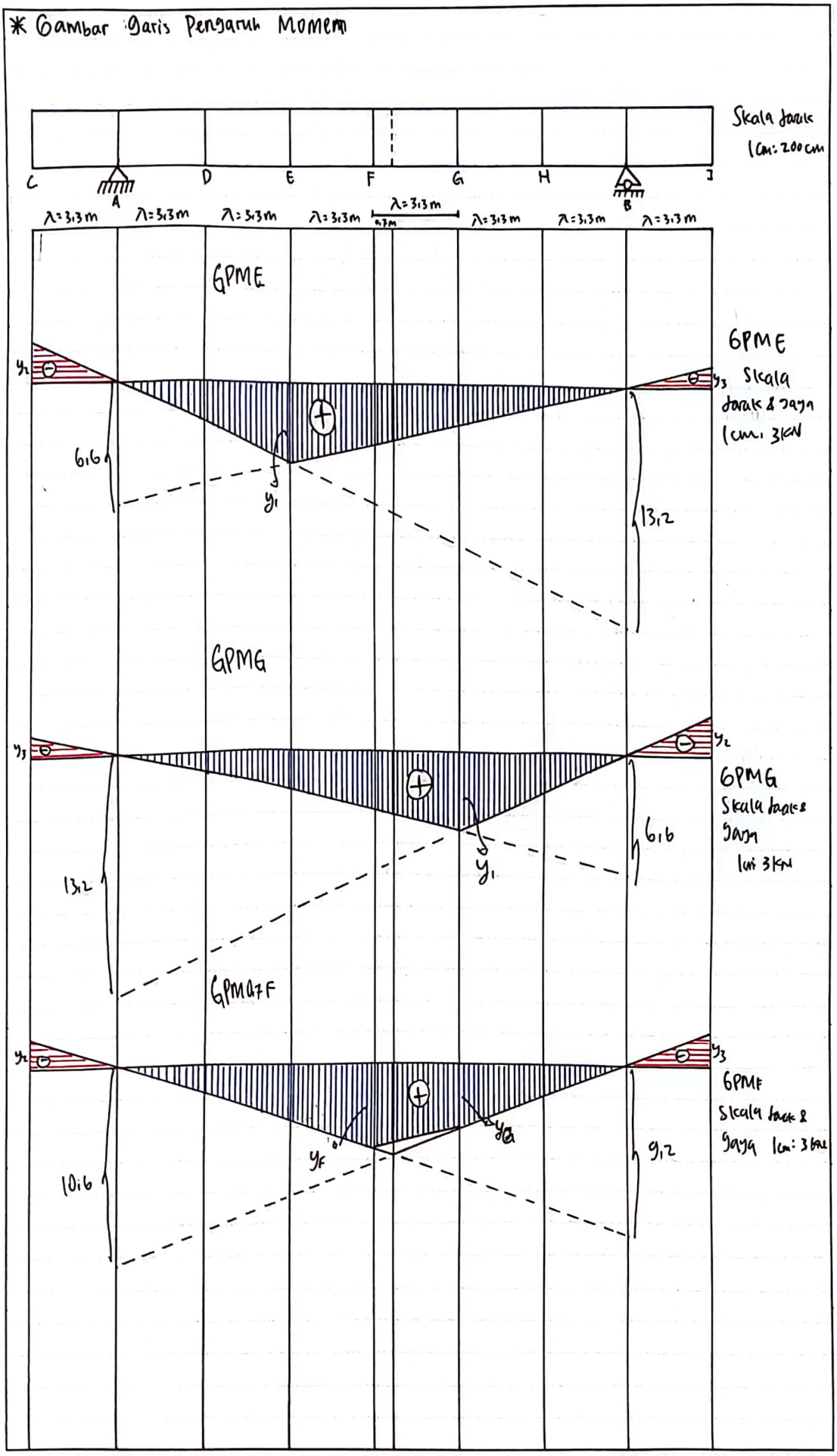
* Gambar Garis Pengaruh Momen



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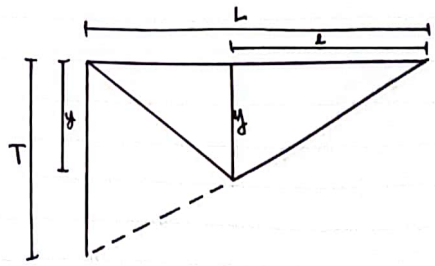
✳ Perhitungan Garis Pengaruh Momen



$$\frac{y}{T} = \frac{l}{L}$$

$$y = \frac{l \cdot T}{L}$$

~o Titik E

- $y_1 = \frac{(4\lambda)(2\lambda)}{6\lambda} = \frac{13{,}2 \cdot 6{,}6}{19{,}8} = 4{,}4$
- $y_2 = \frac{3{,}3 \cdot 13{,}2}{19{,}8} = 2{,}2$
- $y_3 = \frac{3{,}3 \cdot 6{,}6}{19{,}8} = 1{,}1$

~> Titik G

- $y_1 = \frac{(2\lambda)(4\lambda)}{6\lambda} = \frac{6{,}6 \cdot 13{,}2}{19{,}8} = 4{,}4$
- $y_2 = \frac{3{,}3 \cdot 6{,}6}{19{,}8} = 1{,}1$
- $y_3 = \frac{3{,}3 \cdot 13{,}2}{19{,}8} = 2{,}2$

~> Titik F

- $y_F = \frac{3\lambda \cdot (3\lambda - 0{,}7)}{6\lambda} = \frac{9{,}9 \cdot 9{,}2}{19{,}8} = 4{,}6$
- $y_G = \frac{2\lambda \cdot (3\lambda + 0{,}7)}{6\lambda} = \frac{6{,}6 \cdot 10{,}6}{19{,}8} = 3{,}5333$
- $y_F - y_G = 4{,}6 - 3{,}5333 = 1{,}0667$
- $y_1 = \frac{(\lambda - 0{,}7)(y_F - y_G)}{\lambda} = \frac{2{,}6 \cdot 1{,}0667}{3{,}3} = 0{,}8409$
- $y_2 = \frac{\lambda \cdot (3\lambda - 0{,}7)}{6\lambda} = \frac{3{,}3 \cdot 9{,}2}{19{,}8} = 1{,}5333$
- $y_3 = \frac{\lambda \cdot (3\lambda + 0{,}7)}{6\lambda} = \frac{3{,}3 \cdot 10{,}6}{19{,}8} = 1{,}7667$

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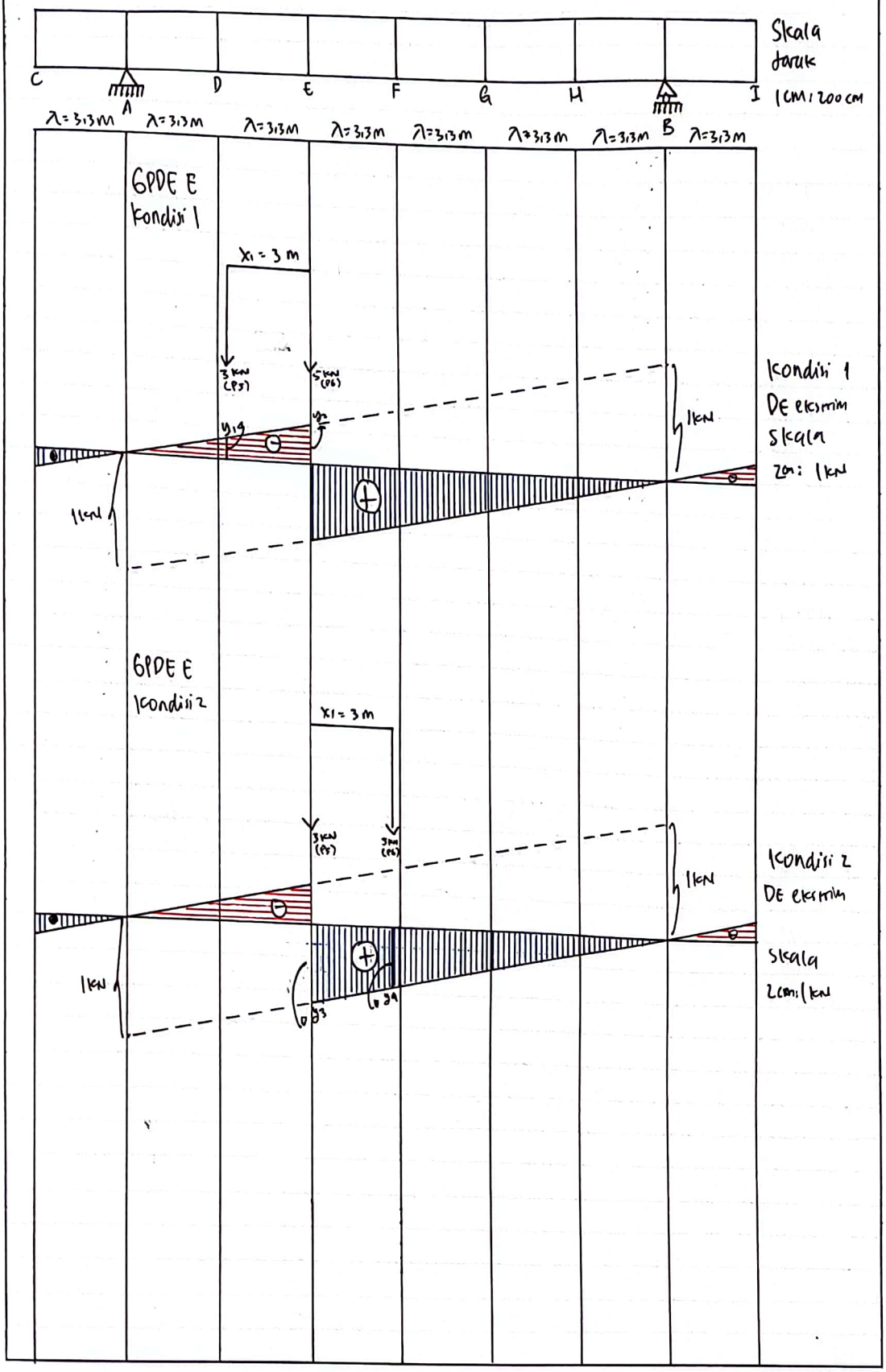
C. Hitung besar momen ekstrim dan lintang ekstrim pada point (b) akibat rangkaian beban berjalan (PS, PG) dari A ke B.

* Lintang ekstrim di titik E akibat beban berjalan



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→ Lintang elastrim Pada titik E

- $y_1 = \frac{2\lambda - x_1}{6\lambda} = \frac{6.6 - 3}{19.8} = 0,1818$
- $y_2 = \frac{2\lambda}{6\lambda} = \frac{6.6}{19.8} = 0,3333$
- $y_3 = \frac{4\lambda}{6\lambda} = \frac{13,2}{19.8} = 0,6667$
- $y_4 = \frac{4\lambda - x_1}{6\lambda} = \frac{13,2 - 3}{19.8} = 0,5152$

DE Negatif

- Kondisi 1 : $-y_1 . P_5 - y_2 . P_6$
  : $-0,1818(3) - 0,3333(5) = -2,2119$ kN
- Kondisi 2 : $-y_2 . P_5$
  : $-0,3333(3) = -0,9999$ kN

DE Positif

- Kondisi 1 : $y_3 . P_6$
  : $0,6667(5) = 3,3335$ kN
- Kondisi 2 : $y_3 . P_5 + y_4 . P_6$
  : $0,6667(3) + 0,5152(5) = 4,5761$ kN

DE Max terjadi Pada kondisi 2 : 4,5761 kN
DE Min terjadi Pada kondisi 1 : -2,2119 kN

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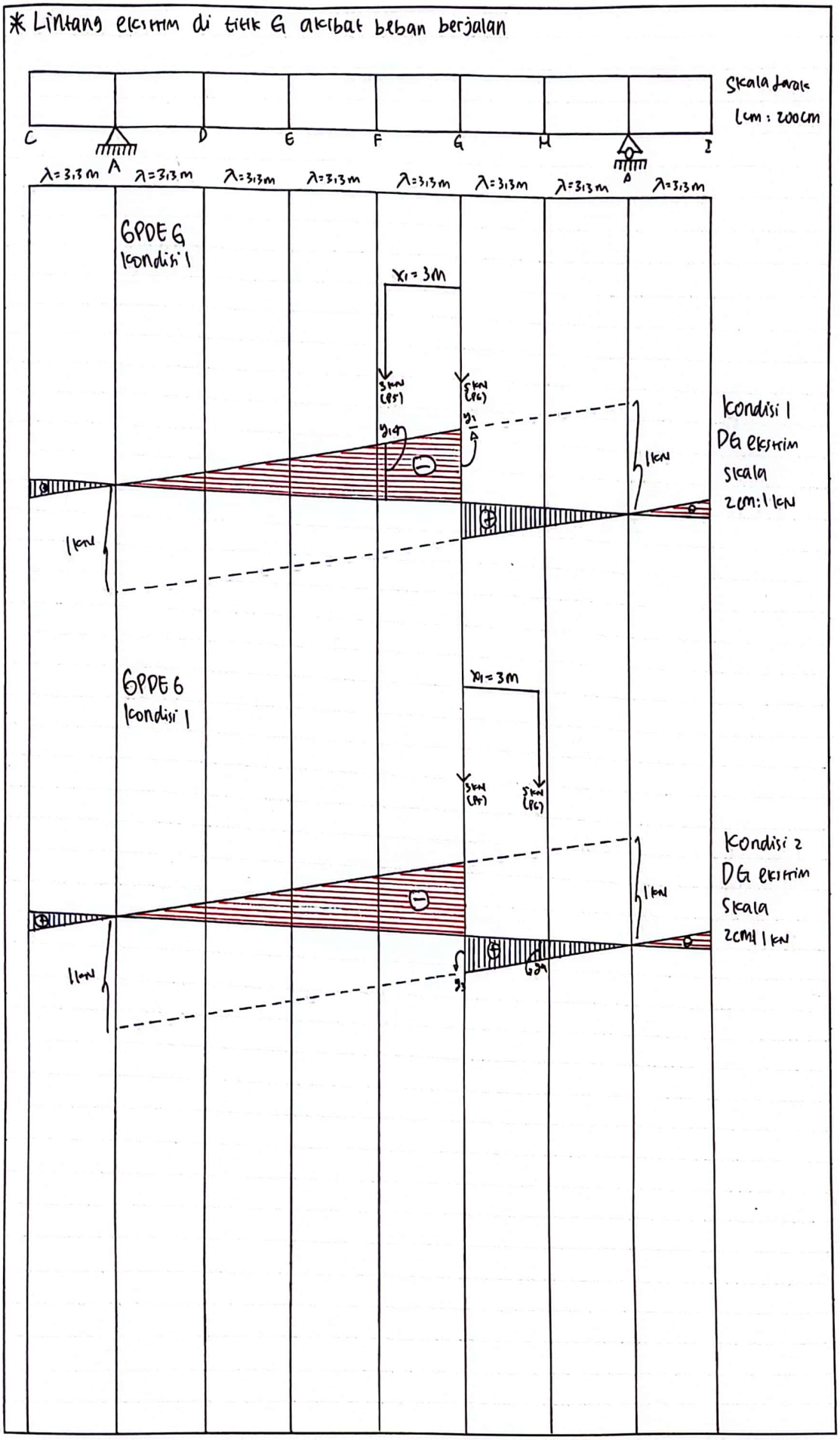
* Lintang ekstrim di titik G akibat beban berjalan



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~> Lintang elemen Pada titik G

- $y_1 = \frac{9\lambda - x_1}{6\lambda} = \frac{13,2 - 3}{19,8} = 0,5152$
- $y_2 = \frac{9\lambda}{6\lambda} = \frac{13,2}{19,8} = 0,6667$
- $y_3 = \frac{2\lambda}{6\lambda} = \frac{6,6}{19,8} = 0,3333$
- $y_4 = \frac{2\lambda - x_1}{6\lambda} = \frac{6,6 - 3}{19,8} = 0,1818$

DG Negatif

- Kondisi 1 $= -y_1 . P5 - y_2 . P6$
  $= -0,5152(3) - 0,6667(5) = -4,8791$ KN
- Kondisi 2 $= -y_2 . P5$
  $= -0,6667(3) = -2,0001$ KN

DG Positif

- Kondisi 1 $= -y_3 . P6 +$
  $= 0,3333(5) = 1,6665$ KN
- Kondisi 2 $= -y_3 . P5 + y_4 . P6$
  $= -0,3333(3) + 0,1818(5) = 1,9089$ KN

DG Max terjadi Pada kondisi 2 = 1,9089 KN
DG Min terjadi Pada kondisi 1 = -4,8791 KN

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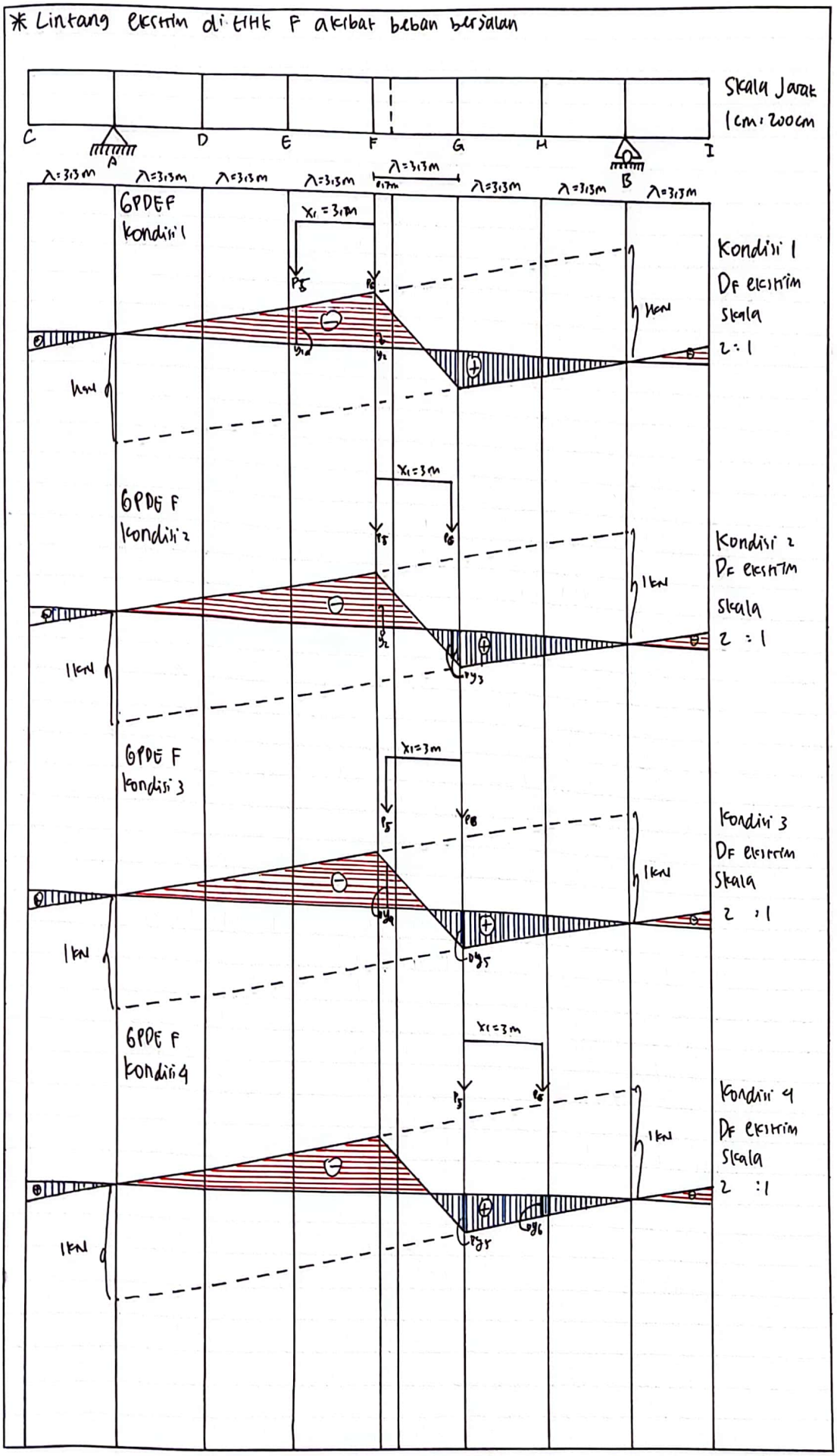
* Lintang ekstrim di titik F akibat beban bersalan



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* Lintang ekstrim pada titik F

- $y_1 = \frac{3\lambda - x_1}{6\lambda} = \frac{9.9 - 3}{19.8} = 0.3485$
- $y_2 = \frac{3\lambda}{6\lambda} = \frac{9.9}{19.8} = 0.5$
- $y_3 = \frac{3\lambda - x_1}{6\lambda} = \frac{9.9 - 3}{19.8} = 0.3485$
- $y_4 = \frac{4\lambda - x_1}{6\lambda} = \frac{13.2 - 3}{19.8} = 0.5152$
- $y_5 = \frac{2\lambda}{6\lambda} = \frac{6.6}{19.8} = 0.3333$
- $y_6 = \frac{2\lambda - x_1}{6\lambda} = \frac{6.6 - 3}{19.8} = 0.1818$

DF Negatif

- kondisi 1 : $-y_1 . P_5 - y_2 . P_6$
  $= -0.3485 . 3 - 0.5 . 5 = -3.5455$ kN
- kondisi 2 : $-y_2 . P_5$
  $= -0.5 . 3 = -1.5$ kN
- kondisi 3 : $-y_4 . P_5$
  $= -0.5152 . 3 = -1.5456$ kN

DF Positif

- kondisi 2 : $y_3 . P_6$
  $= 0.3485 . 5 = 1.7425$ kN
- kondisi 3 : $y_5 . P_6 +$
  $= 0.3333 . 5 = 1.6665$ kN
- kondisi 4 : $y_5 . P_5 + y_6 . P_6$
  $= 0.3333 . 3 + 0.1818 . 5 = 1.9089$ kN

DF max terjadi pada kondisi 4, = 1.9089 kN
DF min terjadi pada kondisi 1 = -3.5455 kN

GALIH ABIE SADEWA
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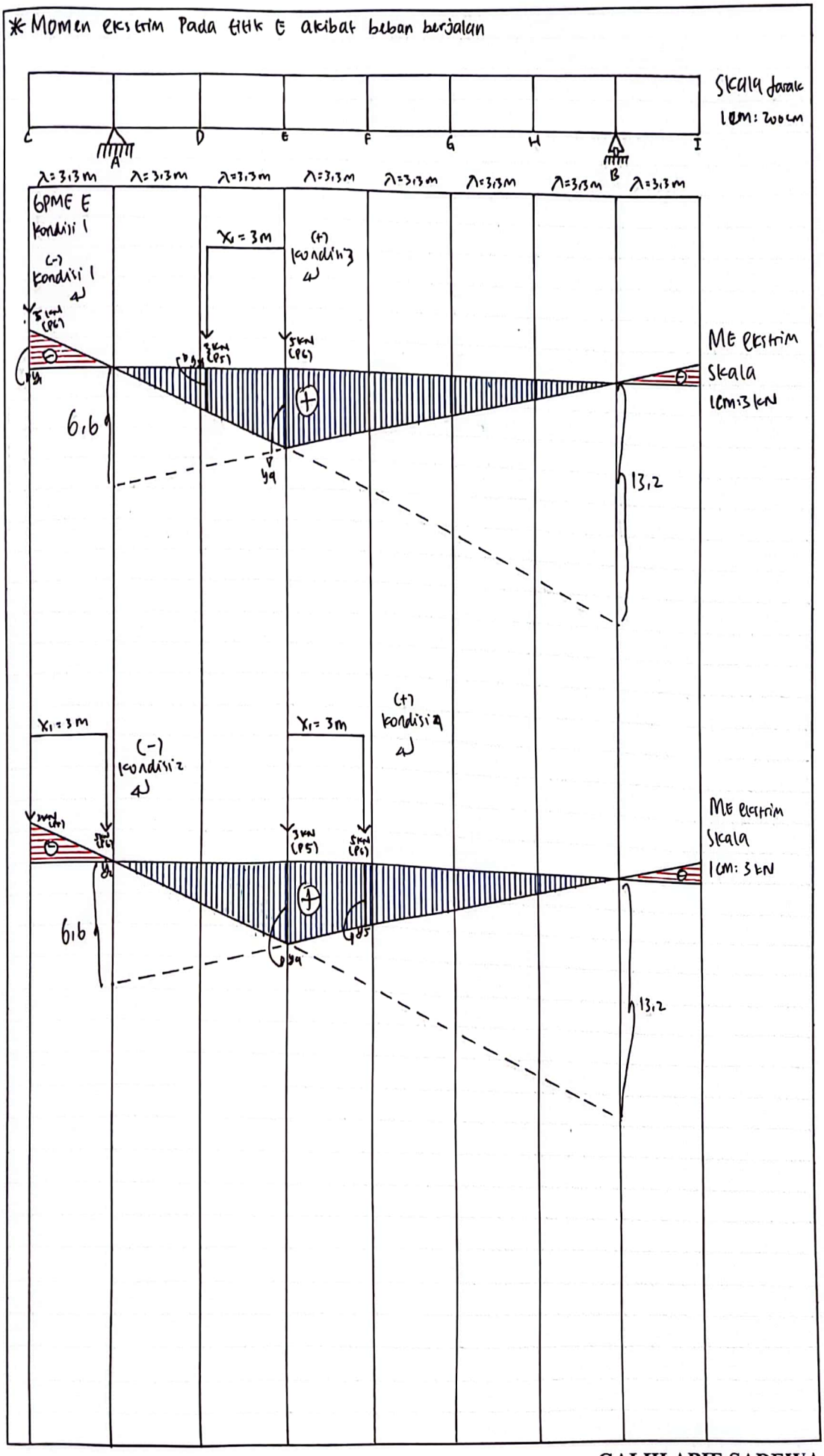
* Momen ekstrim Pada titik E akibat beban berjalan



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* Momen elastisitas pada titik E

- $y_1 = \frac{\lambda \cdot 9\lambda}{6\lambda} = \frac{3.3 \cdot 13.2}{19.8} = 2.2$
- $y_2 = \frac{(\lambda - x_1).(9\lambda)}{6\lambda} = \frac{0.3 \cdot 13.2}{19.8} = 0.2$
- $y_3 = \frac{(2\lambda - x_1).(9\lambda)}{6\lambda} = \frac{3.6 \cdot 13.2}{19.8} = 2.4$
- $y_4 = \frac{2\lambda \cdot 9\lambda}{6\lambda} = \frac{6.6 \cdot 13.2}{19.8} = 4.4$
- $y_5 = \frac{(2\lambda + x_1)(9\lambda - x_1)}{6\lambda} = \frac{9.6 \cdot 10.2}{19.8} = 4.9455$

ME Negatif

- Kondisi 1 : $-y_1 \cdot P6$
  $= -2.2(5) = -11$ kN.m
- Kondisi 2 : $-y_1 \cdot P5 - y_2 \cdot P6$
  $= -2.2(3) - 0.2(5) = -8.1$ kN.m

ME Positif

- Kondisi 3 : $y_3 \cdot P5 + y_4 \cdot P6$
  $= 2.4(3) + 4.4(5) = 29.2$ kN.m
- Kondisi 4 : $y_4 \cdot P5 + y_5 \cdot P6$
  $= 4.4(3) + 4.9455(5) = 37.9275$ kN.m

ME Max terjadi pada kondisi 2 : 37,9275 kN.m
ME Min terjadi pada kondisi 1 : -11 kN.m

GALIH ABIE SADEWA
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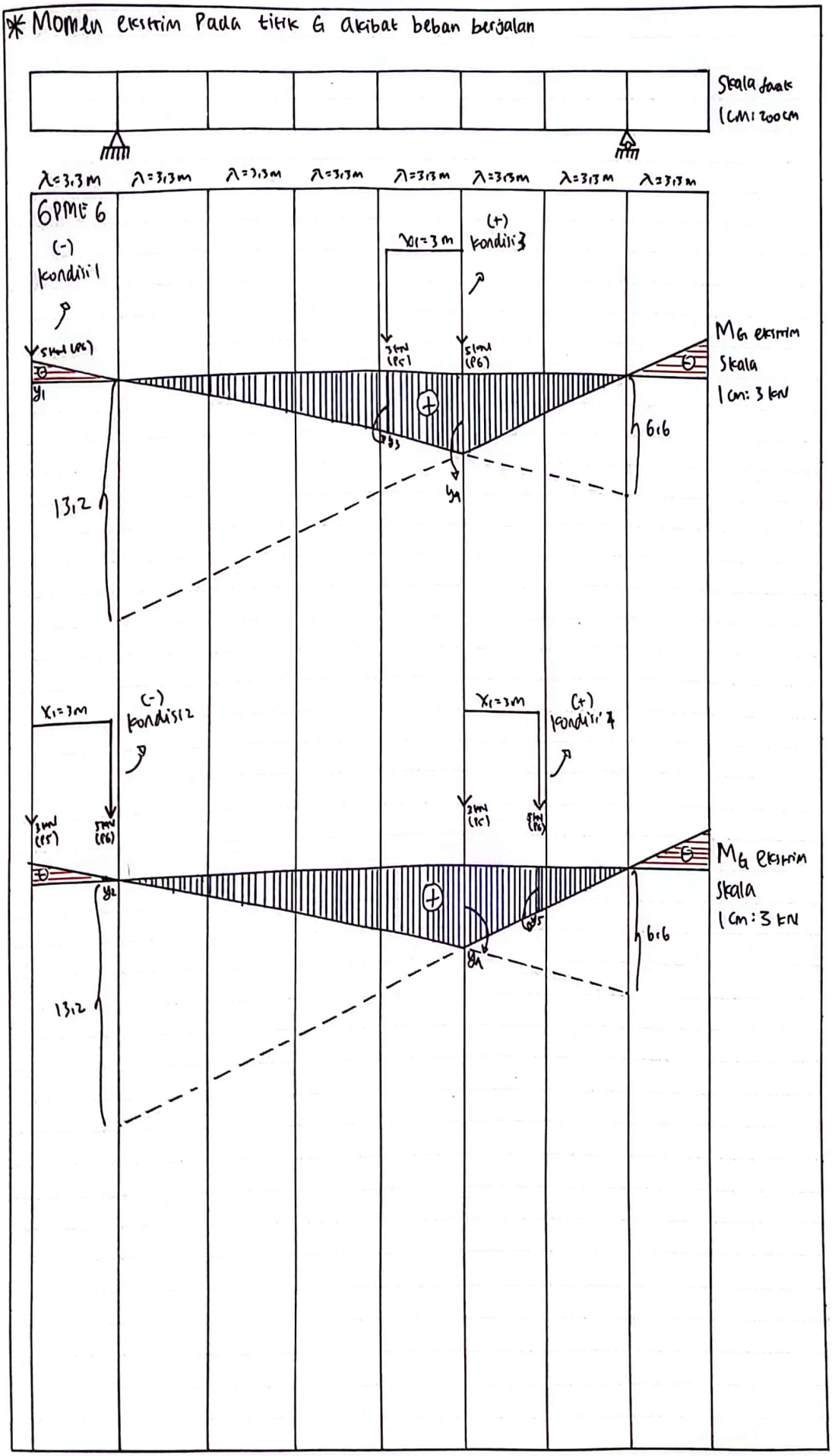
* Momen ekstrim Pada titik G akibat beban berjalan



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*Momen ekstrim pada titik G

- $y_1 = \frac{\lambda \cdot 2\lambda}{6\lambda} = \frac{3{,}3 \cdot 6{,}6}{19{,}8} = 1{,}1$
- $y_2 = \frac{(\lambda - x_1) \cdot 2\lambda}{6\lambda} = \frac{(3{,}3 - 3) \cdot 6{,}6}{19{,}8} = 0{,}1$
- $y_3 = \frac{(4\lambda - x_1) 2\lambda}{6\lambda} = \frac{(13{,}2 - 3) \cdot 6{,}6}{19{,}8} = 3{,}4$
- $y_4 = \frac{4\lambda \cdot 2\lambda}{6\lambda} = \frac{13{,}2 \cdot 6{,}6}{19{,}8} = 4{,}4$
- $y_5 = \frac{(2\lambda - x_1) \cdot 4\lambda}{6\lambda} = \frac{(6{,}6 - 3) \cdot 13{,}2}{19{,}8} = 2{,}4$

M6 Negatif

- kondisi 1 : $-y_1 \cdot P_6$
  $= -1{,}1 \cdot 5 = -5{,}5$ kN.m
- kondisi 2 : $-y_1 \cdot P_5 - y_2 \cdot P_6$
  $= -1{,}1 \cdot 3 - 0{,}1 \cdot 5 = -3{,}8$ kN.M

M6 positif

- kondisi 3 : $y_3 \cdot P_5 + y_4 \cdot P_6$
  $= 3{,}4 \cdot 3 + 4{,}4 \cdot 5 = 32{,}2$ kNm
- kondisi 4 : $y_4 \cdot P_5 + y_5 \cdot P_6$
  $= 4{,}4 \cdot 3 + 2{,}4 \cdot 5 = 25{,}2$ kNm

M6 Max terjadi pada kondisi 3 : 32,2 kN.m
M6 Min terjadi pada kondisi 1 : -5,5 kNm

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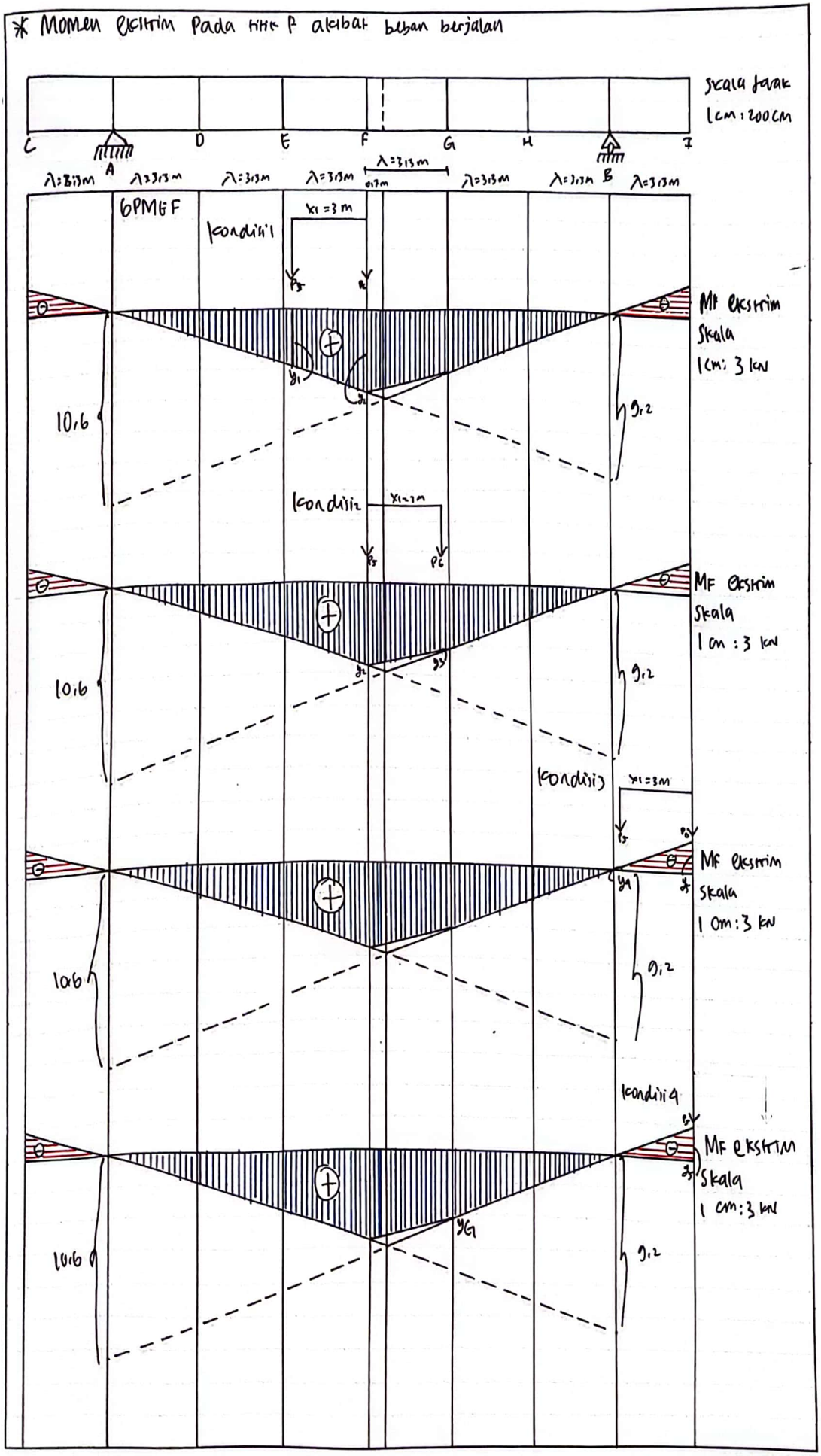
* Momen ekstrim pada titik F akibat beban berjalan



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→ Momen ekstrim pada titik F

- $y_6 = \frac{3\lambda + 0.7}{6\lambda} \cdot \frac{10.6}{19.8} = 0.5359$

- $y_1 = \frac{(3\lambda - x_1)(3\lambda - 0.7)}{6\lambda} = \frac{6.9 \cdot 9.2}{19.8} = 3.2061$

- $y_2 = \frac{3\lambda \cdot (3\lambda - 0.7)}{6\lambda} = \frac{9.9 \cdot 9.2}{19.8} = 4.6$

- $y_3 = \frac{(\lambda - x_1)(4.6 - 0.5359)}{\lambda} = \frac{0.3 \cdot 4.0646}{3.3} = 0.0616$

- $y_4 = \frac{(\lambda - x_1) \cdot (3\lambda + 0.7)}{6\lambda} = \frac{0.3 \cdot 10.6}{19.8} = 0.1606$

- $y_5 = \frac{\lambda \cdot (3\lambda + 0.7)}{6\lambda} = \frac{3.3 \cdot 10.6}{19.8} = 1.7667$

Mf Negatif

- kondisi 3 : $-P_5 \cdot y_4 - P_6 \cdot y_5$
  $= -3 \cdot (0.1606) - 5 \cdot (1.7667) = -9.3153$ kN.m

- kondisi 4 : $-P_5 \cdot y_5$
  $= -3 \cdot (1.7667) = -5.3001$ kN.m

Mf Positif

- kondisi 1 : $P_5 \cdot y_1 + P_6 \cdot y_2$
  $= 3 \cdot (0.5359) + 5 \cdot (3.2061) = 17.6367$ kN.m

- kondisi 2 : $P_5 \cdot y_2 + P_6 \cdot y_3$
  $= 3 \cdot (4.6) + (5)(0.0616) = 14.1080$ kN.m

Mf max terjadi pada kondisi 1 = 17.6367 kN.m
Mf min terjadi pada kondisi 1 = -9.3153 kN.m

GALIH ABIE SADEWA
2315011042

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN, RISET, DAN TEKNOLOGI
FAKULTAS TEKNIK-JURUSAN TEKNIK SIPIL
UNIVERSITAS LAMPUNG
Jl. Prof. Dr. Sumantri Brojonegoro No. 1 Bandar Lampung
Telp./fax.(0721) 704947 http: eng.unila.ac.id

LEMBAR ASISTENSI TUGAS SEMESTER

NAMA : **GALIH ABIE SADEWA**
NPM : **2315011042**
SEMESTER : **1 (SATU)**
MATA KULIAH : **STATIKA**

NO	TANGGAL	KETERANGAN	PARAF
	14-11-2023	Perbaiki diagram freebody.	✓
	26-11-2023	tambahkan momen maksimum dan	✓
		ganti perhitungan dengan persamaan	
	28-11-2023	ACC	✓

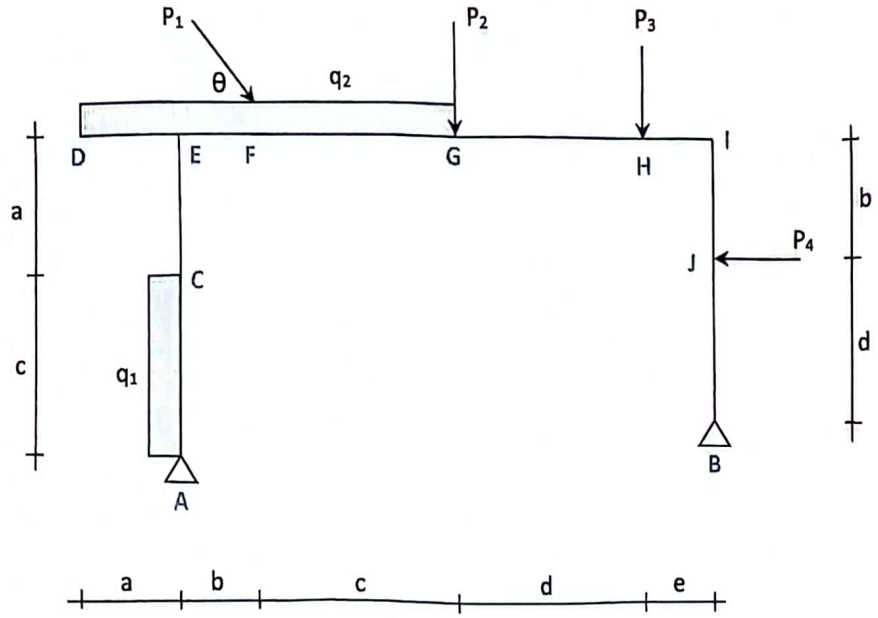
Bandar Lampung, 2023
Asisten Dosen

MUHAMMAD FATIH NABAN
NPM. 2015011030

NAMA : GALIH ABIE SADEWA
NPM : 2315011042

SOAL NO. 3

Diketahui struktur portal dengan beban seperti tergambar.



Data-data sebagai berikut:

Perletakan		Beban		Jarak	
A	Rol	q_1	1,0 kN/m	a	2,2 m
B	Sendi	q_2	2,5 kN/m	b	2,0 m
		P_1	3,0 kN	c	2,5 m
		P_2	1,0 kN	d	3,5 m
		P_3	4,0 kN	e	1,2 m
		P_4	1,5 kN	Sudut θ	30 °

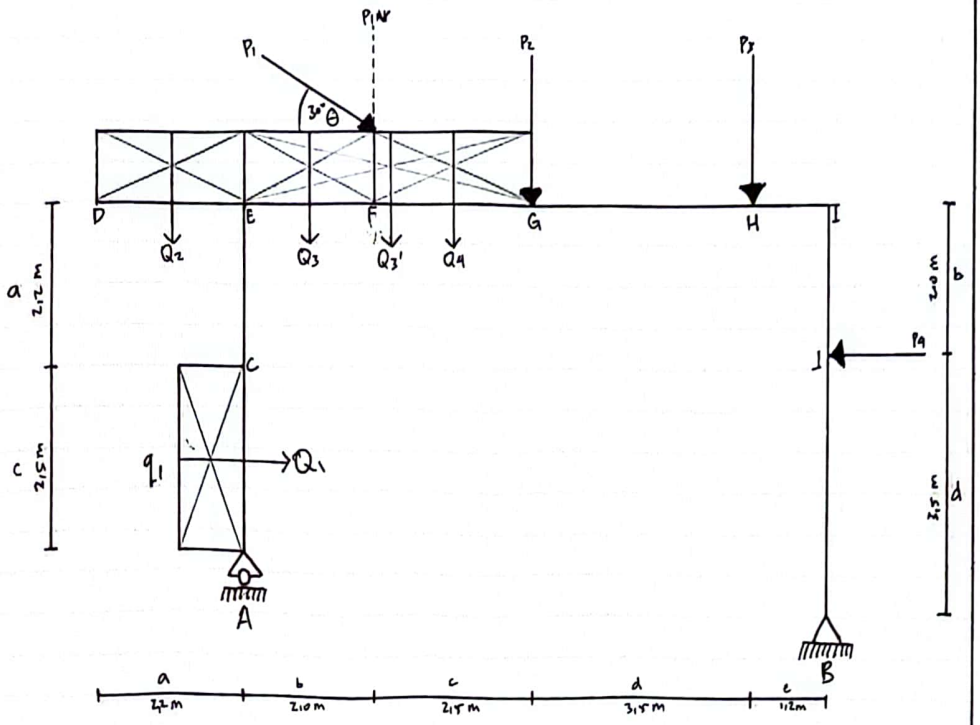
Pertanyaan:

Hitung dan gambarkan bidang momen, lintang dan normal secara analitis.

Asisten Responsi,

MUHAMMAD FATIH NABAN
NPM. 2015011030

Diketahui struktur Portal dengan beban seperti tergambar.



Data-data sebagai berikut :

Perletakan		Beban		Jarak	
A	Rol	q_1	1,0 kN/m	a	2,12 m
B	Sendi	q_2	2,15 kN/m	b	2,10 m
		P_1	3,0 kN	c	2,15 m
		P_2	1,0 kN	d	3,15 m
		P_3	9,0 kN	e	1,12 m
		P_4	1,5 kN	sudut θ	30°

Pertanyaan :

Hitung dan gambarkan bidang momen, lintang, dan normal secara analitis.

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2315011042

Diketahui :

. P_{1V} $= P_1 . \sin\theta$
$= 3 . \sin 30°$
$= 1{,}5$ kN

. P_{1H} $= P_1 . \cos\theta$
$= 3 . \cos 30°$
$= 2{,}5981$ kN

. Q_1 $= q_1 . c$
$= 1 . 2{,}5$
$= 2{,}5$ kN

. Q_2 $= q_2 . a$
$= 2{,}5 . 2{,}2$
$= 5{,}5$ kN

. Q_3 $= q_2 . b$
$= 2{,}5 . 2$
$= 5$ kN

. Q_4 $= q_2 . c$
$= 2{,}5 . 2{,}5$
$= 6{,}25$ kN

. Q_3' $= q_2 . (b + c)$
$= 2{,}5 . (2{,}0 + 2{,}5)$
$= 11{,}25$ kN

~o Reaksi Perletakan

- $P_4 - Q_1 - P_{1H} - R_{BH} = 0$
$-R_{BH} = -P_4 + Q_1 + P_{1H}$
$-R_{BH} = -1{,}5 + 2{,}5 + 2{,}5981$
$-R_{BH} = 3{,}5981$
$R_{BH} = -3{,}5981$ kN

- $\Sigma M_B = 0$

$R_{AV}.(b+c+d+e) + Q_1((b+d)-(\frac{1}{2}a)) - Q_2(\frac{1}{2}a+b+c+d+e)$
$- Q_3'(\frac{1}{2}(b+c)+d+e) + P_{1H}(b+d) - P_{1V}(c+d+e) - P_2(d+e)$
$- P_3(e) - P_4(d) = 0$

$R_{AV}(9{,}2) + 2{,}5(5{,}5 - 1{,}25 + 2{,}2) - 5{,}5(\frac{1}{2}.2{,}2 + 9{,}2)$
$- 11{,}25(\frac{1}{2}(4{,}5) + 4{,}7) + 2{,}5981(5{,}5) - 1{,}5(7{,}2) - 1(4{,}7) - 4(1{,}2)$
$- 1{,}5(3{,}5) = 0$

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$9{,}2\ R_{AV} + 5{,}1250 - 56{,}65 - 78{,}1875 + 19{,}2896 - 10{,}8 - 4{,}7 - 4{,}8 - 5{,}25 = 0$

$9{,}2\ R_{AV} = 140{,}9729$

$R_{AV} = \frac{140{,}9729}{9{,}2}$

$R_{AV} = 15{,}3231\ kN\ (\uparrow)$

- $\Sigma MA = 0$

$-R_{BV}(b+c+d+e) - P_4((a+c)-b) + P_3(d+c+b) + P_2(b+c) + Q_3'(\frac{1}{2}(b+c))$
$+ P_{1H}(a+c) + P_{1V}(b) - Q_2(\frac{1}{2}a) + Q_1(\frac{1}{2}c) - R_{BH}((b+a)-(a+c)) = 0$

$-R_{BV}(9{,}2) - 1{,}5(2{,}7) + 4(8)\,|\,(4{,}5) + 11{,}25(2{,}25) + 2{,}5981(4{,}7)$
$+ 1{,}5(2) - 5{,}5(1{,}1) + 2{,}5(1{,}25) + 3{,}5981(0{,}8) = 0$

$-9{,}2\ R_{BV} - 4{,}05 + 32 + 4{,}5 + 25{,}3125 + 12{,}2111 + 3 - 6{,}05 + 3{,}125 + 2{,}0785 = 0$

$-9{,}2\ R_{BV} = -72{,}9271$

$R_{BV} = \frac{-72{,}9271}{-9{,}2}$

$R_{BV} = 7{,}9269\ kN\ (\uparrow)$

- $\Sigma V = 0$ (checking)

$R_{AV} + R_{BV} = Q_2 + Q_3 + Q_4 + P_{1V} + P_2 + P_3$

$15{,}3231 + 7{,}9269 = 5{,}15 + 5 + 6{,}25 + 1{,}5 + 1 + 4$

$23{,}25\ kN = 23{,}25\ kN$ (OK!!)

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~> Gambar Freebody

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~o Bidang Normal

- Bentang A-E

  NAE : - RAv = - 15,3231 kN (Tekan)

- Bentang D-I

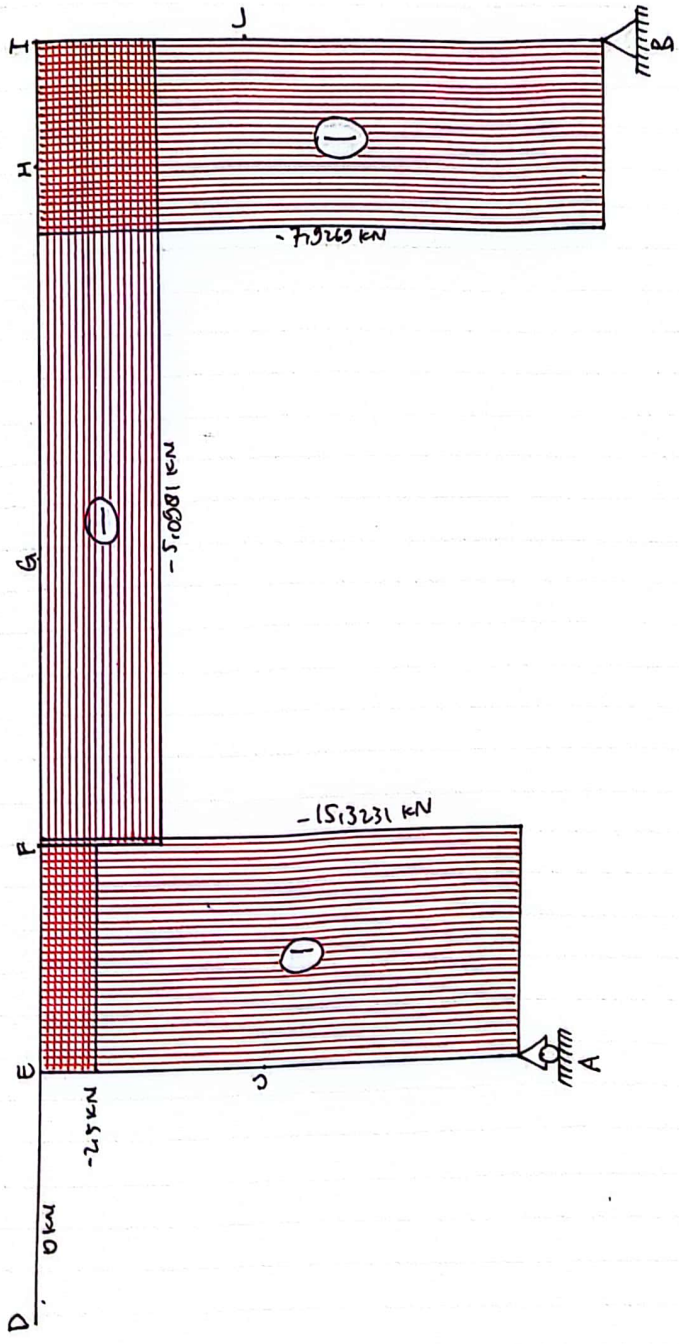
  NED : 0 kN

  NEF : - Q1 = - 2,5 kN (Tekan)

  NFI : - Q1 - P1H = - 2,5 - 2,5981 = - 5,0981 kN (Tekan)

- Bentang I-B

  NIB : - RBv = - 7,9269 kN (Tekan)



Skala jarak : 1 cm : 150 cm

Skala gaya : 1 cm : 5 kN

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~> Bidang Lintang

· Bentang A-C (0 < x < 2,5)

D_A = 0 kN

D_{AC} = $-q_1 . x$

= $-1 . x$

x (m)	1	2	2,5
Dx (kN)	-1	-2	-2,5

· Bentang C-E (2,5 < x < 4,7)

D_{CE} = $-Q_1$

= -2,5 kN

· Bentang D-E (0 < x < 2,2)

D_D = 0 kN

D_{DE} = $-q_2 . x$

= $-2,5 . x$

x (m)	1	2	2,2
Dx (kN)	-2,5	-5	-5,5

· Bentang E-F (2,2 < x < 4,2)

$D_{E\,kiri}$ = $-Q_2$

= -5,5

D_{EF} = $-q_2 . x + RAV$

= $-2,5 . x + 15,3231$

x (m)	2,2	3	4	4,2
Dx (kN)	9,8231	7,8231	5,3231	4,8231

· Bentang F-G (4,2 < x < 6,7)

$D_{F\,kiri}$ = 4,8231 kN

D_{FG} = $-q_2 . x + RAV - P_{IV}$

= $-2,5 . x + 15,3231 - 1,5$

x (m)	4,2	5	6	6,7
Dx (kN)	3,3231	1,3231	-1,1769	-2,9269

· Bentang G-H

$D_{G\,kiri}$ = -2,9269 kN

$D_{GH\,kiri}$ = $-q_2 . 6,7 + RAV - P_{IV} - P_2$

= $-2,5 . 6,7 + 15,3231 - 1,5 - 1$

= -3,9269 kN

· Bentang H-I

$D_{H\,kanan}$ = $D_{GH\,kiri} - P_3$

= $-3,9269 - 4$ = -7,9269 kN

$D_{I\,kiri}$ = $D_{H\,kanan}$ = -7,9269 kN

$D_{I\,kanan}$ = $D_{I\,kiri} + RBV$

= $-7,9269 + 7,9269$ = 0 kN

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- Bentang I - J kiri

$D_{IJkiri} = Q_1 + P_{1H}$

$= 2{,}5 + 2{,}5981$

$= 5{,}0981$ kN

- Bentang J - B

$D_{JBkiri} = D_{IJkiri} - P_4$

$= 5{,}0981 - 1{,}5$

$= 3{,}5981$ kN

- $D_B = D_{Bkiri} - R_{BH}$

$= 3{,}5981 - 3{,}5981$

$= 0$ kN

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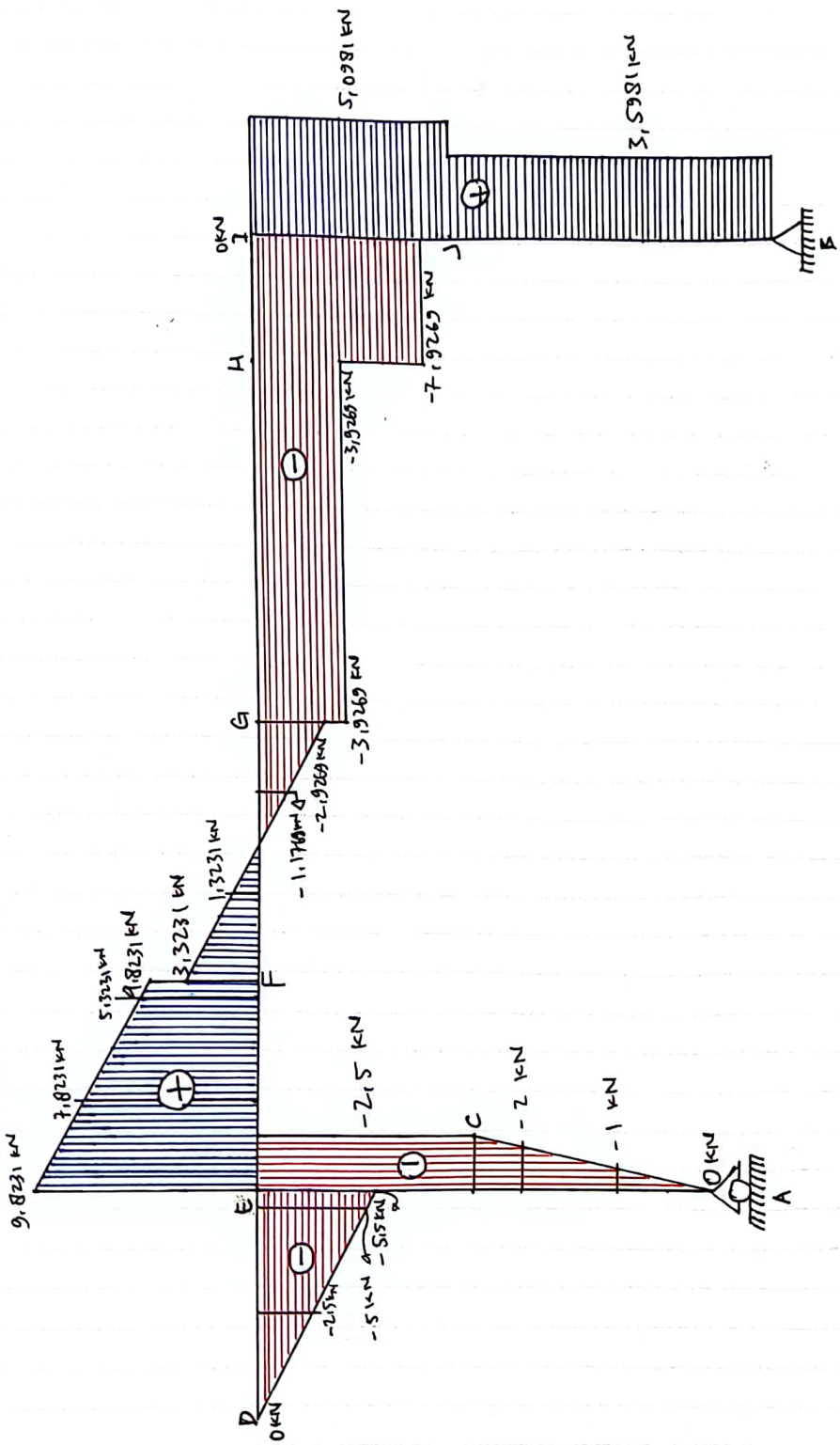
* Gambar bidang lintang



Skala jarak : 1 cm : 150 cm
Skala gaya : 1 cm : 3 kN

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~o Bidang Momen

- Bentang A - C $(0 < x \leq 2{,}5)$

$M_x = -\frac{1}{2} \cdot q_1 \cdot x^2$

$= -\frac{1}{2} \cdot 1 \cdot x^2$

X (m)	0	1	2	2,5
M_x (kN.m)	0	-0,5	-2	-3,125

- Bentang C - E $(2{,}5 < x \leq 4{,}7)$

$M_x = -Q_1 \cdot (x - \frac{5}{2})$

$= -2{,}5 \cdot (x - \frac{2{,}5}{2})$

X (m)	2,5	3	4	4,7
M_x (kN.m)	-3,125	-4,375	-6,875	-8,625

- Bentang D - E $(0 < x \leq 2{,}2)$

$M_x = -\frac{1}{2} \cdot q_2 \cdot x^2$

$= -\frac{1}{2} \cdot 2{,}5 \cdot x^2$

X (m)	0	1	2	2,2
M_x (kN.m)	0	-1,25	-5	-6,05

- Bentang E - F $(2{,}2 < x \leq 4{,}2)$

$M_x = -Q_1 \cdot (\frac{5}{2} + a) - \frac{1}{2} \cdot q_2 \cdot x^2 + RAV\,(x - a)$

$= -2{,}5 \cdot (\frac{2{,}5}{2} + 2{,}2) - \frac{1}{2} \cdot 2{,}5 \cdot x^2 + 15{,}3231\,(x - 2{,}2)$

X (m)	2,2	3	4	4,2
M_x (kN.m)	-14,675	-7,6165	-1,043	-0,0288

- Bentang F - G $(4{,}2 < x \leq 6{,}7)$

$M_x = -Q_1 \cdot (\frac{5}{2} + a) - \frac{1}{2} \cdot q_2 \cdot x^2 + RAV\,(x-a) - P_{1V}(x - (a+b))$

$= -2{,}5 \cdot (\frac{2{,}5}{2} + 2{,}2) - \frac{1}{2} \cdot 2{,}5 \cdot x^2 + 15{,}3231\,(x - 2{,}2) - 1{,}5\,(x - 4{,}2)$

X (m)	4,2	5	6	6,7
M_x (kN.m)	-0,0288	1,8297	1,9028	0,4665

- Bentang G - H $(6{,}7 < x \leq 10{,}2)$

$M_G = M_{H\,kiri} = -Q_1 \cdot (\frac{5}{2} + a) - Q_2 \cdot (\frac{9}{2} + b + c + d) + RAV \cdot (b + c + d)$

$- P_{1V}\,(c + d) - Q_3' \cdot (\frac{b+c}{2} + d) - P_2 \cdot (d)$

$= -2{,}5 \cdot (\frac{2{,}5}{2} + 2{,}2) - 5{,}5 \cdot (\frac{2{,}2}{2} + 8) + 15{,}3231\,(8)$

$- 1{,}5\,(\text{[illegible]}) - 11{,}25 \cdot (\frac{4{,}5}{2} + 3{,}5) - 1 \cdot (3{,}5)$

$= -13{,}2777$ kN.m

- Bentang H - I

$M_H - M_I = -Q_1 \cdot (\frac{5}{2} + a) - Q_2 \cdot (\frac{9}{2} + b + c + d + e) + RAV \cdot (b + c + d + e)$

$- Q_3' \cdot (\frac{b+c}{2} + d + e) - P_{1V} \cdot (c + d + e) - P_2 \cdot (d + e) - P_3 \cdot (e)$

$= -2{,}5 \cdot (\frac{2{,}5}{2} + 2{,}2) - 5{,}5 \cdot (\frac{2{,}2}{2} + 9{,}2) + 15{,}3231 \cdot (9{,}2)$

$- 11{,}25 \cdot (\frac{4{,}5}{2} + 4{,}7) - 1{,}5 \cdot (7{,}2) - P_2 \cdot (4{,}7) - 4 \cdot (1{,}2)$

$= -22{,}79$ kN.m

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· Bentang I – B

$M_I = -22,79$ kN.m

$M_J = -R_{BH} \cdot d$

$= -3,5981 \cdot 3,5$

$= -12,5934$ kN.m

$M_B = 0$ kNM

~> Mencari nilai momen maksimum

$M_{max} = -Q_1 \cdot (\frac{5}{2} + a) - \frac{1}{2} \cdot q_2 \cdot x^2 + R_{AV} \cdot (x-a) - P_{IV}(x-(a+3))$

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

$-q_2 \cdot x + R_{AV} - P_{IV} = 0$

$-q_2 \cdot x = -R_{AV} + P_{IV}$

$-2,15x = -15,3231 + 11,5$

$x = \frac{-13,8231}{-2,15}$

$x = 5,5292$ m

$M_{max} = -Q_1 \cdot (\frac{5}{2} + a) - \frac{1}{2} \cdot q_2 \cdot x^2 + R_{AV} \cdot (x-a) - (x-(a+4))$

$= -2,15 \cdot (\frac{2,5}{2} + 2,12) - \frac{1}{2} \cdot 2,15 \cdot 5,5292^2 + 15,3231 \cdot (5,5292 - 2,12) - 11,5(5,5292 - 4,12)$

$= 2,1798$ kN.m

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* Gambar bidang Momen

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KEMENTERIAN PENDIDIKAN, KEBUDAYAAN, RISET, DAN TEKNOLOGI
FAKULTAS TEKNIK-JURUSAN TEKNIK SIPIL
UNIVERSITAS LAMPUNG
Jl. Prof. Dr. Sumantri Brojonegoro No. 1 Bandar Lampung
Telp./fax.(0721) 704947 http: eng.unila.ac.id

LEMBAR ASISTENSI TUGAS SEMESTER

NAMA : **GALIH ABIE SADEWA**
NPM : **2315011042**
SEMESTER : **1 (SATU)**
MATA KULIAH : **STATIKA**

NO	TANGGAL	KETERANGAN	PARAF
	28-11-2023	Perbaiki garis pengaruh lintang dan	
		momen	
	29-11-2023	ACC	

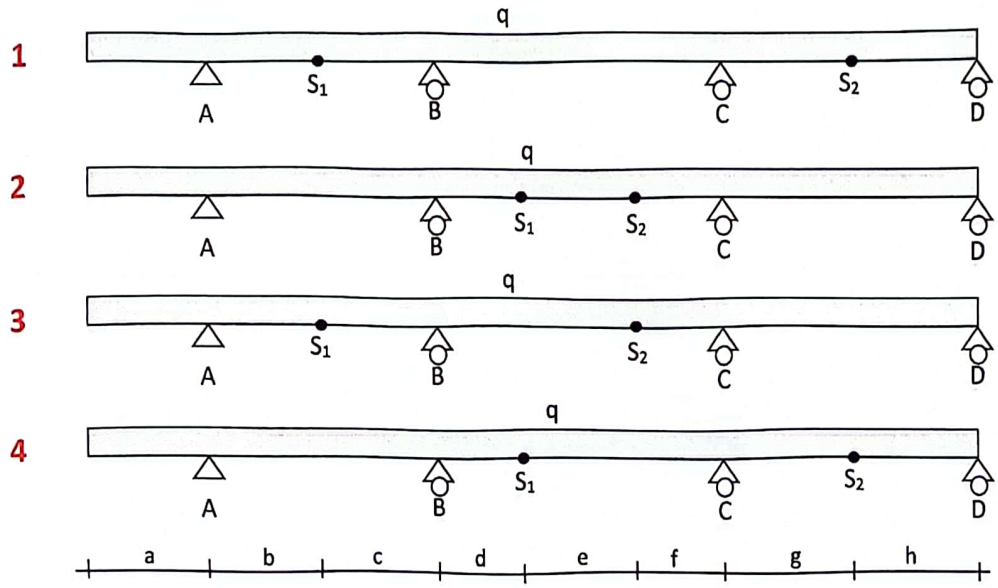
Bandar Lampung, 2023
Asisten Dosen

MUHAMMAD FATIH NABAN
NPM. 2015011030

NAMA : GALIH ABIE SADEWA
NPM : 2315011042

SOAL NO. 4

Diketahui struktur balok gerber dengan beban seperti tergamba



Data-data sebagai berikut:

Jenis Balok Gerber		Jarak		Beban berjalan	
2		a	2,8 m	P_1	1,2 kN
		b	3,8 m	P_2	2,4 kN
		c	1,7 m		
Beban		d	1,6 m		
q	3,9 kN/m'	e	1,9 m		
		f	1,5 m		
		g	1,3 m		
		h	2,8 m	x_1	2,5 m

Pertanyaan:

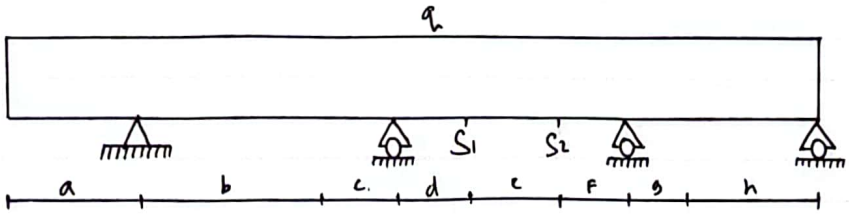
a. Hitung dan gambarkan bidang momen dan lintang akibat beban tetap yang bekerja.
b. Hitung dan gambar garis pengaruh monen dan lintang akibat beban jika P = 1 kN bergerak dengan arah dari tumpuan A ke B, pada titik potongan:
   - I : 1,6 m dari titik A
   - II : 1,4 m dari titik B
   - III : 1,0 m dari titik C
c. Hitung besar momen ekstrim dan lintang ekstrim pada point (b) akibat rangkaian beban berjalan (P_1 dan P_2) dengan arah dari A ke B.

Asisten Responsi,

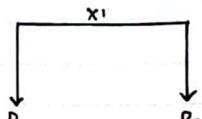
MUHAMMAD FATIH NABAN
NPM. 2015011030

Diketahui struktur balok Gerber dengan beban seperti tergambar.

(2.)

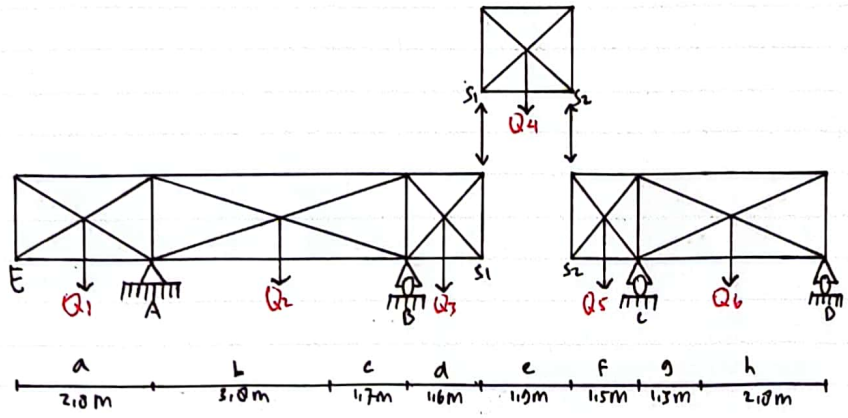


Data-data soal sebagai berikut :

Jenis balok gerber		Jarak		Beban bergalan	
Tipe 2	a	2,8m	P1	1,2 kN
	b	3,8m	P2	2,9 kN
Beban	c	1,7m			
q	3,9 kN/m	d	1,6 m		
		e	1,9m		
		f	1,5 m		
		g	1,3m		
		h	2,8m	X1	2,5m

Pertanyaan :

a.) Hitung dan gambarkan bidang momen dan lintang akibat beban tetap yang bekerja!



Diketahui :

$Q_1 = q_h \cdot a$
$= 3,9 \cdot 2,8$
$= 10,92$ kN

$Q_2 = q_h \cdot (b+c)$
$= 3,9 \cdot 5,5$
$= 21,45$ kN

$Q_3 = q_h \cdot d$
$= 3,9 \cdot 1,6$
$= 6,24$ kN

$Q_4 = q_h \cdot e$
$= 3,9 \cdot 1,9$
$= 7,41$ kN

$Q_5 = q_h \cdot F$
$= 3,9 \cdot 1,5$
$= 5,85$ kN

$Q_6 = q_h \cdot (g+h)$
$= 3,9 \cdot 4,1$
$= 15,99$ kN

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~> Reaksi Perletakan

* Balok S1 - S2

$\Sigma M_{S2} = 0$

$R_{VS1} \cdot 1{,}9 - Q_4 \cdot 0{,}95 = 0$

$1{,}9 R_{VS1} - 7{,}41 \cdot 0{,}95 = 0$

$1{,}9 R_{VS1} - 7{,}0395 = 0$

$R_{VS1} = \frac{7{,}0395}{1{,}9} = 3{,}7050$ kN (↑)

$\Sigma M_{S1} = 0$

$-R_{VS2} \cdot 1{,}9 + Q_4 \cdot 0{,}95 = 0$

$-1{,}9 R_{VS2} + 7{,}41 \cdot 0{,}95 = 0$

$-1{,}9 R_{VS2} + 7{,}0395 = 0$

$R_{VS2} = \frac{-7{,}0395}{-1{,}9} = 3{,}7050$ kN (↑)

Checking

$\Sigma V = 0$

$R_{VS1} + R_{VS2} - Q_4 = 0$

$3{,}7050 + 3{,}7050 - 7{,}41 = 0$

$0 = 0$ (OK)

* Balok E - S1

$\Sigma M_B = 0$

$R_{AV} \cdot 5{,}5 - Q_2 \cdot 2{,}75 + Q_3 \cdot 0{,}8 + R_{VS1} \cdot 1{,}6 = 0$

$5{,}5 R_{AV} - 10{,}92 \cdot 6{,}9 - 21{,}45 \cdot 2{,}75 + 6{,}24 \cdot 0{,}8 + 3{,}7050 \cdot 1{,}6 = 0$

$5{,}5 R_{AV} - 75{,}3480 - 58{,}9875 + 4{,}9920 + 5{,}9280 = 0$

$5{,}5 R_{AV} - 123{,}4155 = 0$

$R_{AV} = \frac{123{,}4155}{5{,}5}$

$R_{AV} = 22{,}4392$ kN (↑)

$\Sigma M_A = 0$

$-R_{BV} \cdot 5{,}5 + R_{VS1} \cdot 7{,}1 + Q_3 \cdot 6{,}3 + Q_2 \cdot 2{,}75 - Q_1 \cdot 1{,}4 = 0$

$-5{,}5 R_{BV} + 3{,}7050 \cdot 7{,}1 + 6{,}24 \cdot 6{,}3 + 21{,}45 \cdot 2{,}75 - 10{,}92 \cdot 1{,}4 = 0$

$-5{,}5 R_{BV} + 26{,}3055 + 39{,}3120 + 58{,}9875 - 15{,}2880 = 0$

$-5{,}5 R_{BV} + 109{,}3170 = 0$

$R_{BV} = \frac{-109{,}3170}{-5{,}5}$

$R_{BV} = 19{,}8758$ kN (↑)

Checking

$\Sigma V = 0$

$R_{AV} + R_{BV} - Q_1 - Q_2 - Q_3 - R_{VS1} = 0$

$22{,}4392 + 19{,}8758 - 10{,}92 - 21{,}45 - 6{,}24 - 7{,}41 - 3{,}7050 = 0$

$0 = 0$ (OK)

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* Balok S2 - D

$\Sigma MD = 0$

$R_{VC} . 4{,}1 - R_{VS2} . 5{,}6 - Q_5 . 4{,}85 - Q_6 . 2{,}05 = 0$

$4{,}1\ R_{VC} - 3{,}7050 . 5{,}6 - 5{,}85 . 4{,}85 - 15{,}99 . 2{,}05 = 0$

$4{,}1\ R_{VC} - 20{,}7480 - 28{,}3725 - 32{,}7795 = 0$

$4{,}1\ R_{VC} - 81{,}9 = 0$

$R_{VC} = \frac{81{,}9}{4{,}1}$

$R_{VC} = 19{,}9756$ kN (↑)

$\Sigma MC = 0$

$-R_{VD} . 4{,}1 + Q_6 . 2{,}05 - Q_5 . 0{,}75 - R_{VS2} . 1{,}5 = 0$

$-4{,}1\ R_{VD} + 15{,}99 . 2{,}05 - 5{,}85 . 0{,}75 - 3{,}7050 . 1{,}5 = 0$

$-4{,}1\ R_{VD} + 32{,}7795 - 4{,}3875 - 5{,}5575 = 0$

$-4{,}1\ R_{VD} + 22{,}8345 = 0$

$R_{VD} = \frac{-22{,}8345}{-4{,}1}$

$R_{VD} = 5{,}5694$ kN (↑)

Checking $\Sigma V = 0$

$R_{VC} + R_{VD} - R_{VS2} - Q_5 - Q_6 = 0$

$19{,}9756 + 5{,}5694 - 3{,}7050 - 5{,}85 - 15{,}99 = 0$

$0 = 0$ (Ok)

Checking seluruh balok

$\Sigma V = 0$

$R_{AV} + R_{BV} + R_{VC} + R_{VD} - q_h . (a+b+c+d+e+f+g+h) = 0$

$22{,}4392 + 19{,}8758 + 19{,}9756 + 5{,}5694 - 3{,}9\ (17{,}4) = 0$

$0 = 0$ (Ok)

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~o Bidang lintang

· Bentang E – A (0 < x < 2,8)

Dx = -q . x

= -3,9 . x

x (m)	0	1	2	2,8
Dx (kN)	0	-3,9	-7,8	-10,92

· Bentang A – B (2,8 < x < 8,3)

Dx = - Q1 + RAv - 9. (x - 2,8)

= -10,92 + 22,4392 - 3,9. (x - 2,8)

x (m)	2,8	3	4	5	6	7	8	8,3
Dx (kN)	11,5192	10,7392	6,8392	2,9392	-0,9608	-4,8608	-8,7608	-9,9308

· Bentang B – C (8,3 < x < 13,3)

Dx = - Q1 + RAv - Q2 + RBv - 3,9. (x - 8,3)

= -10,92 + 22,4392 - 21,45 + 19,8758 - 3,9. (x - 8,3)

x (m)	8,3	9	10	11	12	13	13,3
Dx (kN)	9,945	7,215	3,3150	-0,5850	-4,4850	-8,3850	-9,5550

· Bentang C – D (13,3 < x < 17,4)

Dx = - Q1 + RAv - Q2 + RBv - Q3 - Q4 - Q5 + RVc - 9. (x - 13,3)

= -10,92 + 22,4392 - 21,45 + 19,8758 - 6,24 - 7,41 - 5,85 + 19,9756 - 3,9 (x - 13,3)

x (m)	13,3	14	15	16	17	17,4
Dx (kN)	10,4206	7,6906	3,7906	-0,1094	-4,0094	-5,5694

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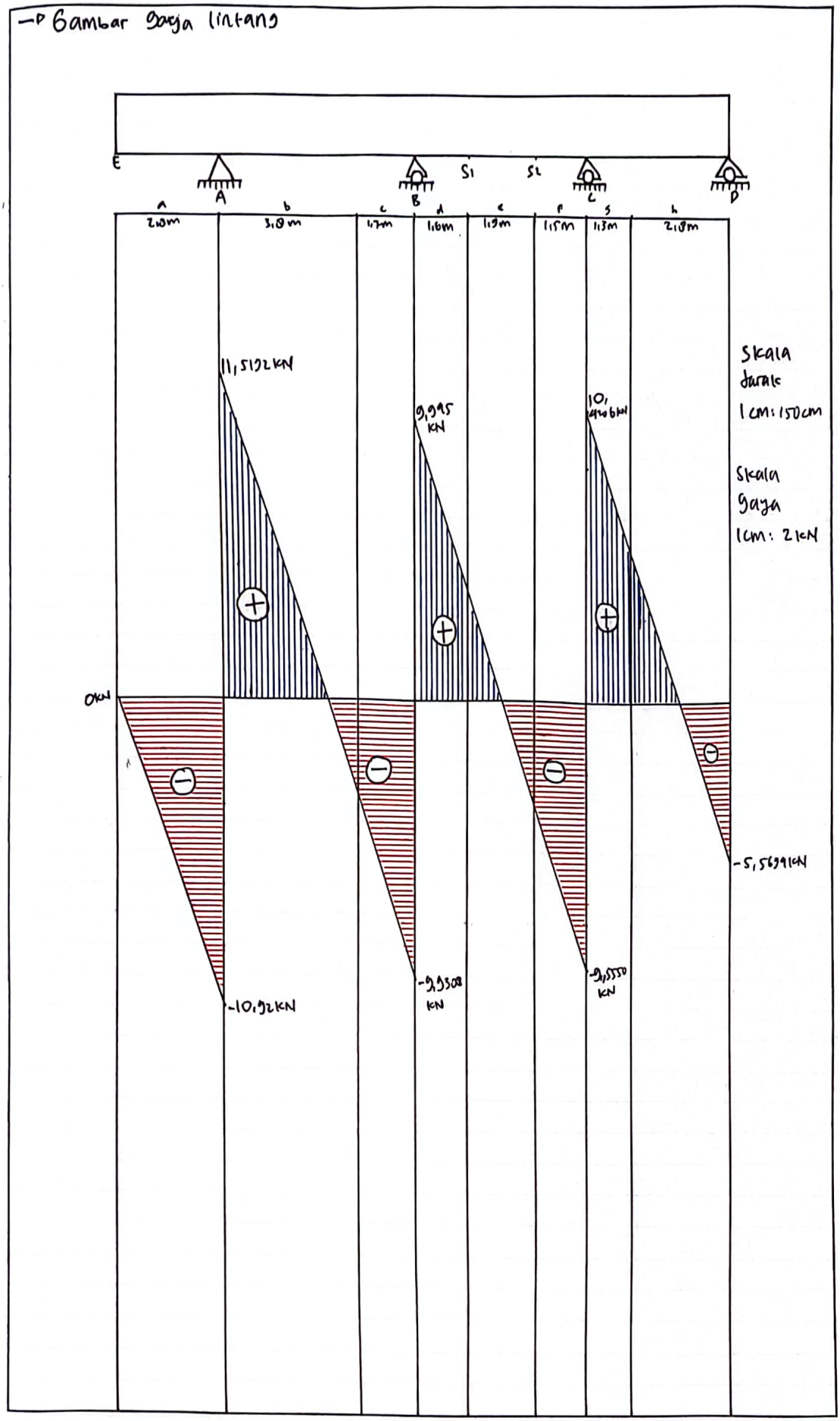
→ Gambar gaya lintang



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⇝ Bidang Momen

- Bentang E - A ($0 < x < 2{,}8$)

$M_x = -\frac{1}{2} \cdot 9 \cdot x^2$

$= -\frac{1}{2} \cdot 3.9 \cdot x^2$

x (m)	0	1	2	2,8
M_x (kN.m)	0	-1,95	-7,8	-15,288

- Bentang A - B ($2{,}8 < x < 8{,}3$)

$M_x = -\frac{1}{2} \cdot 9 \cdot x^2 + RAv \cdot (x - 2{,}8)$

$= -\frac{1}{2} \cdot 3{,}9 \cdot x^2 + 22{,}4392 \cdot (x - 2{,}8)$

x (m)	2,8	3	4	5	6	7
M_x (kN.m)	-15,288	-13,0622	-4,273	0,6162	1,6054	-1,3054

x (m)	8	8,3
M_x (kN.m)	-8,1662	-10,9199

- Bentang B - C ($8{,}3 < x < 13{,}3$)

$M_x = -\frac{1}{2} \cdot 9 \cdot x^2 + RAv\,(x - 2{,}8) + RBv\,(x - 8{,}3)$

$= -\frac{1}{2} \cdot 3{,}9 \cdot x^2 + 22{,}4392 \cdot (x - 2{,}8) + 10{,}8758\,(x - 8{,}3)$

x (m)	8,3	9	10	11	12	13,3
M_x (kN.m)	-10,9199	-4,9139	0,3511	1,7161	-0,8189	-9,9449

- Bentang C - D ($13{,}3 < x < 17{,}4$)

$M_x = -\frac{1}{2} \cdot 9 \cdot x^2 + RAv \cdot (x - 2{,}8) + RBv\,(x - 8{,}3) + RCv\,(x - 13{,}3)$

$= -\frac{1}{2} \cdot 3{,}9 \cdot x^2 + 22{,}4392 \cdot (x - 2{,}8) + 10{,}8758\,(x - 8{,}3) + 19{,}9756 \cdot (x - 13{,}3)$

x (m)	13,3	14	15	16	17	17,4
M_x (kN.m)	-9,9449	-3,6060	2,1346	3,9752	1,9158	0

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→ Momen Maksimum

· Bentang A - B

$M_{max1} = -\frac{1}{2} \cdot 9 \cdot x^2 + R_{AV} \cdot (x - 2{,}8)$

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

$-9 \cdot x + R_{AV} = 0$

$-3{,}9x = -22{,}4392$

$x = \frac{-22{,}4392}{-3{,}9} = 5{,}7536 \text{ m}$

$M_{max1} = -\frac{1}{2} \cdot 9 \cdot x^2 + R_{AV} \cdot (x - 2{,}8)$

$= -\frac{1}{2} \cdot 3{,}9 \cdot 5{,}7536^2 + 22{,}4392\,(5{,}57536 - 2{,}8)$

$= 1{,}7238 \text{ kN.M}$

· Bentang B - C

$M_{max2} = -\frac{1}{2} \cdot 9 \cdot x^2 + R_{AV} \cdot (x - 2{,}8) + R_{BV}(x - 8{,}3)$

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

$-9 \cdot x + R_{AV} + R_{BV} = 0$

$-3{,}9x = -22{,}4392 - 19{,}8758$

$x = \frac{-42{,}3150}{-3{,}9} = 10{,}85 \text{ m}$

$M_{max2} = -\frac{1}{2} \cdot 9 \cdot x^2 + R_{AV} \cdot (x - 2{,}8) + R_{BV}\,(x - 8{,}3)$

$= -\frac{1}{2} \cdot 3{,}9 \cdot 10{,}85^2 + 22{,}4392\,(10{,}85 - 2{,}8) + 19{,}8758\,(10{,}85 - 8{,}3)$

$= 1{,}76 \text{ kN.M}$

· Bentang C - D

$M_{max3} = -\frac{1}{2} \cdot 9 \cdot x^2 + R_{AV} \cdot (x - 2{,}8) + R_{BV} \cdot (x - 8{,}3) + R_{CV} \cdot (x - 13{,}3)$

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

$-9 \cdot x + R_{AV} + R_{BV} + R_{CV} = 0$

$-3{,}9x = -22{,}4392 - 19{,}8758 - 19{,}9756$

$x = \frac{-62{,}2906}{-3{,}9} = 15{,}9719$

$M_{max3} = -\frac{1}{2} \cdot 9 \cdot x^2 + R_{AV} \cdot (x - 2{,}8) + R_{BV}(x - 8{,}3) + R_{CV} \cdot (x - 13{,}3)$

$= -\frac{1}{2} \cdot 3{,}9 \cdot 15{,}9719^2 + 22{,}4392 \cdot (15{,}9719 - 2{,}8) + 19{,}8758\,(15{,}9719 - 8{,}3) + 19{,}9756\,(15{,}9719 - 13{,}3)$

$= 3{,}9767 \text{ kN.M}$

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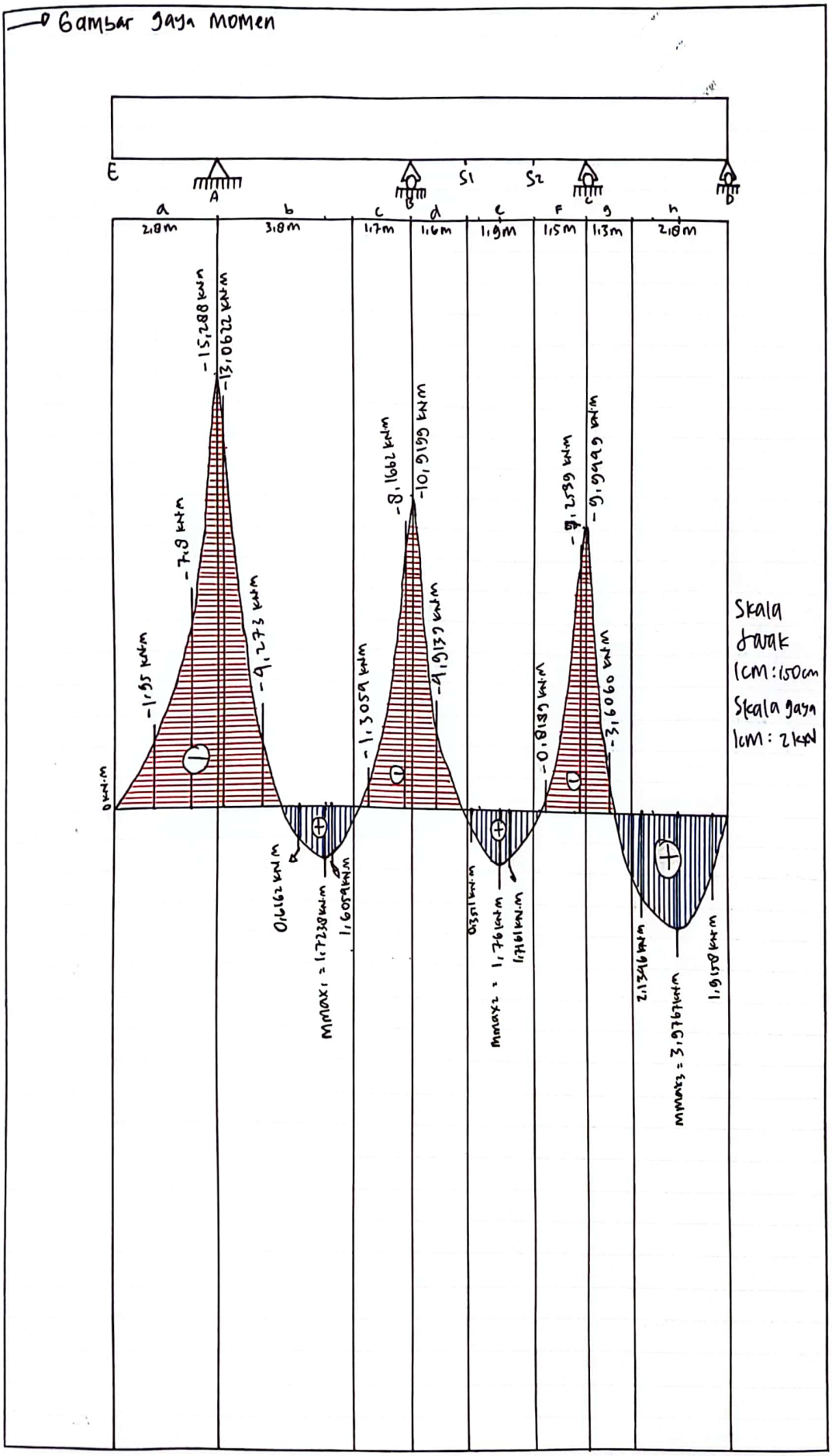
Gambar gaya momen



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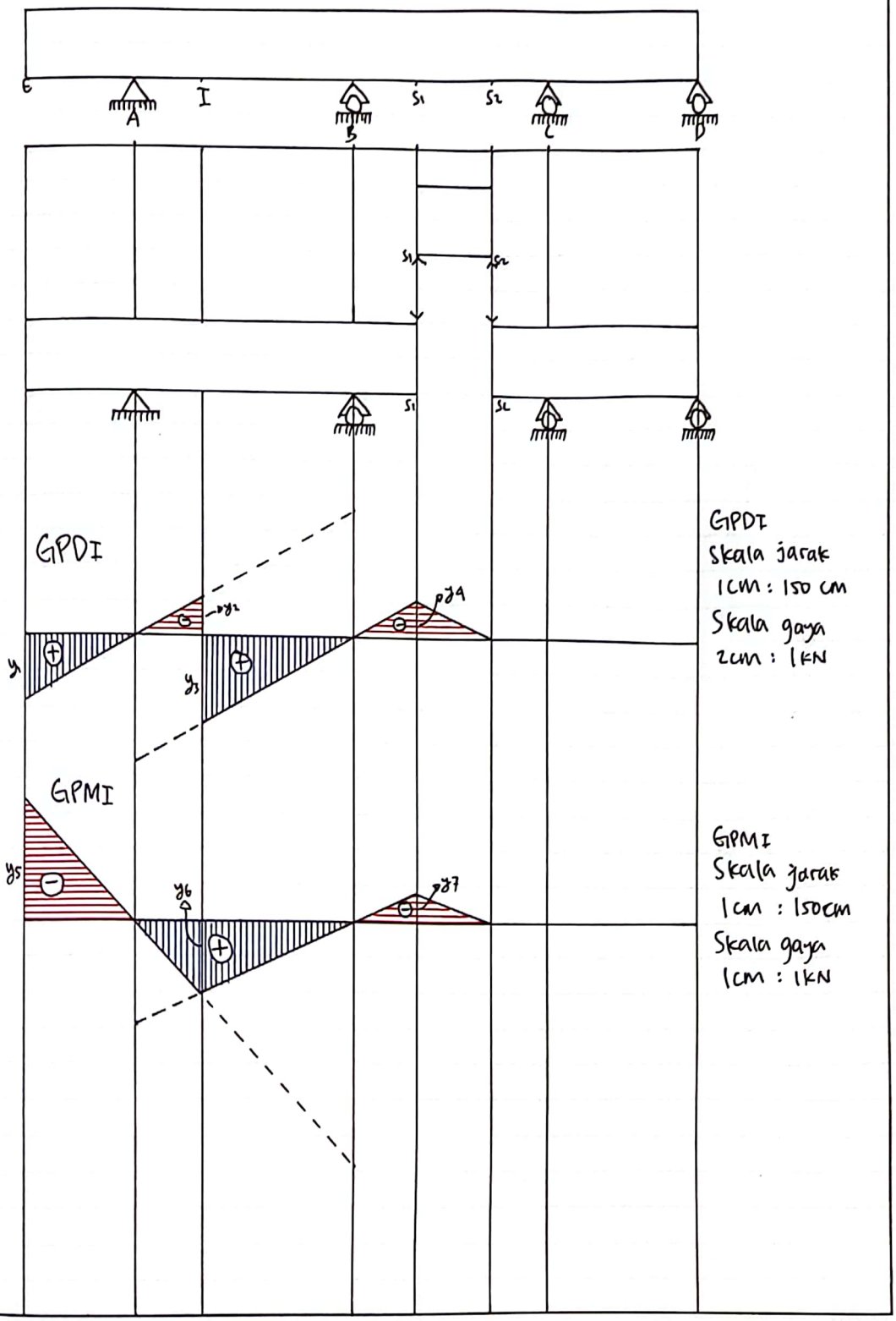
b. Hitung dan gambar garis pengaruh momen dan lintang akibat beban jika P = 1 kN bergerak dengan arah tumpuan A ke B, pada titik potongan :

- I : 1,6 m dari titik A
- II : 1,4 m dari titik B
- III : 1,0 m dari titik C

→ Garis pengaruh lintang dan momen pada titik I



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→ Garis Pengaruh lintang dan momen di titik I

2. Lintang

- $y_1 = \frac{2,8 \cdot 1}{5,5} = 0,5091$
- $y_2 = \frac{1,6 \cdot 1}{5,5} = 0,2909$
- $y_3 = \frac{3,9 \cdot 1}{5,5} = 0,7091$
- $y_4 = \frac{1,6 \cdot 1}{5,5} = 0,2909$

2. Momen

- $y_5 = \frac{2,8 \cdot 3,9}{5,5} = 1,9855$
- $y_6 = \frac{1,6 \cdot 3,9}{5,5} = 1,1345$
- $y_7 = \frac{1,6 \cdot 1,6}{5,5} = 0,4655$

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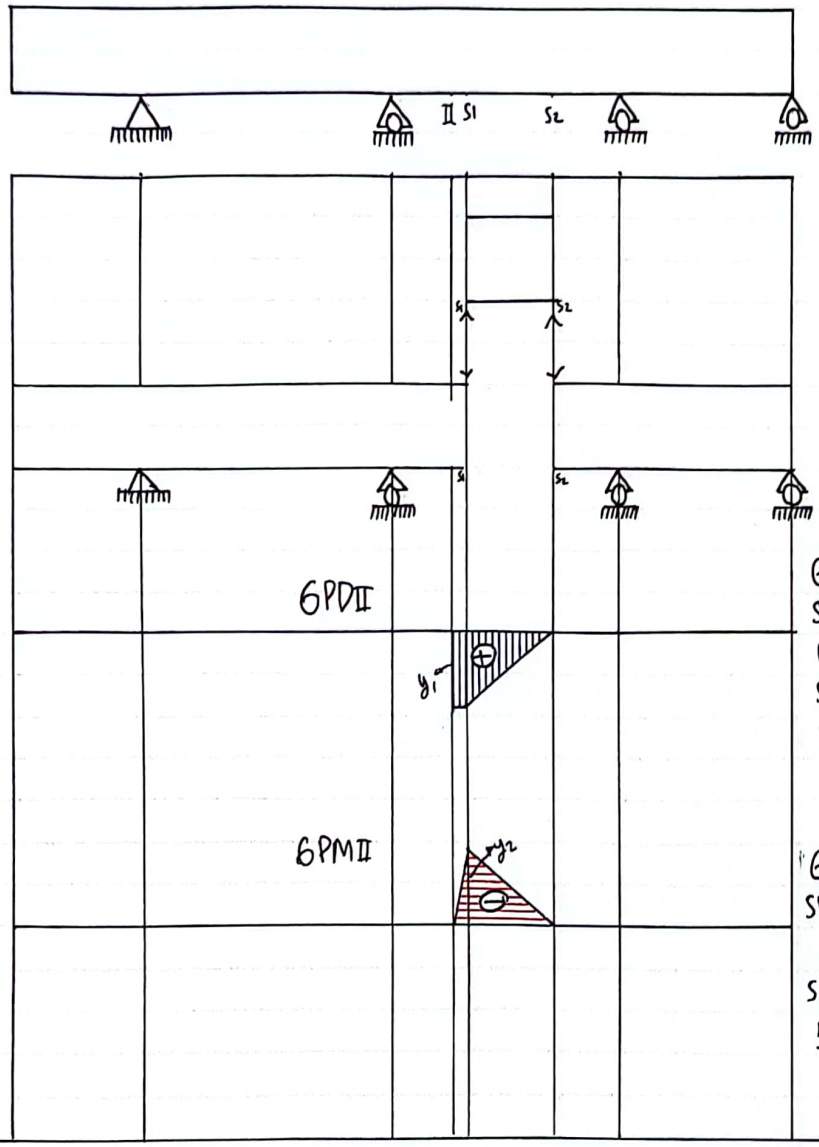
—▷ Garis pengaruh lintang dan momen pada titik II



GPDII
Skala jarak
1cm : 150cm
Skala gaya
1cm : 1 kN

GPMII
Skala jarak
1cm : 150cm
Skala gaya
5cm : 1 kN

2▷ Lintang
· y_1 : 1

2▷ Momen
· y_2 : 0,2

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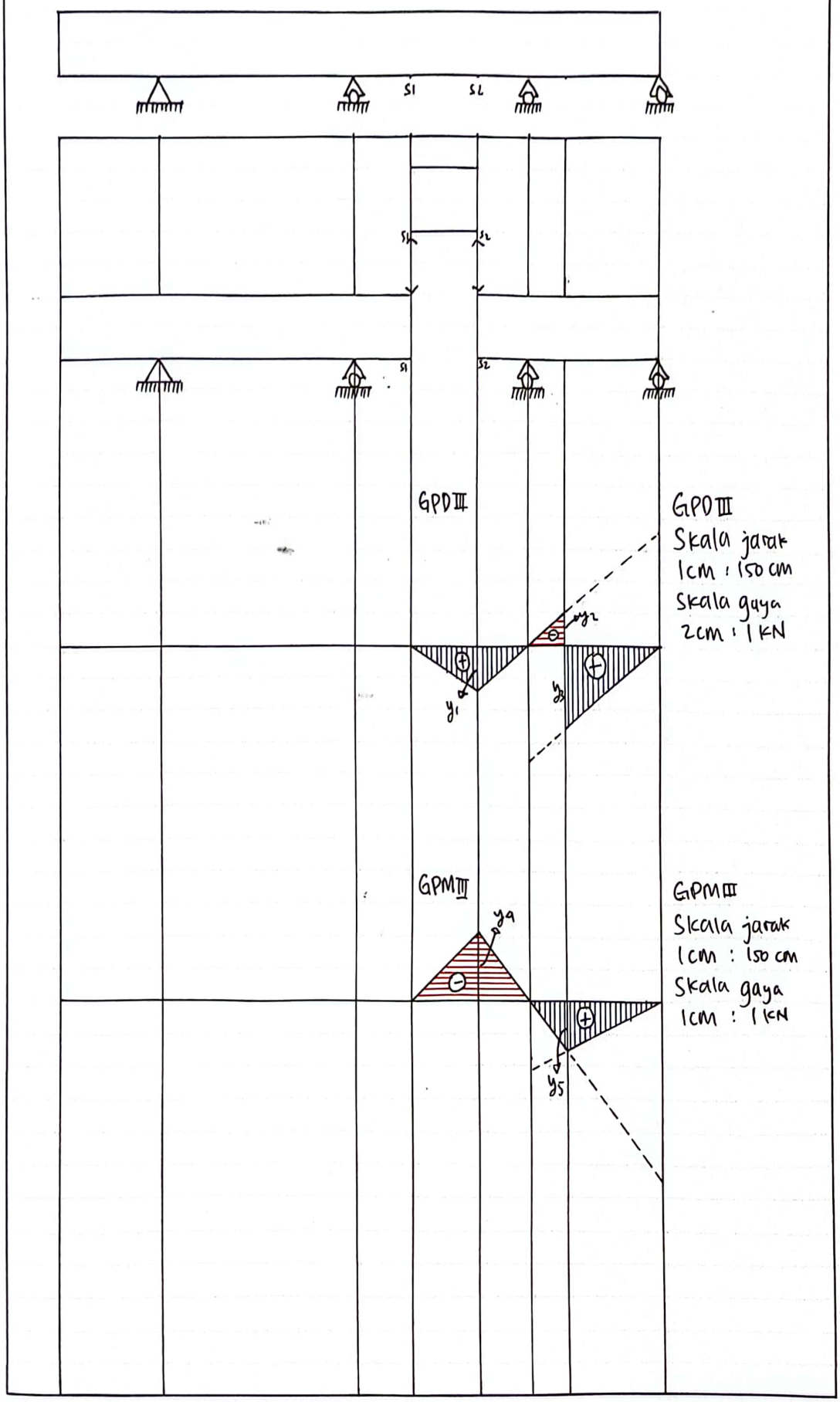
→ Garis pengaruh lintang dan momen pada titik III



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— Garis Pengaruh lintang dan momen dititik III

2. Lintang

- $y_1 = \frac{1,5 \cdot 1}{4,1} = 0,3659$
- $y_2 = \frac{1 \cdot 1}{4,1} = 0,2439$
- $y_3 = \frac{3,1 \cdot 1}{4,1} = 0,7561$

2. Momen

- $y_4 = \frac{1,5 \cdot 3,1}{4,1} = 1,1341$
- $y_5 = \frac{1 \cdot 3,1}{4,1} = 0,7561$

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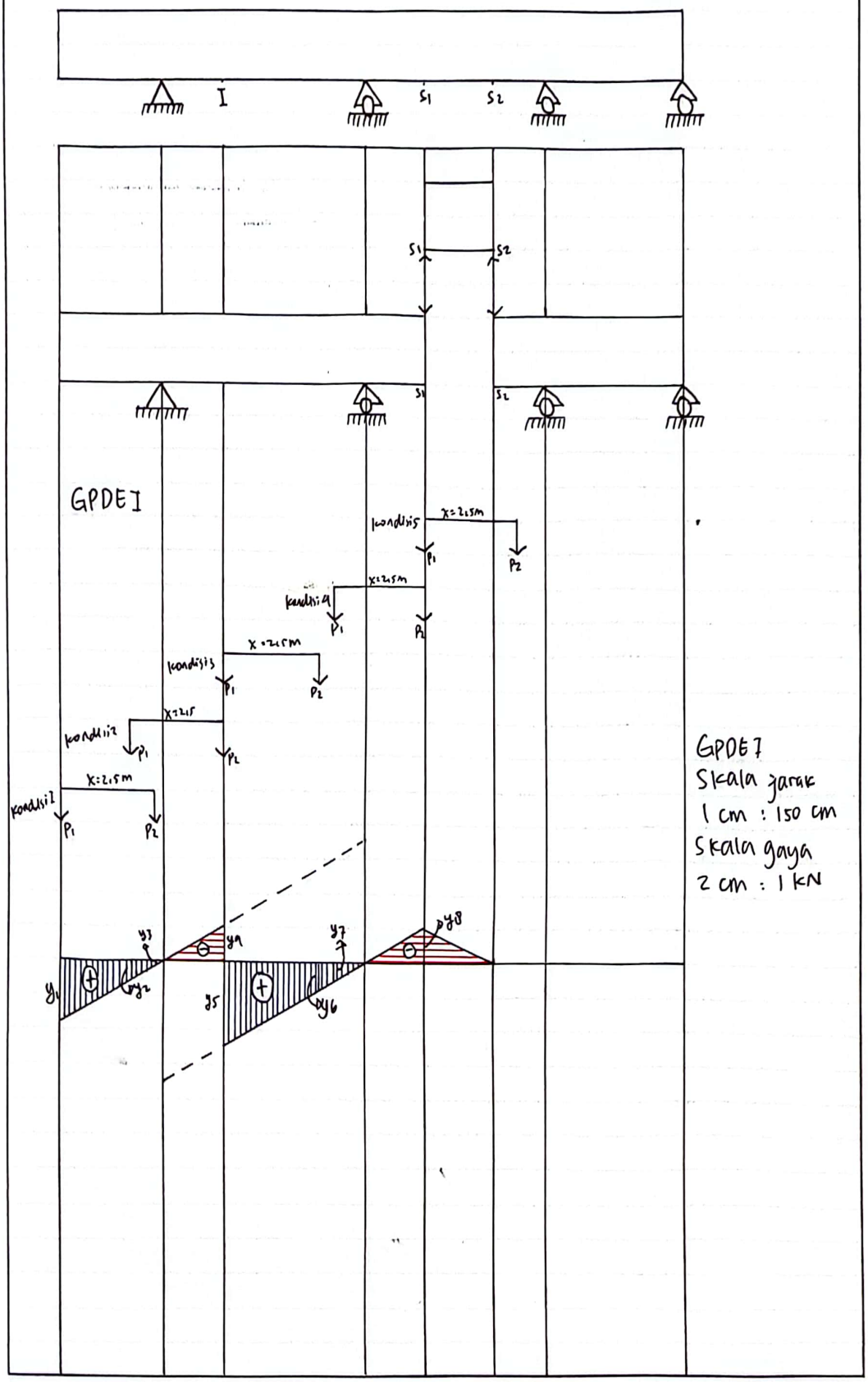
C. Hitung besar momen ekstrim dan lintang ekstrim pada point (b) akibat rangkaian beban berjalan (P_1 dan P_2) dengan arah dari A ke B.

→ Lintang ekstrim pada titik I



GPDE I
Skala jarak
1 cm : 150 cm
Skala gaya
2 cm : 1 kN

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$y_1 = \frac{2,8 \cdot 1}{5,5} = 0,5091$

$y_2 = \frac{0,9 \cdot 1}{5,5} = 0,1636$

$y_3 = \frac{0,3 \cdot 1}{5,5} = 0,0545$

$y_4 = \frac{1,6 \cdot 1}{5,5} = 0,2909$

$y_5 = \frac{3,9 \cdot 1}{5,5} = 0,7091$

$y_6 = \frac{1,4 \cdot 1}{5,5} = 0,2545$

$y_7 = \frac{0,9 \cdot 1}{5,5} = 0,1636$

$y_8 = \frac{1,6 \cdot 1}{5,5} = 0,2909$

→ Lintang Negatif

· kondisi 2

$D_I = -y_4 \cdot P_2$
$= -0,2909 \cdot 2,4$
$= -0,6982$ kN

· Kondisi 3

$D_I = -y_4 \cdot P_2 - y_4 \cdot P_1$
$= -0,2909 \cdot 2,4 - 0,2909 \cdot 1,2$
$= -1,0472$ kN

· Kondisi 4

$D_I = -y_8 \cdot P_2$
$= -0,2909 \cdot 2,4$
$= -0,6982$ kN

· Kondisi 5

$D_I = -y_8 \cdot P_2 - y_8 \cdot P_1$
$= -0,2909 \cdot 2,4 - 0,2909 \cdot 1,2$
$= -1,0472$ kN

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→ Lintang positif

· kondisi 1

$D_I = y_1 . P_1 + y_3 . P_2$

$= 0,5091 . 1,2 + 0,0545 . 2,9$

$= 0,7417$ kN

· kondisi 2

$D_I = y_3 . P_2$

$= 0,0545 . 2,9$

$= 0,1308$ kN

· kondisi 3

$D_I = y_5 . P_1 + y_6 . P_2$

$= 0,7091 . 1,2 + 0,2545 . 2,9$

$= 1,4617$ kN

· kondisi 4

$D_I = y_7 . P_1$

$= 0,1636 . 1,2$

$= 0,1963$ kN

* D_I Minimum terjadi pada kondisi 3 dan 5, yaitu $D_I = -1,0472$ kN
* D_I Maksimum terjadi pada kondisi 3, yaitu $D_I = 1,4617$ kN

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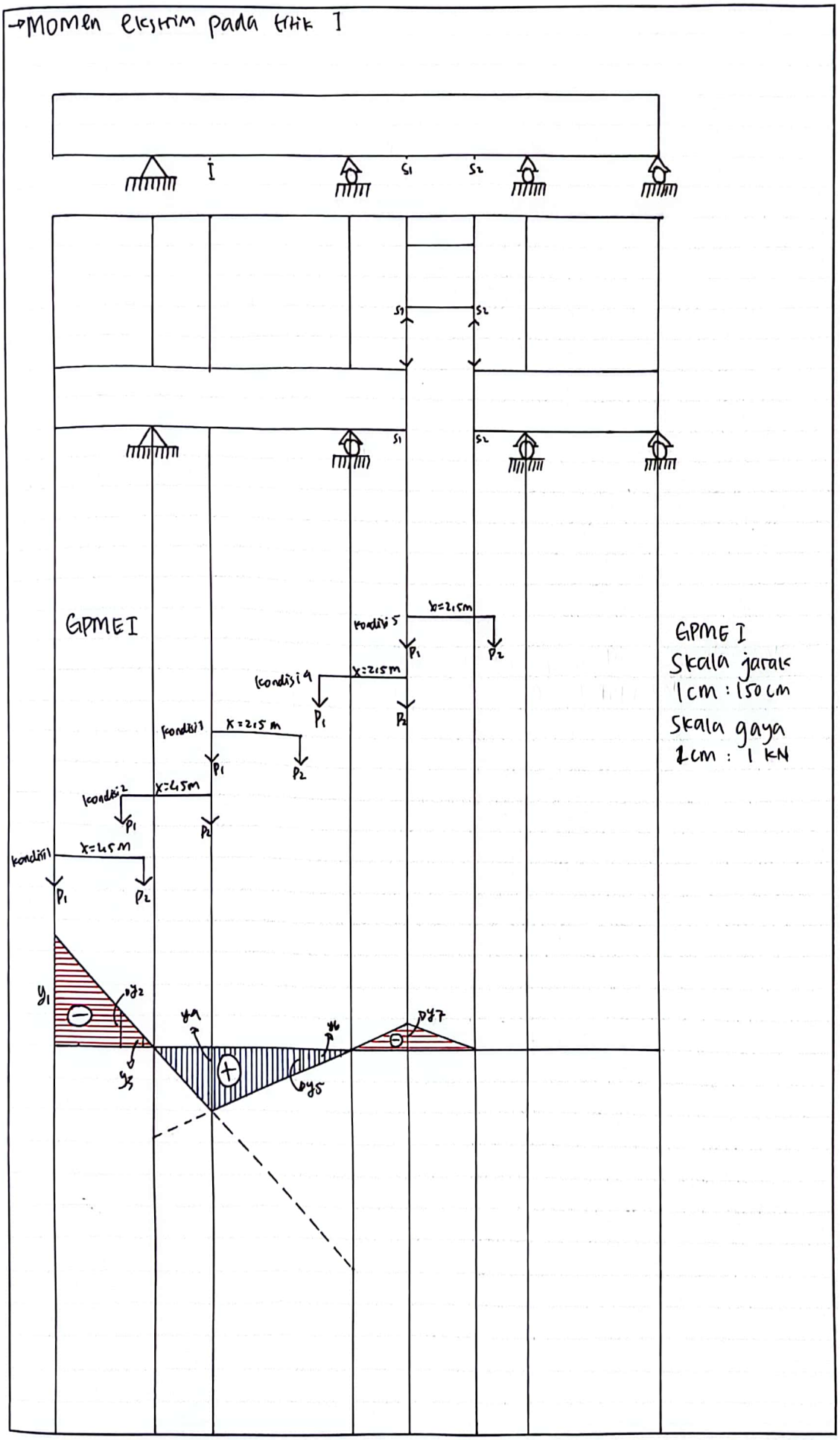
-> Momen elastrim pada titik I



GPME I
Skala jarak
1 cm : 150 cm
Skala gaya
1 cm : 1 KN

GALIH ABIE SADEWA
2315011042

$y_1 = \frac{2,8 \cdot 3,9}{5,5} = 1,9855$

$y_2 = \frac{0,9 \cdot 3,9}{5,5} = 0,6382$

$y_3 = \frac{0,3 \cdot 3,9}{5,5} = 0,2127$

$y_4 = \frac{1,6 \cdot 3,9}{5,5} = 1,1345$

$y_5 = \frac{1,4 \cdot 1,6}{5,5} = 0,4073$

$y_6 = \frac{0,9 \cdot 1,6}{5,5} = 0,2618$

$y_7 = \frac{1,6 \cdot 1,6}{5,5} = 0,4655$

→ Momen negatif

- kondisi 1

$M_I = -y_1 \cdot P_1 - y_3 \cdot P_2$
$= -1,9855 \cdot 1,2 - 0,2127 \cdot 2,9$
$= -2,8925$ KN.m

- kondisi 2

$M_I = -y_2 \cdot P_1$
$= -0,6382 \cdot 1,2$
$= -0,7658$ KN.m

- kondisi 4

$M_I = -y_7 \cdot P_2$
$= -0,4655 \cdot 2,9$
$= -1,1172$ KN.m

- kondisi 5

$M_I = -y_7 \cdot P_1$
$= -0,4655 \cdot 1,2$
$= -0,5586$ KN.m

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→ Momen Positif

· kondisi 2

$M_1 = y_4 \cdot P_2$

$= 1,1345 \cdot 2,9$

$= 2,7228$ kN.m

· kondisi 3

$M_1 = y_4 \cdot P_1 + y_5 \cdot P_2$

$= 1,1345 \cdot 1,2 + 0,4073 \cdot 2,9$

$= 2,3389$ kN.m

· kondisi 4

$M_1 = y_6 \cdot P_1$

$= 0,2618 \cdot 1,2$

$= 0,3142$ kN.m

* M_1 minimum terjadi pada kondisi 1, yaitu $M_1 = -2,8925$ kN.m
* M_1 maksimum terjadi pada kondisi 2, yaitu $M_1 = 2,7228$ kN.m

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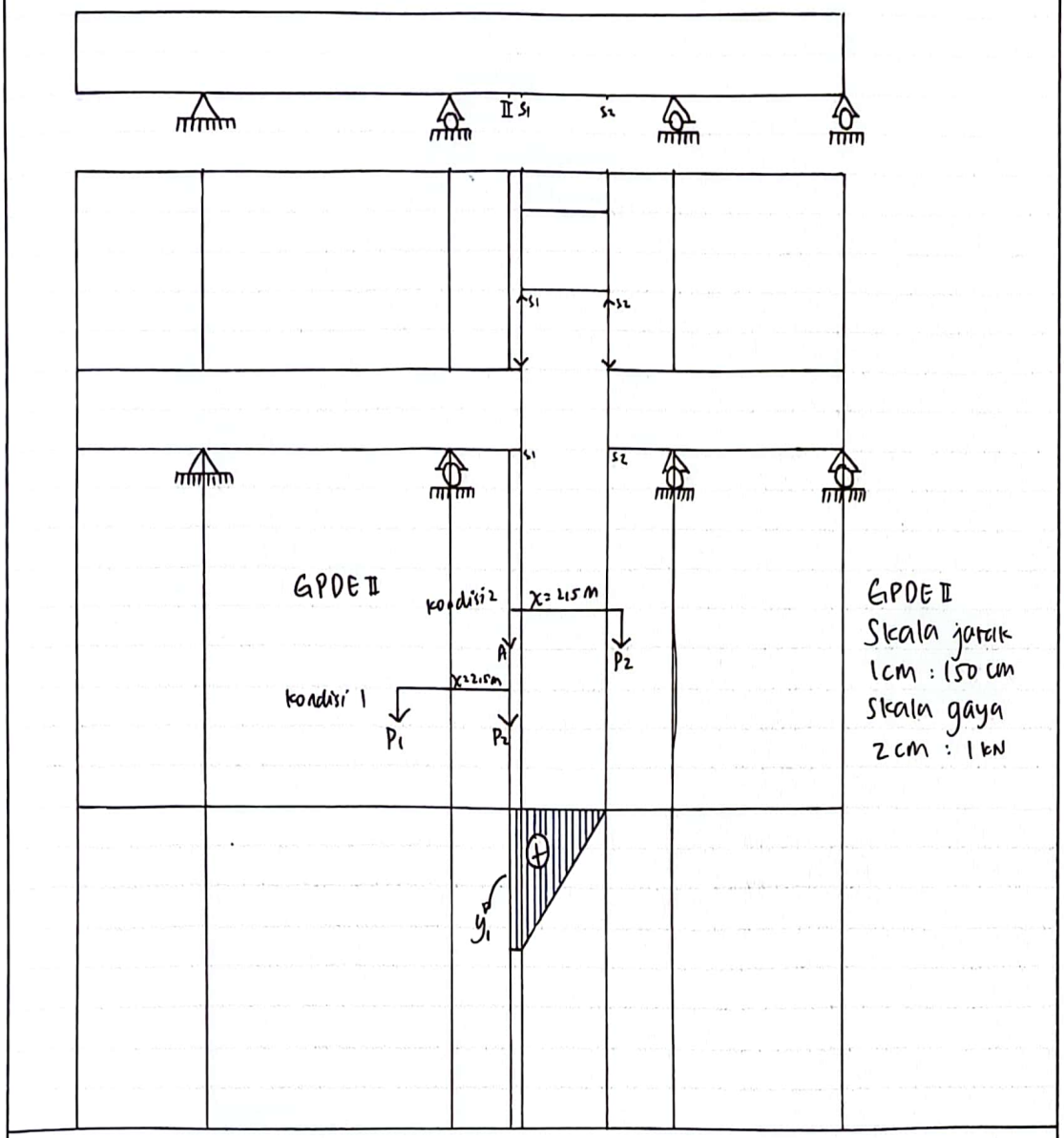
→ Lintang ekstrim pada titik II



y_1 = 1 kN

→ Lintang Positif

· Kondisi 1

D_{II} = $y_1 . P_2$

= 1 . 2,9

= 2,9 kN

· Kondisi 2

D_{II} = $y_1 . P_1$

= 1 . 1,2

= 1,2 kN

* D_{II} Minimum terjadi Pada kondisi 2, yaitu D_{II} = 1,2 kN
* D_{II} Maksimum terjadi Pada kondisi 1, yaitu D_{II} = 2,9 kN

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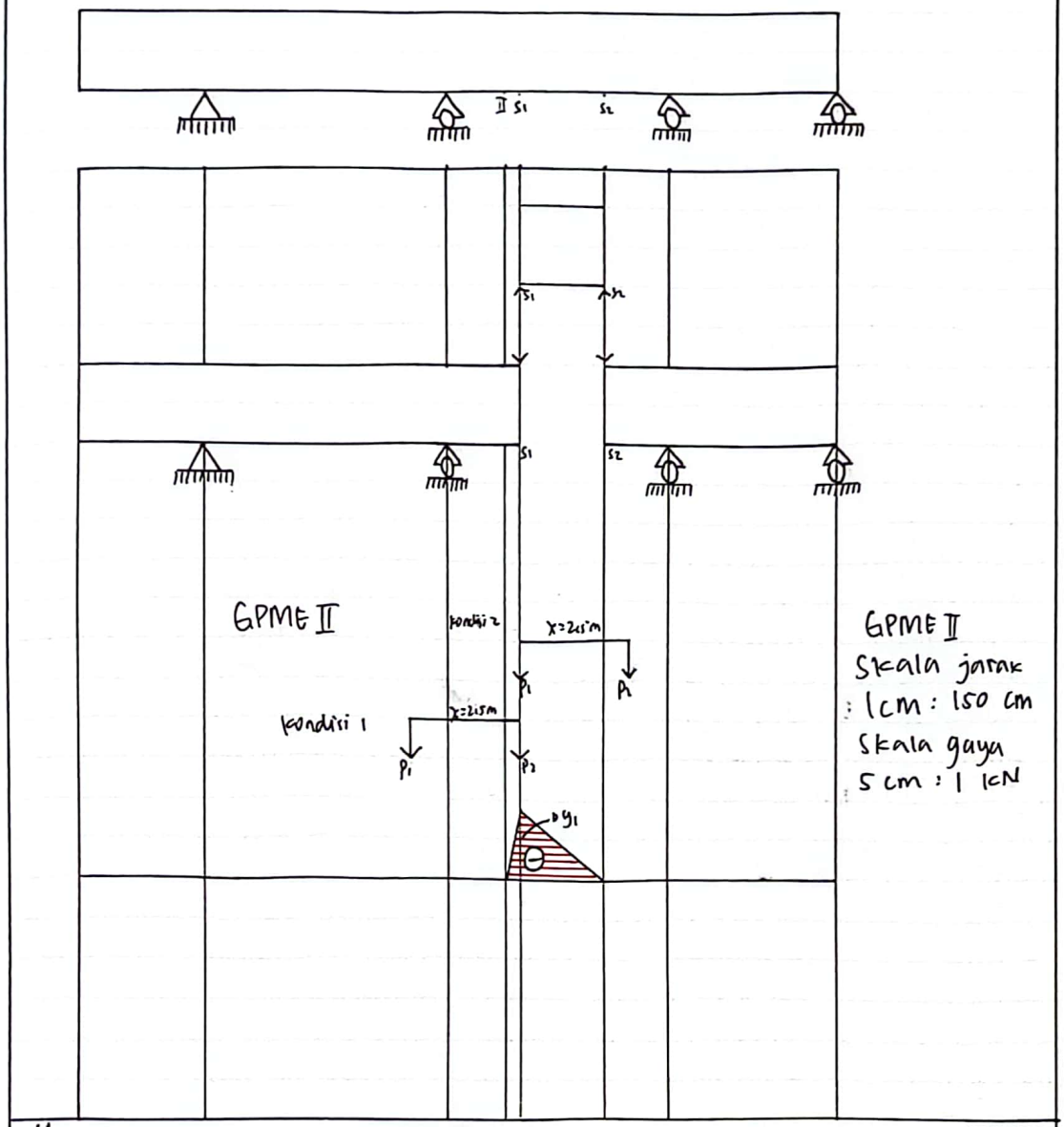
— Momen ekstrim pada titik II



$y_1 = 0,2$

— Momen negatif

· kondisi 1

$M_{II} = -y_1 . P_2$

$= -0,2 . 2,4$

$= -0,48$ kN.m

· kondisi 2

$M_{II} = -y_1 . P_1$

$= -0,2 . 1,2$

$= -0,24$ kN.m

* M_{II} Minimum terjadi pada kondisi 1, yaitu $M_{II} = -0,48$ kN.m
* M_{II} Maksimum terjadi pada kondisi 2, yaitu $M_{II} = -0,24$ kN.m

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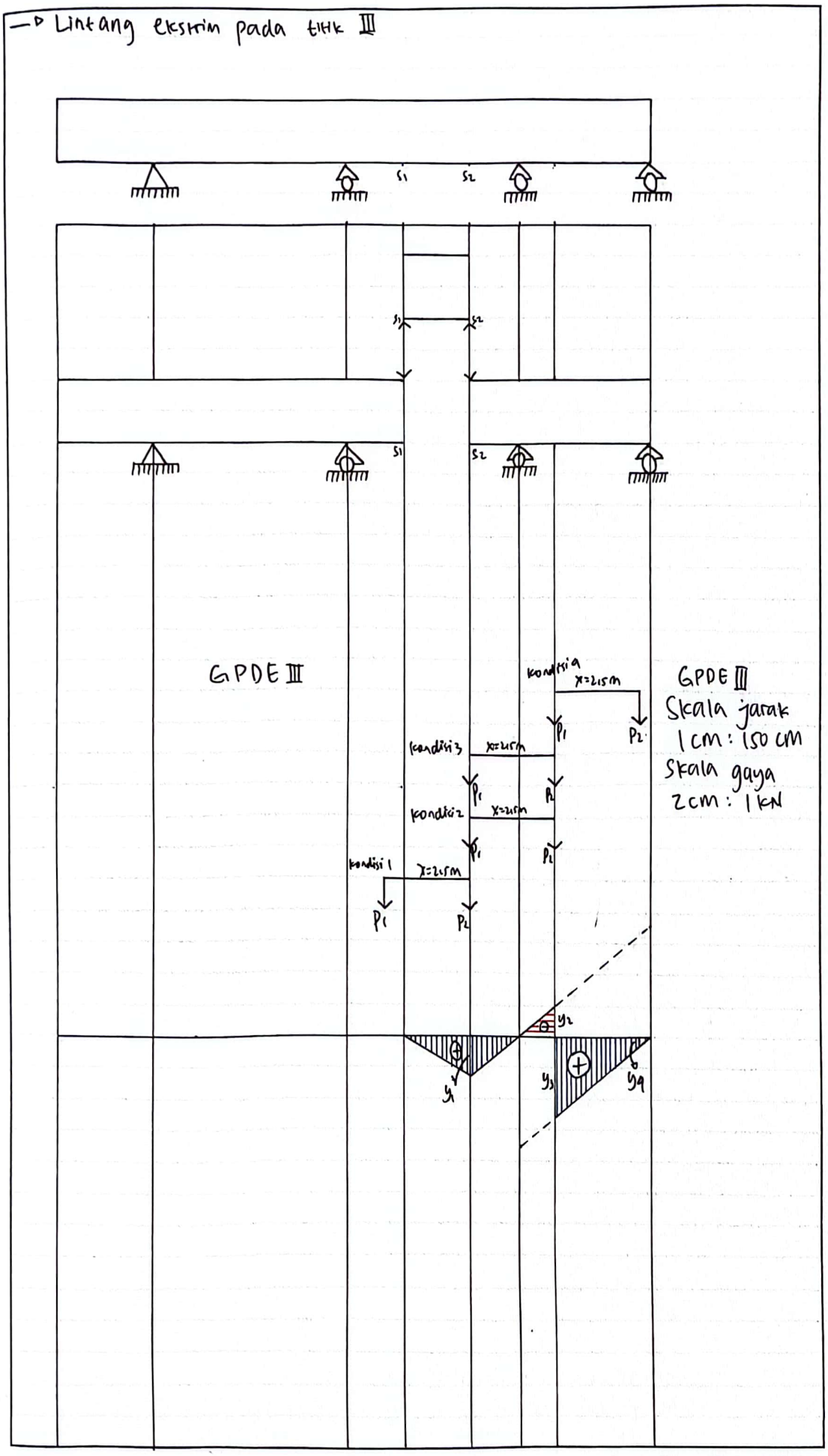
— Lintang ekstrim pada titik III



GALIH ABIE SADEWA
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$y_1 = \frac{1,5 \cdot 1}{4,1} = 0,3659$

$y_2 = \frac{1 \cdot 1}{4,1} = 0,2439$

$y_3 = \frac{3,1 \cdot 1}{4,1} = 0,7561$

$y_4 = \frac{0,6 \cdot 1}{4,1} = 0,1463$

→ Lintang negatif

· kondisi 2

$D_{III} = -y_2 \cdot P_2$
$= -0,2439 \cdot 2,4$
$= -0,5854$ kN

· kondisi 3

$D_{III} = -y_2 \cdot P_2$
$= -0,2439 \cdot 2,4$
$= -0,5854$ kN

· kondisi 4

$D_{III} = -y_2 \cdot P_1$
$= -0,2439 \cdot 1,2$
$= -0,2927$ kN

→ Lintang positif

· kondisi 1

$D_{III} = y_1 \cdot P_2$
$= 0,3659 \cdot 2,4$
$= 0,8782$ kN

· kondisi 2

$D_{III} = y_1 \cdot P_1$
$= 0,3659 \cdot 1,2$
$= 0,4391$ kN

· kondisi 3

$D_{III} = y_1 \cdot P_1$
$= 0,3659 \cdot 1,2$
$= 0,4391$ kN

· kondisi 4

$D_{III} = y_3 \cdot P_1 + y_4 \cdot P_2 = 0,7561 \cdot 1,2 + 0,1463 \cdot 2,4 = 1,2584$ kN

* D_{III} minimum terjadi pada kondisi 2 dan 3, yaitu $D_{III} = -0,5854$

* D_{III} maksimum terjadi pada kondisi 4, yaitu $D_{III} = 1,2584$ kN

GALIH ABIE SADEWA
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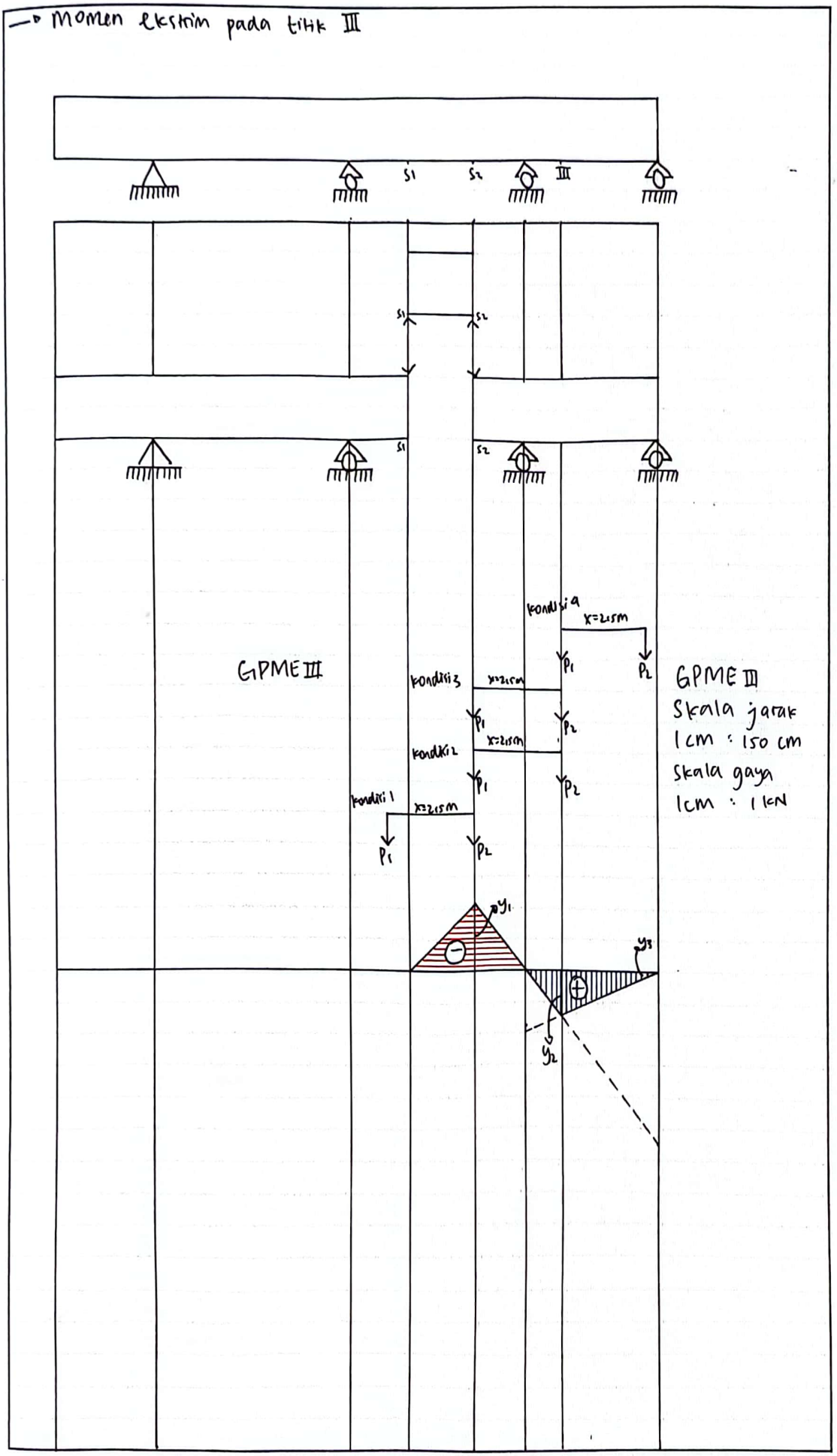
→ Momen ekstrim pada titik III



GALIH ABIE SADEWA
2315011042

$y_1 = \frac{1{,}5 \cdot 3{,}1}{4{,}1} = 1{,}1341$

$y_2 = \frac{1 \cdot 3{,}1}{4{,}1} = 0{,}7561$

$y_3 = \frac{0{,}6 \cdot 1}{4{,}1} = 0{,}1463$

→ Momen negatif

- kondisi 1

$M_{III} = -y_1 \cdot P_2$
$= -1{,}1341 \cdot 2{,}9$
$= -2{,}7218$ KN.m

- kondisi 2

$M_{III} = -y_1 \cdot P_1$
$= -1{,}1341 \cdot 1{,}2$
$= -1{,}3609$ KN.m

- kondisi 3

$M_{III} = -y_1 \cdot P_1$
$= -1{,}1341 \cdot 1{,}2$
$= -1{,}3609$ KN.m

→ Momen positif

- kondisi 2

$M_{III} = y_2 \cdot P_2$
$= 0{,}7561 \cdot 2{,}9$
$= 1{,}8196$ KN.m

- kondisi 3

$M_{III} = y_2 \cdot P_2$
$= 0{,}7561 \cdot 2{,}9$
$= 1{,}8196$ KN.m

- kondisi 4

$M_{III} = y_2 \cdot P_1 + y_3 \cdot P_2$
$= 0{,}7561 \cdot 1{,}2 + 0{,}1463 \cdot 2{,}9$
$= 1{,}2584$ KN.m

* M_{III} minimum terjadi pada kondisi 1, yaitu $M_{III} = -2{,}7218$ KN.m
* M_{III} maksimum terjadi pada kondisi 2 dan 3, yaitu $M_{III} = 1{,}8196$ KN.m

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