

Exercise walk-through

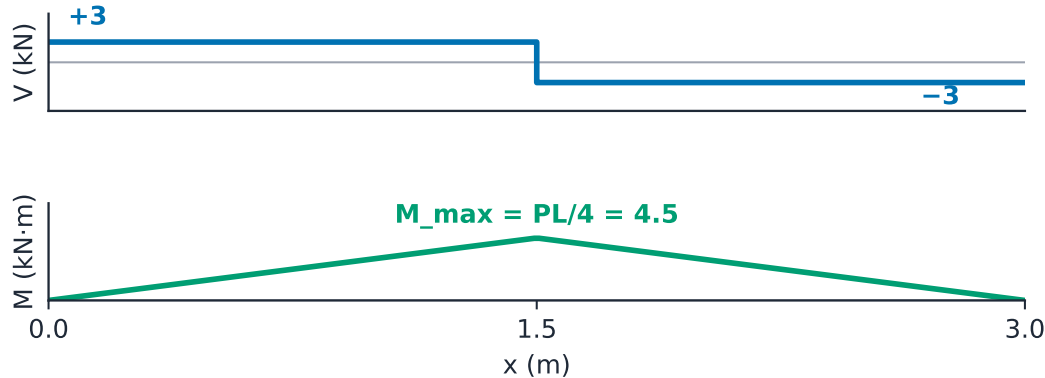
6.3

Shear and bending

University Mechanical Engineering

Shear and bending: the diagrams

central load: $P = 6 \text{ kN}$ on a 3 m span, reactions 3 kN each



Central $P = 6 \text{ kN}$ on 3 m : reactions 3 kN , V steps $+3 \rightarrow -3 \text{ kN}$, $M_{\max} = PL/4 = 4.5 \text{ kN}\cdot\text{m}$. Uniform $w = 2 \text{ kN/m}$: $M_{\max} = wL^2/8 = 2.25 \text{ kN}\cdot\text{m}$.

Exercises 2.1·2.2

2.1 A simply supported span of $L = 5$ m carries a central point load $P = 10$ kN: the support reactions and the maximum bending moment (one decimal, kN · m). [3]

2.2 A simply supported span of $L = 4$ m carries a uniform load $w = 3$ kN/m over the whole span: the support reactions, the maximum shear force and the maximum bending moment (one decimal, kN · m). [4]

Exercises 2.1-2.2

2.1 A simply supported span of $L = 5$ m carries a central point load $P = 10$ kN: the support reactions and the maximum bending moment (one decimal, kN · m). [3]

2.1

- Symmetric span: $R = P/2 = \mathbf{5}$ kN each.
- $M_{max} = PL/4 = 10 \times 5/4 = \mathbf{12.5}$ kN · m at mid-span.

2.2 A simply supported span of $L = 4$ m carries a uniform load $w = 3$ kN/m over the whole span: the support reactions, the maximum shear force and the maximum bending moment (one decimal, kN · m). [4]

2.2

- $R = wL/2 = 3 \times 4/2 = \mathbf{6}$ kN each.
- $V_{max} = \mathbf{6}$ kN at the supports.
- $M_{max} = wL^2/8 = 3 \times 16/8 = \mathbf{6.0}$ kN · m at mid-span.

Exercises 2.3-2.4

2.3 For the beam of 2.2: where does the bending moment peak, and what are the two differential relations that connect load, shear and moment? [4]

2.4 One sentence each: what does a hinge do to the bending moment diagram, and why does a kink in the moment diagram mean a point load acts there? [3]

Exercises 2.3-2.4

2.3 For the beam of 2.2: where does the bending moment peak, and what are the two differential relations that connect load, shear and moment? [4]

2.3

- It peaks at mid-span, where the shear diagram crosses zero.
- $dV/dx = -w(x)$ - the load intensity tilts the shear diagram.
- $dM/dx = V$ - the shear is the slope of the moment diagram.

2.4 One sentence each: what does a hinge do to the bending moment diagram, and why does a kink in the moment diagram mean a point load acts there? [3]

2.4

- A hinge carries no moment: $M = 0$ at the hinge pin.
- A kink means the moment slope changes abruptly, and $dM/dx = V$ - a step in V , i.e. a point load.