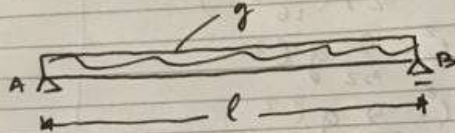


STATIKA

NAMA _____
NIM _____
JURUSAN _____
TANGGAL _____
TD. TANGAN _____

SMT _____

Contoh soal
→ Beban merata



Ditanya

- Hitung reaksi perletakan di A dan B
- Gbr bidang Momen dan Lintang
- Tentukan momen maksimumnya.

Jawab
langkah-langkah penyelesaian:

- 1) Tentukan statis tertentu dan tak tentu dari struktur balok diatas

$$SE = n - 3$$

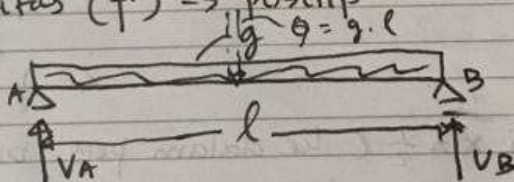
dimana

$$n = 3 \text{ (2 sendi dan 1 roll)}$$

Jadi

$$SE = 3 - 3 = 0 \rightarrow (st)$$

- 2) Hitung reaksi perletakan di A dan B, di misalkan Reaksi di A (V_A) dan di B (V_B) ke atas (+) → positif



Kemudian kita EM kan ke salah satu titik (A atau B). Sekarang kita mulai ke titik B

$$\sum M_B = 0$$

$$+V_A(l) - Q(1/2l) = 0$$

$$= 1/2 q \cdot l \left. \begin{aligned} V_A &= \frac{Q \cdot 1/2 l}{l} \\ &= +1/2 q l (+) \end{aligned} \right\}$$

$$\sum M_A = 0$$

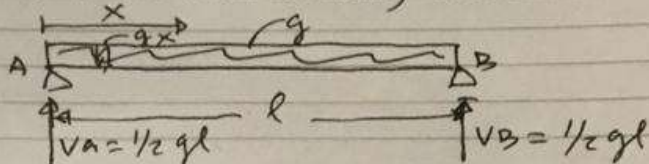
$$-V_B(l) + Q(1/2l) = 0$$

$$V_B = \frac{Q \cdot 1/2 l}{l} = 1/2 Q = +1/2 q \cdot l (+)$$

dimana:
 $Q = q \cdot l$

\Rightarrow Check: $\Sigma V = 0$
 $+V_A - \phi + V_B = 0$
 $+1/2 ql - ql + 1/2 ql = 0$
 $0 = 0 \dots OK$

3) Buat Persamaan Bidang Momen dan Lintang



lihat Free Body sebelah kiri
 $0 \leq x \leq l$

* Momen

$$M_x = +V_A(x) - qx \left(\frac{1}{2}x\right)$$

$$= +V_A(x) - \frac{1}{2}qx^2$$

$$x=0 \rightarrow M=0$$

$$x = \frac{1}{4}l \rightarrow M = +\frac{1}{2}ql\left(\frac{1}{4}l\right) - \frac{1}{2}q\left(\frac{1}{4}l\right)^2$$

$$= \frac{1}{8}ql^2 - \frac{1}{32}ql^2$$

$$= \frac{4}{32}ql^2 - \frac{1}{32}ql^2$$

$$= +\frac{3}{32}ql^2$$

$$x = \frac{1}{2}l \rightarrow M = \frac{1}{2}ql\left(\frac{1}{2}l\right) - \frac{1}{2}q\left(\frac{1}{2}l\right)^2$$

$$= \frac{1}{4}ql^2 - \frac{1}{8}ql^2$$

$$= \frac{2}{8}ql^2 - \frac{1}{8}ql^2$$

$$= +\frac{1}{8}ql^2$$

Lintang

$$\frac{dM_x}{dx} = L_x = +V_A - qx$$

$$= +\frac{1}{2}ql - qx$$

$$x=0 \rightarrow L = +\frac{1}{2}ql$$

$$x = \frac{1}{4}l \rightarrow L = +\frac{1}{2}ql - q\left(\frac{1}{4}l\right)$$

$$= +\frac{1}{2}ql - \frac{1}{4}ql$$

$$= \frac{2}{4}ql - \frac{1}{4}ql$$

$$= +\frac{1}{4}ql$$

$$x = \frac{1}{2}l \rightarrow L = +\frac{1}{2}ql - q\left(\frac{1}{2}l\right)$$

$$= +\frac{1}{2}ql - \frac{1}{2}ql$$

$$= 0$$

3

Momen

$$\begin{aligned}
 x = \frac{3}{4}l \rightarrow M &= \frac{1}{2}q\left(\frac{3}{4}l\right) - \frac{1}{2}q\left(\frac{3}{4}l\right)^2 \\
 &= \frac{3}{8}ql - \frac{1}{2}q\left(\frac{9}{16}l^2\right) \\
 &= \frac{3}{8}ql - \frac{9}{32}ql^2 \\
 &= \frac{12}{32}ql - \frac{9}{32}ql^2 \\
 &= +\frac{3}{32}ql^2 \\
 x = l \rightarrow M &= \frac{1}{2}ql(l) - \frac{1}{2}q(l)^2 \\
 &= \frac{1}{2}ql^2 - \frac{1}{2}ql^2 \\
 &= 0
 \end{aligned}$$

→ Menentukan besarnya Momen Maksimum

Ditentukan dari persamaan Bidang Momen dan diturunkan

$$\begin{aligned}
 M(x) &= +\frac{1}{2}qx^2 - \frac{1}{2}qx^2 \\
 \frac{dM(x)}{dx} &= 0 \\
 +\frac{1}{2}q(2x) - qx &= 0 \\
 x &= \frac{\frac{q}{2}}{q} \\
 x &= \frac{1}{2}l
 \end{aligned}$$

Masukkan nilai $x = \frac{1}{2}l$ ke dalam pers. bidang Momen jadi:

$$\begin{aligned}
 M_{max} &= +\frac{1}{2}q\left(\frac{1}{2}l\right) - \frac{1}{2}q\left(\frac{1}{2}l\right)^2 \\
 &= +\frac{1}{4}ql^2 - \frac{1}{8}ql^2 \\
 &= +\frac{2}{8}ql^2 - \frac{1}{8}ql^2 \\
 &= +\frac{1}{8}ql^2
 \end{aligned}$$

Lintang

$$\begin{aligned}
 x = \frac{3}{4}l \rightarrow L &= +\frac{1}{2}ql - q\left(\frac{3}{4}l\right) \\
 &= +\frac{2}{4}ql - \frac{3}{4}ql \\
 &= -\frac{1}{4}ql \\
 x = l \rightarrow L &= +\frac{1}{2}ql - ql \\
 &= +\frac{1}{2}ql - ql \\
 &= -\frac{1}{2}ql
 \end{aligned}$$

4) Gambar Bidang Momen dan Lintang

