The Structural Behaviour Examination

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The Institution of Structural Engineers

Key Drivers

- Graduate competence in understanding structural behaviour
- BEng graduates want CM status, but TR hurdle
- AM pass rate 80%
- AM plus success in SBE leads to CM route
- Early professional qualification
- No TR or MSc needed

Formative Assessment and Feedback

- Randomly-generated online test for any member of IStructE to practise
- Covers basic statics
- Reasons for wrong answers flagged
- Could be used by universities and companies
- Will go live before end of 2013
- Will monitor test results to gauge levels
- Questions grouped by topic, and also by time

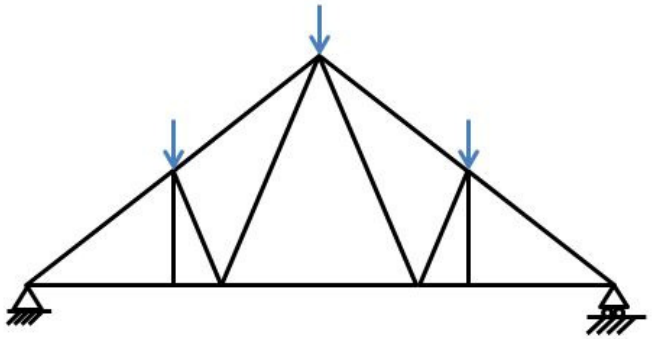
Structural Behaviour Examination

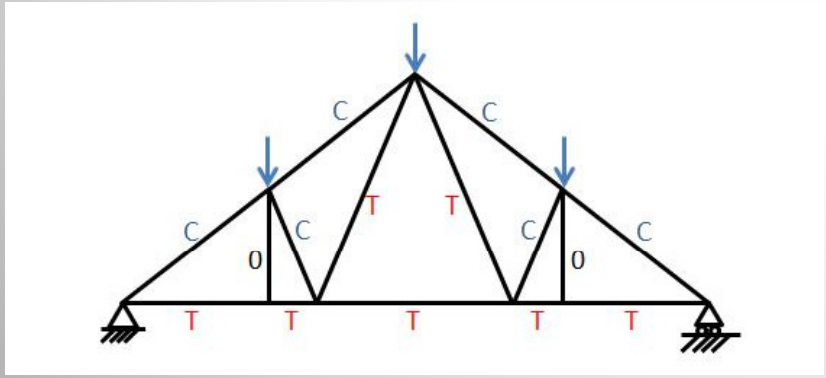
- Multiple-choice test
- Probably two hours
- Online
- Completed under invigilation
- Probably around 15 questions (new each time)
- Pass mark yet to be determined
- Will receive certificate

Database of 200+ Questions

- Trusses – qualitative
- Trusses – quantitative
- Beams – qualitative BM & SF diagrams (incl deflected shapes)
- Beams – quantitative BM & SF diagrams (incl approximation)
- Portals – qualitative BM diagrams (incl deflected shapes)
- Portals – quantitative BM diagrams (incl approximation)
- Plasticity
- Stiffness
- Cables and arches
- Dynamics

Examples




C
C
C
C
T
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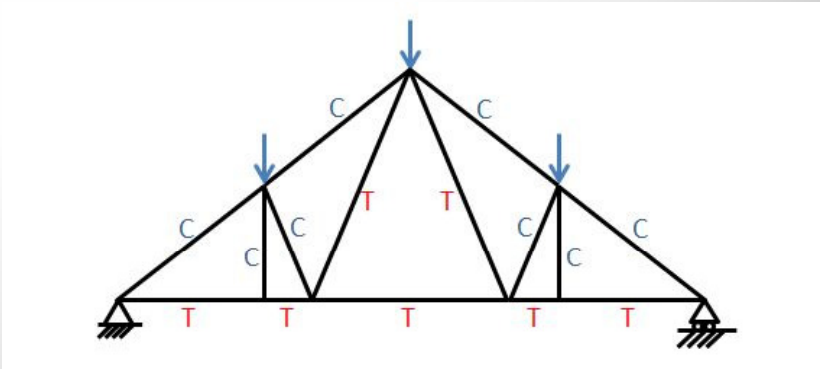
T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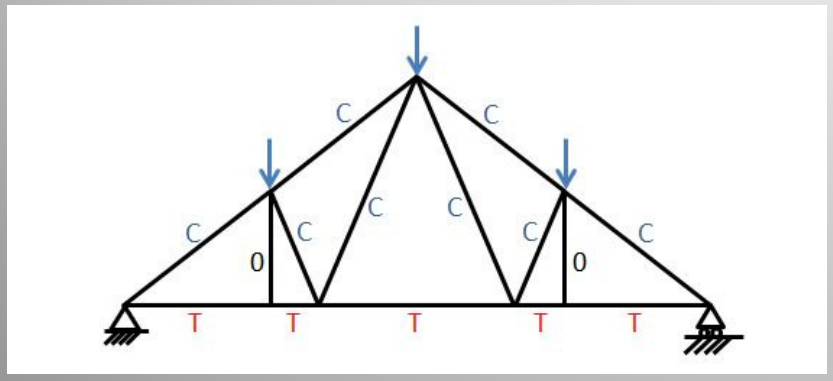
C
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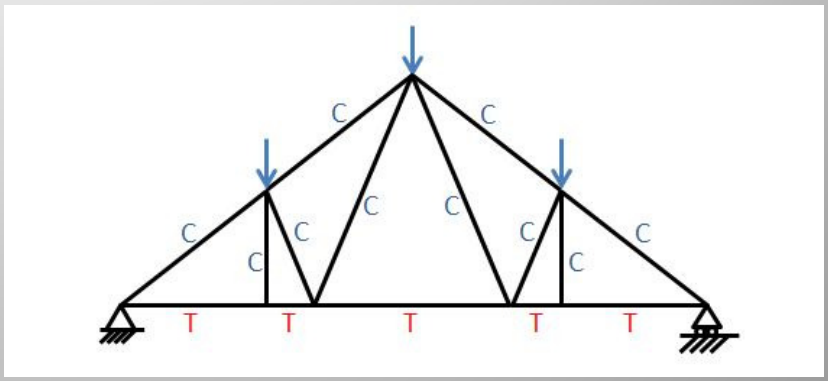
C
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T
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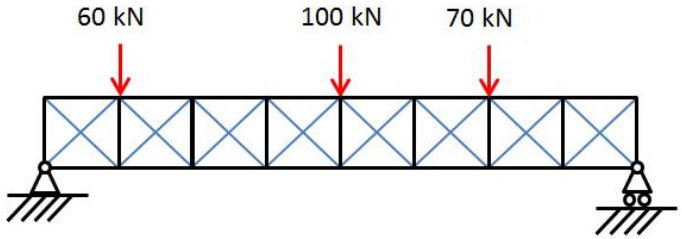
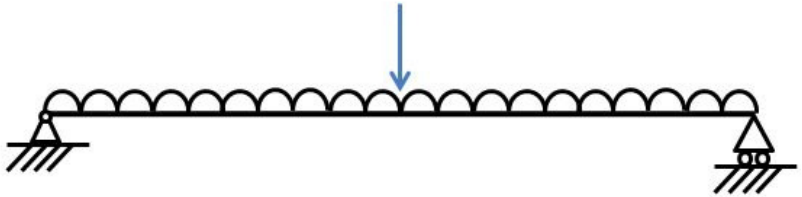
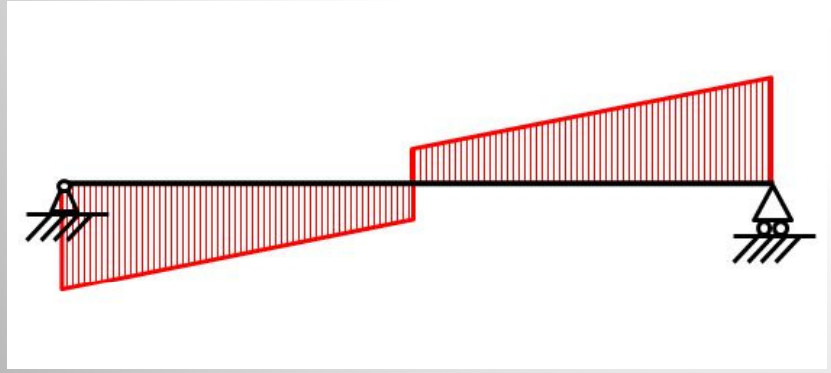
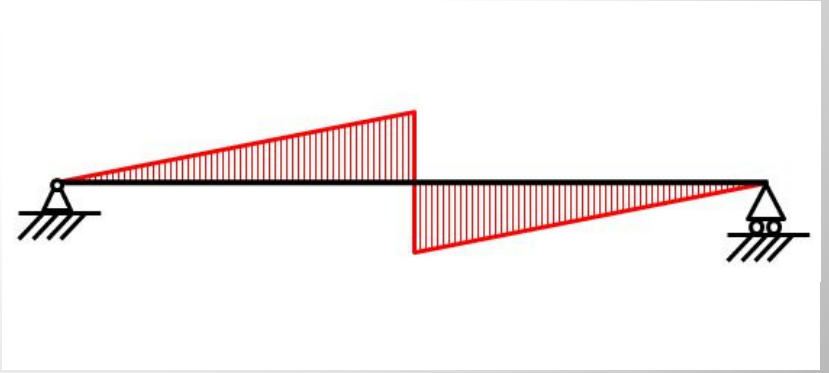
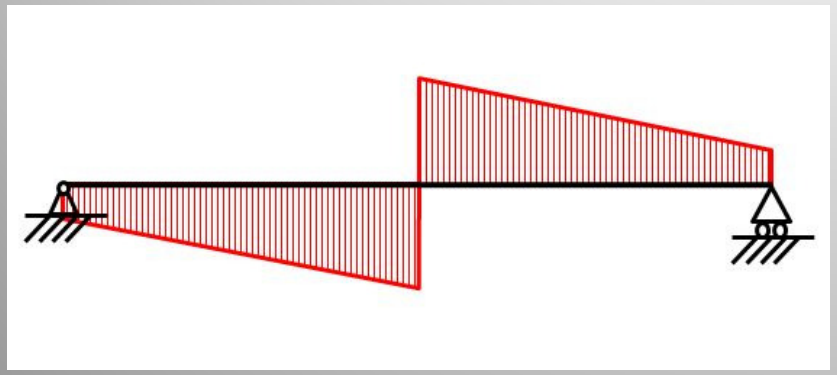


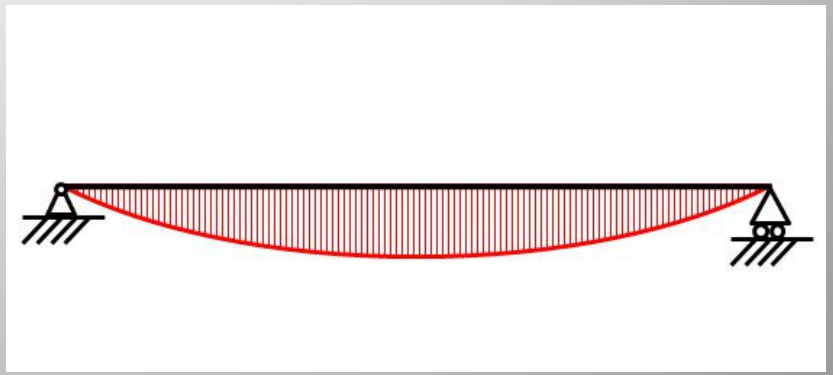
Maximum force in any member if diagonals are wires, unable to carry compression?

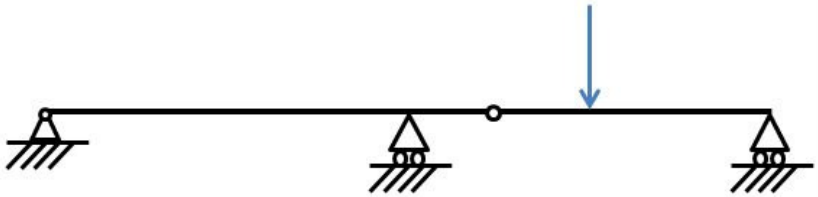


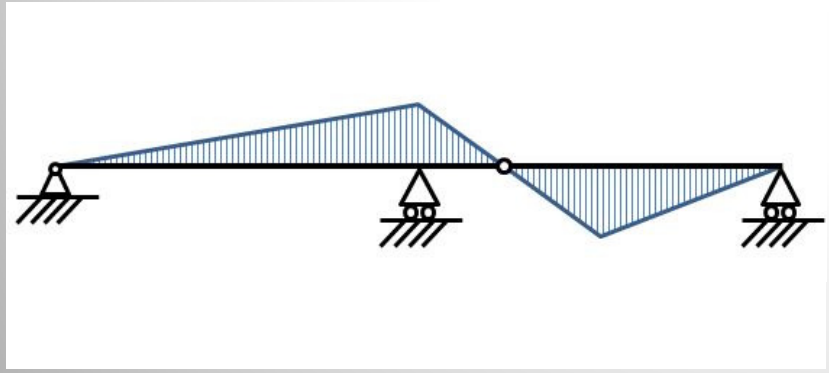


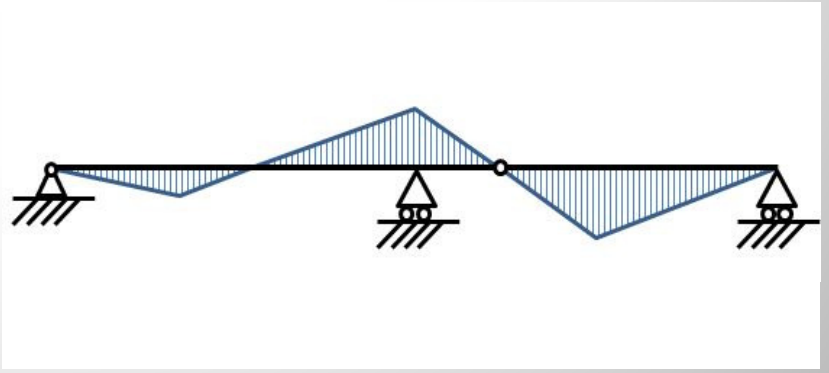


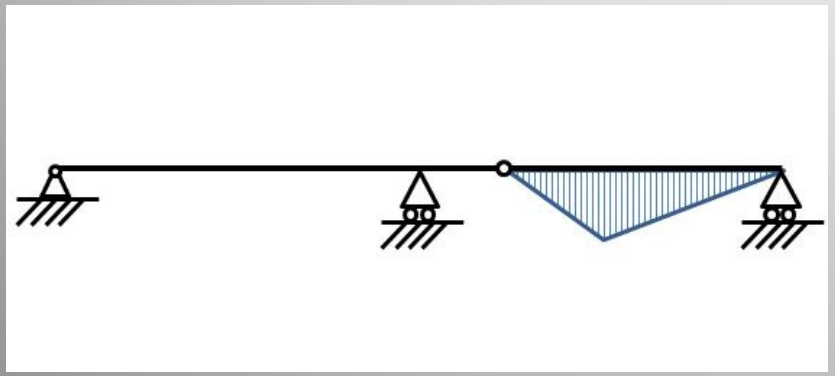


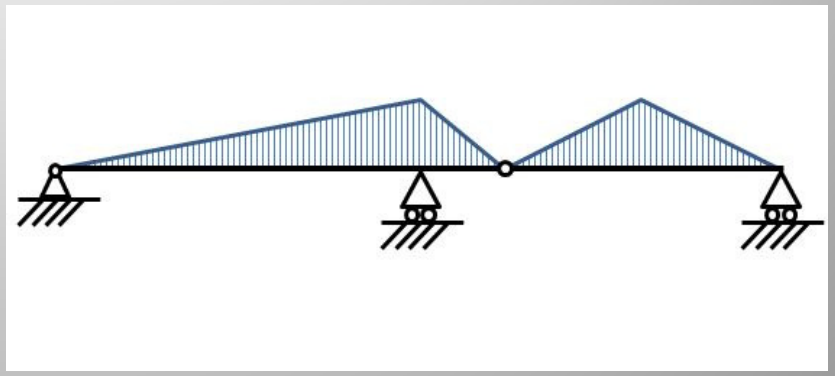






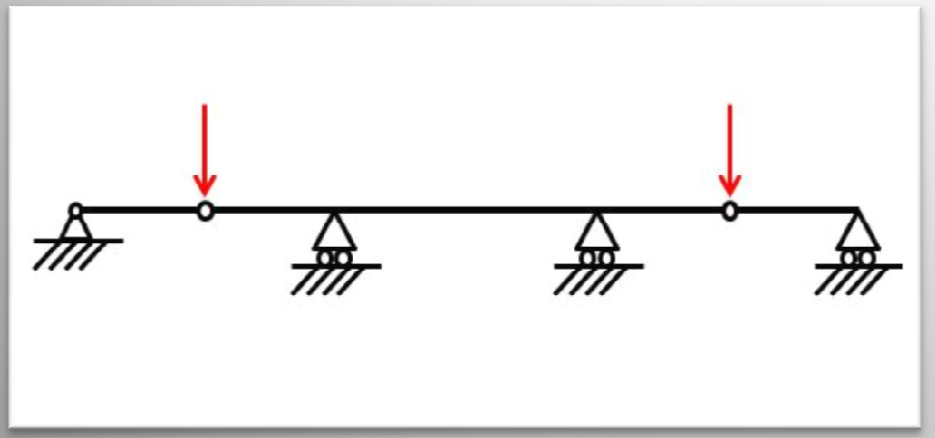






Sample feedback

Identify the correct deflected shape for the load case shown. Ignore self-weight.



a.

b.

c.

d.

a.

b.

c.

d.

Correct!

a.

b.

c.

d.

Due to the fact that they do not have an external load on them and have pins at either end, the outer spans rotate but remain straight.

a.

b.

c.

d.

The middle span would require a point load pushing down on it to deflect like this.

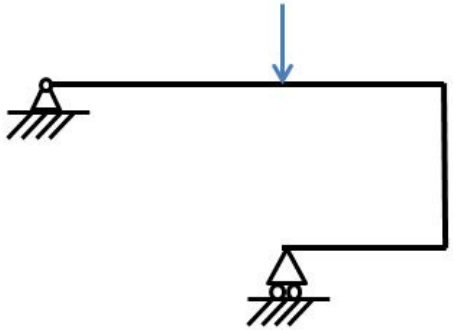
a.

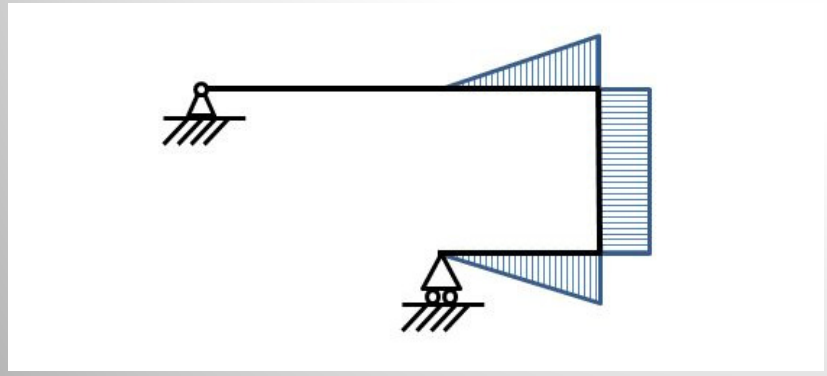
b.

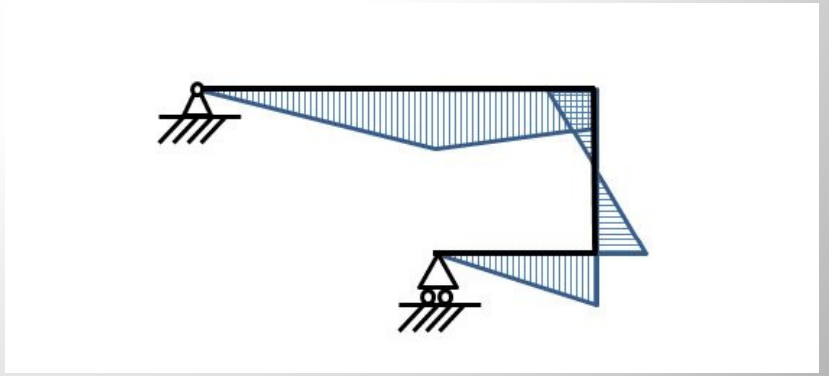
c.

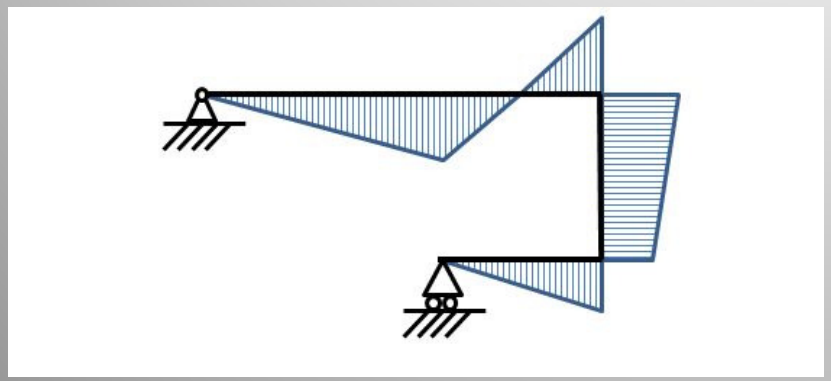
d.

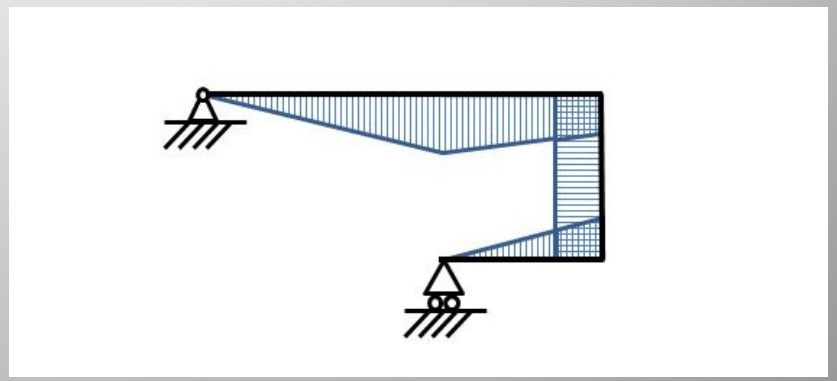
The middle span would require a point load pushing down on it to deflect like this. And due to the fact that they do not have an external load on them and have pins at either end, the outer spans rotate but remain straight.

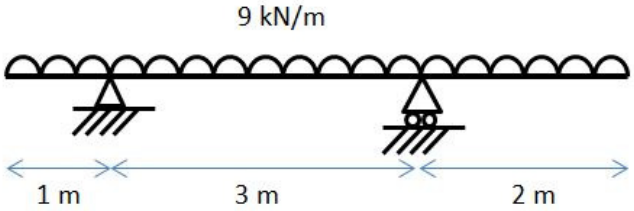


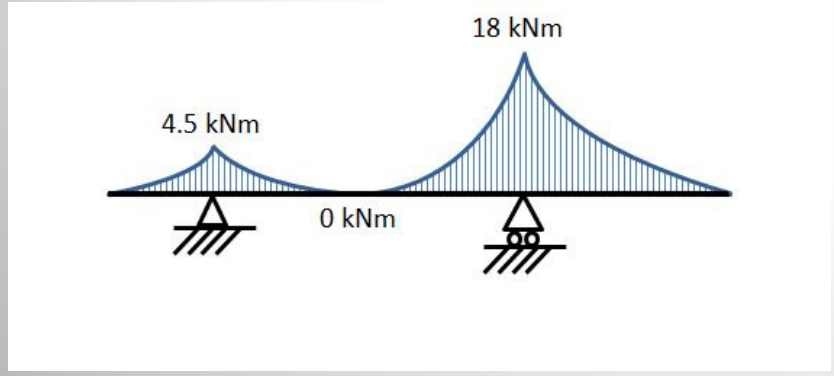


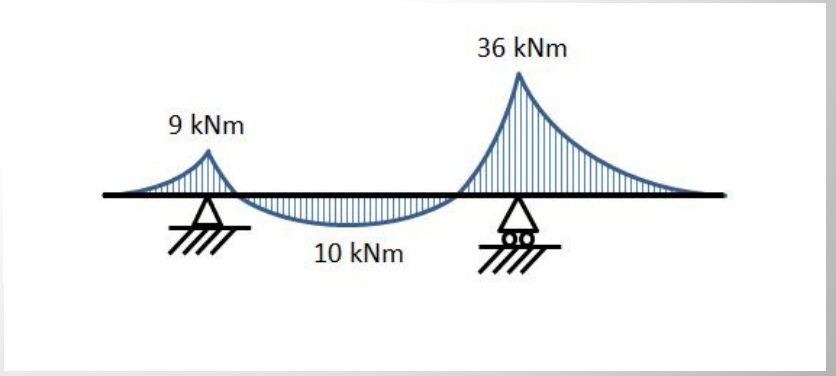


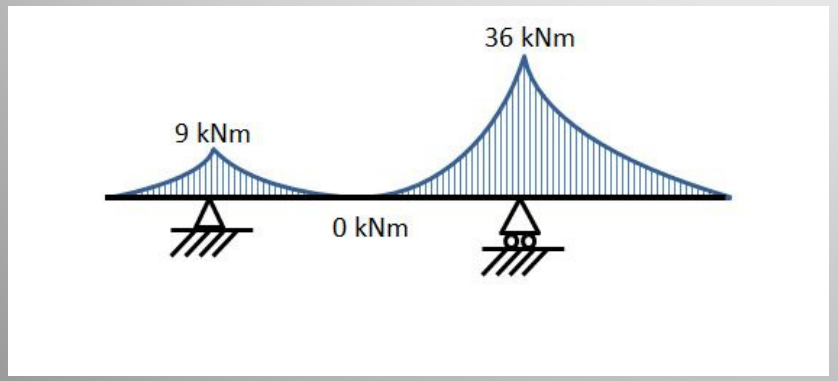


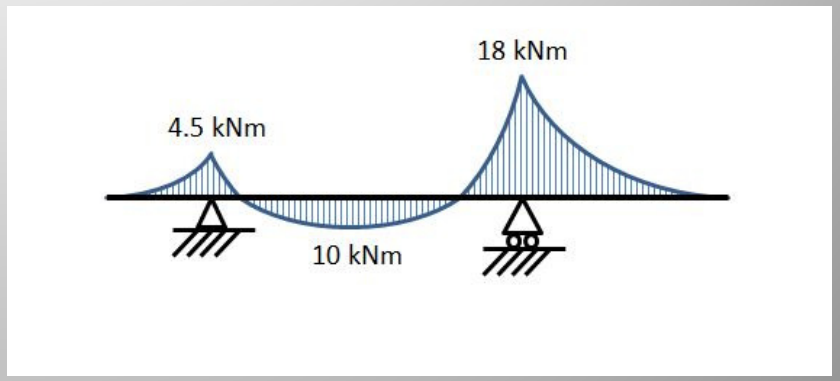


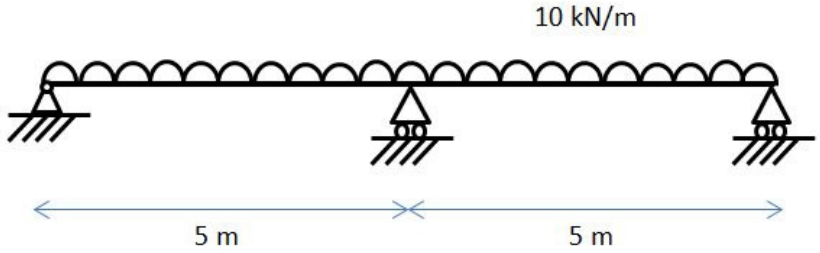

9 kN/m
1 m
3 m
2 m

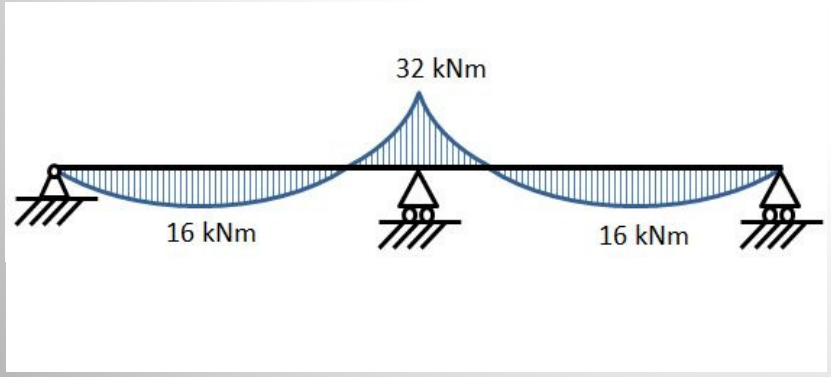

18 kNm
4.5 kNm
0 kNm

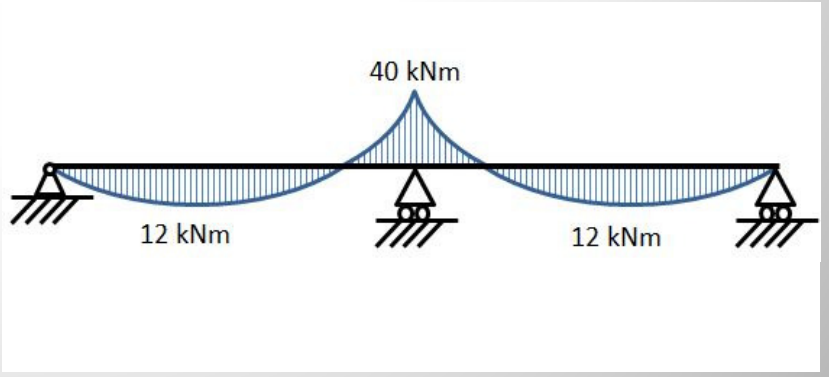

36 kNm
9 kNm
10 kNm

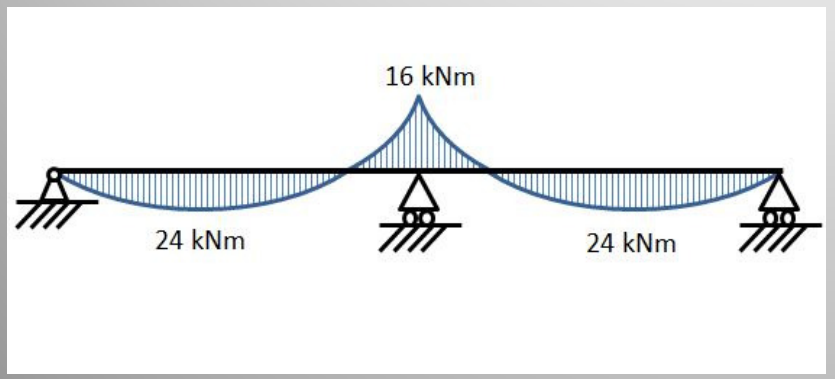

36 kNm
9 kNm
0 kNm

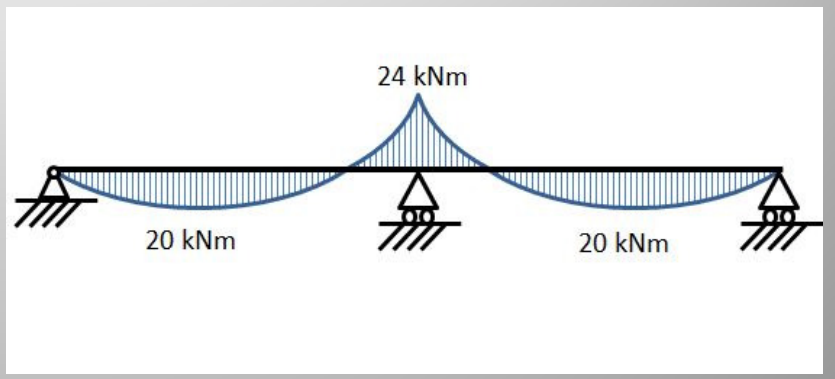

18 kNm
4.5 kNm
10 kNm

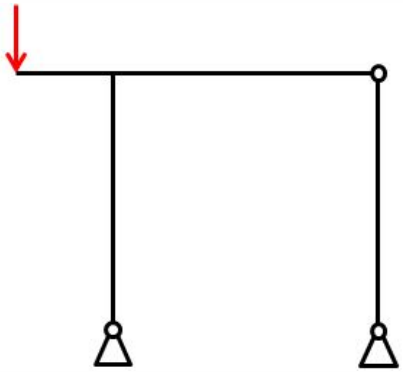

10 kN/m
5 m
5 m

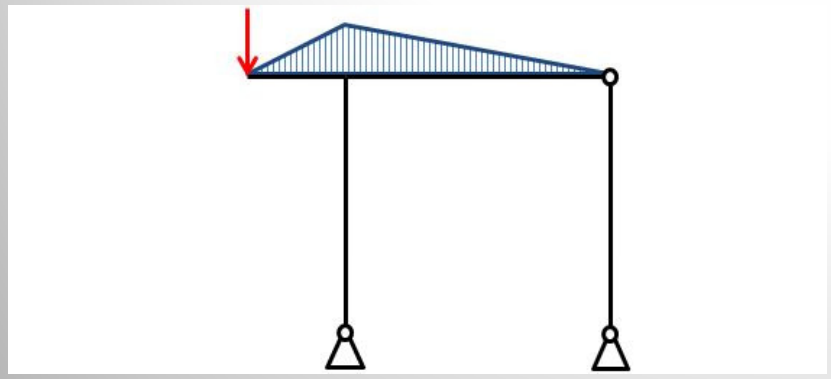

32 kNm
16 kNm
16 kNm

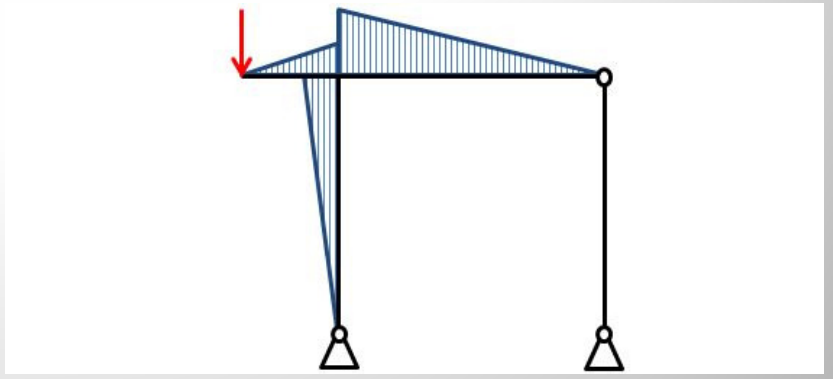

40 kNm
12 kNm
12 kNm

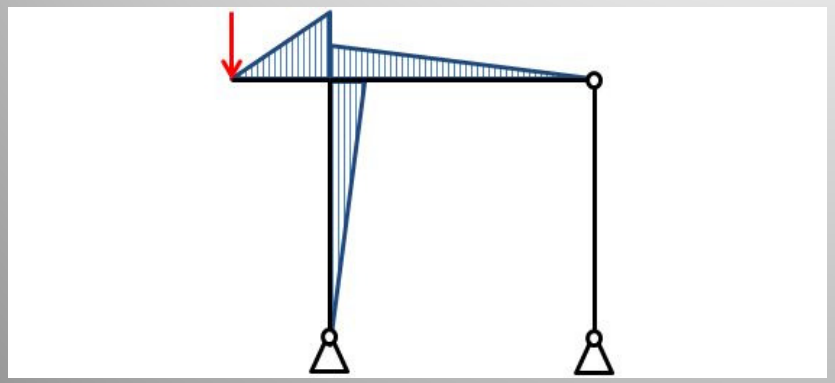

16 kNm
24 kNm
24 kNm

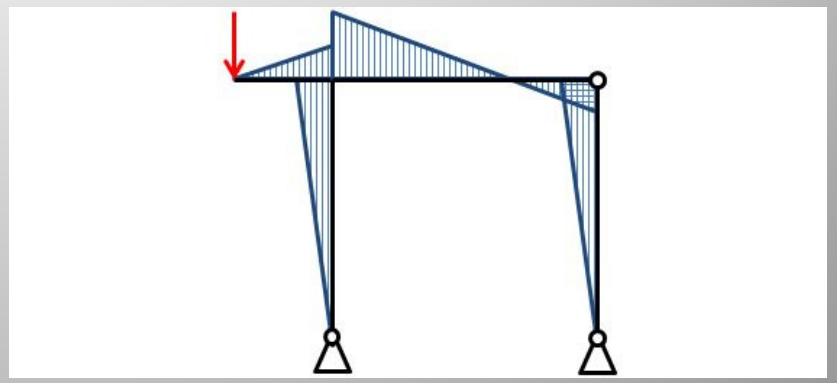

24 kNm
20 kNm
20 kNm

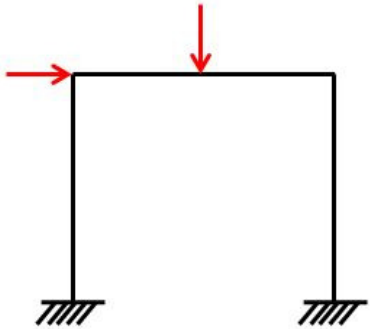


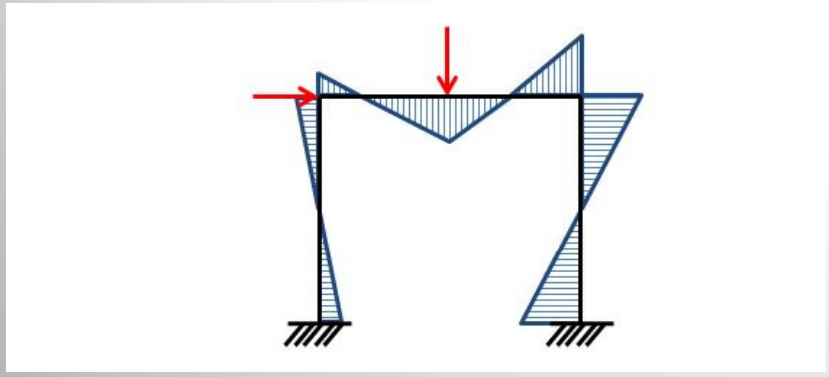


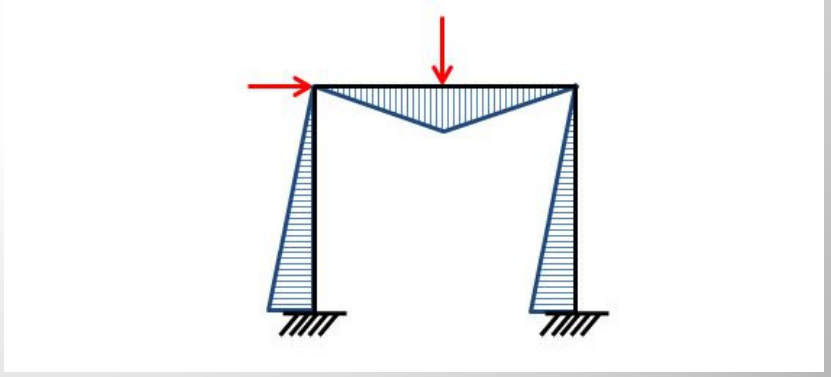


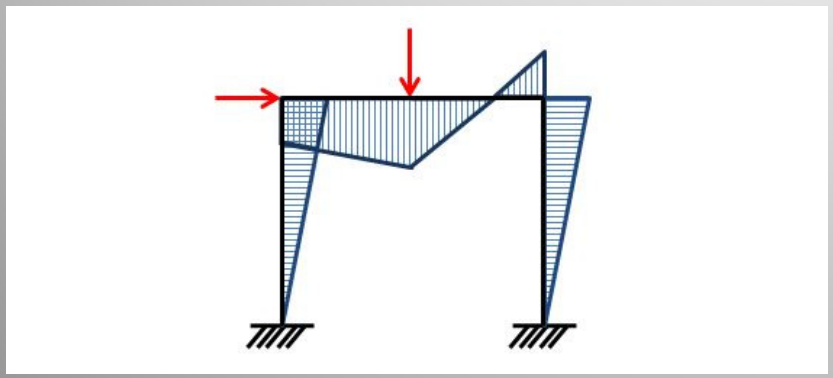


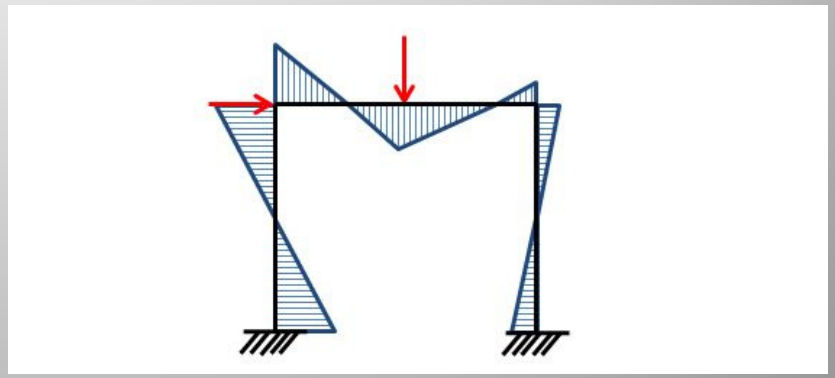


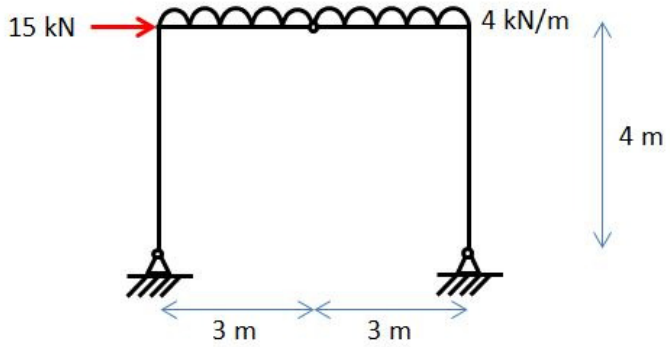


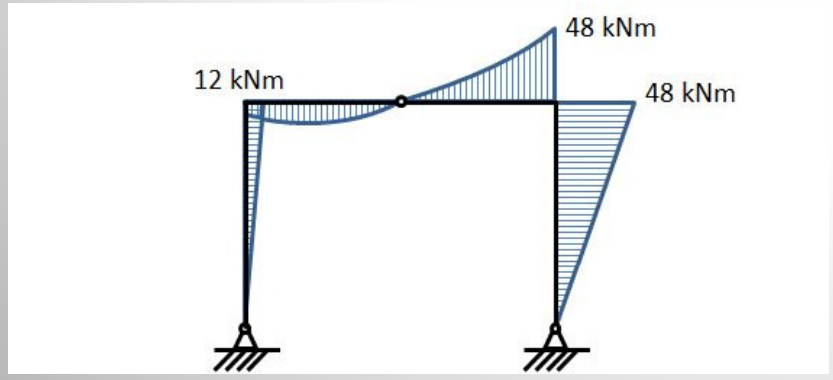


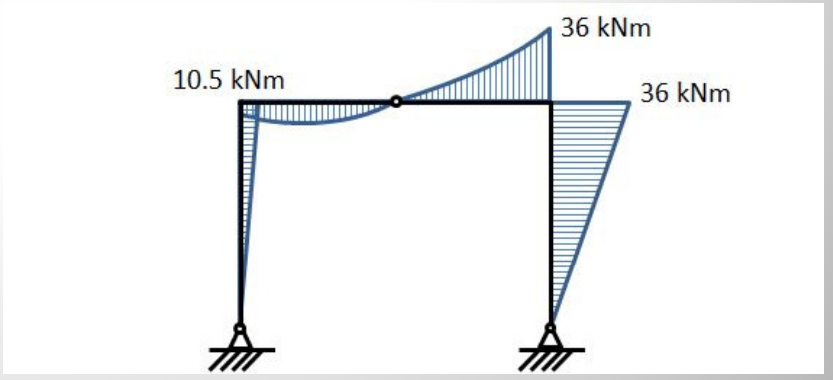


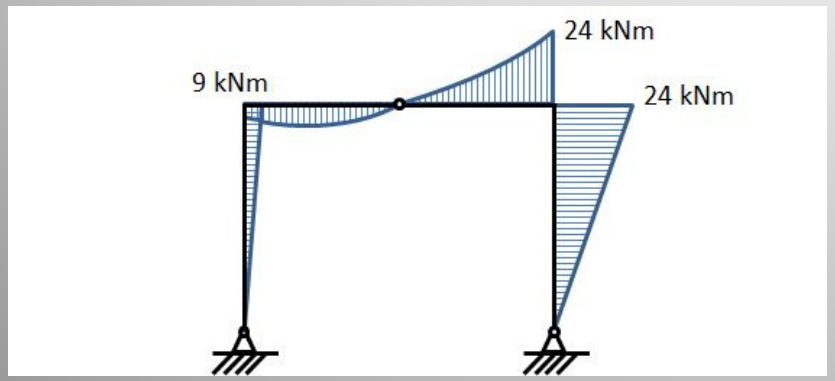


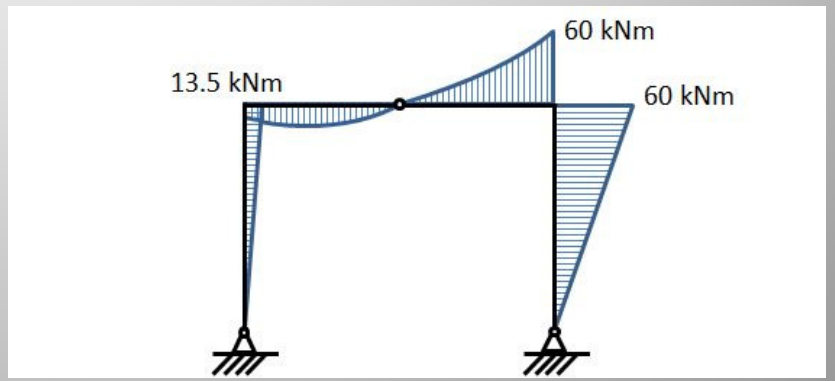


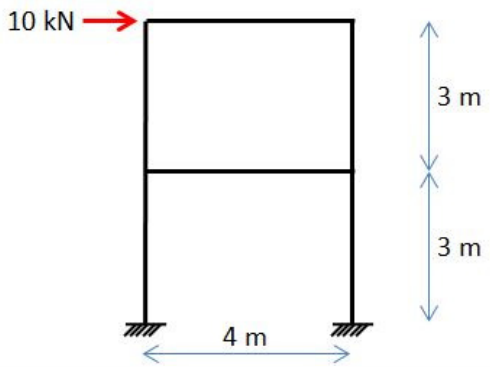

15 kN
4 kN/m
4 m
3 m
3 m

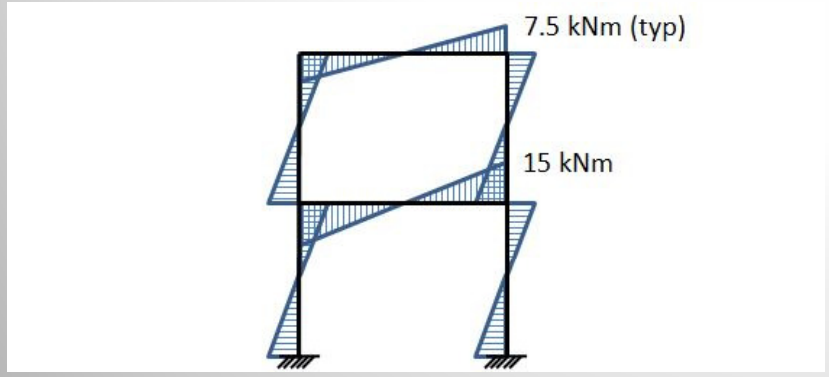

48 kNm
12 kNm
48 kNm

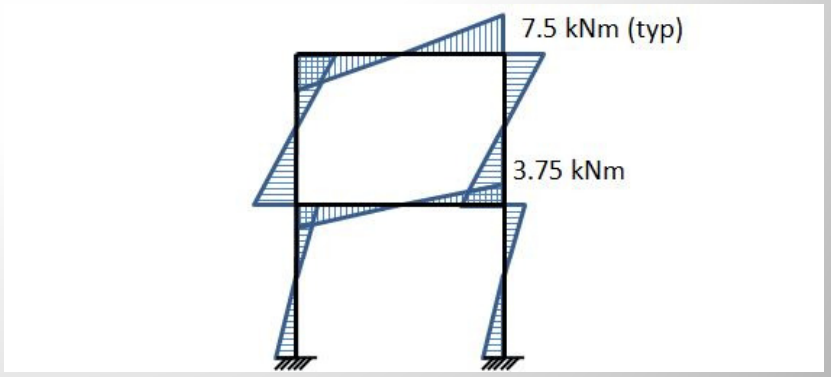

36 kNm
10.5 kNm
36 kNm

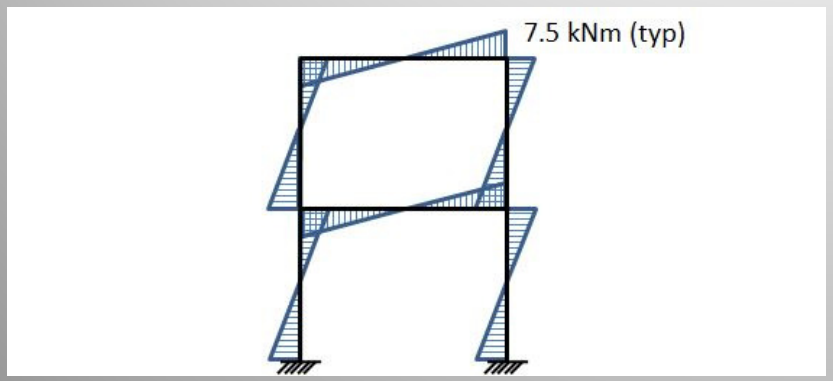

24 kNm
9 kNm
24 kNm

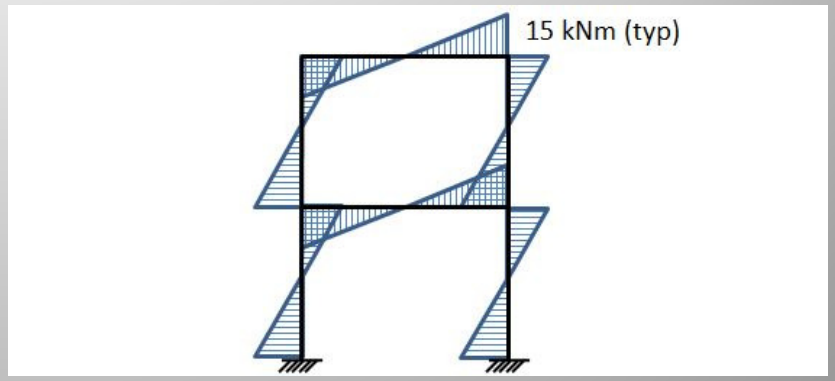

60 kNm
13.5 kNm
60 kNm

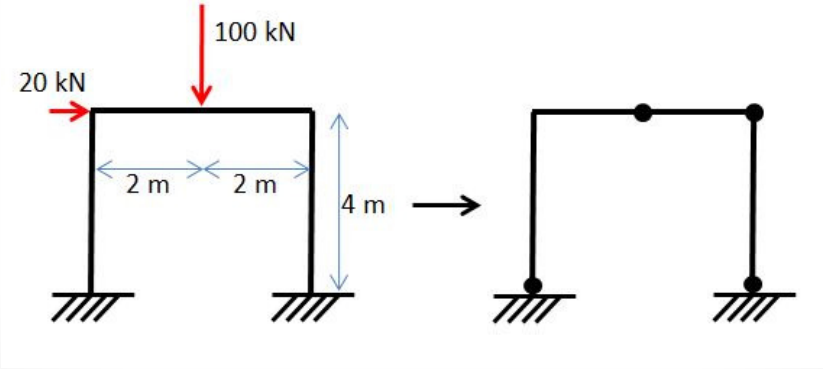

10 kN
3 m
3 m
4 m


7.5 kNm (typ)
15 kNm

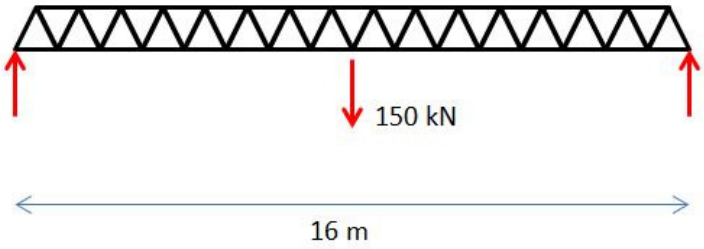

7.5 kNm (typ)
3.75 kNm


7.5 kNm (typ)

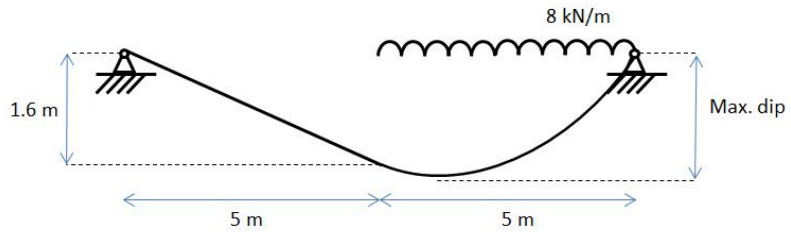

15 kNm (typ)



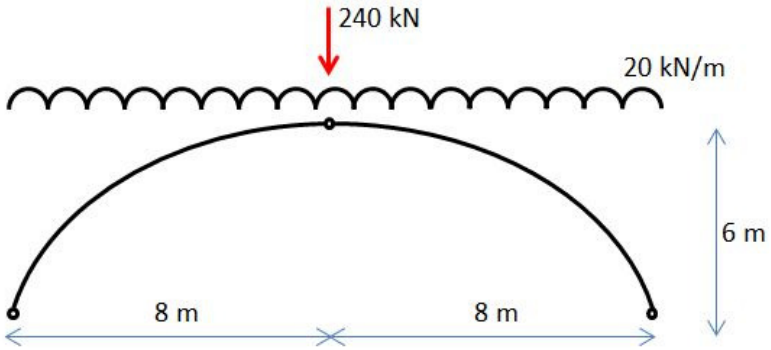
The frame shown has uniform plastic moment capacity throughout. If the critical plastic collapse mechanism is as shown, what is the minimum required plastic moment capacity? Ignore any possible instability effects.



The top and bottom chords of this long truss are CHS sections, and each has I = 31x10^6 mm4 and A = 6300 mm2. Take E_{steel} = 200 GPa. All members have the same length of 1m. What is the approximate vertical deflection at midspan?



The weightless cable is loaded on one half only and sags as shown. If the dip at midspan is 1.6m, what is the maximum dip in the cable?



In this parabolic three-pin arch, what is the bending moment at the quarter points?

Proposed Teaching Route to Chartered Membership

- Qualifications approved
- PRI
- 5,000-word report on teaching philosophy (innovation, inspiration, evidence of success)
- Reviewed by three appropriate members
- Enhanced SBE sat and passed