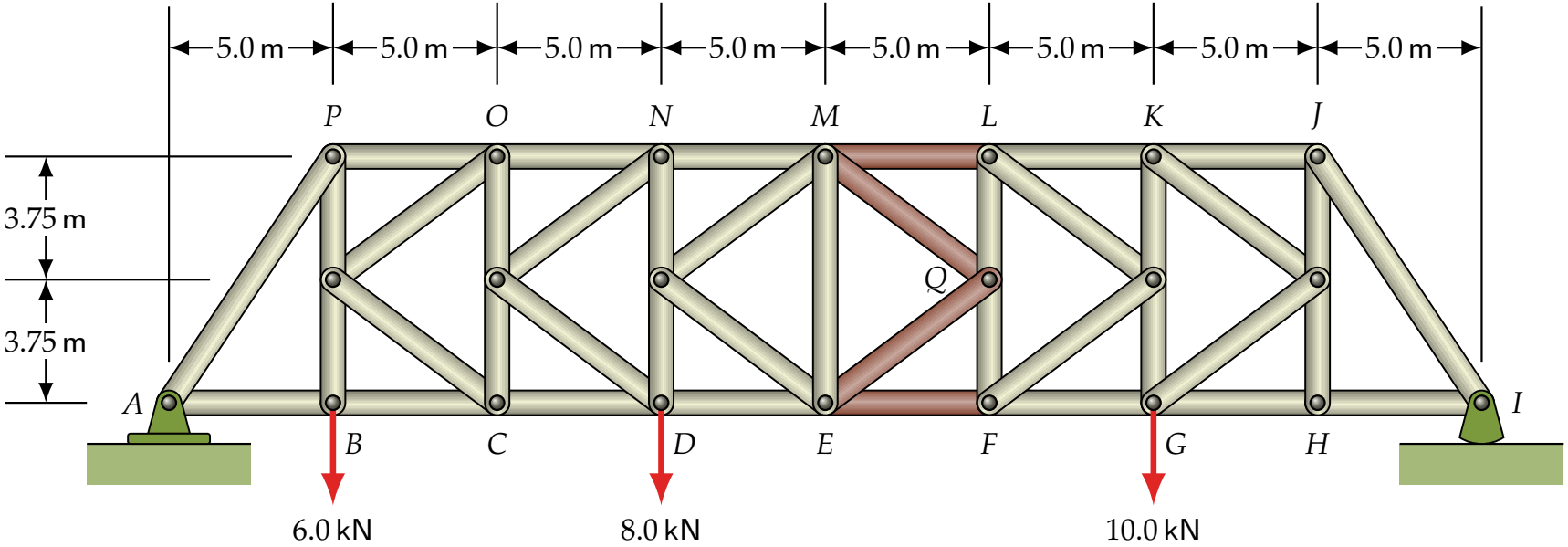
Method of Sections — Step by Step Examples

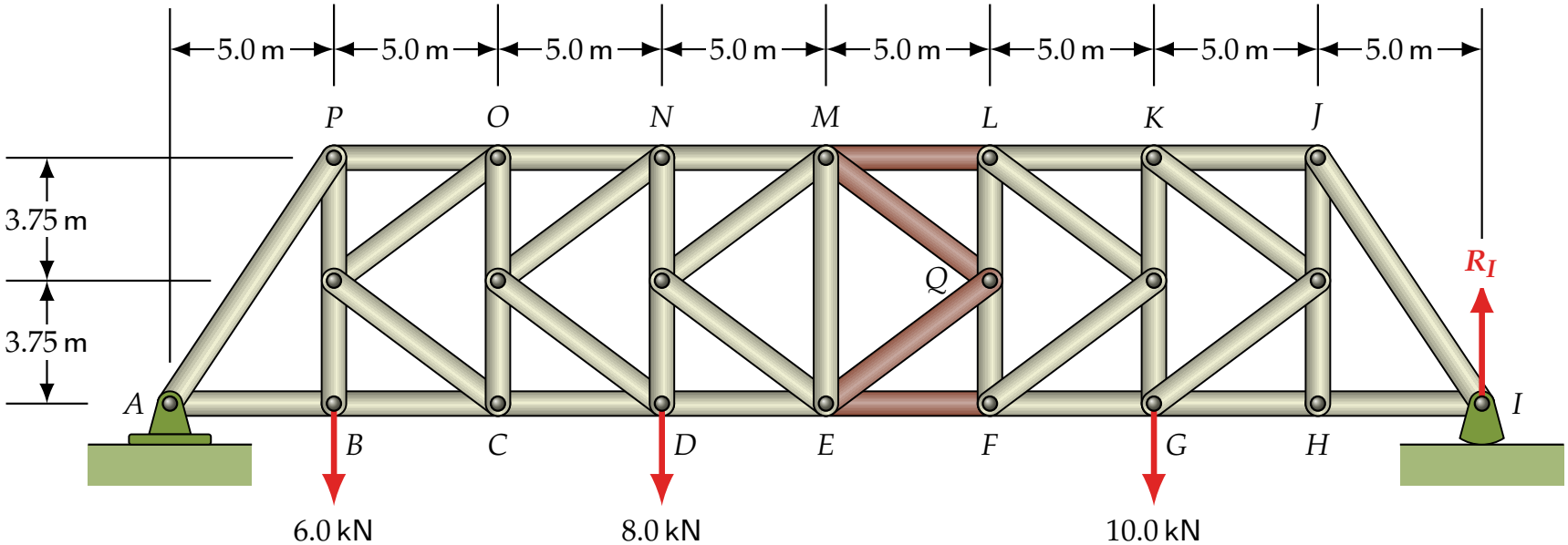
Engineering Statics

Last revision on October 23, 2025



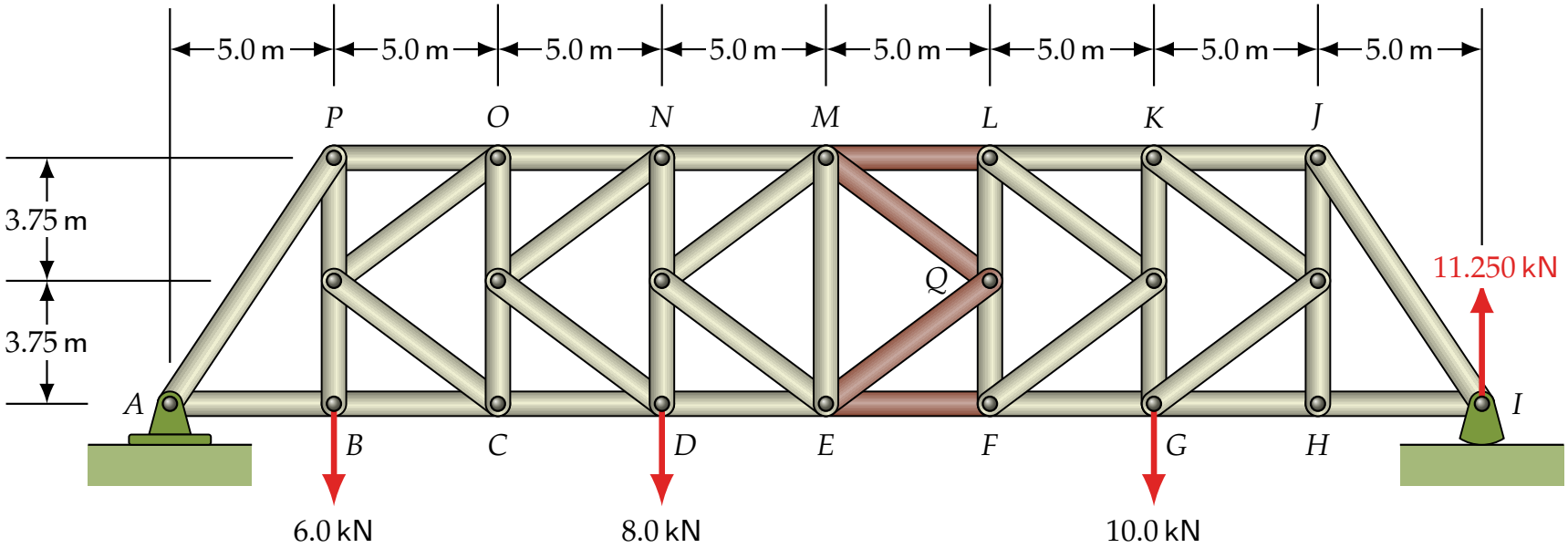
Method of Sections: Example 6

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



Find the reaction at I:

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

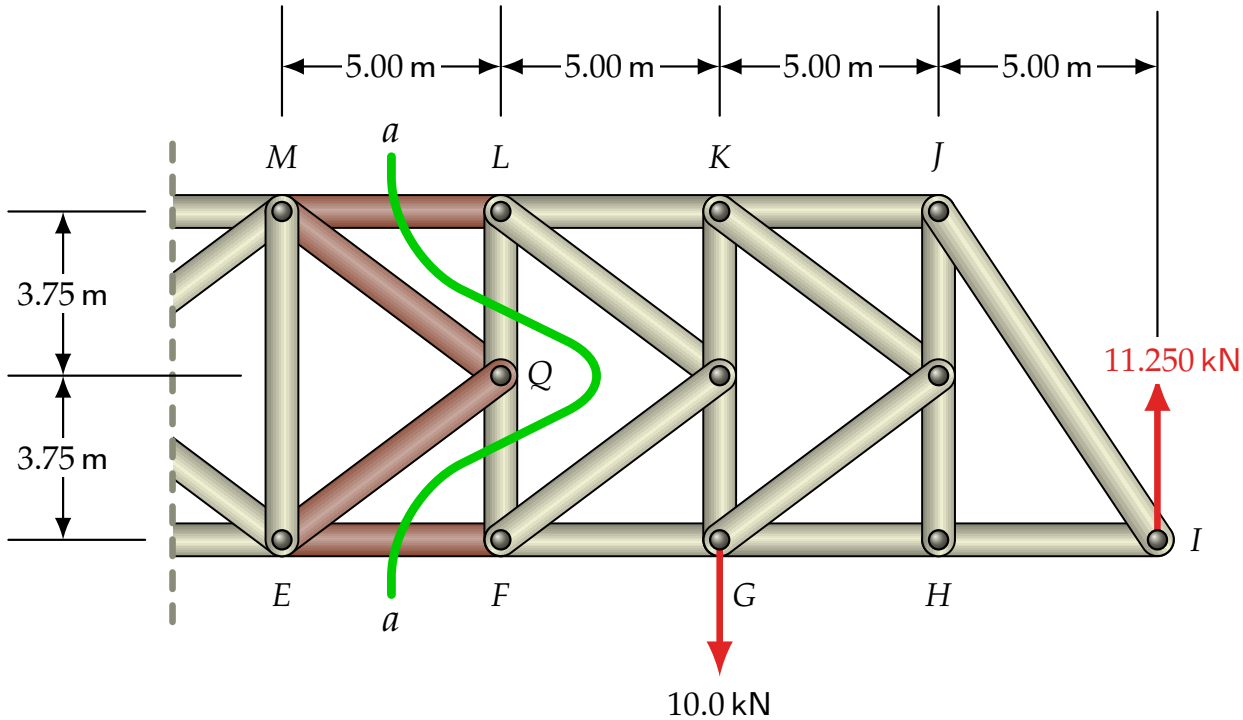


Find the reaction at I:

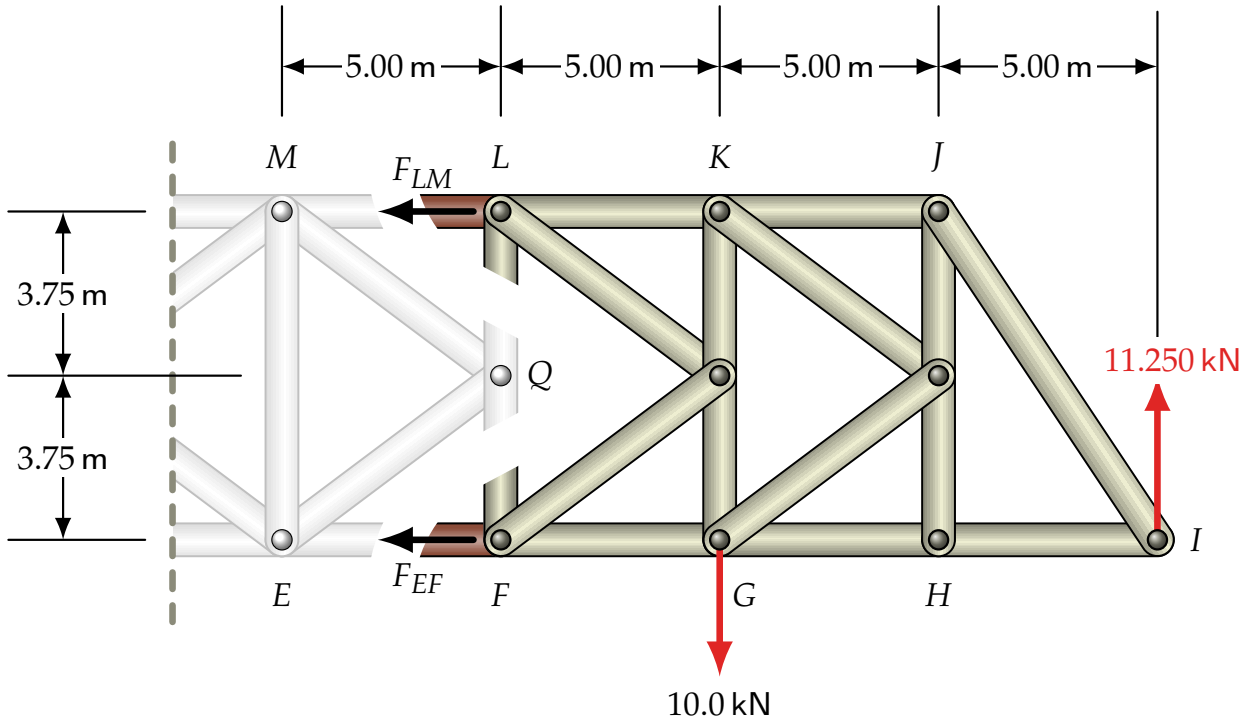
$$\Sigma M_A = R_I \cdot (40.0\,\text{m}) - 6.0\,\text{kN} \cdot (5.0\,\text{m}) - 8.0\,\text{kN} \cdot (15.0\,\text{m}) - 10.0\,\text{kN} \cdot (30.0\,\text{m}) = 0$$

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

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}.

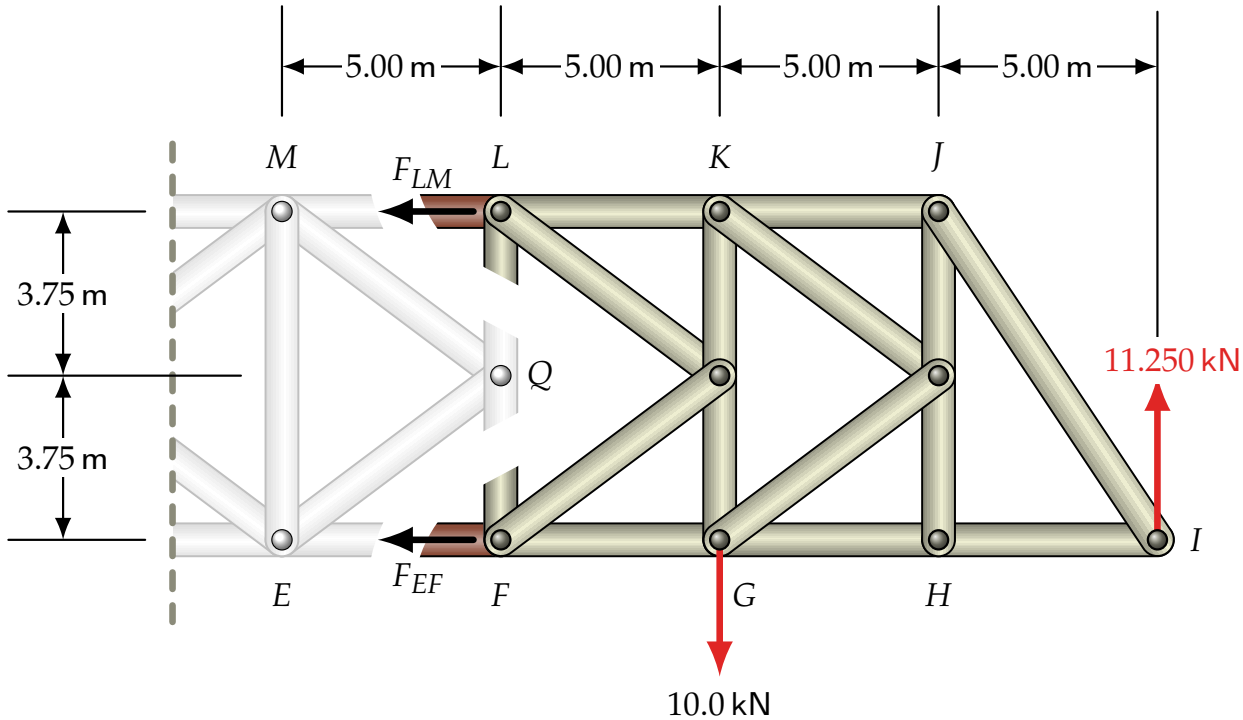


$F_{EF} = 15.833\,\text{kN}$

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.

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

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



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

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

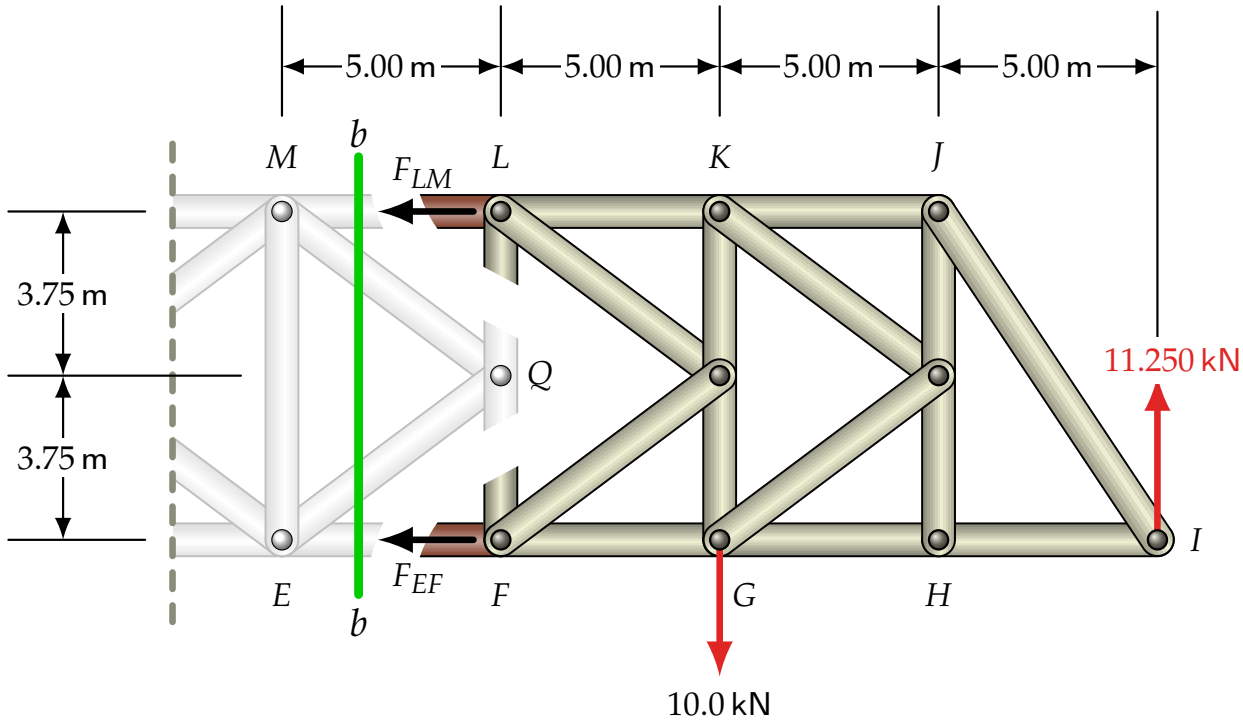
1. As in the previous example, section $a-a$ will give access to F_{EF} and F_{LM}.
2. Sum the moments about joint L.
3. Sum the moments about joint F.

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

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

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

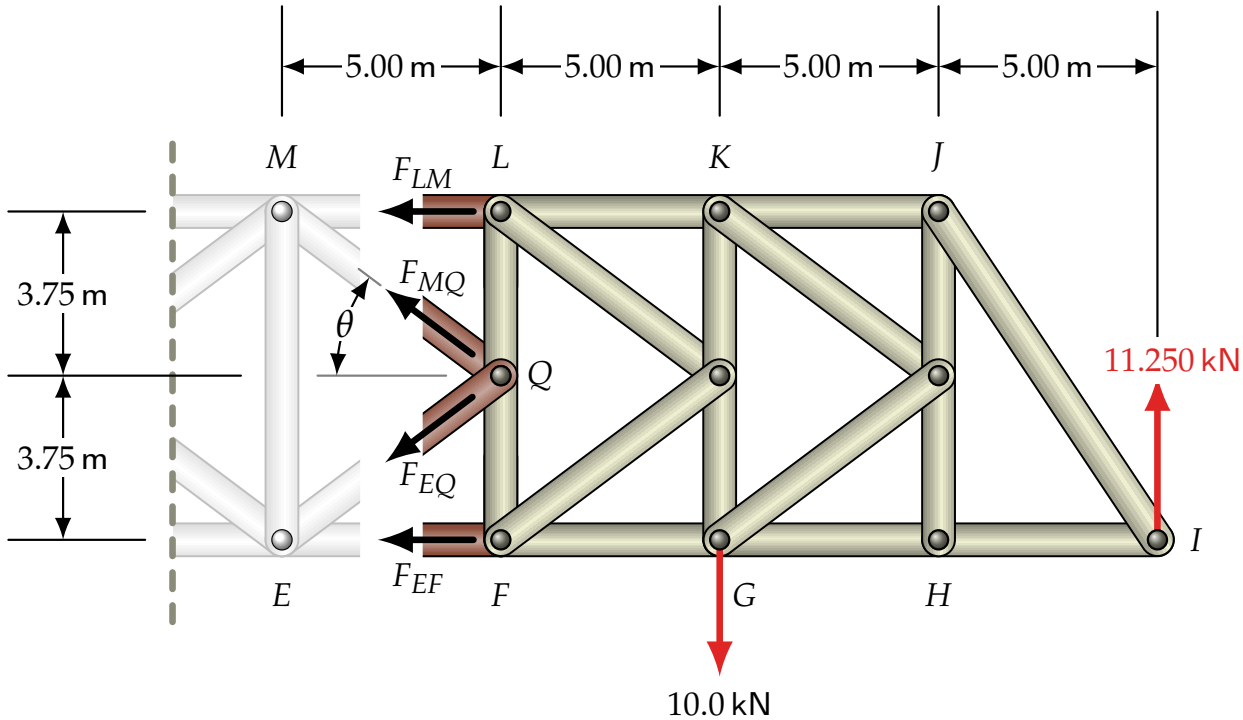
$$\Rightarrow F_{LM} = -15.833\,\text{kN}$$



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

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

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.
4. Now, consider section $b-b$ for the remaining two unknowns.



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

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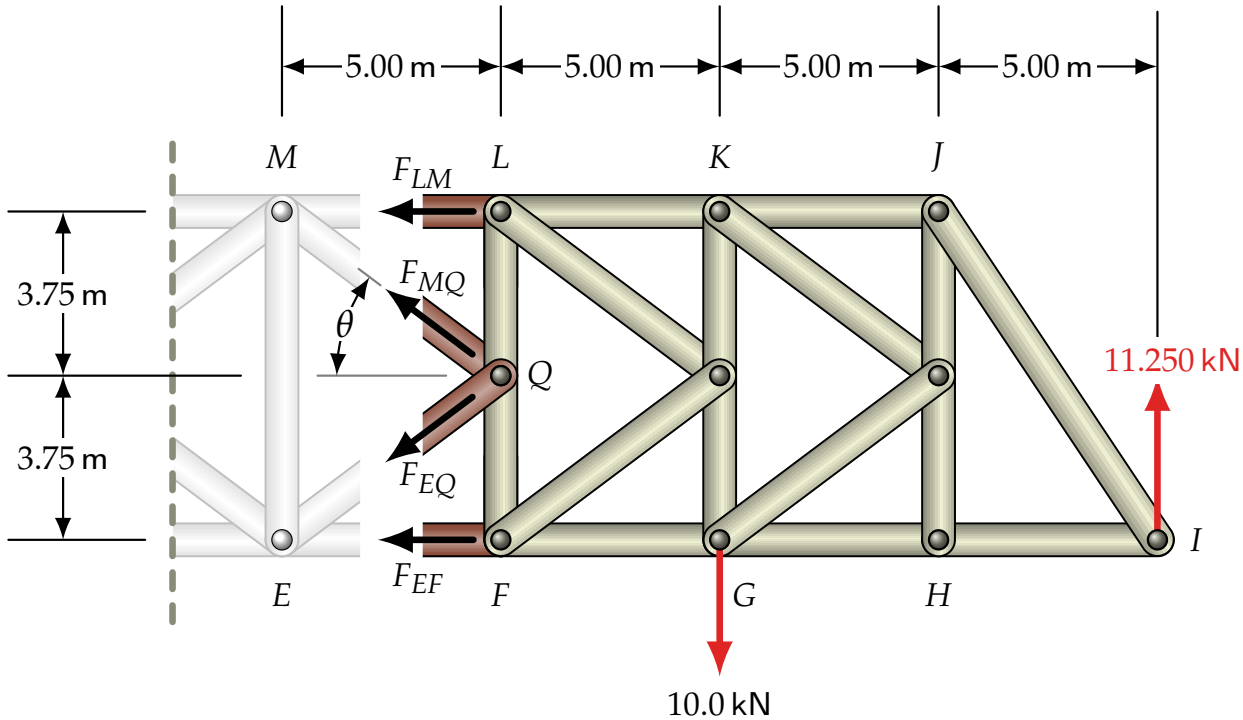
1. As in the previous example, section $a-a$ will give access to F_{EF} and F_{LM}.
2. Sum the moments about joint L.
3. Sum the moments about joint F.
4. Now, consider section $b-b$ for the remaining two unknowns.
5. Find the diagonal member angle θ.



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

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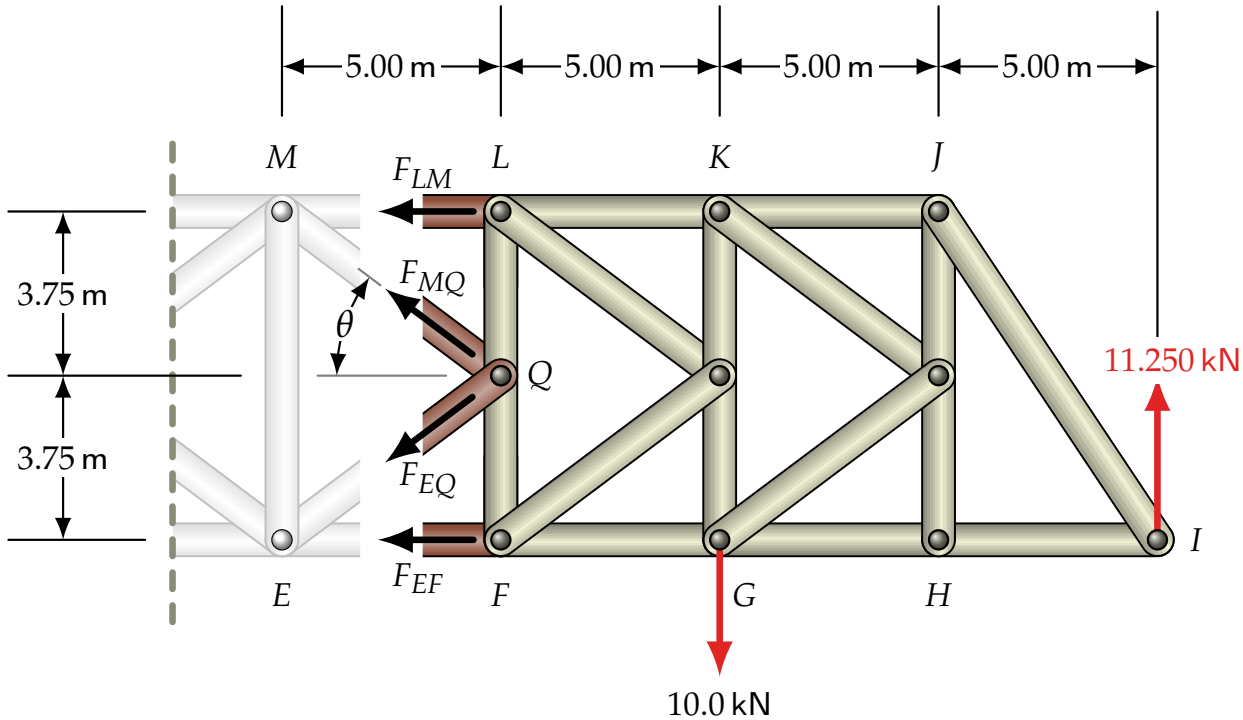
$\theta = 36.870^\circ$

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.

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



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

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

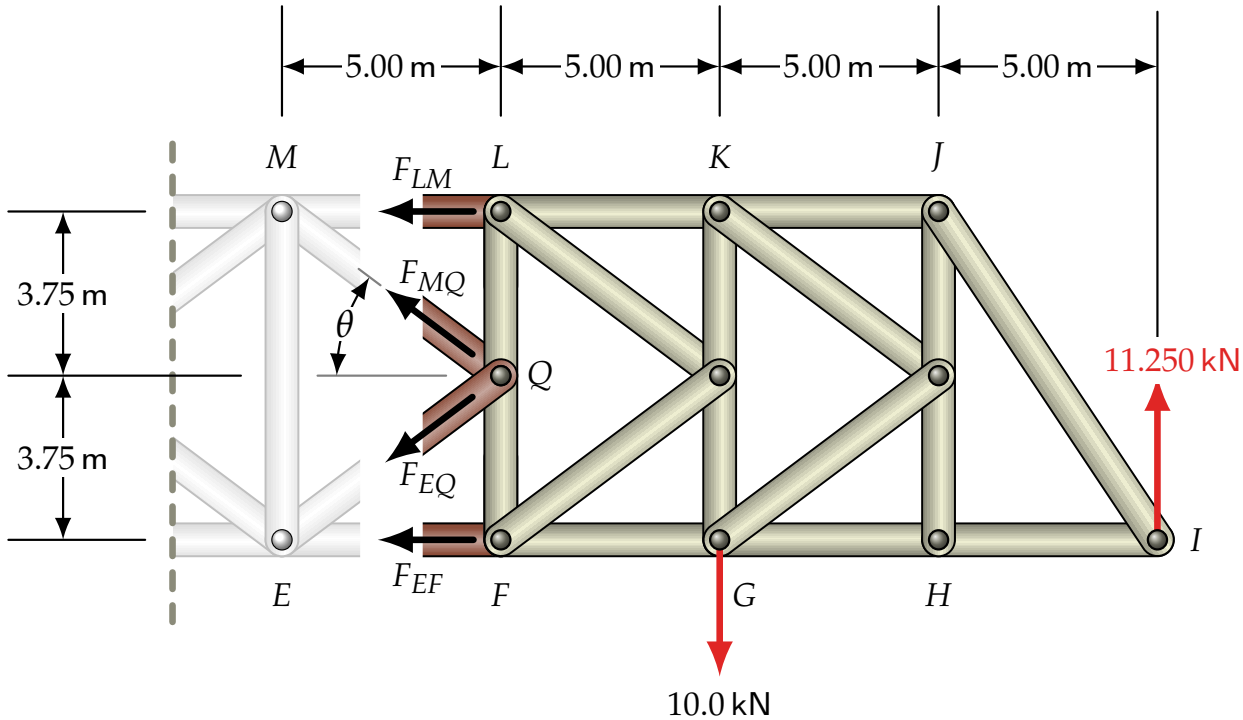
$\theta = 36.870^\circ$

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

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

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

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



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

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

$\theta = 36.870^\circ$

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

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

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

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

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

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

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

$\theta = 36.870^\circ$

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

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

$$
\begin{aligned}
&= -(15.833\,\text{kN})\cdot(7.50\,\text{m}) \\
&\quad - F_{EQ}\cdot(3.0000\,\text{m} + 3.0000\,\text{m}) \\
&\quad + 225.00\,\text{kN}\cdot\text{m} - 100.00\,\text{kN}\cdot\text{m} = 0 \\
\Rightarrow F_{EQ} &= 1.0421\,\text{kN}
\end{aligned}
$$

The Answers

$$
\begin{aligned}
F_{EF} &= 15.8\,\text{kN} \quad \text{(Tension)} \\
F_{EQ} &= 1.04\,\text{kN} \quad \text{(Tension)} \\
F_{LM} &= 15.8\,\text{kN} \quad \text{(Compression)} \\
F_{EQ} &= 1.04\,\text{kN} \quad \text{(Compression)}
\end{aligned}
$$