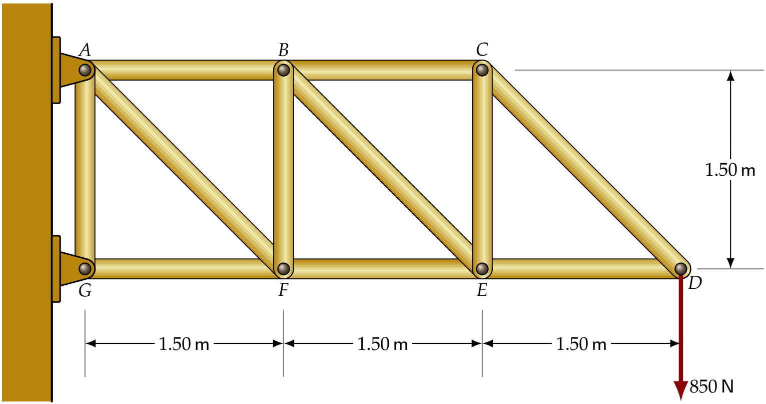
Method of Sections — Step by Step Examples

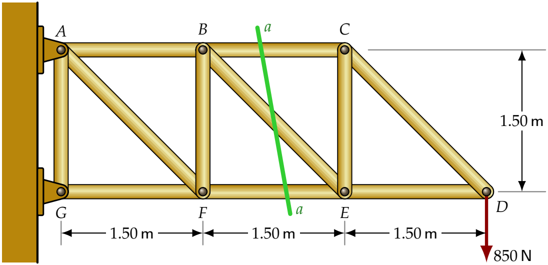
Engineering Statics

Last revision on October 24, 2025

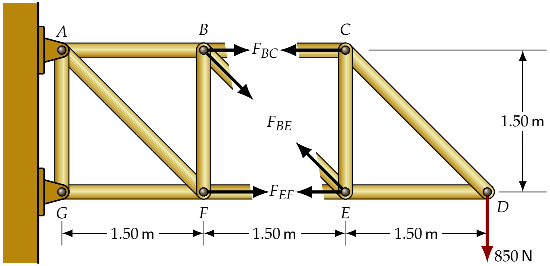


Method of Sections: Example 1

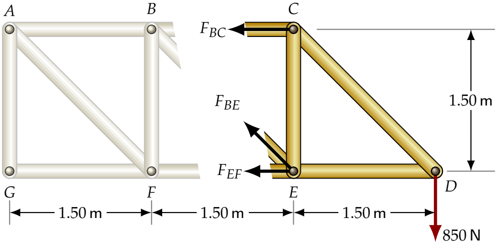
Use the method of sections to determine the forces in members BC, BE and EF.



1. Draw section $a-a$.

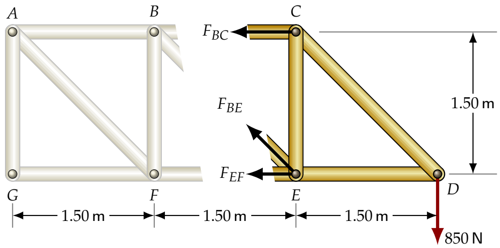


1. Draw section $a-a$.
2. This section exposes the forces in members BC, BE and EF



1. Draw section $a-a$.
2. This section exposes the forces in members BC, BE and EF
3. The right portion of the truss is the easier to analyze – it does not require solving for, and then using, the reactions at A and G.

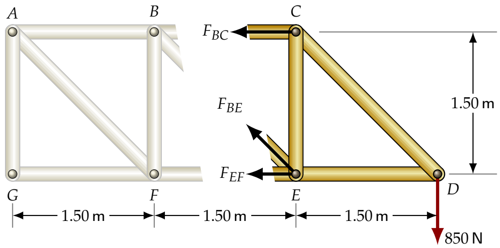
   (**Note** that we can't actually solve for those reactions at this stage: they are statically indeterminate.)



4. Take moments about the joint B to find F_{EF}.

$$\Sigma M_B = -F_{EF}\cdot(1.50\,\text{m}) - (850\,\text{N})\cdot(3.00\,\text{m}) = 0$$

$$\Rightarrow F_{EF} = -1700\,\text{N}$$



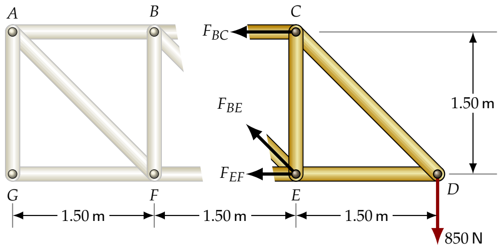
4. Take moments about the joint B to find F_{EF}.
5. Take moments about the joint E to find F_{BC}.

$$\Sigma M_B = -F_{EF} \cdot (1.50\,\text{m}) - (850\,\text{N}) \cdot (3.00\,\text{m}) = 0$$

$$\Rightarrow F_{EF} = -1700\,\text{N}$$

$$\Sigma M_E = F_{BC} \cdot (1.50\,\text{m}) - (850\,\text{N}) \cdot (1.50\,\text{m}) = 0$$

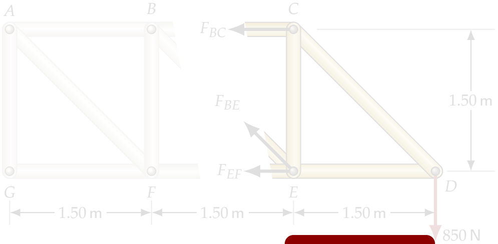
$$\Rightarrow F_{BC} = 850\,\text{N}$$



4. Take moments about the joint B to find F_{EF}.
5. Take moments about the joint E to find F_{BC}.
6. Notice that $\angle BEF = 45°$.
   Sum the y-components to find F_{BE}.

$$F_{EF} = -1700\,\text{N}$$
$$F_{BC} = 850\,\text{N}$$

$$\Sigma F_y = -F_{BE} \cdot \sin 45° - 850\,\text{N} = 0$$
$$\Rightarrow F_{BE} = -1202.1\,\text{N}$$



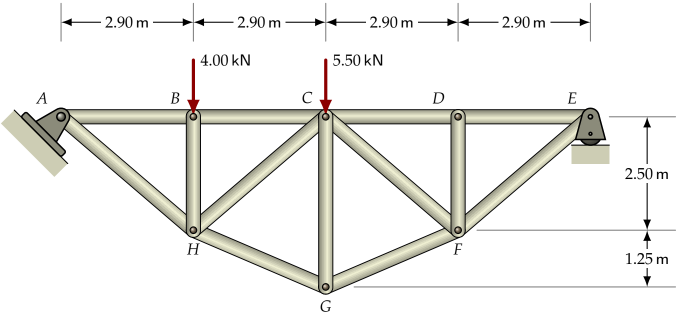
The Answers

$BC = 850\,\text{N}$ (Tension)

$BE = 1200\,\text{N}$ (Compression)

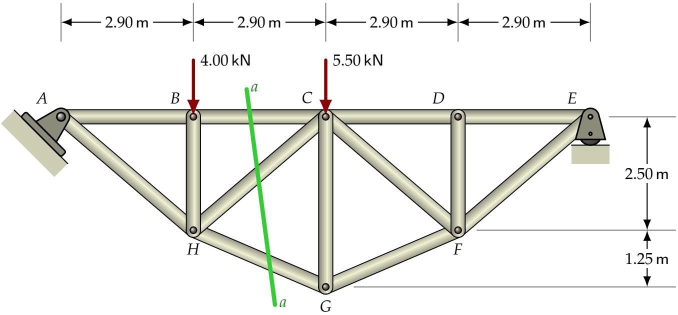
$EF = 1700\,\text{N}$ (Compression)

4. Take moments about the joint B to find F_{EF}.
5. Take moments about the joint E to find F_{BC}.
6. Notice that $\angle BEF = 45°$.
   Sum the y-components to find F_{BE}.

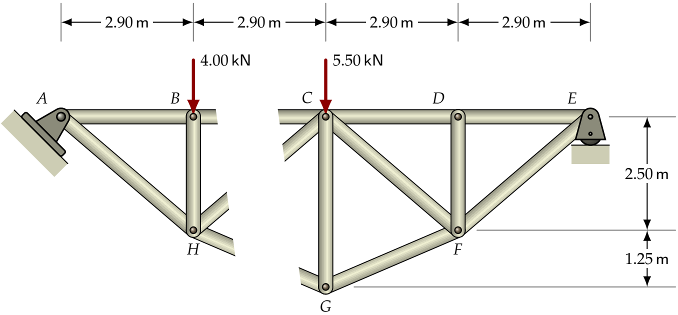


Method of Sections: Example 2

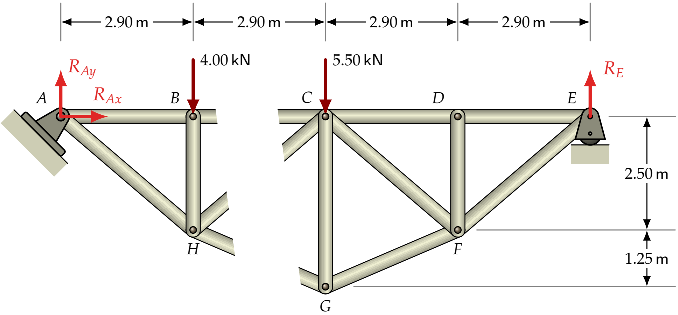
Use the method of sections to determine the forces in members BC, CH and GH.



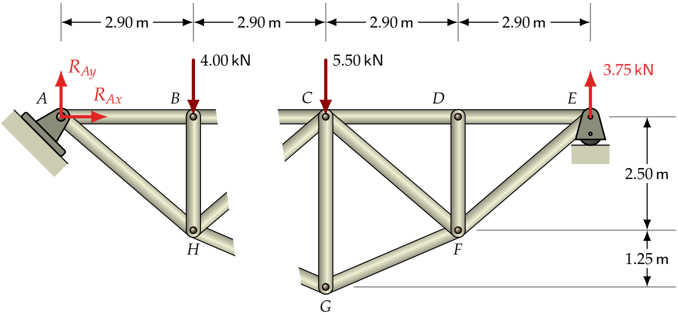
- Section $a\text{—}a$ is the obvious choice for exposing the forces in members BC, CH and GH.



- Section $a-a$ is the obvious choice for exposing the forces in members BC, CH and GH.
- There is no clear advantage to using one side of the section over the other. Each side has one load and one reaction to consider. We shall use the right portion of the truss, simply because then we don't have to find R_A.



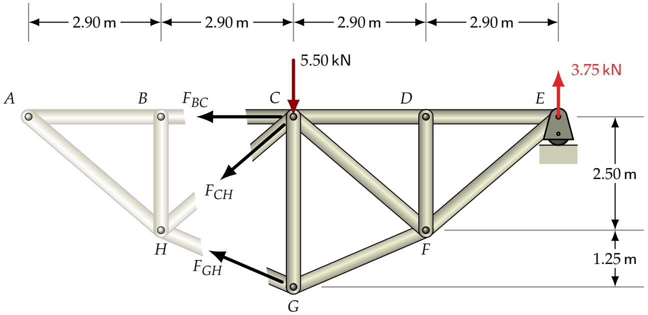
- Section $a-a$ is the obvious choice for exposing the forces in members BC, CH and GH.
- There is no clear advantage to using one side of the section over the other. Each side has one load and one reaction to consider. We shall use the right portion of the truss, simply because then we don't have to find R_A.
- Find the reaction at E.



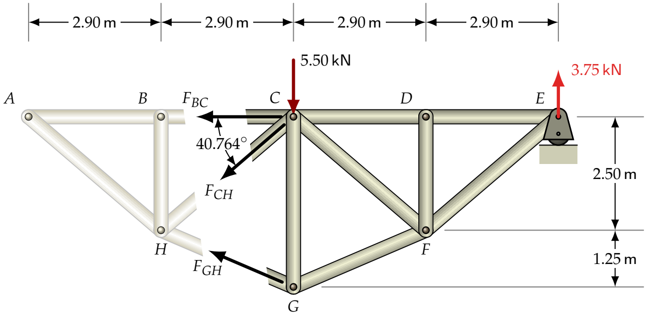
- Section $a{-}a$ is the obvious choice for exposing the forces in members BC, CH and GH.
- There is no clear advantage to using one side of the section over the other. Each side has one load and one reaction to consider. We shall use the right portion of the truss, simply because then we don't have to find R_A.
- Find the reaction at E.

$$\Sigma M_A = R_E \cdot (11.60\,\text{m}) - (4.00\,\text{kN}) \cdot (2.90\,\text{m}) - (5.50\,\text{kN}) \cdot (5.80\,\text{m}) = 0$$

$$\Rightarrow R_E = 3.75\,\text{kN}$$



- Section $a{-}a$ is the obvious choice for exposing the forces in members BC, CH and GH.
- There is no clear advantage to using one side of the section over the other. Each side has one load and one reaction to consider. We shall use the right portion of the truss, simply because then we don't have to find R_A.
- Find the reaction at E.
- Now for some angles…



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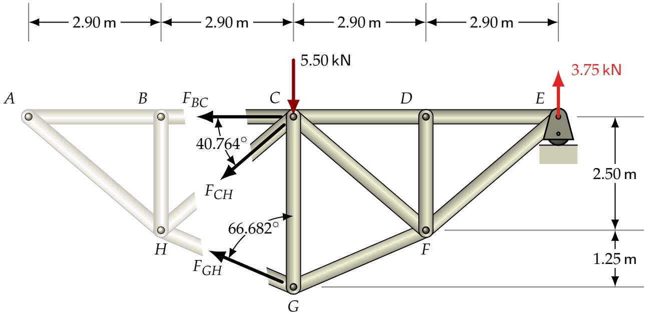
- There is no clear advantage to using one side of the section over the other. Each side has one load and one reaction to consider. We shall use the right portion of the truss, simply because then we don't have to find R_A.
- Find the reaction at E.
- Now for some angles...

$$\angle BCH = \tan^{-1}\left[\frac{2.50\text{ m}}{2.90\text{ m}}\right]$$

$$= 40.764^\circ$$



- Section $a-a$ is the obvious choice for exposing the forces in members BC, CH and GH.
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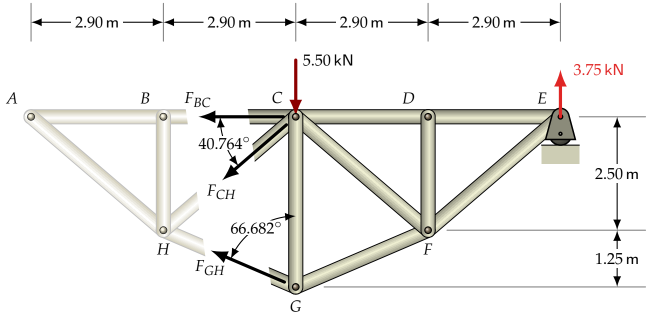
- Find the reaction at E.
- Now for some angles...

$$\angle BCH = \tan^{-1}\left[\frac{2.50\text{ m}}{2.90\text{ m}}\right]$$

$$= 40.764^\circ$$

$$\angle CGH = \tan^{-1}\left[\frac{2.90\text{ m}}{1.25\text{ m}}\right]$$

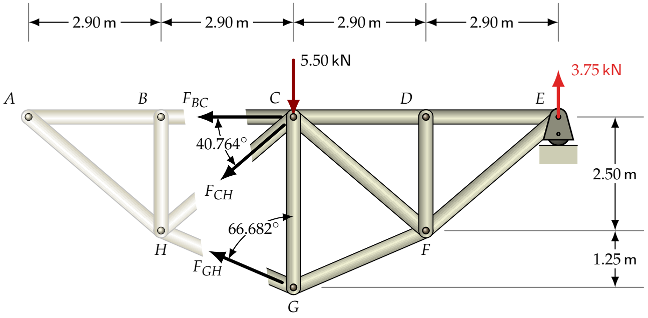
$$= 66.682^\circ$$



- Taking moments about the intersection of the lines of action of two of the required forces allows us to solve for the third unknown without resorting to solving simultaneous equations. Thus, taking moments about C will give direct access to F_{GH}.

$$\Sigma M_C = (3.75\,\text{kN})\cdot(5.80\,\text{m}) - F_{GH}\cdot\sin 66.682^\circ\cdot(3.75\,\text{m}) = 0$$

$$\Rightarrow F_{GH} = 6.3159\,\text{kN}$$



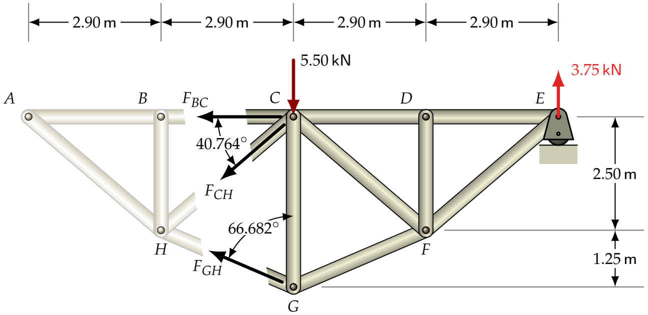
- Taking moments about the intersection of the lines of action of two of the required forces allows us to solve for the third unknown without resorting to solving simultaneous equations. Thus, taking moments about C will give direct access to F_{GH}.
- Similarly, moments about H yield F_{BC}.

$$\Sigma M_C = (3.75\,\text{kN})\cdot(5.80\,\text{m}) - F_{GH}\cdot\sin 66.682^\circ\cdot(3.75\,\text{m}) = 0$$

$$\Rightarrow F_{GH} = 6.3159\,\text{kN}$$

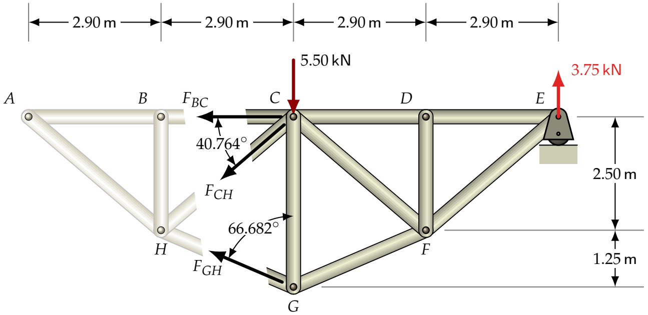
$$\Sigma M_H = (3.75\,\text{kN})\cdot(8.70\,\text{m}) + F_{BC}\cdot(2.50\,\text{m}) - (5.50\,\text{kN})\cdot(2.90\,\text{m}) = 0$$

$$\Rightarrow F_{BC} = -6.6700\,\text{kM}$$



- There are a number of options now:
  $\Sigma F_y = 0$ involves 5 terms;
  $\Sigma F_x = 0$ involves 3 terms;
  $\Sigma M_G = 0$ involves 3 terms.
  We could even recognize that the lines of action of F_{BC} and of F_{GH} intersect at a point 2.90 m to the left of A – moments about this point would involve 3 terms.

  Taking moments about G is a good option.



- There are a number of options now:

  $\Sigma F_y = 0$ involves 5 terms;

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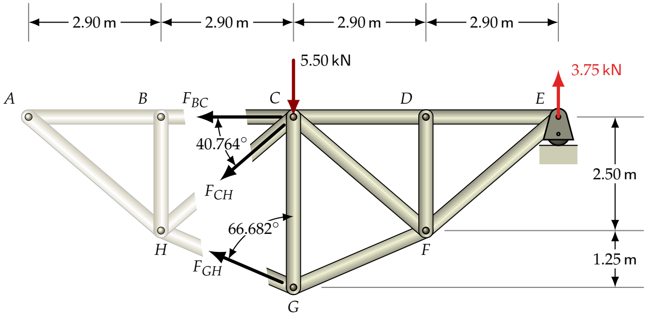
  $\Sigma M_G = 0$ involves 3 terms.

  We could even recognize that the lines of action of F_{BC} and of F_{GH} intersect at a point 2.90 m to the left of A – moments about this point would involve 3 terms.

  Taking moments about G is a good option.

$$
\begin{aligned}
\Sigma M_G &= (3.75\,\text{kN})\cdot(5.80\,\text{m}) \\
&\quad + F_{CH}\cdot\cos 40.764^\circ(3.75\,\text{m}) \\
&\quad + F_{BC}\cdot(3.75\,\text{m}) \\
&= 21.75\cdot\text{kN}\cdot\text{m} + F_{CH}(2.8403\,\text{m}) \\
&\quad + (-6.6700\,\text{kN})\cdot(3.75\,\text{m}) = 0
\end{aligned}
$$

$$\Rightarrow F_{CH} = 1.1486\,\text{kN}$$



- There are a number of options now:
  $\Sigma F_y = 0$ involves 5 terms;
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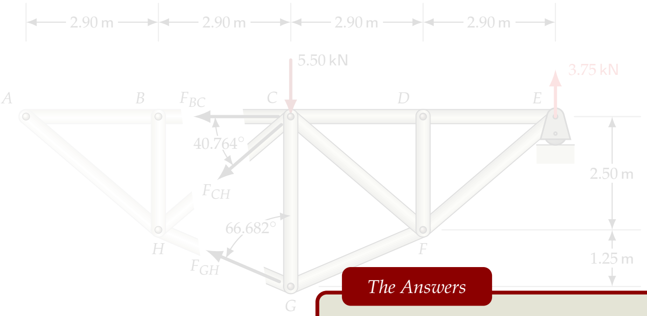
  Taking moments about G is a good option.

$$\begin{aligned}\Sigma M_G &= (3.75\,\text{kN})\cdot(5.80\,\text{m}) \\ &\quad + F_{CH}\cdot\cos 40.764^\circ\,(3.75\,\text{m}) \\ &\quad + F_{BC}\cdot(3.75\,\text{m}) \\ &= 21.75\cdot\text{kN}\cdot\text{m} + F_{CH}\,(2.8403\,\text{m}) \\ &\quad + (-6.6700\,\text{kN})\cdot(3.75\,\text{m}) = 0\end{aligned}$$

$$\Rightarrow F_{CH} = 1.1486\,\text{kN}$$



The Answers

$BC = 6.67\,\text{kN}$ (Compression)

$BE = 1.15\,\text{kN}$ (Tension)

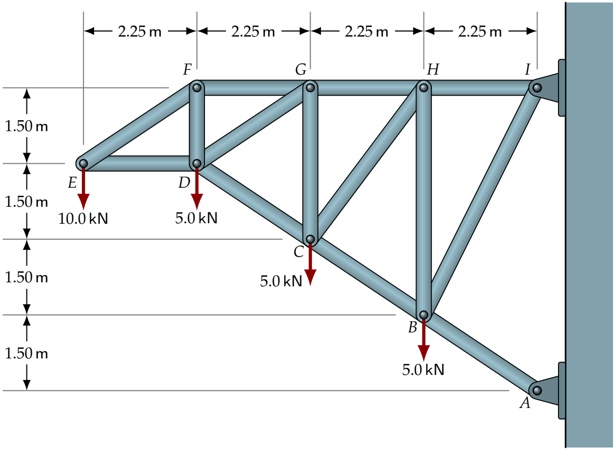
$EF = 6.32\,\text{kN}$ (Tension)

- There are a number of options now:
  $\Sigma F_y = 0$ involves 5 terms;
  $\Sigma F_x = 0$ involves 3 terms;
  $\Sigma M_G = 0$ involves 3 terms.
  We could even recognize that the lines of action of F_{BC} and of F_{GH} intersect at a point 2.90 m to the left of A – moments about this point would involve 3 terms.

  Taking moments about G is a good option.

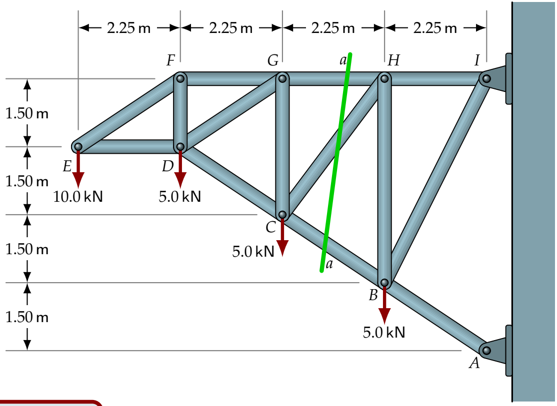
$$= 21.75\cdot\text{kN}\cdot\text{m} + F_{CH}(2.8403\,\text{m}) + (-6.6700\,\text{kN})\cdot(3.75\,\text{m}) = 0$$

$$\Rightarrow F_{CH} = 1.1486\,\text{kN}$$

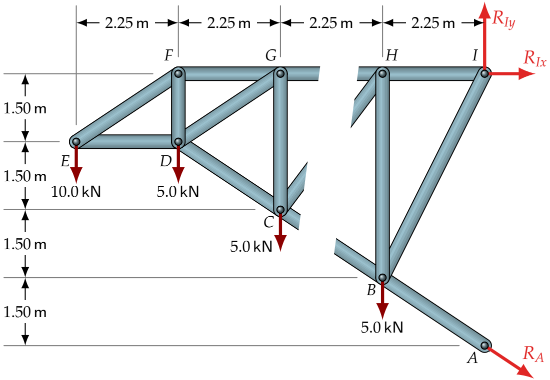


Method of Sections: Example 3

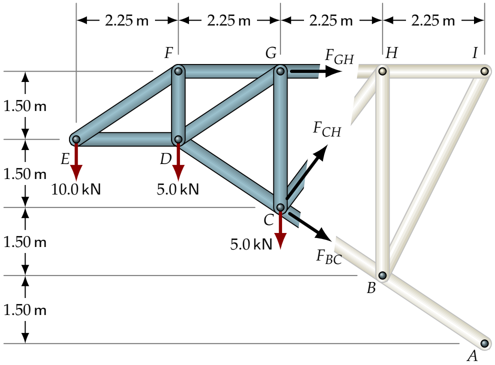
Use the method of sections to determine the forces in members BC, CH and GH.



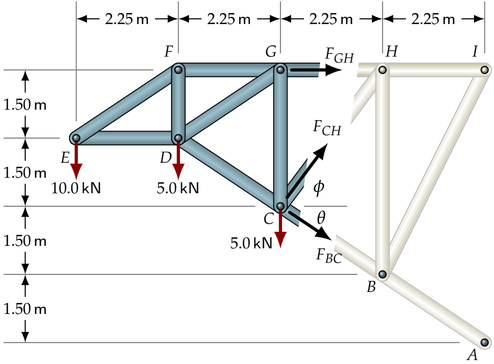
- Draw section $a - a$ to expose the forces in members BC, CH and GH.



- Draw section $a-a$ to expose the forces in members BC, CH and GH.
- The right portion of the truss involves solving for the reactions, and then including these reactions in all our calculations. Although the left portion has more applied loads, it is still the more convenient option.



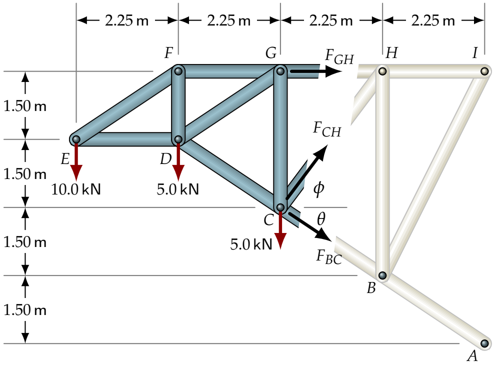
- Draw section $a-a$ to expose the forces in members BC, CH and GH.
- The right portion of the truss involves solving for the reactions, and then including these reactions in all our calculations. Although the left portion has more applied loads, it is still the more convenient option.



- Draw section $a\text{—}a$ to expose the forces in members BC, CH and GH.
- The right portion of the truss involves solving for the reactions, and then including these reactions in all our calculations. Although the left portion has more applied loads, it is still the more convenient option.
- Find the angles we'll need...

$$\theta = \tan^{-1}\left[\frac{1.50\text{ m}}{2.25\text{ m}}\right] = 33.690^\circ$$

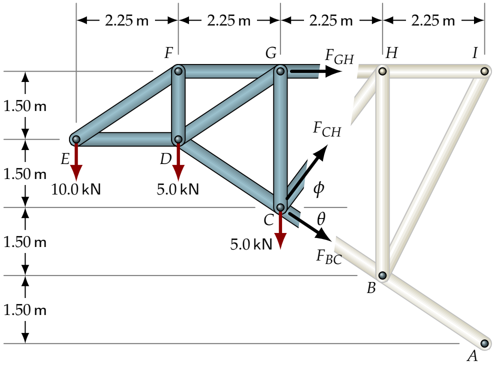
$$\phi = \tan^{-1}\left[\frac{3.00\text{ m}}{2.25\text{ m}}\right] = 53.130^\circ$$



- Sum moments about C to find F_{GH}.

$$\Sigma M_C = (10.0\,\text{kN})\cdot(4.50\,\text{m}) + (5.0\,\text{kN})\cdot(2.25\,\text{m}) - F_{GH}(3.00\,\text{m}) = 0$$

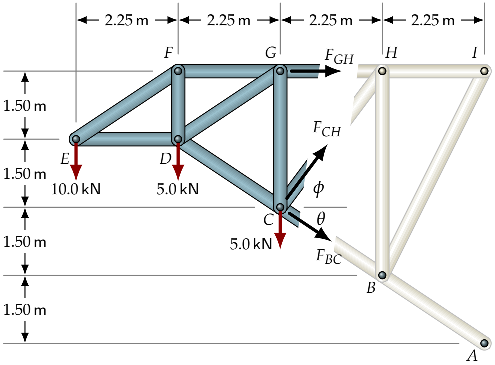
$$\Rightarrow F_{GH} = 18.750\,\text{kN}$$



- Sum moments about C to find F_{GH}.
- In this example, it is probably simplest now to sum both the x-components and the y-components,

$$\Sigma F_x = F_{GH} + F_{CH} \cdot \cos\phi + F_{BC} \cdot \cos\theta$$
$$= 18.750\,\text{kN} + F_{CH} \cdot 0.60000\,\text{kN} + F_{BC} \cdot 0.83205\,\text{kN}$$
$$= 0$$

$$\Sigma F_y = F_{CH} \cdot \sin\phi - F_{BC} \cdot \sin\theta - 20.0\,\text{kN}$$
$$= F_{CH} \cdot 0.80000\,\text{kN} - F_{BC} \cdot 0.55470\,\text{kN} - 20.0\,\text{kN}$$
$$= 0$$



- Sum moments about C to find F_{GH}.
- In this example, it is probably simplest now to sum both the x-components and the y-components, and to then solve the resulting system of equations.

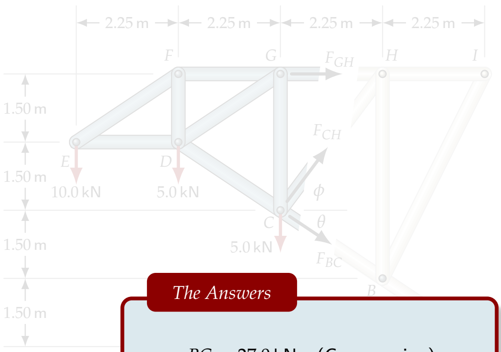
$$0.83205 \cdot F_{BC} + 0.60000 \cdot F_{CH} = -18.750\,\text{kN}$$

$$0.55470 \cdot F_{BC} - 0.80000 \cdot F_{CH} = -20.0\,\text{kN}$$

From the system-solver:

$$F_{BC} = -27.042\,\text{kN}$$

$$F_{CH} = 6.2500\,\text{kN}$$



- Sum moments about C to find F_{GH}.
- In this example, it is probably simplest now to sum both the x-components and the y-components, and to then solve the resulting system of equations.

$$0.55470 \cdot F_{BC} - 0.80000 \cdot F_{CH} = -20.0\,\text{kN}$$

From the system-solver:

$$F_{BC} = -27.042\,\text{kN}$$

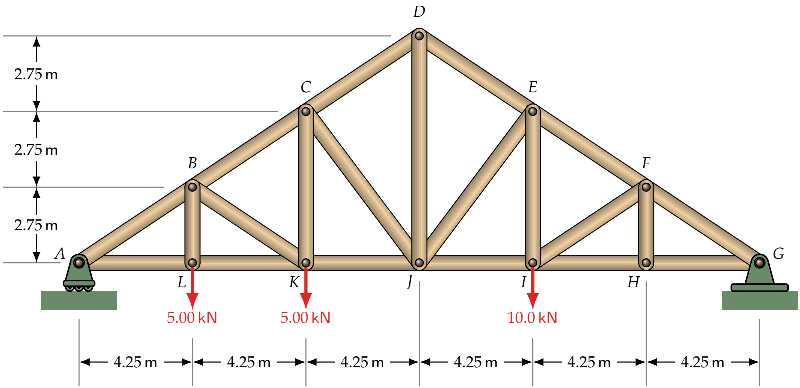
$$F_{CH} = 6.2500\,\text{kN}$$

The Answers

$$BC = 27.0\,\text{kN} \quad \text{(Compression)}$$

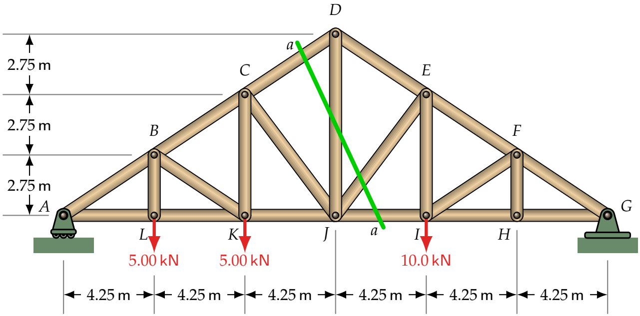
$$CH = 6.25\,\text{kN} \quad \text{(Tension)}$$

$$GH = 18.8\,\text{kN} \quad \text{(Tension)}$$

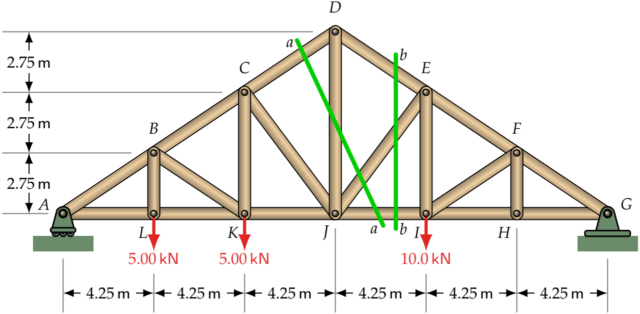


Method of Sections: Example 4

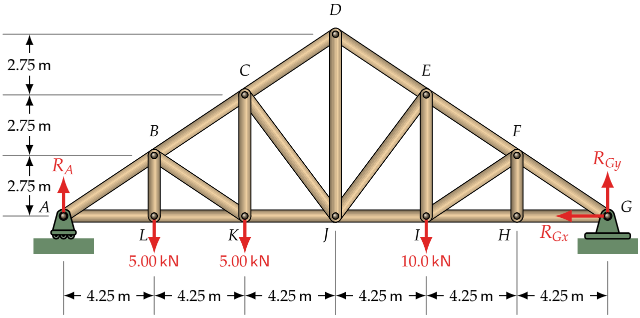
Use the method of sections to determine the force in DJ.



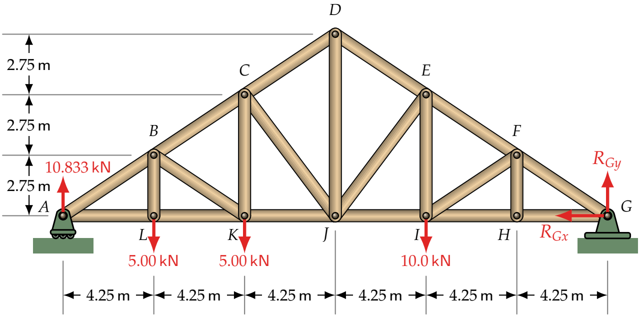
- Each section that cuts through DJ, such as $a{-}a$, also cuts through at least three other members. But we cannot solve for four unknowns with the three equilibrium equations.



- Each section that cuts through DJ, such as $a{-}a$, also cuts through at least three other members. But we cannot solve for four unknowns with the three equilibrium equations.
- A vertical section $b{-}b$ will enable us to solve for the force in IJ, after which we can solve for what we need using $a{-}a$.

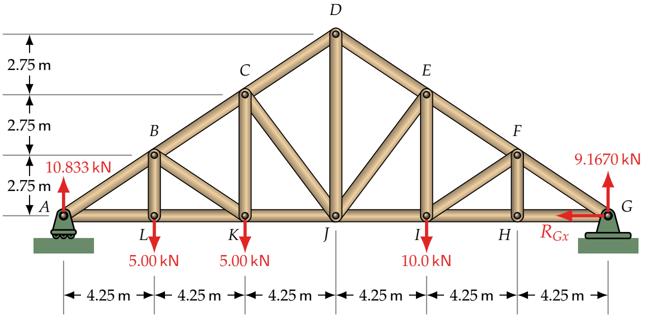


- Each section that cuts through DJ, such as $a-a$, also cuts through at least three other members. But we cannot solve for four unknowns with the three equilibrium equations.
- A vertical section $b-b$ will enable us to solve for the force in IJ, after which we can solve for what we need using $a-a$.
- First, find the reactions.



- Each section that cuts through DJ, such as $a-a$, also cuts through at least three other members. But we cannot solve for four unknowns with the three equilibrium equations.
- A vertical section $b-b$ will enable us to solve for the force in IJ, after which we can solve for what we need using $a-a$.
- First, find the reactions.

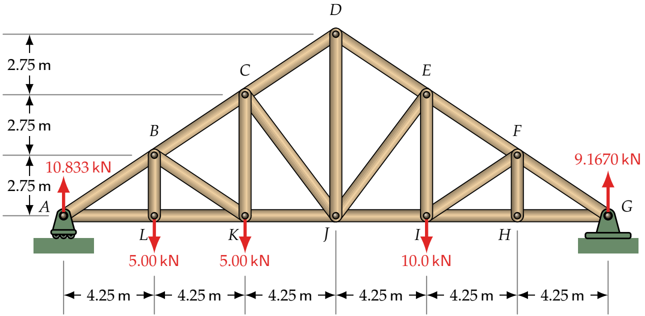
$$\begin{aligned}\Sigma M_G &= (10.0\,\text{kN})\cdot(8.5\,\text{m}) \\ &\quad + (5.00\,\text{kN})\cdot(17.0\,\text{m}) \\ &\quad + (5.00\,\text{kN})\cdot(21.25\,\text{m}) \\ &\quad - R_A\cdot(25.50\,\text{m}) = 0 \\ \Rightarrow R_A &= 10.833\,\text{kN}\end{aligned}$$



- Each section that cuts through DJ, such as $a-a$, also cuts through at least three other members. But we cannot solve for four unknowns with the three equilibrium equations.
- A vertical section $b-b$ will enable us to solve for the force in IJ, after which we can solve for what we need using $a-a$.
- First, find the reactions.

$$\begin{aligned}\Sigma M_G &= (10.0\,\text{kN})\cdot(8.5\,\text{m}) \\ &\quad + (5.00\,\text{kN})\cdot(17.0\,\text{m}) \\ &\quad + (5.00\,\text{kN})\cdot(21.25\,\text{m}) \\ &\quad - R_A\cdot(25.50\,\text{m}) = 0 \\ \Rightarrow R_A &= 10.833\,\text{kN}\end{aligned}$$

$$\begin{aligned}\Sigma F_y &= R_{Gy} + 10.833\,\text{kN} - 20.0\,\text{kN} = 0 \\ \Rightarrow R_{Gy} &= 9.1670\,\text{kN}\end{aligned}$$



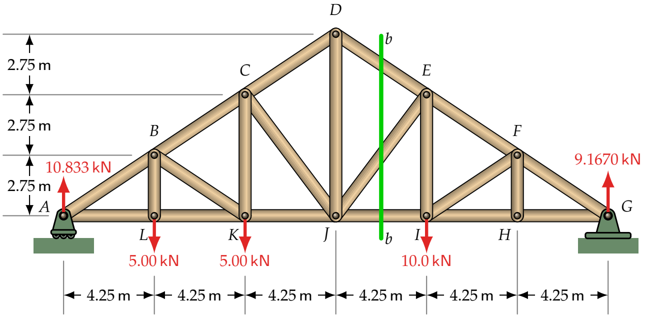
- Each section that cuts through DJ, such as $a-a$, also cuts through at least three other members. But we cannot solve for four unknowns with the three equilibrium equations.
- A vertical section $b-b$ will enable us to solve for the force in IJ, after which we can solve for what we need using $a-a$.
- First, find the reactions.

$$\begin{aligned}
\Sigma M_G &= (10.0\,\text{kN})\cdot(8.5\,\text{m}) \\
&\quad + (5.00\,\text{kN})\cdot(17.0\,\text{m}) \\
&\quad + (5.00\,\text{kN})\cdot(21.25\,\text{m}) \\
&\quad - R_A\cdot(25.50\,\text{m}) = 0 \\
\Rightarrow R_A &= 10.833\,\text{kN}
\end{aligned}$$

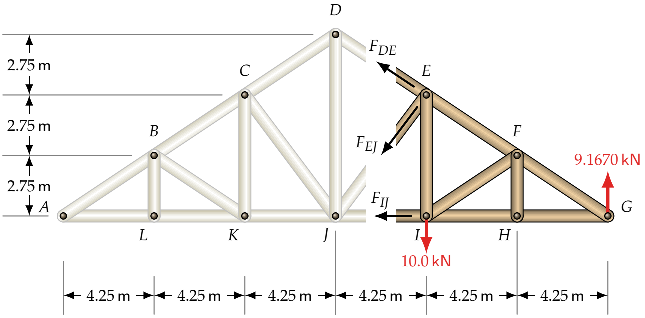
$$\Sigma F_y = R_{Gy} + 10.833\,\text{kN} - 20.0\,\text{kN} = 0$$

$$\Rightarrow R_{Gy} = 9.1670\,\text{kN}$$

$$R_{Gx} = 0$$



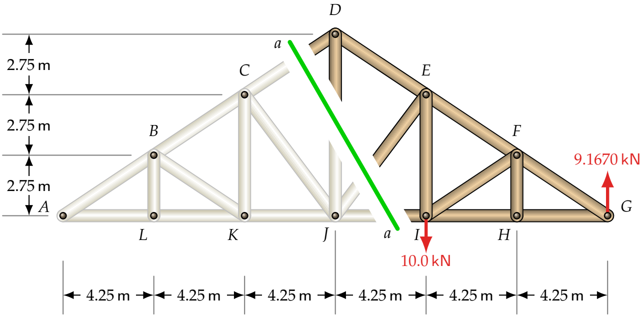
- Each section that cuts through DJ, such as $a\!-\!a$, also cuts through at least three other members. But we cannot solve for four unknowns with the three equilibrium equations.
- A vertical section $b\!-\!b$ will enable us to solve for the force in IJ, after which we can solve for what we need using $a\!-\!a$.
- First, find the reactions.
- Now, find the force in IJ using section $b\!-\!b$.



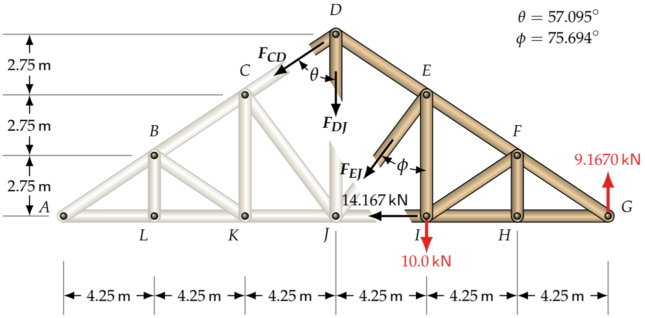
- Each section that cuts through DJ, such as $a-a$, also cuts through at least three other members. But we cannot solve for four unknowns with the three equilibrium equations.
- A vertical section $b-b$ will enable us to solve for the force in IJ, after which we can solve for what we need using $a-a$.
- First, find the reactions.
- Now, find the force in IJ using section $b-b$.
- Using the right portion of the truss...

$$\Sigma M_E = (9.1670\,\text{kN})\cdot(8.5\,\text{m}) - T_{IJ}\cdot(5.50\,\text{m}) = 0$$

$$\Rightarrow F_{IJ} = 14.167\,\text{kN}$$



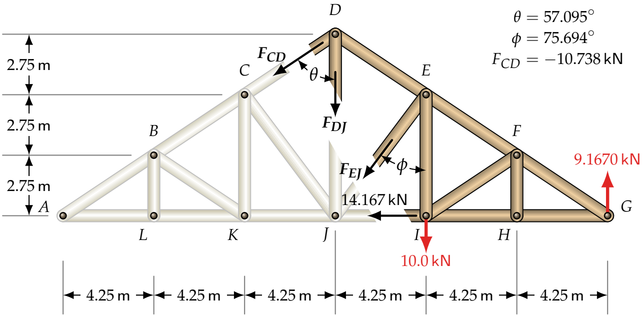
- Now we'll use section $a{-}a$...



- Now we'll use section $a{-}a$...
- Some angles that we'll need...

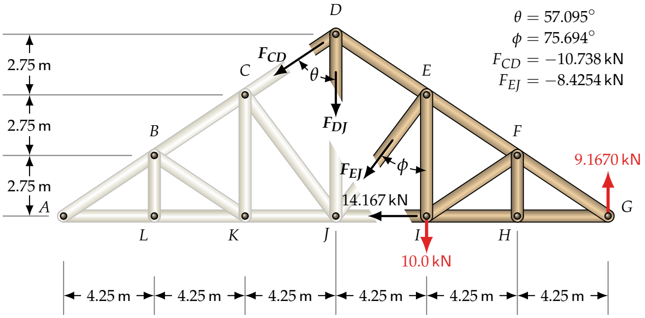
$$\theta = \tan^{-1}\left[\frac{4.25}{2.75}\right] = 57.095^\circ$$

$$\phi = \tan^{-1}\left[\frac{4.25}{5.50}\right] = 75.694^\circ$$



- Now we'll use section $a-a$...
- Some angles that we'll need...
- Take moments about J to find F_{CD}

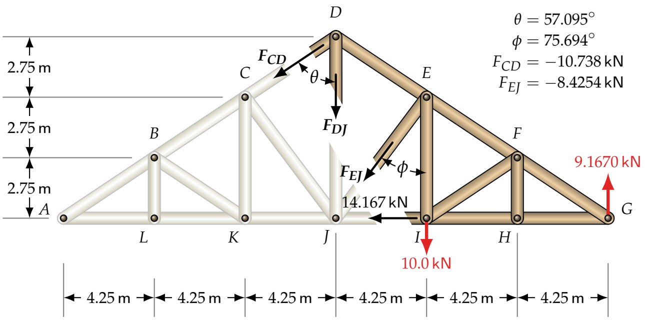
$$\begin{aligned}\Sigma M_J &= F_{CD} \cdot \sin 57.095° \cdot (8.25\,\text{m}) \\ &\quad + (9.1670\,\text{kN}) \cdot (12.75\,\text{m}) \\ &\quad - (10.0\,\text{kN}) \cdot (4.25\,\text{m}) \\ &= 0 \\ \Rightarrow F_{CD} &= -10.738\,\text{kN}\end{aligned}$$



- Now we'll use section $a-a$...
- Some angles that we'll need...
- Take moments about J to find F_{CD}
- Sum the x-components to find F_{EJ}

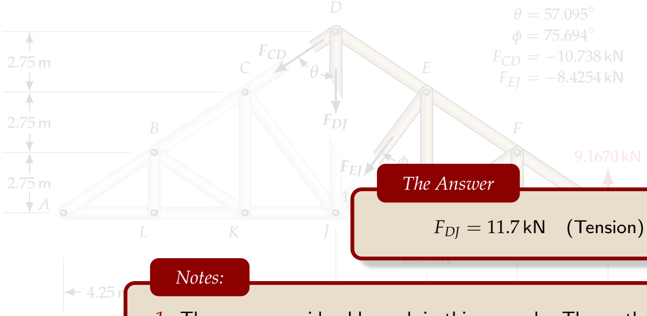
$$\begin{aligned}
\Sigma F_x &= -F_{CD} \cdot \sin\theta \\
&\quad - (14.167\,\text{kN}) \\
&\quad - F_{EJ} \cdot \sin\phi \\
&= -(-10.738\,\text{kN}) \cdot \sin 57.095° \\
&\quad - (14.167\,\text{kN}) \\
&\quad - F_{EJ} \cdot \sin 75.694° \\
&= 0
\end{aligned}$$

$$\Rightarrow F_{EJ} = -8.4254\,\text{kN}$$



- Now we'll use section $a-a$...
- Some angles that we'll need...
- Take moments about J to find F_{CD}
- Sum the x-components to find F_{EJ}
- Sum the y-components to find F_{DJ}

$$\begin{aligned}
\Sigma F_y &= -F_{CD}\cdot\cos\theta - F_{DJ} \\
&\quad - F_{EJ}\cdot\cos\phi \\
&\quad - 10.0\,\text{kN} + 9.1760\,\text{kN} \\
&= 10.738\,\text{kN}\cdot\cos 57.095^\circ - F_{DJ} \\
&\quad + 8.4254\,\text{kN}\cdot\cos 75.694^\circ \\
&\quad - 0.82400\,\text{kN} \\
&= 0 \\
\Rightarrow F_{DJ} &= 11.676\,\text{kN}
\end{aligned}$$



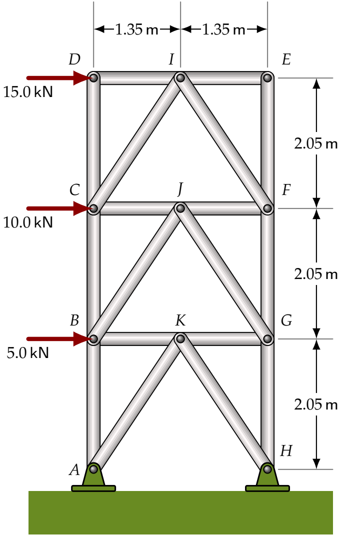
- Now we'll use section $a-$
- Some angles that we'll n
- Take moments about J t
- Sum the x-components t
- Sum the y-components t

The Answer

$$F_{DJ} = 11.7\,\text{kN} \quad \text{(Tension)}$$

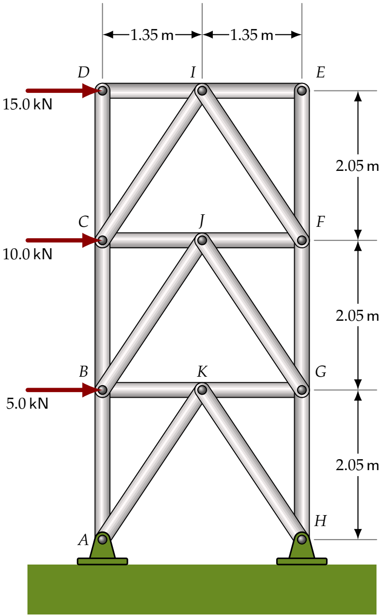
Notes:

1. There was considerable work in this example. The method of sections was required by the example statement but it might not be the simplest procedure for this truss.
2. Given that this is a relatively 'narrow' truss, the method of joints would only have required analysis of three joints: G, F and D since FH and IF are zero-force members.
3. The most straightforward – and – quickest approach, if free to choose, is to use either of sections $a-a$ or $b-b$ to take moments about J and find F_{CD} or F_{DE}. Then a single method of joints analysis, of joint D, gives F_{DJ}.
4. A combination of the method of sections and the method of joints is often worth considering.



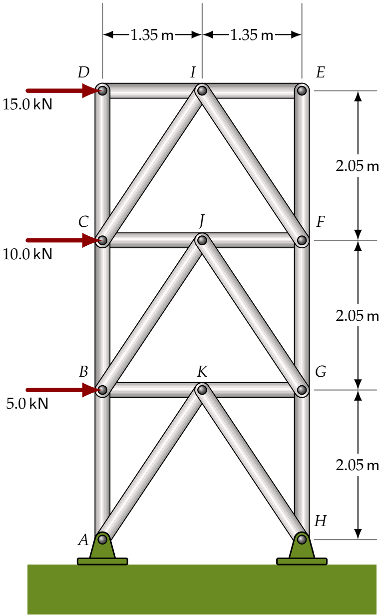
Method of Sections: Example 5

Determine the forces in members *AB* and *GH*.



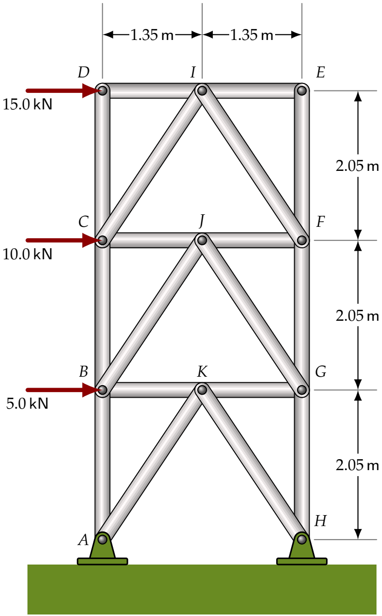
Notes:

1. The reactions at A and H cannot be immediately determined. There are four unknowns (R_{Ax}, R_{Ay}, R_{Hx} and R_{Hy}) and we can only solve systems with three unknowns using the equations of equilibrium. A and H are said to be **statically indeterminate**.



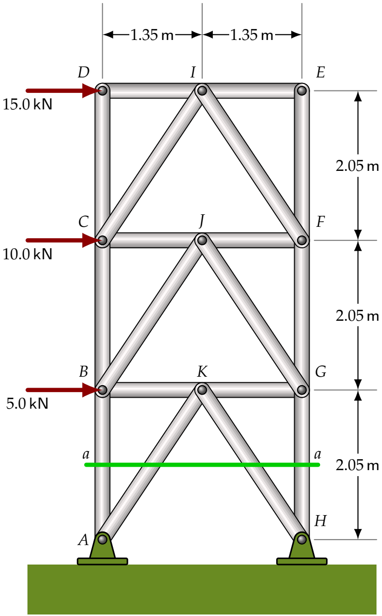
Notes:

1. The reactions at A and H cannot be immediately determined. There are four unknowns (R_{Ax}, R_{Ay}, R_{Hx} and R_{Hy}) and we can only solve systems with three unknowns using the equations of equilibrium. A and H are said to be **statically indeterminate**.
2. We **could** determine the reactions at A and H (if required) by calculating the forces in AB, AK, GH and HK.



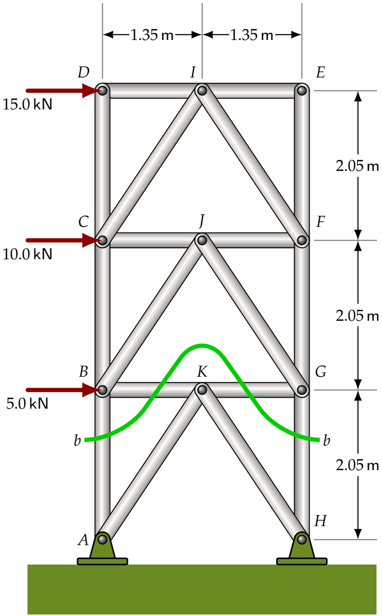
Notes:

1. The reactions at A and H cannot be immediately determined. There are four unknowns (R_{Ax}, R_{Ay}, R_{Hx} and R_{Hy}) and we can only solve systems with three unknowns using the equations of equilibrium. A and H are said to be **statically indeterminate**.
2. We **could** determine the reactions at A and H (if required) by calculating the forces in AB, AK, GH and HK.
3. Can we use the method of sections? Any section going through either AB or GH cuts at least four members.



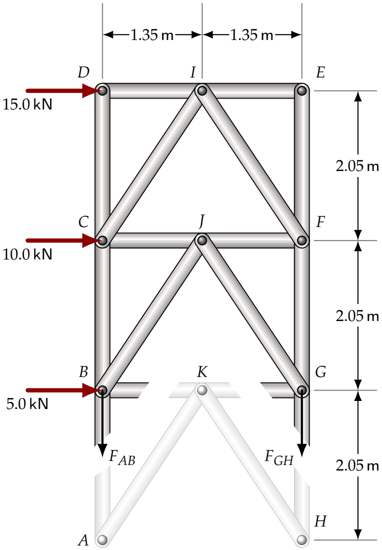
Notes:

1. The reactions at A and H cannot be immediately determined. There are four unknowns (R_{Ax}, R_{Ay}, R_{Hx} and R_{Hy}) and we can only solve systems with three unknowns using the equations of equilibrium. A and H are said to be **statically indeterminate**.
2. We **could** determine the reactions at A and H (if required) by calculating the forces in AB, AK, GH and HK.
3. Can we use the method of sections? Any section going through either AB or GH cuts at least four members.
4. Section $a-a$ doesn't help: there is nowhere to take moments about that will isolate either of AB or GH



Notes:

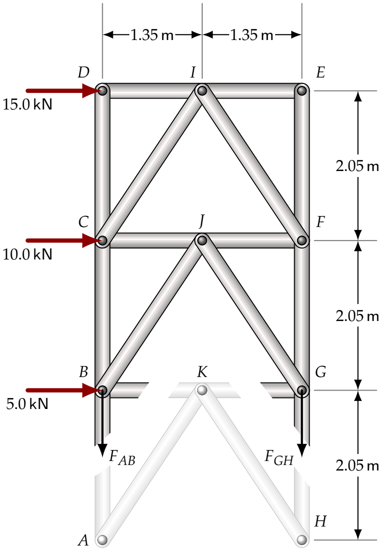
1. The reactions at A and H cannot be immediately determined. There are four unknowns (R_{Ax}, R_{Ay}, R_{Hx} and R_{Hy}) and we can only solve systems with three unknowns using the equations of equilibrium. A and H are said to be **statically indeterminate**.
2. We **could** determine the reactions at A and H (if required) by calculating the forces in AB, AK, GH and HK.
3. Can we use the method of sections? Any section going through either AB or GH cuts at least four members.
4. Section $a-a$ doesn't help: there is nowhere to take moments about that will isolate either of AB or GH
5. Section $b-b$ **does** help. Moments about B isolates GH and moments about G isolates AB.



Take moments about B to determine F_{GH}:

$$\Sigma M_B = -(15.0\,\text{kN})\cdot(4.10\,\text{m}) - (10.0\,\text{kN})\cdot(2.05\,\text{m}) - F_{GH}\cdot(2.70\,\text{m}) = 0$$

$$\Rightarrow F_{GH} = -30.370\,\text{kN}$$



Take moments about B to determine F_{GH}:

$$\Sigma M_B = -(15.0\,\text{kN})\cdot(4.10\,\text{m}) - (10.0\,\text{kN})\cdot(2.05\,\text{m}) - F_{GH}\cdot(2.70\,\text{m}) = 0$$

$$\Rightarrow F_{GH} = -30.370\,\text{kN}$$

Now, take moments about G to find F_{AB}:

$$\Sigma M_G = -(15.0\,\text{kN})\cdot(4.10\,\text{m}) - (10.0\,\text{kN})\cdot(2.05\,\text{m}) + F_{AB}\cdot(2.70\,\text{m}) = 0$$

$$\Rightarrow F_{AB} = 30.370\,\text{kN}$$

Take moments about B to determine F_{GH}:

$$\Sigma M_B = -(15.0\,\text{kN})\cdot(4.10\,\text{m}) - (10.0\,\text{kN})\cdot(2.05\,\text{m}) - F_{GH}\cdot(2.70\,\text{m}) = 0$$

$$\Rightarrow F_{GH} = -30.370\,\text{kN}$$

...nd F_{AB}:

...m)

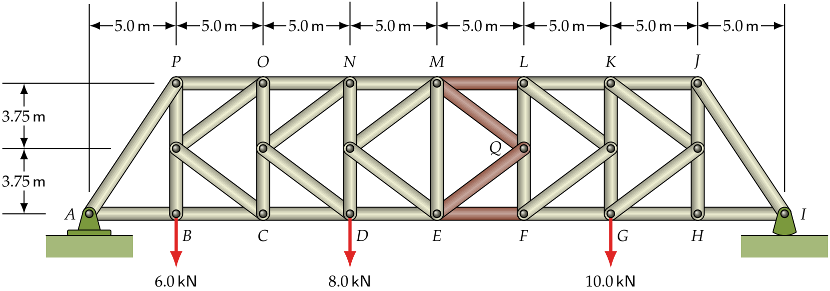
$$+ F_{AB}\cdot(2.70\,\text{m}) = 0$$

$$\Rightarrow F_{AB} = 30.370\,\text{kN}$$

The Answers

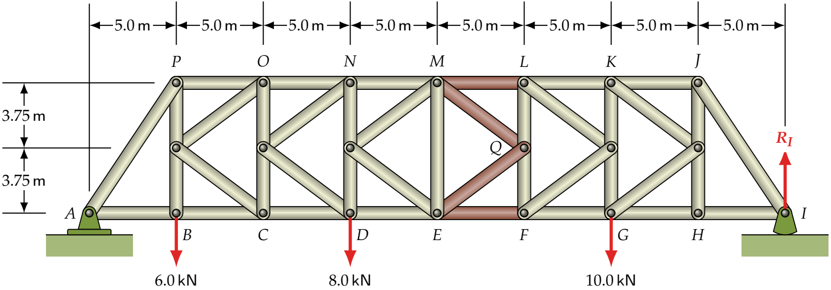
$F_{AB} = 30.4\,\text{kN}$ (Tension)

$F_{GH} = 30.4\,\text{kN}$ (Compression)



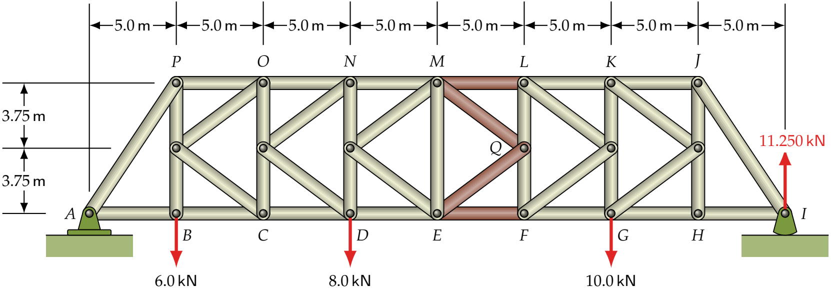
Method of Sections: Example 6

Use the method of sections to determine the forces in *EF*, *EQ*, *LM* and *MQ*.



Find the reaction at I:

$$\Sigma M_A = R_I \cdot (40.0\,\text{m}) - 6.0\,\text{kN} \cdot (5.0\,\text{m})$$
$$- 8.0\,\text{kN} \cdot (15.0\,\text{m}) - 10.0\,\text{kN} \cdot (30.0\,\text{m}) = 0$$

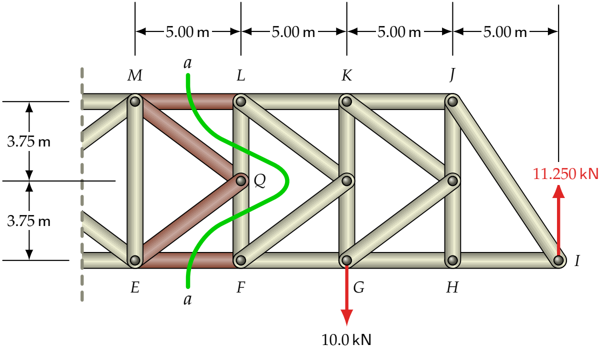


Find the reaction at I:

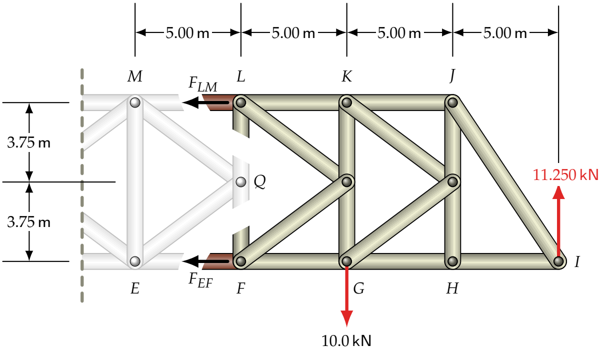
$$\Sigma M_A = R_I \cdot (40.0\,\text{m}) - 6.0\,\text{kN} \cdot (5.0\,\text{m})$$
$$- 8.0\,\text{kN} \cdot (15.0\,\text{m}) - 10.0\,\text{kN} \cdot (30.0\,\text{m}) = 0$$

$$\Rightarrow R_I = 11.250\,\text{kN} \cdot \text{m}$$

This is the only reaction that we need because we will be using the right portion of the truss.



1. As in the previous example, section $a{-}a$ will give access to F_{EF} and F_{LM}.

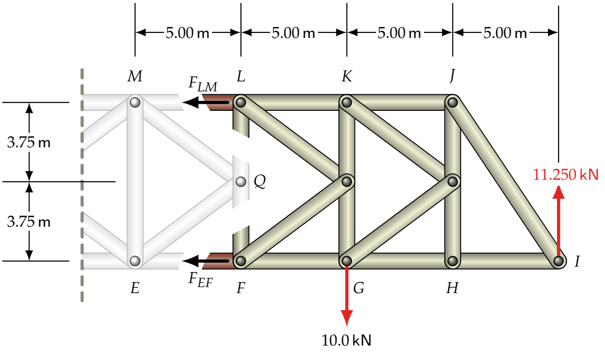


$F_{EF} = 15.833\,\text{kN}$

1. As in the previous example, section $a{-}a$ will give access to F_{EF} and F_{LM}.
2. Sum the moments about joint L.

$$\Sigma M_L = (11.250\,\text{kN})\cdot(15.0\,\text{m}) - (10.0\,\text{kN})\cdot(5.0\,\text{m}) - F_{EF}\cdot(7.50\,\text{m}) = 0$$

$$\Rightarrow F_{EF} = 15.833\,\text{kN}$$



$F_{EF} = 15.833\,\text{kN}$

$F_{LM} = -15.833\,\text{kN}$

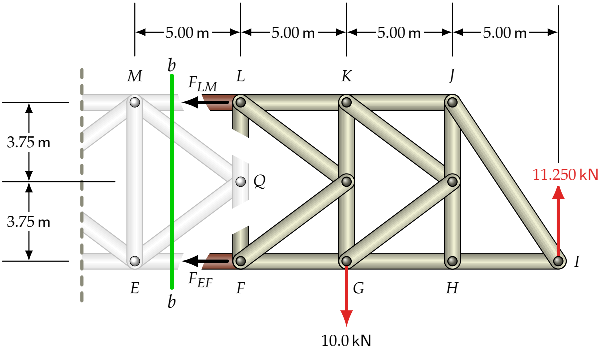
1. As in the previous example, section $a{-}a$ will give access to F_{EF} and F_{LM}.
2. Sum the moments about joint L.
3. Sum the moments about joint F.

$$\Sigma M_L = (11.250\,\text{kN})\cdot(15.0\,\text{m}) - (10.0\,\text{kN})\cdot(5.0\,\text{m}) - F_{EF}\cdot(7.50\,\text{m}) = 0$$

$$\Rightarrow F_{EF} = 15.833\,\text{kN}$$

$$\Sigma M_F = (11.250\,\text{kN})\cdot(15.0\,\text{m}) - (10.0\,\text{kN})\cdot(5.0\,\text{m}) + F_{LM}\cdot(7.50\,\text{m}) = 0$$

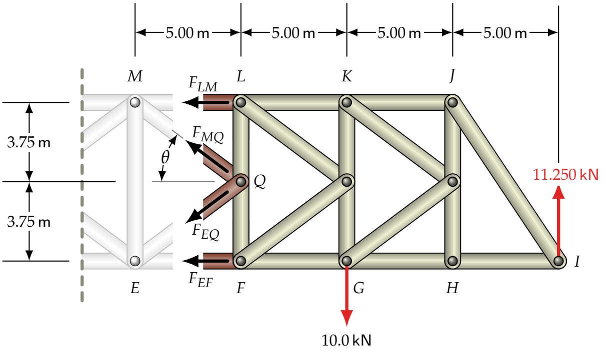
$$\Rightarrow F_{LM} = -15.833\,\text{kN}$$



$F_{EF} = 15.833$ kN

$F_{LM} = -15.833$ kN

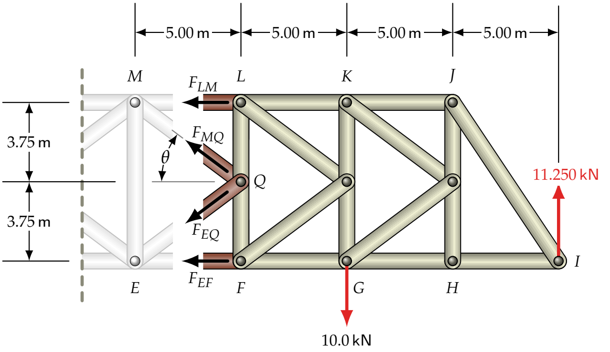
1. As in the previous example, section $a-a$ will give access to F_{EF} and F_{LM}.
2. Sum the moments about joint L.
3. Sum the moments about joint F.
4. Now, consider section $b-b$ for the remaining two unknowns.



$F_{EF} = 15.833$ kN

$F_{LM} = -15.833$ kN

1. As in the previous example, section $a-a$ will give access to F_{EF} and F_{LM}.
2. Sum the moments about joint L.
3. Sum the moments about joint F.
4. Now, consider section $b-b$ for the remaining two unknowns.
5. Find the diagonal member angle θ.



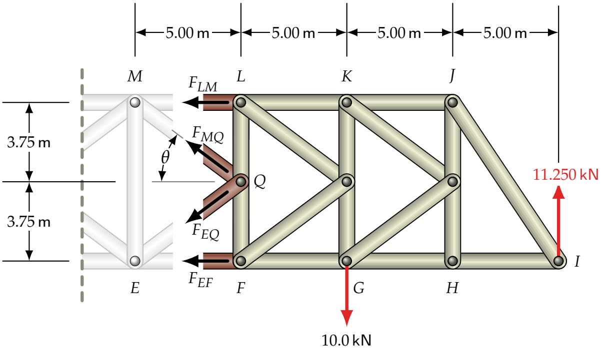
$F_{EF} = 15.833$ kN

$F_{LM} = -15.833$ kN

$\theta = 36.870°$

1. As in the previous example, section $a-a$ will give access to F_{EF} and F_{LM}.
2. Sum the moments about joint L.
3. Sum the moments about joint F.
4. Now, consider section $b-b$ for the remaining two unknowns.
5. Find the diagonal member angle θ.

$$\theta = \tan^{-1}\left[\frac{3.75}{5.00}\right] = 36.870°$$



$F_{EF} = 15.833\,\text{kN}$

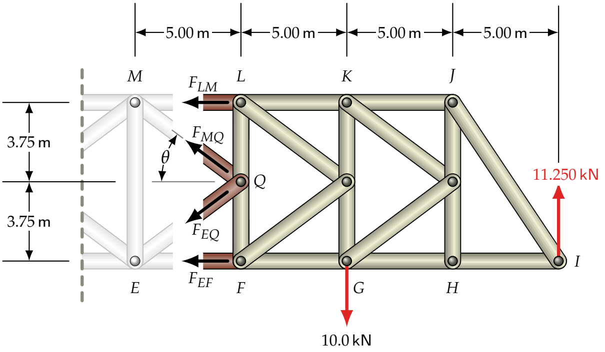
$F_{LM} = -15.833\,\text{kN}$

$\theta = 36.870^\circ$

$F_{MQ} = -1.0421\,\text{kN}$

6. Sum the moments about joint E to find F_{MQ}.

$$
\begin{aligned}
\Sigma M_E &= F_{LM}\cdot(7.50\,\text{m}) + F_{MQ}\cdot\cos\theta\cdot(3.75\,\text{m}) \\
&\quad + F_{MQ}\cdot\sin\theta\cdot(5.00\,\text{m}) + 11.250\,\text{kN}\cdot(20.00\,\text{m}) \\
&\quad - 10.0\,\text{kN}\cdot(10.0\,\text{m}) \\
&= (-15.833\,\text{kN})\cdot(7.50\,\text{m}) \\
&\quad + F_{MQ}\cdot(3.0000\,\text{m} + 3.0000\,\text{m}) \\
&\quad + 225.00\,\text{kN}\cdot\text{m} - 100.00\,\text{kN}\cdot\text{m} = 0 \\
\Rightarrow F_{MQ} &= -1.0421\,\text{kN}
\end{aligned}
$$



$F_{EF} = 15.833\,\text{kN}$

$F_{LM} = -15.833\,\text{kN}$

$\theta = 36.870°$

$F_{MQ} = -1.0421\,\text{kN}$

$F_{EQ} = 1.0421\,\text{kN}$

6. Sum the moments about joint E to find F_{MQ}.
7. Sum the moments about joint M to find F_{EQ}.

$$\begin{aligned}
\Sigma M_M &= -F_{EF}\cdot(7.50\,\text{m}) - F_{EQ}\cdot\cos\theta\cdot(3.75\,\text{m}) \\
&\quad - F_{EQ}\cdot\sin\theta\cdot(5.00\,\text{m}) + 11.250\,\text{kN}\cdot(20.00\,\text{m}) \\
&\quad - 10.0\,\text{kN}\cdot(10.0\,\text{m}) \\
&= -(15.833\,\text{kN})\cdot(7.50\,\text{m}) \\
&\quad - F_{EQ}\cdot(3.0000\,\text{m} + 3.0000\,\text{m}) \\
&\quad + 225.00\,\text{kN}\cdot\text{m} - 100.00\,\text{kN}\cdot\text{m} = 0
\end{aligned}$$

$$\Rightarrow F_{EQ} = 1.0421\,\text{kN}$$

$F_{EF} = 15.833$ kN
$F_{LM} = -15.833$ kN
$\theta = 36.870°$
$F_{MQ} = -1.0421$ kN

6. Sum the moments about joint E to find F_{MQ}.
7. Sum the moments about joint M to find F_{EQ}.

The Answers

$$F_{EF} = 15.8 \text{ kN} \quad \text{(Tension)}$$
$$F_{EQ} = 1.04 \text{ kN} \quad \text{(Tension)}$$
$$F_{LM} = 15.8 \text{ kN} \quad \text{(Compression)}$$
$$F_{EQ} = 1.04 \text{ kN} \quad \text{(Compression)}$$

$$= -(15.833 \text{ kN}) \cdot (7.50 \text{ m})$$
$$- F_{EQ} \cdot (3.0000 \text{ m} + 3.0000 \text{ m})$$
$$+ 225.00 \text{ kN} \cdot \text{m} - 100.00 \text{ kN} \cdot \text{m} = 0$$
$$\Rightarrow F_{EQ} = 1.0421 \text{ kN}$$