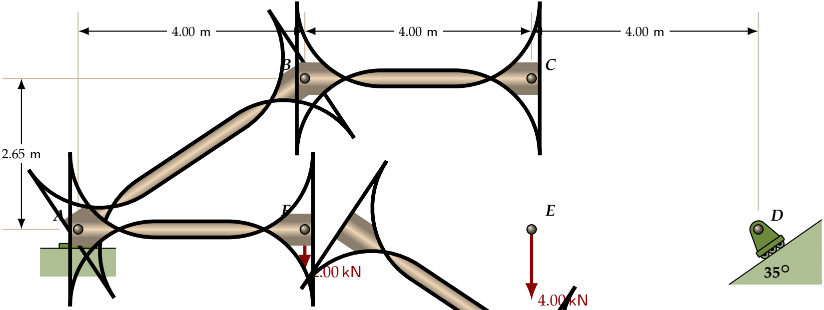
# Method of Joints — Step by Step Examples

## Engineering Statics

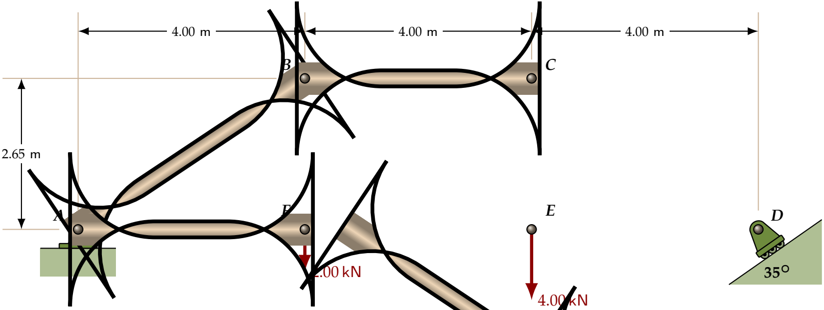
Last revision on September 29, 2025




## Method of Joints: Example 1

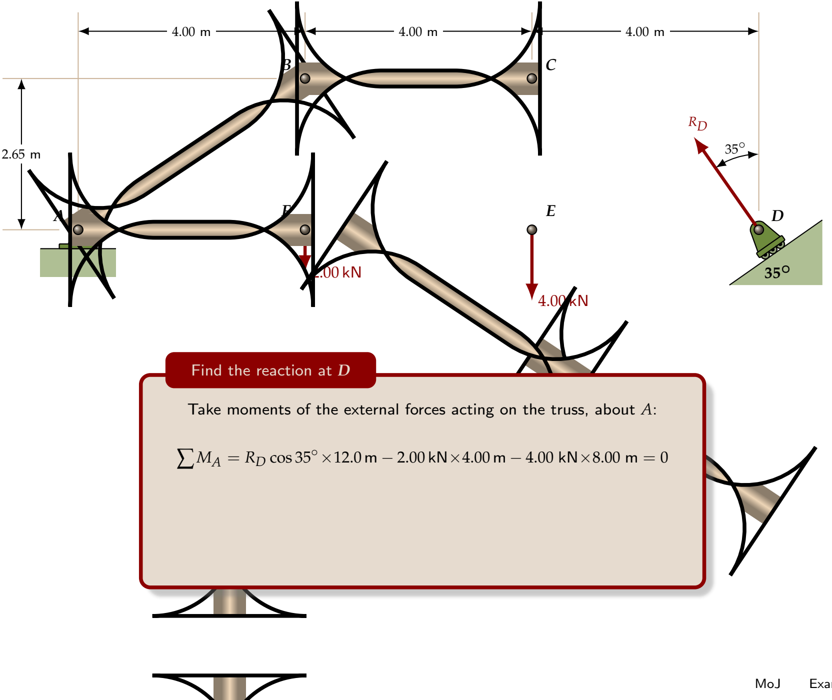
The truss is supported by a pinned connection at $A$ and a roller, inclined at $35^\circ$ to the horizontal, at $D$.

Determine the internal force in each truss member due to the applied loads at $E$ and $F$.




## Find the reaction at $D$

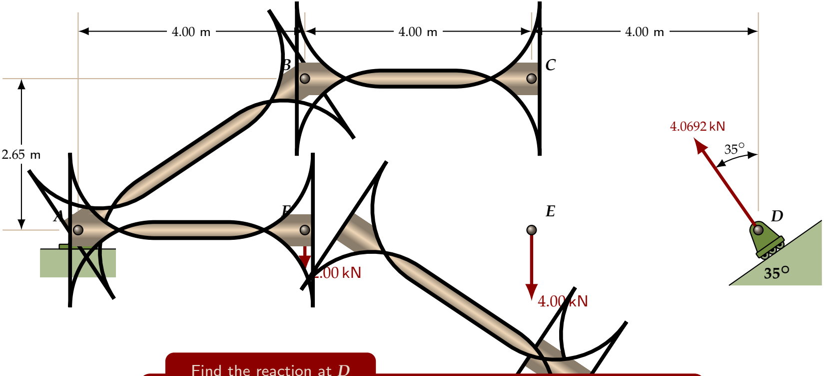
Take moments of the external forces acting on the truss, about $A$:




## Find the reaction at $D$

Take moments of the external forces acting on the truss, about $A$:

$$\sum M_A = R_D \cos 35^\circ \times 12.0\,\text{m} - 2.00\,\text{kN} \times 4.00\,\text{m} - 4.00\,\text{kN} \times 8.00\,\text{m} = 0$$



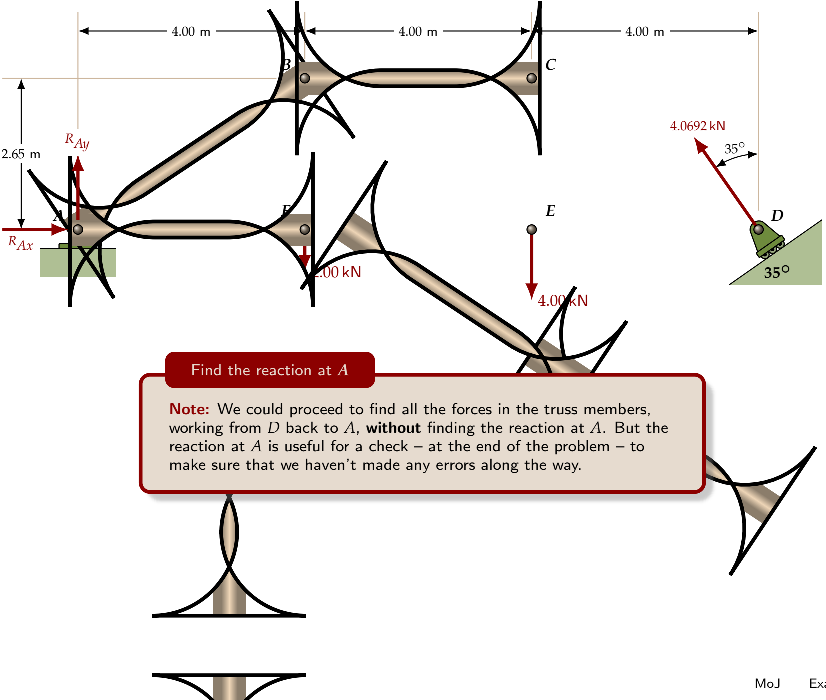

## Find the reaction at $D$

Take moments of the external forces acting on the truss, about $A$:

$$\sum M_A = R_D \cos 35^\circ \times 12.0\,\text{m} - 2.00\,\text{kN} \times 4.00\,\text{m} - 4.00\,\text{kN} \times 8.00\,\text{m} = 0$$

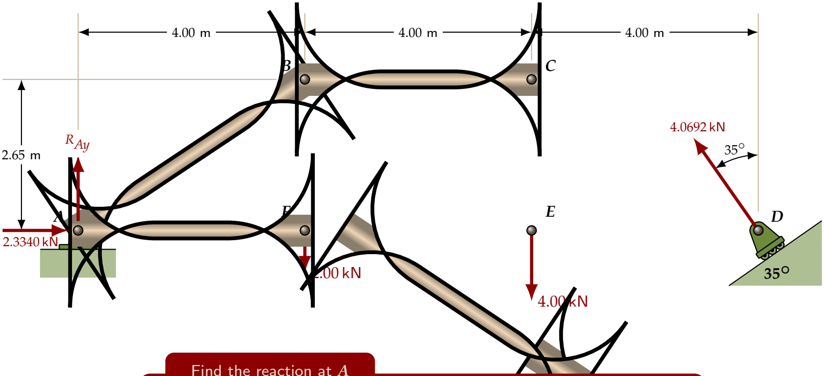
$$\Rightarrow R_D = \frac{40.0\,\text{kN}\cdot\text{m}}{12.0\,\text{m} \times \cos 35^\circ}$$

$$= 4.0692\,\text{kN}$$




## Find the reaction at $A$

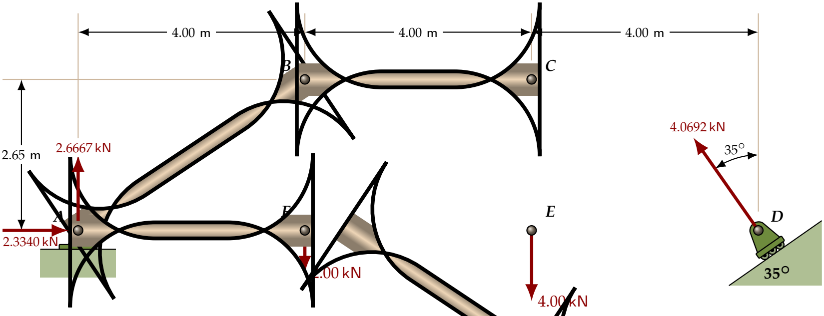
**Note:** We could proceed to find all the forces in the truss members, working from $D$ back to $A$, **without** finding the reaction at $A$. But the reaction at $A$ is useful for a check – at the end of the problem – to make sure that we haven't made any errors along the way.




## Find the reaction at $A$

$$\sum F_x = R_{Ax} - 4.0692 \sin 35^\circ \text{ kN} = 0$$

$$\Rightarrow R_{Ax} = 2.3340 \text{ kN}$$



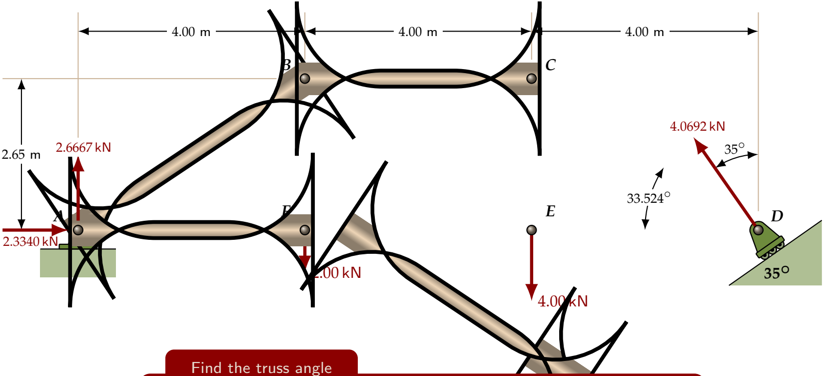

## Find the reaction at $A$

$$\sum F_x = R_{Ax} - 4.0692 \sin 35^\circ \text{ kN} = 0$$

$$\Rightarrow R_{Ax} = 2.3340 \text{ kN}$$

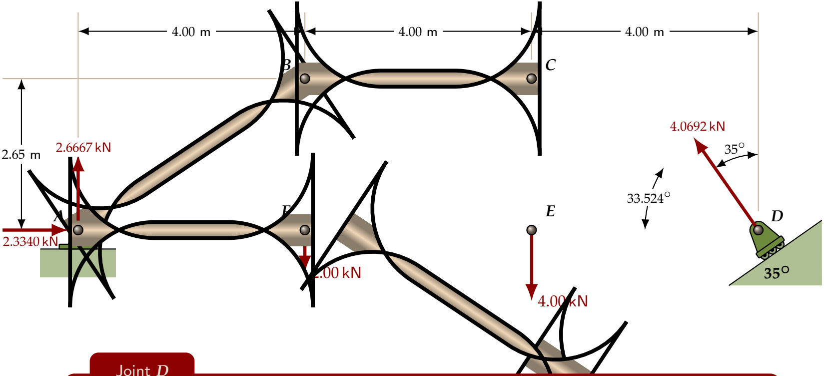
$$\sum F_y = R_{Ay} + 4.0692 \cos 35^\circ \text{ kN} - 2.00 \text{ kN} - 4.00 \text{ kN} = 0$$

$$\Rightarrow R_{Ay} = 2.6667 \text{ kN}$$



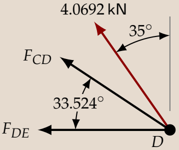

## Find the truss angle

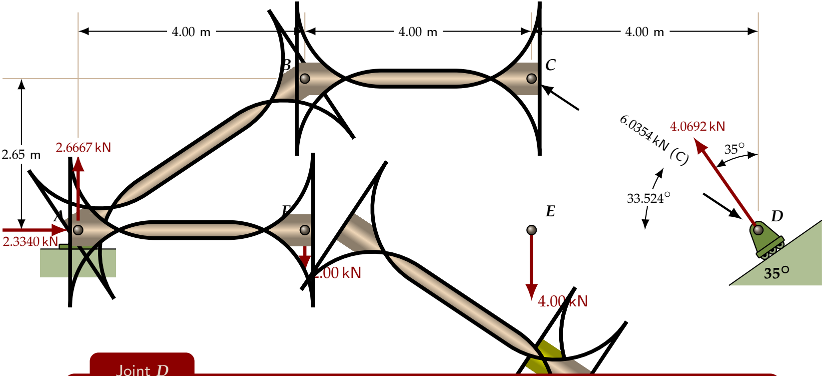
$$\angle CDE = \tan^{-1}\left[\frac{CE}{DE}\right]$$
$$= \tan^{-1}\left[\frac{2.65\,\text{m}}{4.00\,\text{m}}\right]$$
$$= 33.524^\circ$$




## Joint $D$

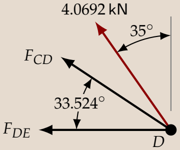
First, the free body diagram:





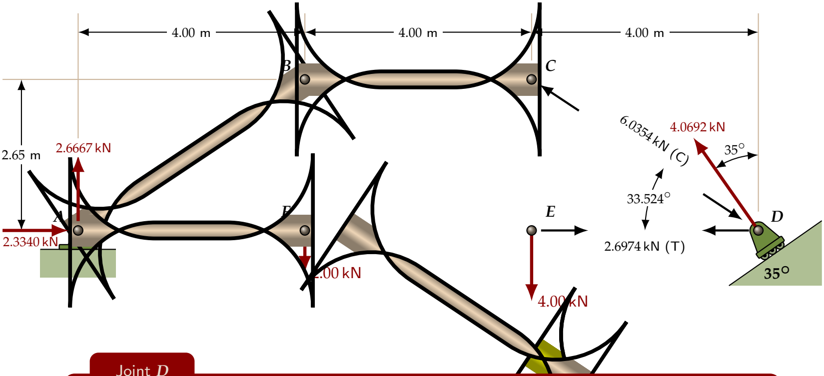

## Joint $D$

First, the free body diagram:



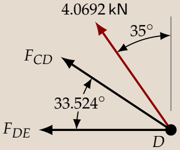

$$\sum F_y = 4.0692 \cos 35^\circ \text{ kN} + F_{CD} \sin 33.524^\circ = 0$$

$$\Rightarrow \boldsymbol{F_{CD} = -6.0354\,\text{kN}}$$




## Joint $D$

First, the free body diagram:



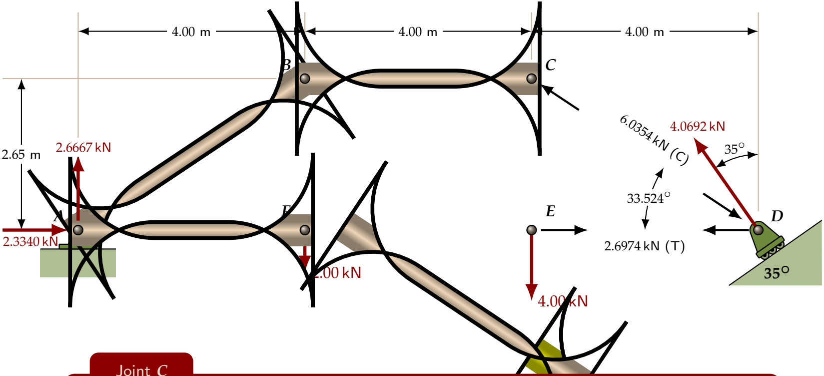

$$\sum F_y = 4.0692 \cos 35^\circ \text{ kN} + F_{CD} \sin 33.524^\circ = 0$$

$$\Rightarrow \boldsymbol{F_{CD} = -6.0354\,\text{kN}}$$

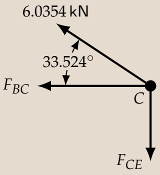
$$\sum F_x = -4.0692 \sin 35^\circ \text{ kN} - F_{CD} \cos 33.524^\circ - F_{DE} = 0$$

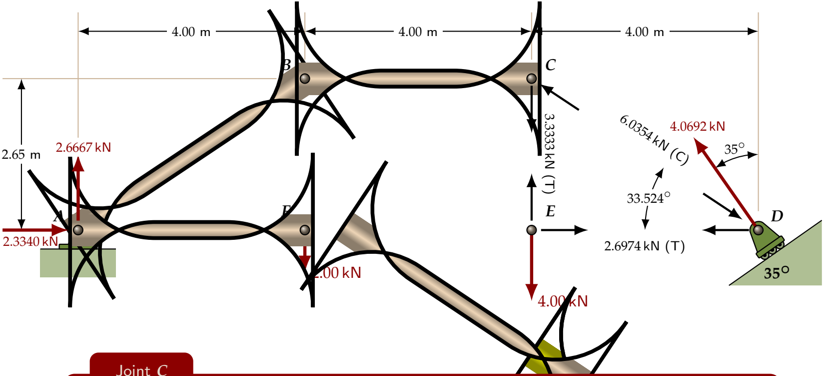
$$= -2.3340\text{ kN} - (-6.0354\text{ kN}) \cos 33.524^\circ - F_{DE} = 0$$

$$\Rightarrow \boldsymbol{F_{DE} = 2.6974\,\text{kN}}$$

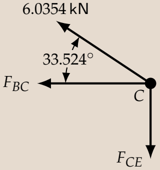

4.00 m
4.00 m
4.00 m
B
C
2.65 m
2.6667 kN
6.0354 kN (C)
4.0692 kN
35°
33.524°
A
E
D
2.3340 kN
2.6974 kN (T)
35°
4.00 kN

## Joint $C$


6.0354 kN
33.524°
$F_{BC}$
$C$
$F_{CE}$

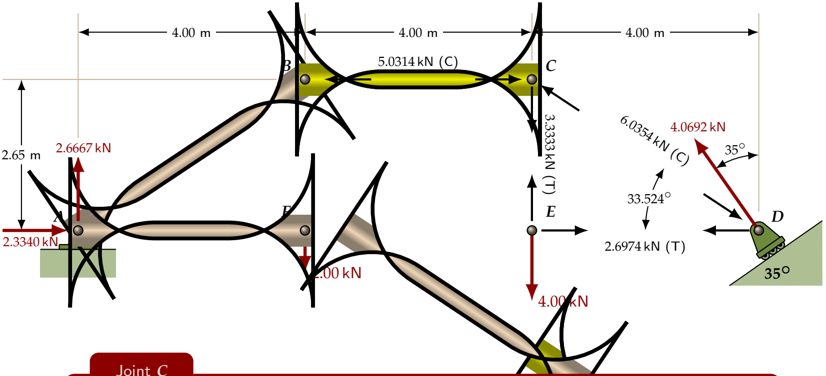



## Joint $C$

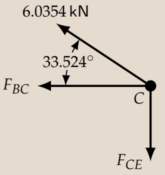



$$\sum F_y = 6.0354 \sin 33.524^\circ \text{ kN} - F_{CE} = 0$$

$$\Rightarrow \boldsymbol{F_{CE} = 3.3333\,\text{kN}}$$




## Joint $C$

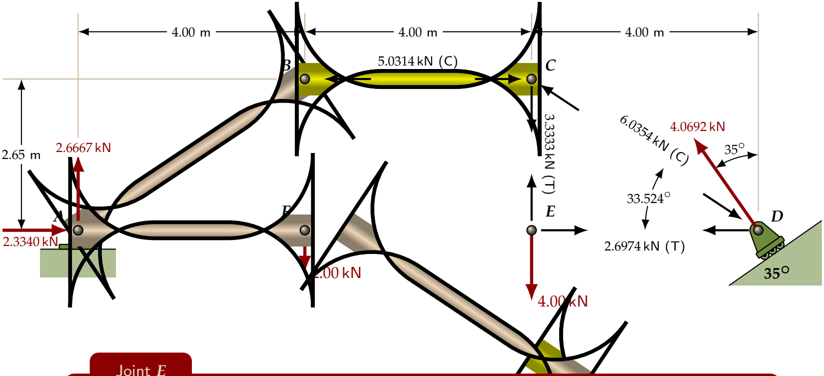



$$\sum F_y = 6.0354 \sin 33.524^\circ \text{ kN} - F_{CE} = 0$$

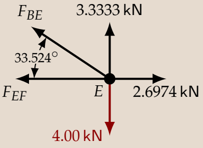
$$\Rightarrow \boldsymbol{F_{CE} = 3.3333\,\text{kN}}$$

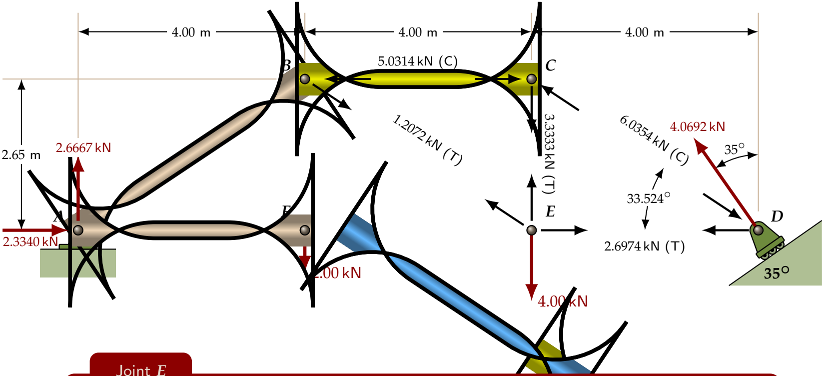
$$\sum F_x = -6.0354 \cos 33.524^\circ \text{ kN} - F_{BC} = 0$$

$$\Rightarrow \boldsymbol{F_{BC} = -5.0314\,\text{kN}}$$

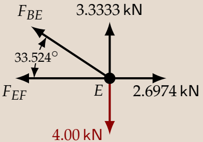

4.00 m
4.00 m
4.00 m
5.0314 kN (C)
B
C
2.65 m
2.6667 kN
A
2.3340 kN
F
.00 kN
3.3333 kN (T)
E
4.00 kN
6.0354 kN (C)
4.0692 kN
35°
33.524°
2.6974 kN (T)
D
35°

## Joint $E$


$F_{BE}$
3.3333 kN
33.524°
$F_{EF}$
E
2.6974 kN
4.00 kN

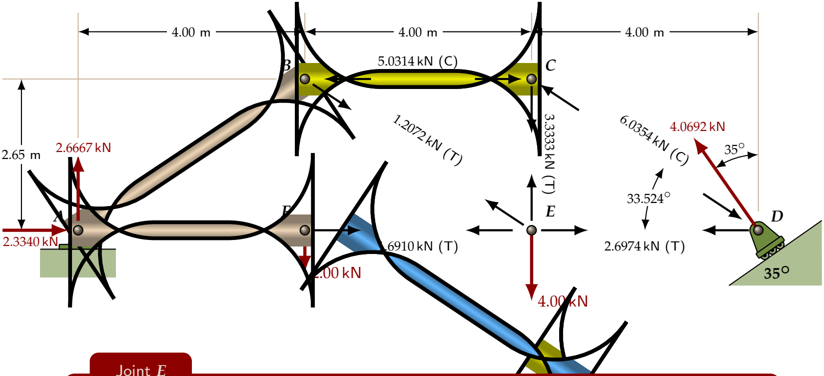



## Joint $E$

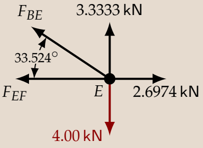



$$\sum F_y = 3.3333\,\text{kN} + F_{BE}\sin 33.524^\circ\ \text{kN} - 4.00\,\text{kN} = 0$$

$$\Rightarrow \boldsymbol{F_{BE} = 1.2072\,\text{kN}}$$




## Joint $E$

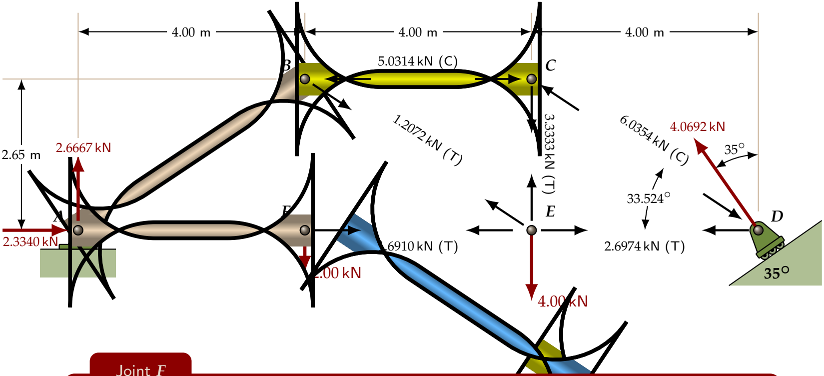



$$\sum F_y = 3.3333\,\text{kN} + F_{BE}\sin 33.524^\circ\,\text{kN} - 4.00\,\text{kN} = 0$$

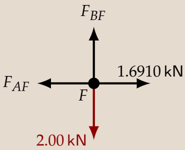
$$\Rightarrow \boldsymbol{F_{BE} = 1.2072\,\text{kN}}$$

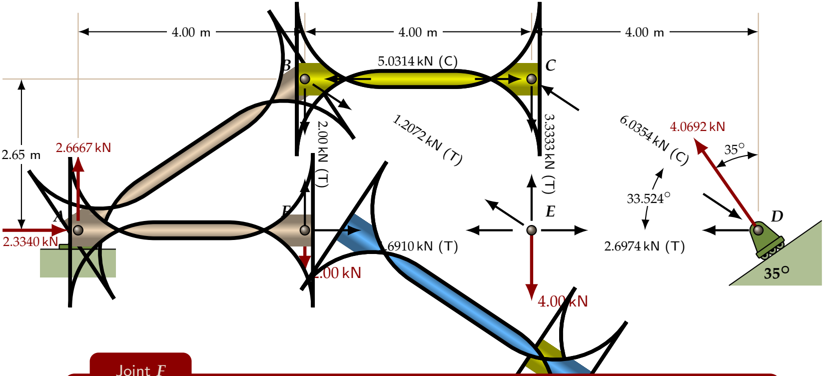
$$\sum F_x = 2.6974\,\text{kN} - 1.2072\cos 33.524^\circ\,\text{kN} - F_{EF} = 0$$

$$\Rightarrow \boldsymbol{F_{EF} = 1.6910\,\text{kN}}$$

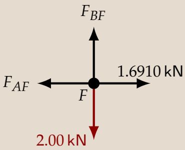

4.00 m
4.00 m
4.00 m
5.0314 kN (C)
B
C
2.65 m
2.6667 kN
1.2072 kN (T)
3.3333 kN (T)
6.0354 kN (C)
4.0692 kN
35°
33.524°
A
F
E
D
2.3340 kN
.6910 kN (T)
.00 kN
4.00 kN
2.6974 kN (T)
35°

## Joint $F$

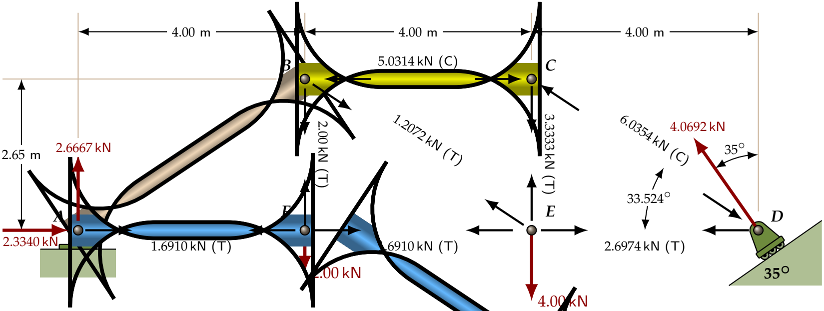

$F_{BF}$
$F_{AF}$
1.6910 kN
$F$
2.00 kN



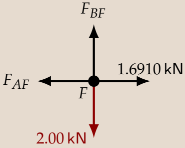

## Joint $F$




$$\sum F_y = F_{BF} - 2.00\,\text{kN}$$
$$\Rightarrow \boldsymbol{F_{BF} = 2.00\,\text{kN}}$$




## Joint $F$

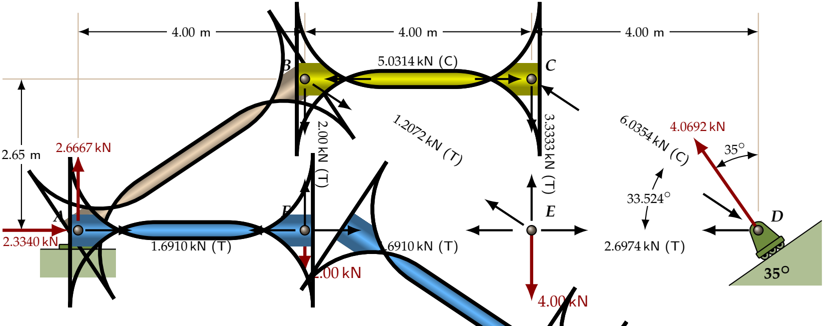



$$\sum F_y = F_{BF} - 2.00\,\text{kN}$$

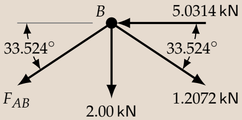
$$\Rightarrow \boldsymbol{F_{BF} = 2.00\,\text{kN}}$$

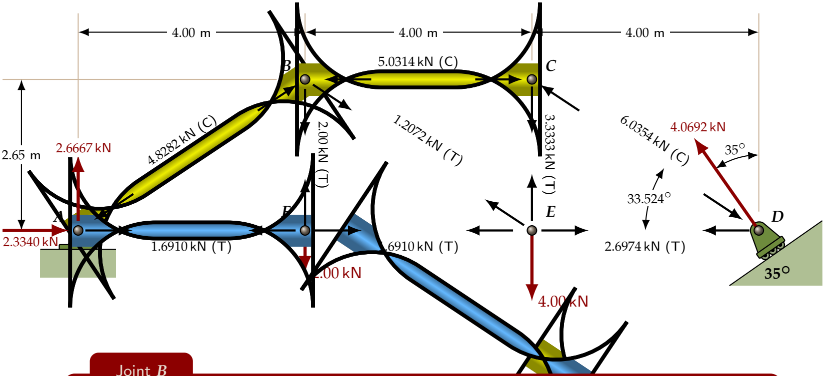
$$\sum F_x = 1.6910\,\text{kN} - F_{AF} = 0$$

$$\Rightarrow \boldsymbol{F_{AF} = 1.6910\,\text{kN}}$$

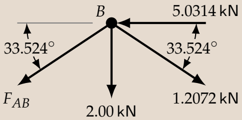

4.00 m
4.00 m
4.00 m
2.65 m
B
C
A
E
D
5.0314 kN (C)
1.2072 kN (T)
2.00 kN (T)
3.3333 kN (T)
6.0354 kN (C)
4.0692 kN
35°
33.524°
2.6667 kN
2.3340 kN
1.6910 kN (T)
2.6974 kN (T)
4.00 kN
35°

## Joint $B$


B
5.0314 kN
33.524°
33.524°
$F_{AB}$
2.00 kN
1.2072 kN

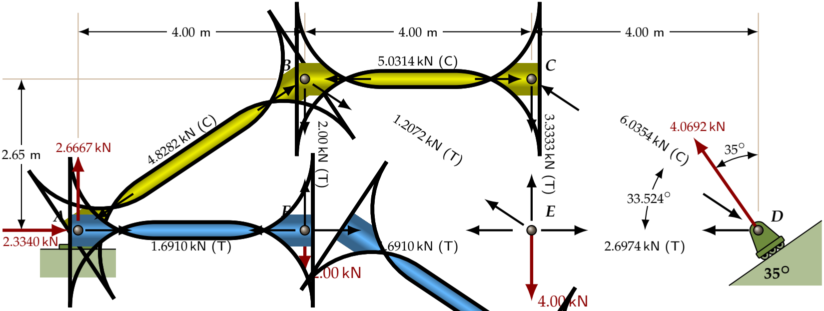



## Joint $B$

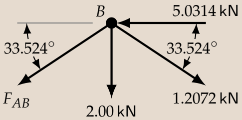



$$\sum F_x = -5.0314\,\text{kN} + 1.2072\cos 33.524^\circ\,\text{kN} - F_{AB}\cos 33.524^\circ = 0$$

$$\Rightarrow \boldsymbol{F_{AB} = -4.8282}\,\text{kN}$$



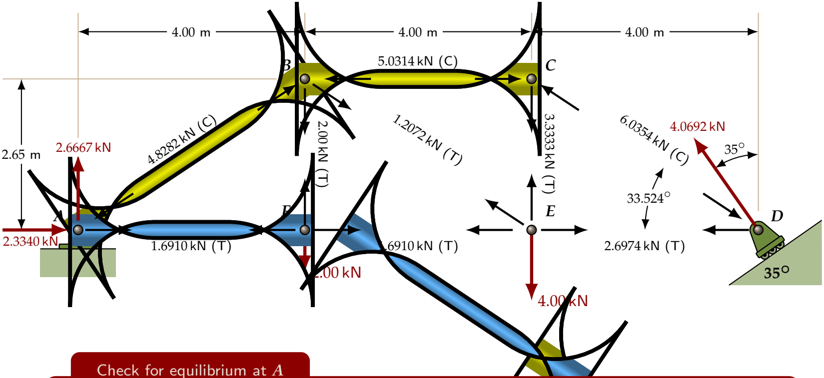

## Joint $B$




$$\sum F_x = -5.0314\,\text{kN} + 1.2072\cos 33.524^\circ\,\text{kN} - F_{AB}\cos 33.524^\circ = 0$$

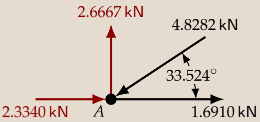
$$\Rightarrow \boldsymbol{F_{AB} = -4.8282}\,\text{kN}$$

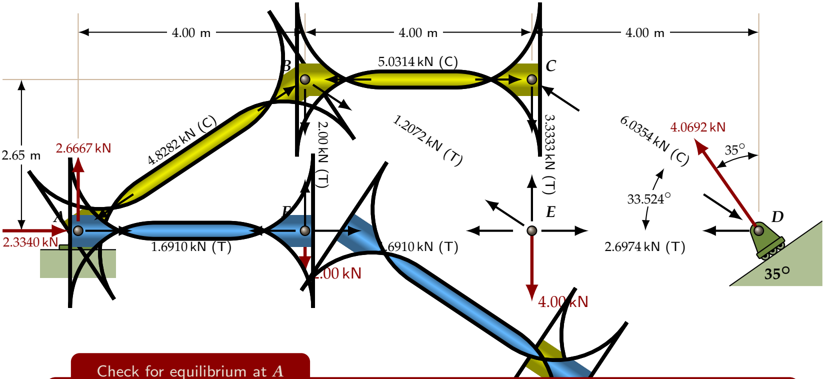
All the truss member forces are now found.




## Check for equilibrium at $A$

This is to verify that we haven't made an error in our member force calculations.



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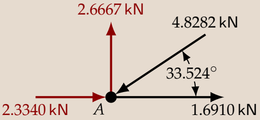
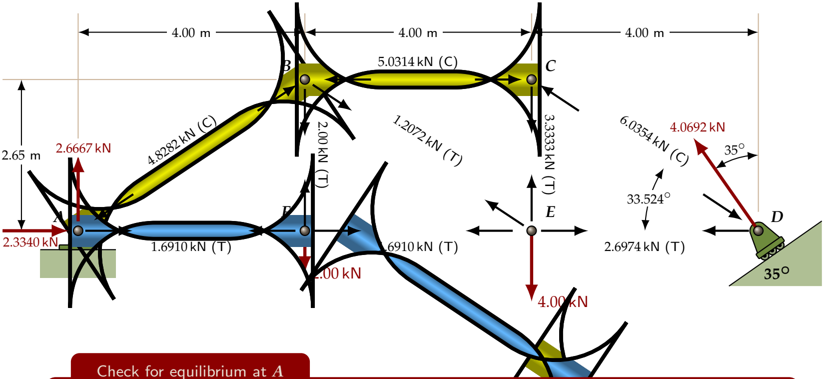
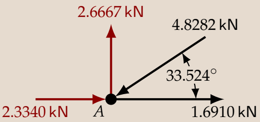



$$\sum F_x = 2.3340\,\text{kN} + 1.6910\,\text{kN} - 4.8282\cos 33.524^\circ\,\text{kN}$$
$$= -0.000050918\,\text{kN} \approx 0 \quad \checkmark$$



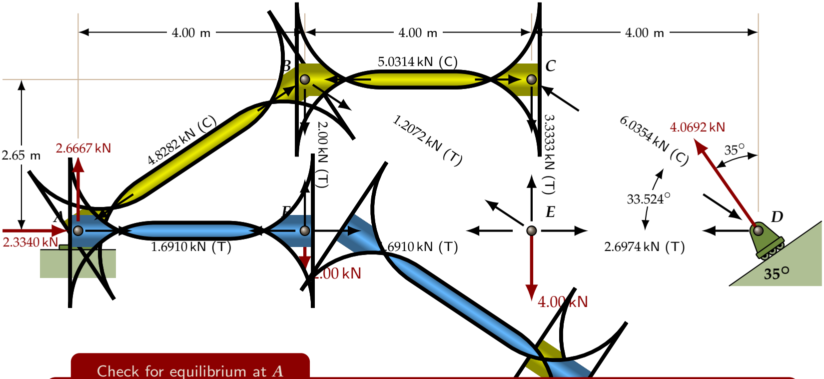

## Check for equilibrium at $A$

This is to verify that we haven't made an error in our member force calculations.



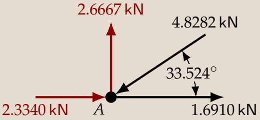

$$\begin{aligned}
\sum F_x &= 2.3340\,\text{kN} + 1.6910\,\text{kN} - 4.8282 \cos 33.524^\circ\ \text{kN} \\
&= -0.000050918\,\text{kN} \approx 0 \quad \checkmark
\end{aligned}$$

$$\begin{aligned}
\sum F_y &= 2.6667\,\text{kN} - 4.8282 \sin 33.524^\circ\ \text{kN} \\
&= 0.00015160\,\text{kN} \approx 0 \quad \checkmark
\end{aligned}$$




## Check for equilibrium at $A$

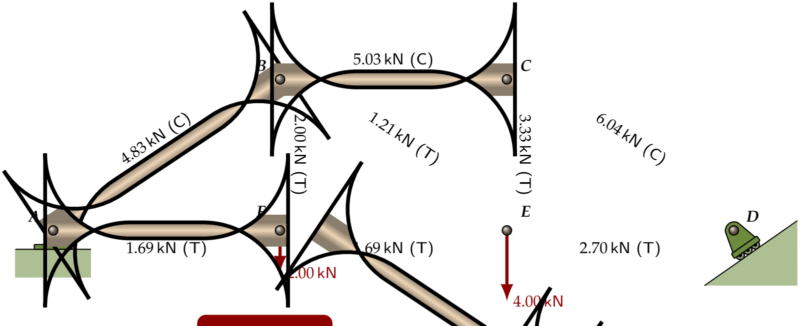
This is to verify that we haven't made an error in our member force calculations.




$$\sum F_x = 2.3340\,\text{kN} + 1.6910\,\text{kN} - 4.8282\cos 33.524^\circ\,\text{kN}$$
$$= -0.000050918\,\text{kN} \approx 0 \quad \checkmark$$

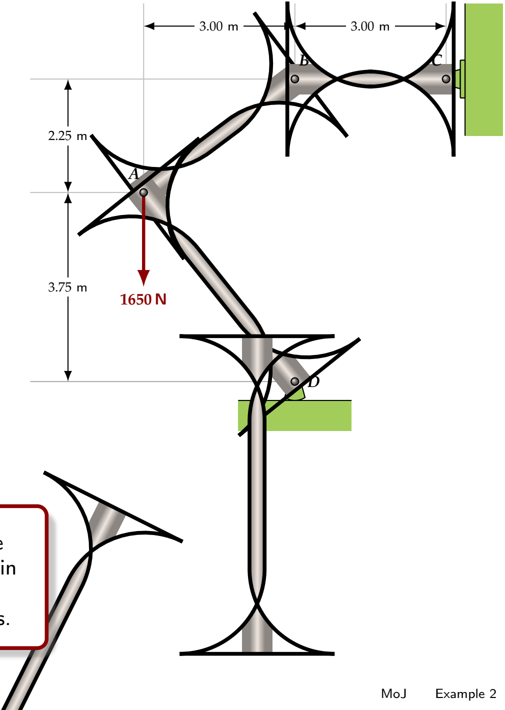
$$\sum F_y = 2.6667\,\text{kN} - 4.8282\sin 33.524^\circ\,\text{kN}$$
$$= 0.00015160\,\text{kN} \approx 0 \quad \checkmark$$

It only remains to convert the results back to the precision given by the input values.




### The Results

$$AB = 4.83\,\text{kN} \quad \text{(Compression)}$$
$$AF = 1.69\,\text{kN} \quad \text{(Tension)}$$
$$BC = 5.03\,\text{kN} \quad \text{(Compression)}$$
$$BE = 1.21\,\text{kN} \quad \text{(Tension)}$$
$$BF = 2.00\,\text{kN} \quad \text{(Tension)}$$
$$CD = 6.04\,\text{kN} \quad \text{(Compression)}$$
$$CE = 3.33\,\text{kN} \quad \text{(Tension)}$$
$$DE = 2.70\,\text{kN} \quad \text{(Tension)}$$
$$EF = 1.69\,\text{kN} \quad \text{(Tension)}$$

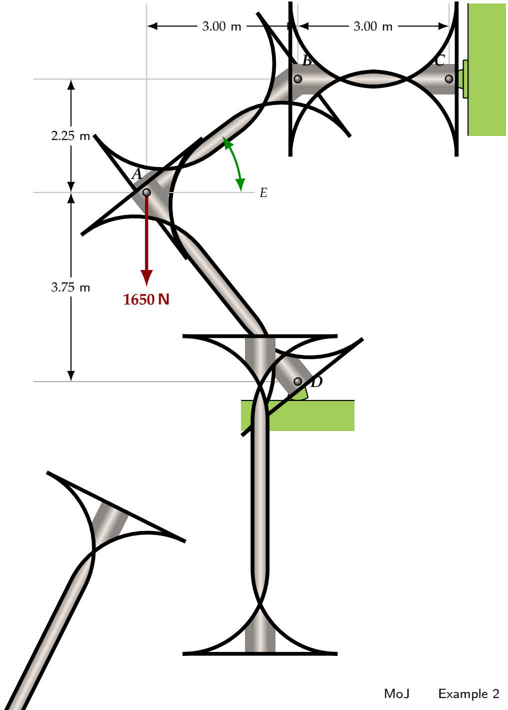



## Method of Joints: Example 2

Solve for the internal forces in each of the truss members. Specify whether they are in tension or in compression. Then use the reactions at $C$ and $D$ to verify your results.

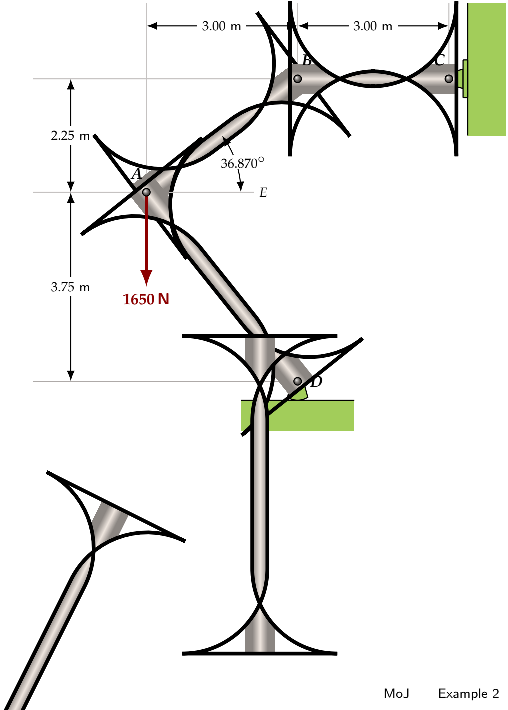
## Find the angles

$$\angle BAE = \tan^{-1}\left[\frac{2.25}{3.00}\right]$$



## Find the angles

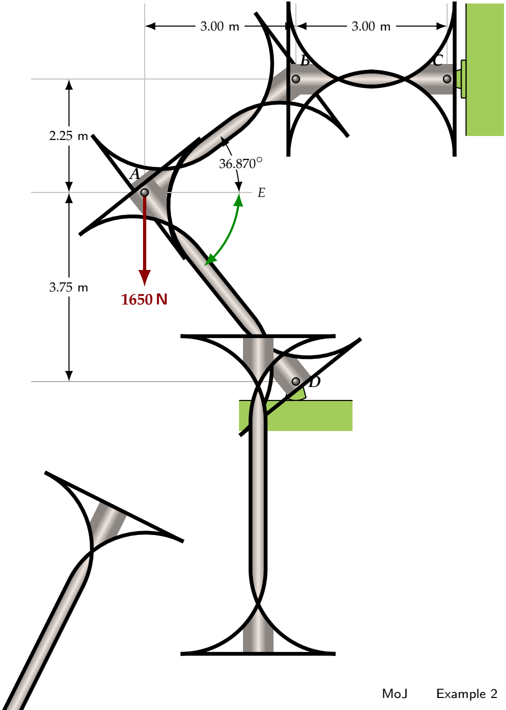
$$\angle BAE = \tan^{-1}\left[\frac{2.25}{3.00}\right]$$
$$= 36.870^\circ$$



## Find the angles

$$\angle BAE = \tan^{-1}\left[\frac{2.25}{3.00}\right]$$
$$= 36.870^\circ$$

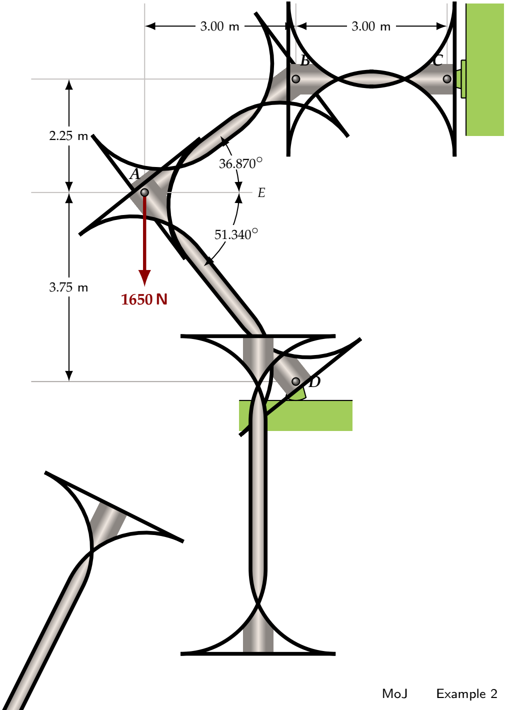
$$\angle DAE = \tan^{-1}\left[\frac{3.75}{3.00}\right]$$



## Find the angles

$$\angle BAE = \tan^{-1}\left[\frac{2.25}{3.00}\right]$$
$$= 36.870^\circ$$

$$\angle DAE = \tan^{-1}\left[\frac{3.75}{3.00}\right]$$
$$= 51.340^\circ$$

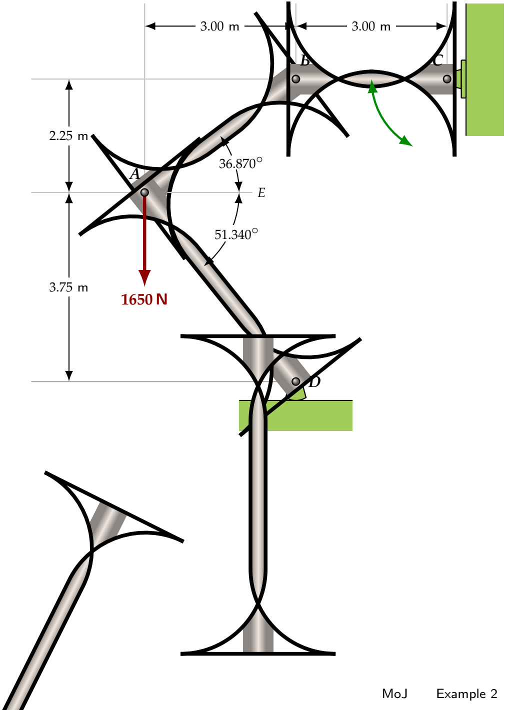


## Find the angles

$$\angle BAE = \tan^{-1}\left[\frac{2.25}{3.00}\right]$$
$$= 36.870^\circ$$

$$\angle DAE = \tan^{-1}\left[\frac{3.75}{3.00}\right]$$
$$= 51.340^\circ$$

$$\angle BCD = \tan^{-1}\left[\frac{6.00}{3.00}\right]$$

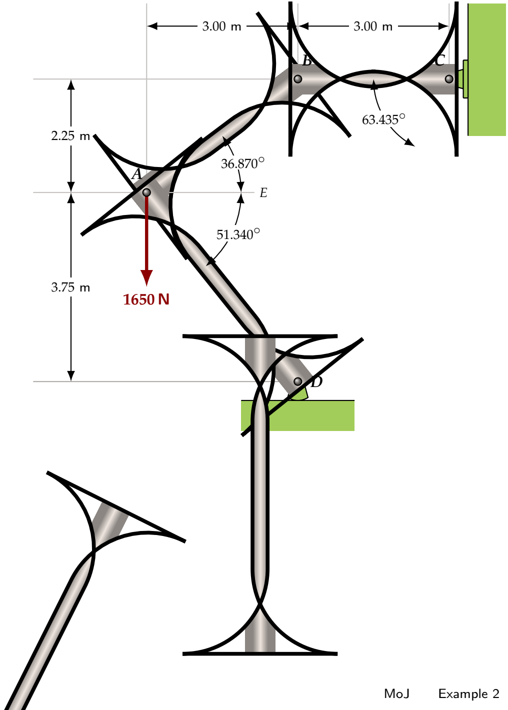


## Find the angles

$$\angle BAE = \tan^{-1}\left[\frac{2.25}{3.00}\right]$$
$$= 36.870^\circ$$

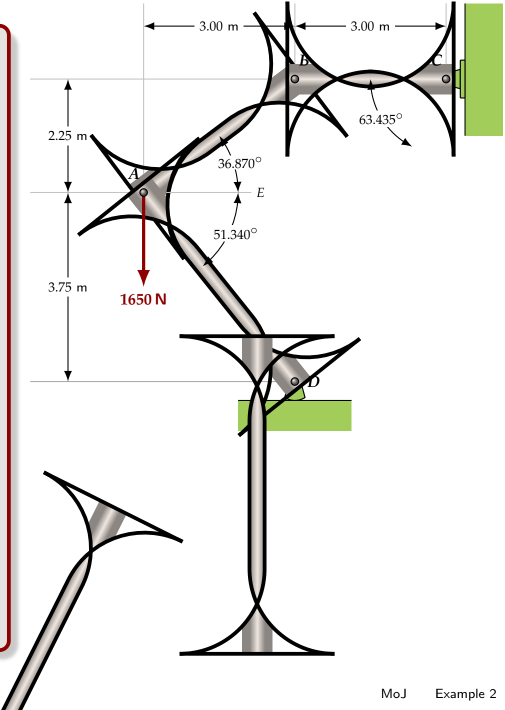
$$\angle DAE = \tan^{-1}\left[\frac{3.75}{3.00}\right]$$
$$= 51.340^\circ$$

$$\angle BCD = \tan^{-1}\left[\frac{6.00}{3.00}\right]$$
$$= 63.435^\circ$$



## Joint $A$

Draw the unknown forces in tension, pointing away from the joint they are acting upon. Then a positive result means the member is in tension and a negative result implies compression.



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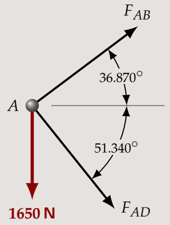


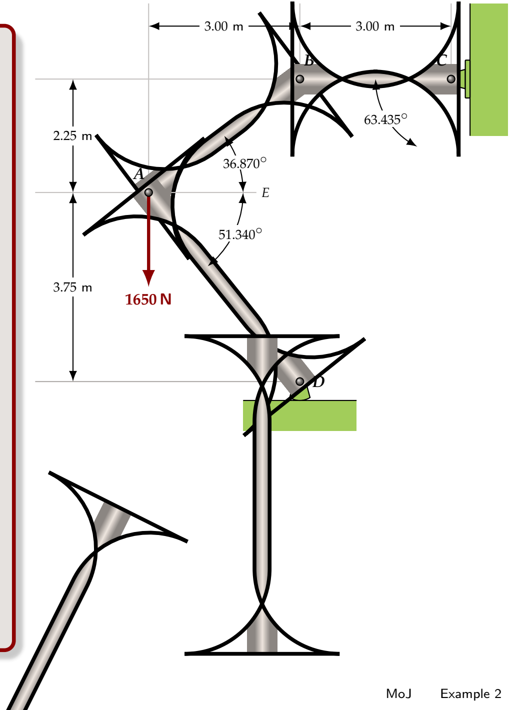

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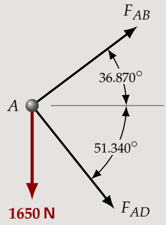
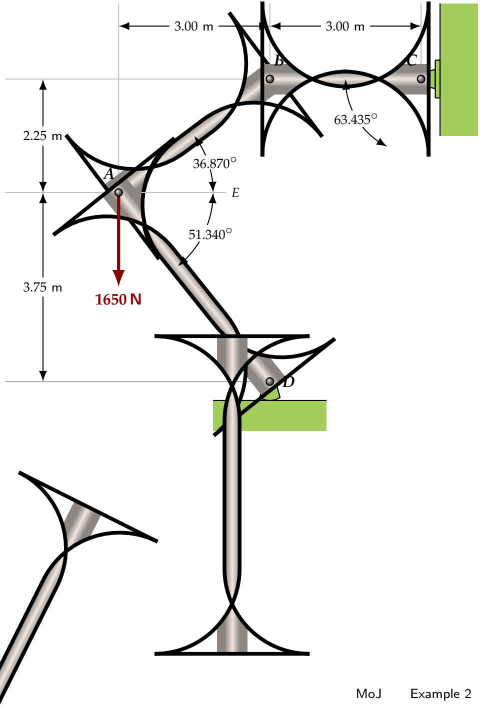



$$\sum F_x = F_{AB}\cos 36.870^\circ + F_{AD}\cos 51.430^\circ = 0$$



## Joint $A$

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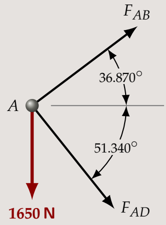
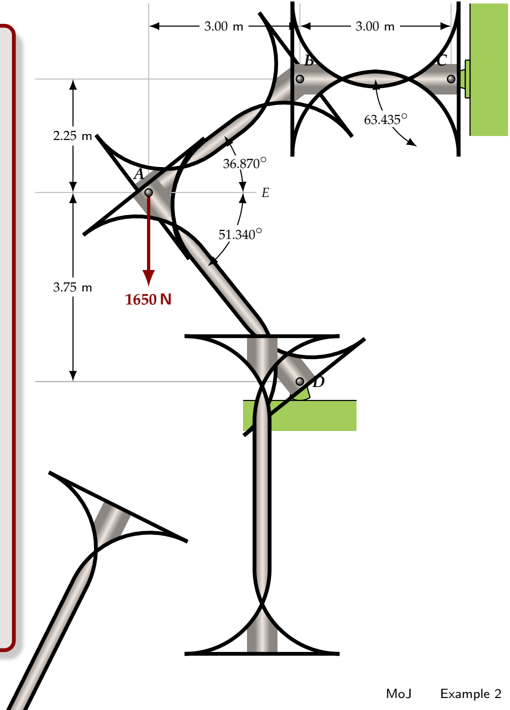



$$\sum F_x = F_{AB} \cos 36.870^\circ + F_{AD} \cos 51.430^\circ = 0$$

$$\sum F_y = F_{AB} \sin 36.870^\circ - F_{AD} \sin 51.340^\circ - 1650\ \mathrm{N} = 0$$



## Joint $A$

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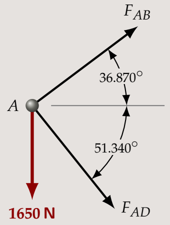
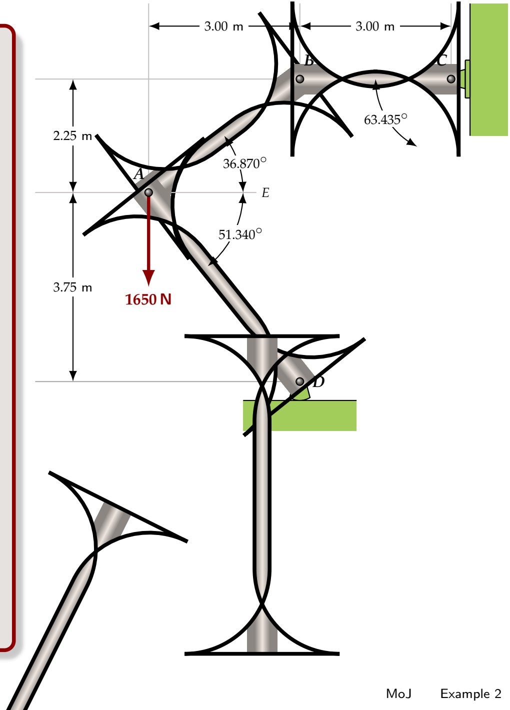



$$\sum F_x = F_{AB}\cos 36.870^\circ + F_{AD}\cos 51.430^\circ = 0$$

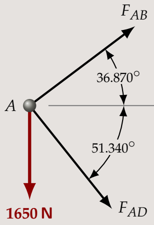
$$\sum F_y = F_{AB}\sin 36.870^\circ - F_{AD}\sin 51.340^\circ - 1650\text{ N} = 0$$

Now, use the **system-solver** on your calculator to solve these two equations for $F_{AB}$ and $F_{AD}$.



## Joint $A$

Draw the unknown forces in tension, pointing away from the joint they are acting upon. Then a positive result means the member is in tension and a negative result implies compression.

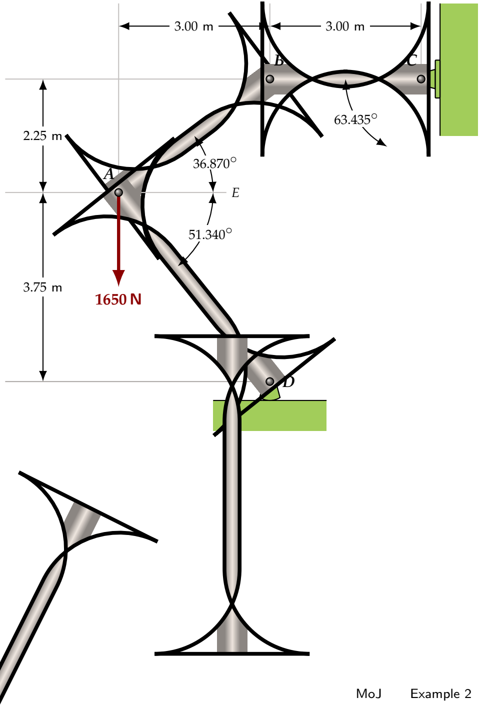



$$\sum F_x = F_{AB}\cos 36.870^\circ + F_{AD}\cos 51.430^\circ = 0$$

$$\sum F_y = F_{AB}\sin 36.870^\circ - F_{AD}\sin 51.340^\circ - 1650\ \text{N} = 0$$

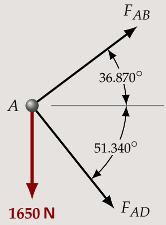
Now, use the **system-solver** on your calculator to solve these two equations for $F_{AB}$ and $F_{AD}$.

$\boldsymbol{F_{AB} = 1031.3\ \text{N}}$ and $\boldsymbol{F_{AD} = -1320.6\ \text{N}}$.



## Joint $A$

Draw the unknown forces in tension, pointing away from the joint they are acting upon. Then a positive result means the member is in tension and a negative result implies compression.



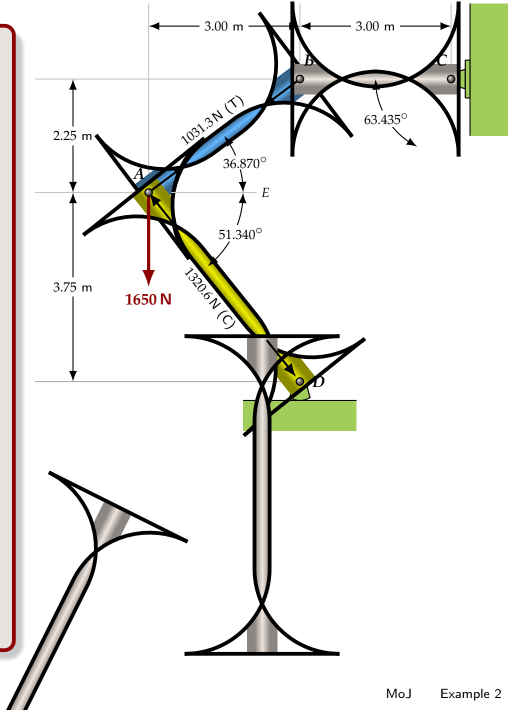

$$\sum F_x = F_{AB} \cos 36.870^\circ + F_{AD} \cos 51.430^\circ = 0$$

$$\sum F_y = F_{AB} \sin 36.870^\circ - F_{AD} \sin 51.340^\circ - 1650\ \mathrm{N} = 0$$

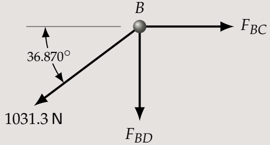
Now, use the **system-solver** on your calculator to solve these two equations for $F_{AB}$ and $F_{AD}$.

$\boldsymbol{F_{AB} = 1031.3}$ **N** and $\boldsymbol{F_{AD} = -1320.6}$ **N**.

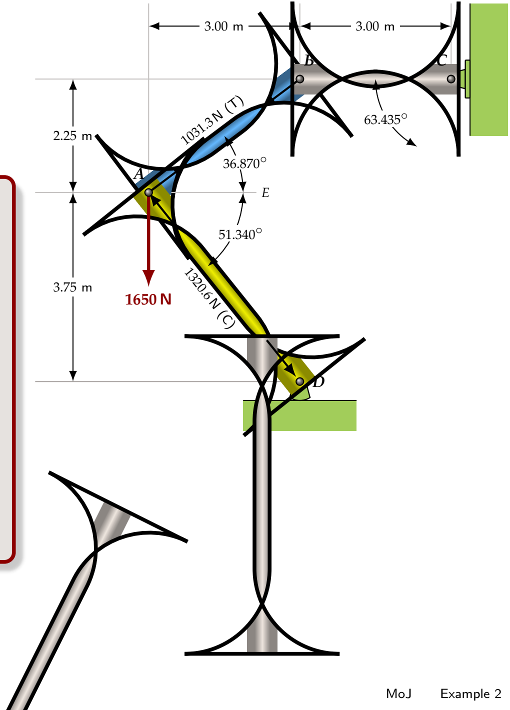
$F_{AB}$ is positive, so member $AB$ is in tension. $F_{AD}$ is negative, so $AD$ is in compression.



## Joint $B$

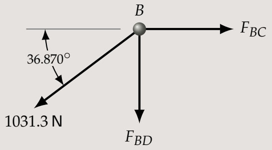


B
$F_{BC}$
36.870°
1031.3 N
$F_{BD}$

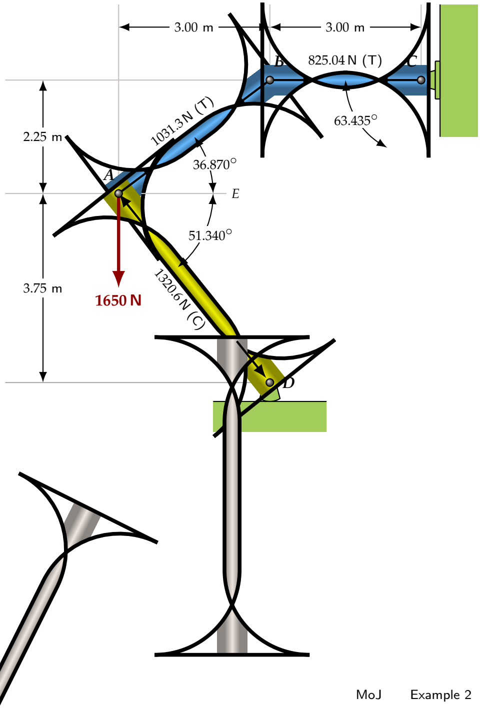
3.00 m
3.00 m
B
C
2.25 m
1031.3 N (T)
63.435°
36.870°
A
E
51.340°
3.75 m
1650 N
1320.6 N (C)
D

## Joint $B$

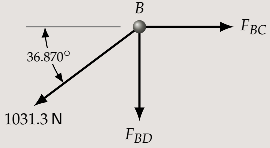



$$\sum F_x = F_{BC} - 1031.3\cos 36.870^\circ\ \mathrm{N} = 0$$

$$\Rightarrow \boldsymbol{F_{BC} = 825.04\ \mathrm{N}}$$



Joint $B$

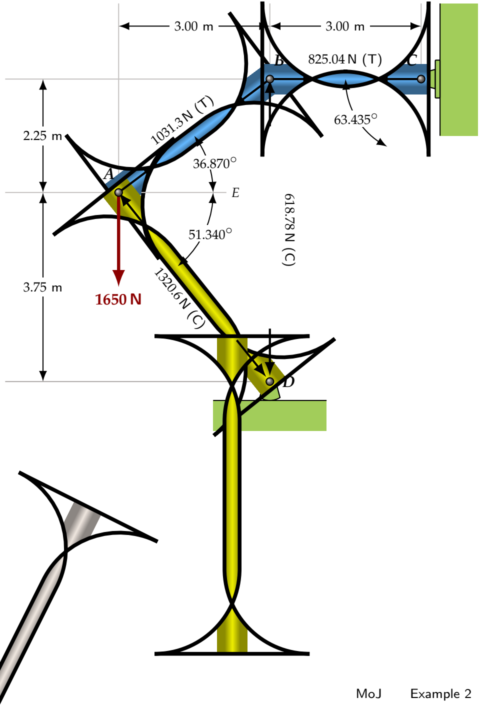



$$\sum F_x = F_{BC} - 1031.3 \cos 36.870^\circ \text{ N} = 0$$

$$\Rightarrow \boldsymbol{F_{BC} = 825.04\,\text{N}}$$

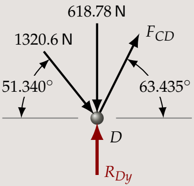
$$\sum F_y = -F_{BD} - 1031.3 \sin 36.870^\circ \text{ N} = 0$$

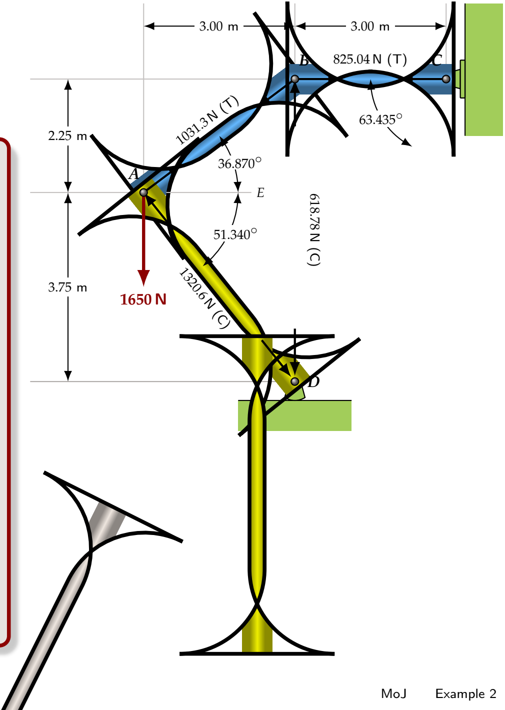
$$\Rightarrow \boldsymbol{F_{BD} = -618.78\,\text{N}}$$



## Joint $D$

Note that we have to include the reaction from the rocker at $D$ in the free body diagram since it also acts on the joint.



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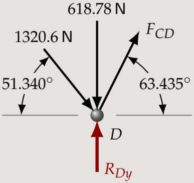
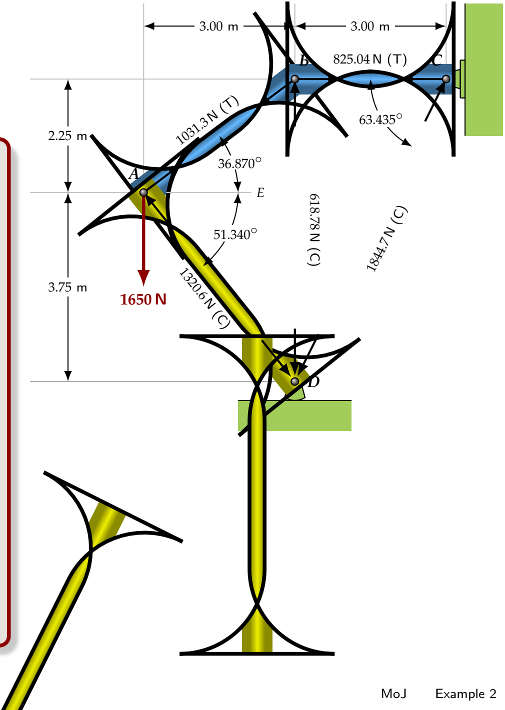



$$\sum F_x = F_{CD}\cos 63.435^\circ + 1320.6\cos 51.340^\circ\ \ \text{N} = 0$$

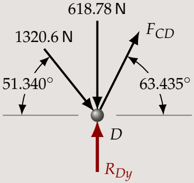
$$\Rightarrow F_{CD} = -\frac{1320.6\cos 51.340^\circ\ \ \text{N}}{\cos 63.435^\circ}$$

$$\Rightarrow \boldsymbol{F_{CD}} = \mathbf{-1844.7\,N}$$



## Joint $D$

Note that we have to include the reaction from the rocker at $D$ in the free body diagram since it also acts on the joint.

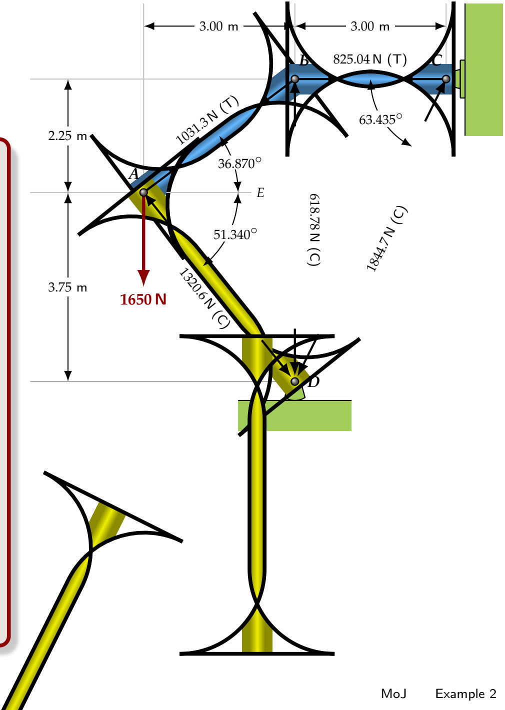



$$\sum F_x = F_{CD}\cos 63.435^\circ + 1320.6\cos 51.340^\circ \ \ \mathrm{N} = 0$$

$$\Rightarrow F_{CD} = -\frac{1320.6\cos 51.340^\circ \ \ \mathrm{N}}{\cos 63.435^\circ}$$

$$\Rightarrow \boldsymbol{F_{CD} = -1844.7\,\mathrm{N}}$$

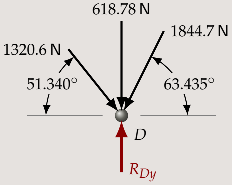
All the internal forces in the truss have now been found.

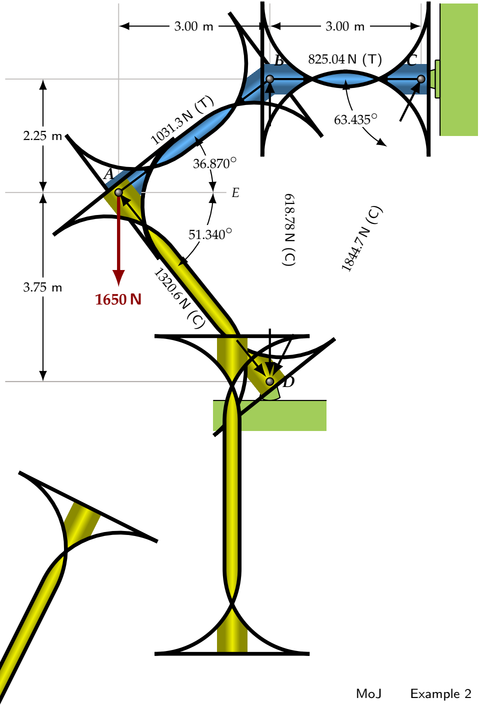


## Do a calculation check!

There are some checks we can make to ensure there are no errors in our calculations. We use moments and the summing of the reactions.

First, determine $R_{Dy}$, the $y$-component of the reaction at $D$ ($D$ is supported by a rocker and has no $x$-component):



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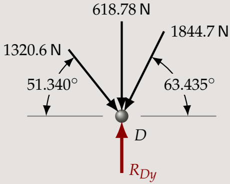
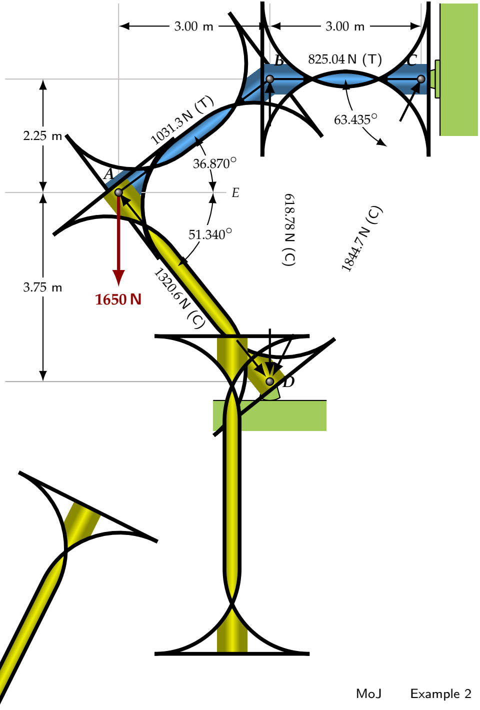



$$\sum F_y = R_{Dy} - 1320.6 \sin 51.340^\circ \text{ N} - 618.78 \text{ N}$$
$$- 1844.7 \sin 63.435^\circ \text{ N} = 0$$
$$\Rightarrow R_{Dy} = 3299.9 \text{ N}$$



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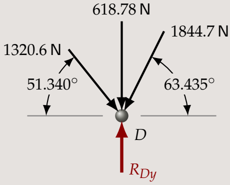


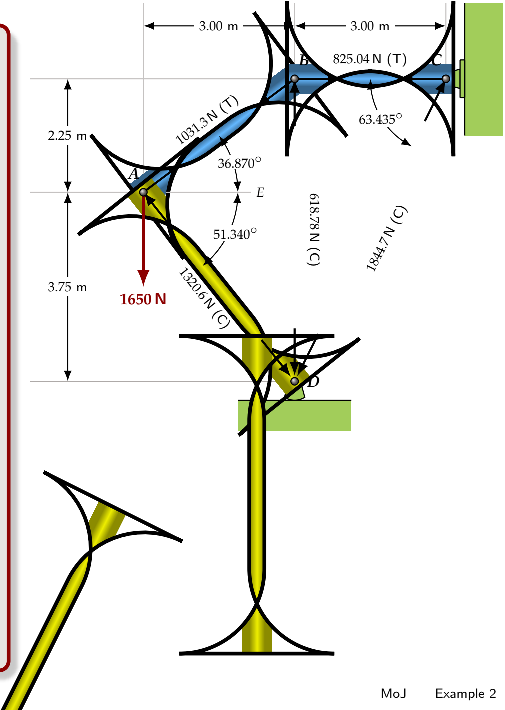

$$\sum F_y = R_{Dy} - 1320.6 \sin 51.340^\circ \text{ N} - 618.78 \text{ N} - 1844.7 \sin 63.435^\circ \text{ N} = 0$$

$$\Rightarrow R_{Dy} = 3299.9 \text{ N}$$

If we calculate $R_{Dy}$ by taking moments about $C$ of the external forces acting the truss, we get:

$$\sum M_C = (1650 \text{ N}) \cdot (6.00 \text{ m}) - R_{Dy} \cdot (3.00 \text{ m}) = 0$$

$$\Rightarrow R_{Dy} = 3300 \text{ N} \quad \checkmark$$



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There are some checks we can make to ensure there are no errors in our calculations. We use moments and the summing of the reactions.

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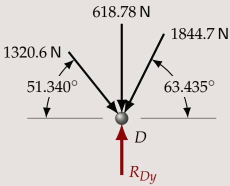


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$$- 1844.7 \sin 63.435^\circ \text{ N} = 0$$
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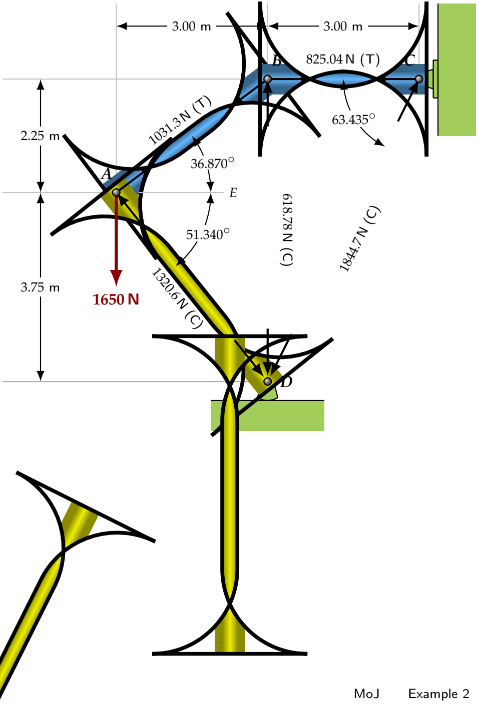
$$\Rightarrow R_{Dy} = 3300 \text{ N} \quad \checkmark$$

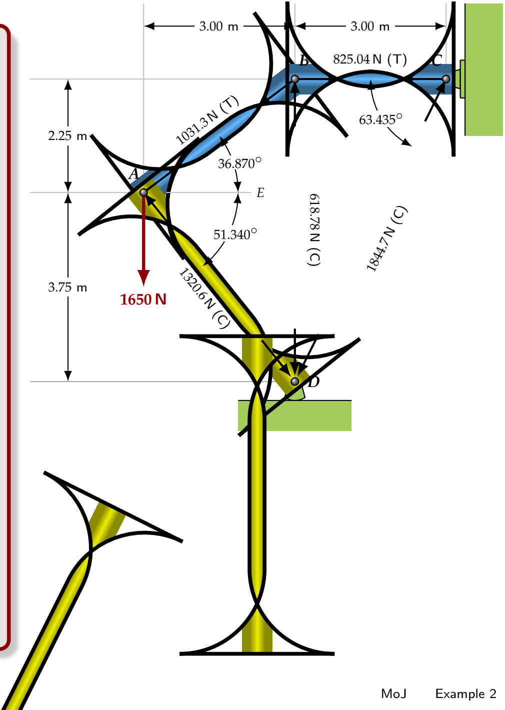
**Note**: This is as expected from our previous calculation — apart from some rounding error in the fifth digit.



## Check cont'd

Notice that results from members $AC$, $AB$, $BD$ and $CD$ were incorporated into this check (since $AB$ was used in the calculation of $BD$) so it is safe to assume that these results are correct.

But we have not checked member $BC$.
We do that by summing all the external forces, and then investigating joint $C$.



Check cont'd

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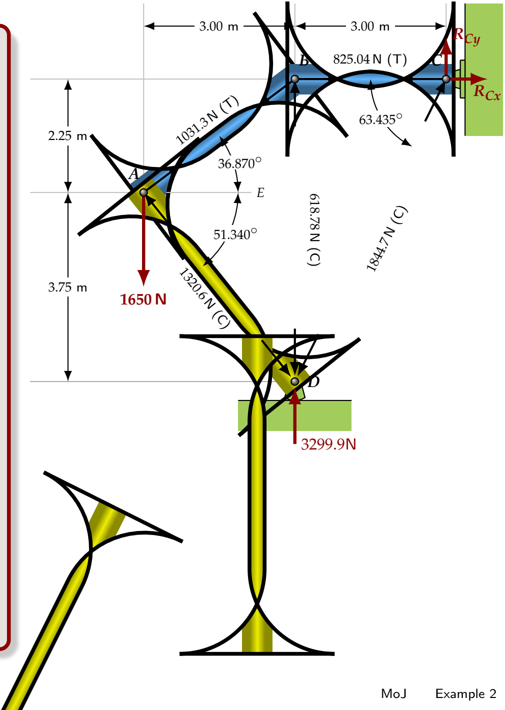
$$\sum F_x = R_{Cx} = 0$$

$$\sum F_y = R_{Cy} + 3299.9\,\mathrm{N} - 1650\,\mathrm{N}$$

$$\Rightarrow R_{Cy} = -1649.9\,\mathrm{N}$$



## Check cont'd

Notice that results from members $AC$, $AB$, $BD$ and $CD$ were incorporated into this check (since $AB$ was used in the calculation of $BD$) so it is safe to assume that these results are correct.

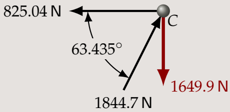
But we have not checked member $BC$. We do that by summing all the external forces, and then investigating joint $C$.

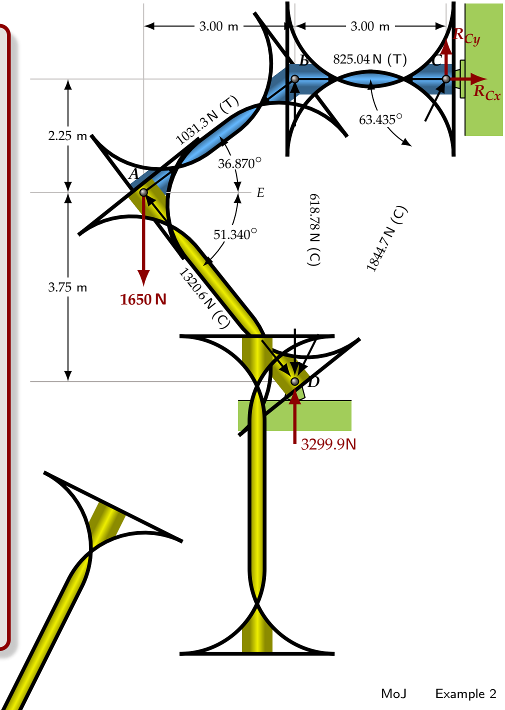
$$\sum F_x = R_{Cx} = 0$$

$$\sum F_y = R_{Cy} + 3299.9\,\text{N} - 1650\,\text{N}$$

$$\Rightarrow R_{Cy} = -1649.9\,\text{N}$$

Now, examine joint $C$ for equilibrium:



## Check cont'd

Notice that results from members $AC$, $AB$, $BD$ and $CD$ were incorporated into this check (since $AB$ was used in the calculation of $BD$) so it is safe to assume that these results are correct.

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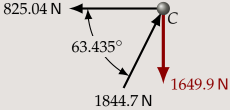
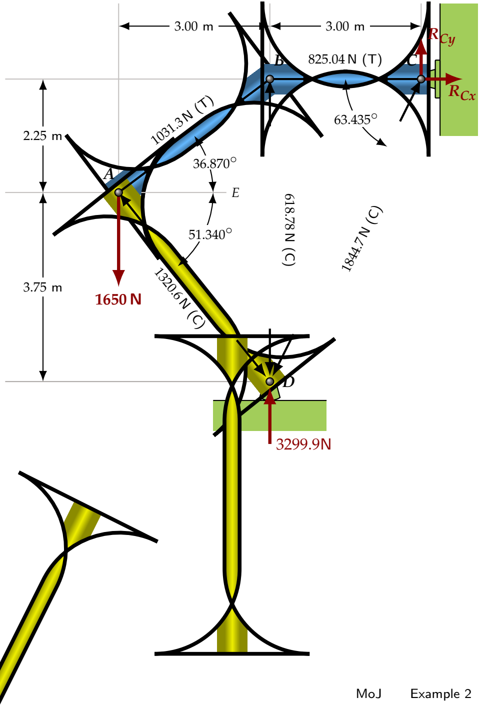



$$\sum F_x = 1844.7\cos 63.435^\circ\text{ N} - 825.04\text{ N}$$
$$= -0.066554\text{ N} \approx 0 \quad \checkmark$$



## Check cont'd

Notice that results from members $AC$, $AB$, $BD$ and $CD$ were incorporated into this check (since $AB$ was used in the calculation of $BD$) so it is safe to assume that these results are correct.

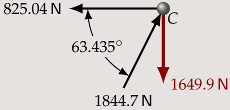
But we have not checked member $BC$.
We do that by summing all the external forces, and then investigating joint $C$.

$$\sum F_x = R_{Cx} = 0$$

$$\sum F_y = R_{Cy} + 3299.9\text{ N} - 1650\text{ N}$$

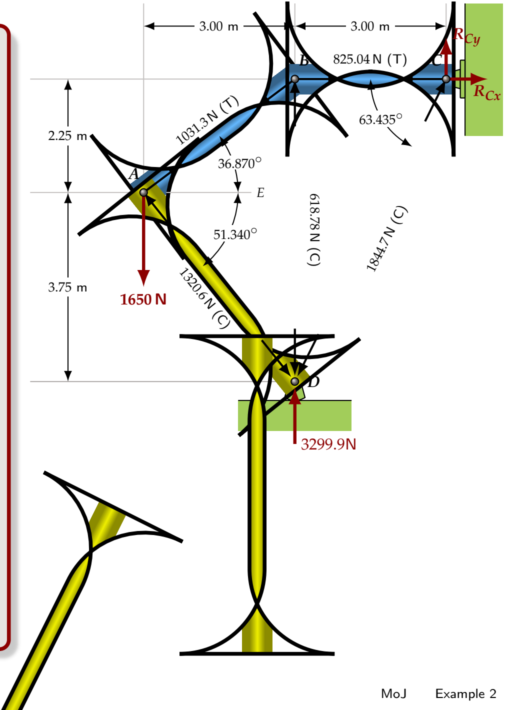
$$\Rightarrow R_{Cy} = -1649.9\text{ N}$$

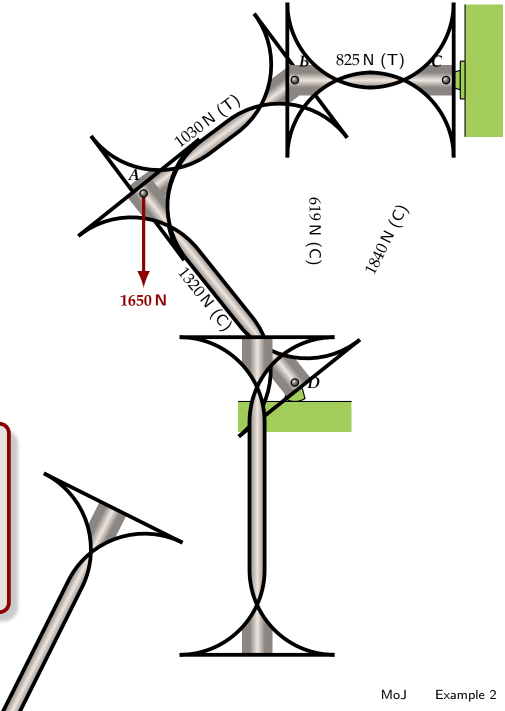
Now, examine joint $C$ for equilibrium:




$$\sum F_x = 1844.7 \cos 63.435^\circ \text{ N} - 825.04\text{ N}$$
$$= -0.066554 \text{ N} \approx 0 \quad \checkmark$$

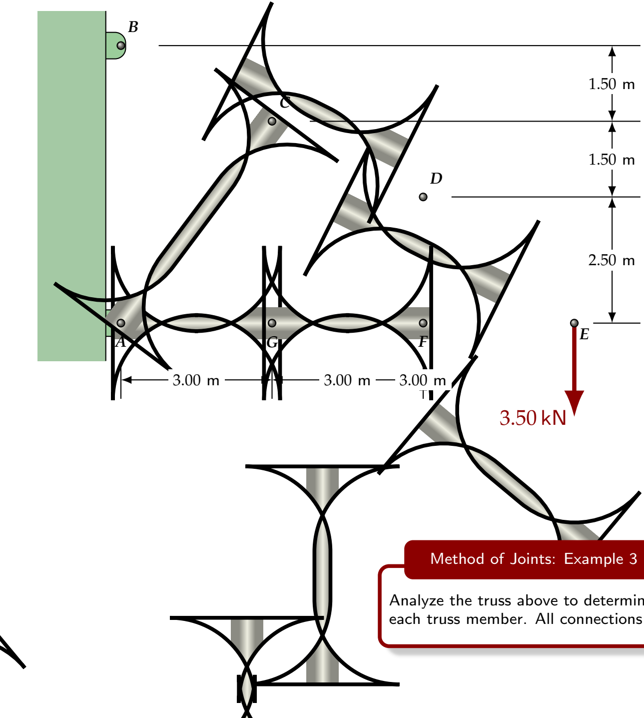
$$\sum F_y = 1844.7 \sin 63.435^\circ - 1649.9\text{ N}$$
$$= 0.05057 \text{ N} \approx 0 \quad \checkmark$$





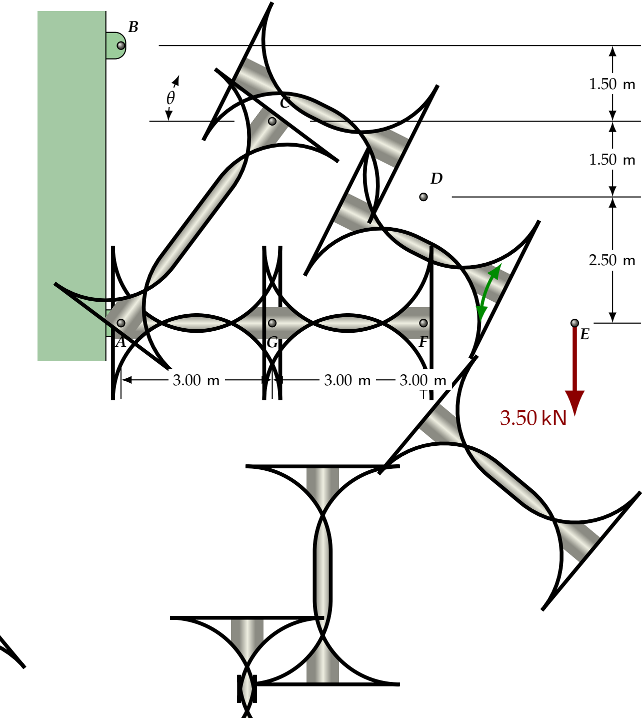

The Results

$AB = 1030$ N (Tension)
$AC = 1320$ N (Compression)
$BC = 825$ N (Tension)
$BD = 619$ N (Compression)
$CD = 1840$ N (Compression)



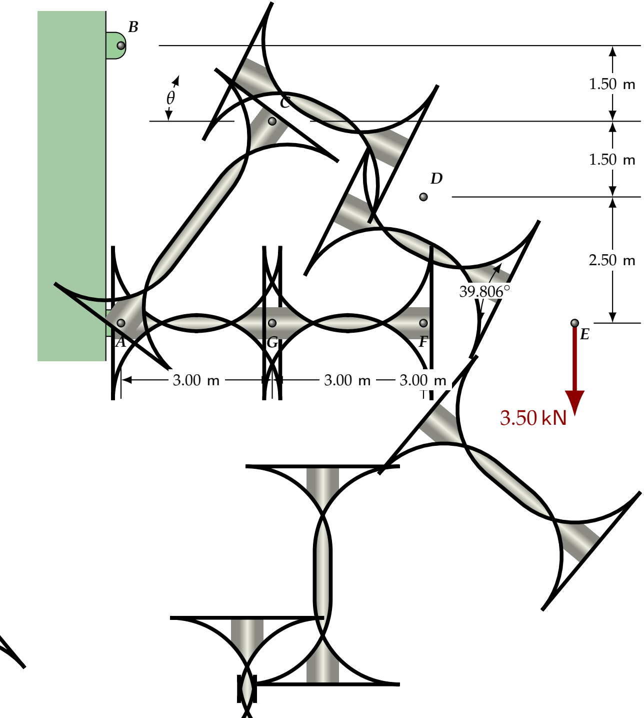

## Method of Joints: Example 3

Analyze the truss above to determine the internal forces in each truss member. All connections are pinned.



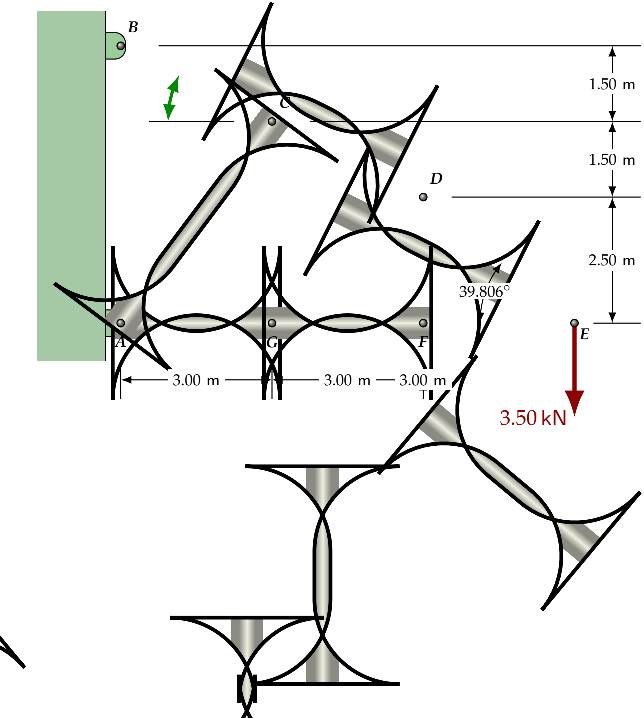

## Find the angles

$$\angle DEF = \tan^{-1}\left[\frac{2.50}{3.00}\right]$$




## Find the angles

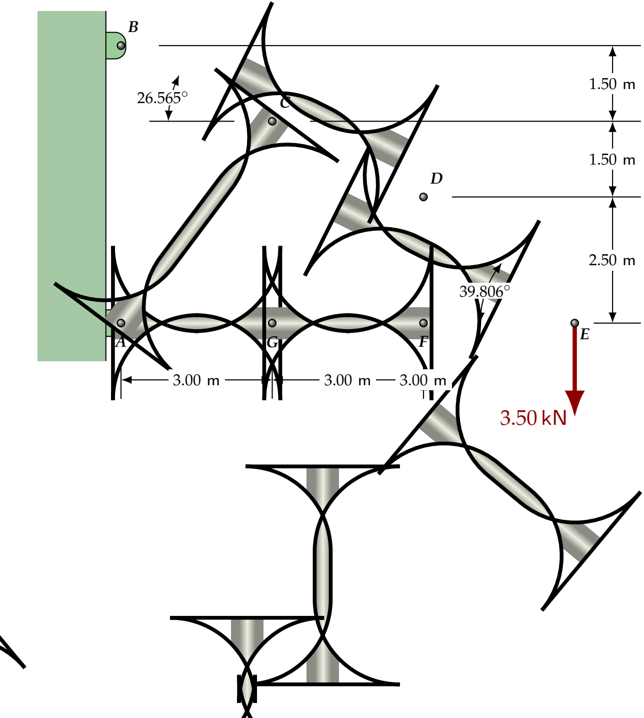
$$\angle DEF = \tan^{-1}\left[\frac{2.50}{3.00}\right]$$
$$= 39.806^\circ$$




## Find the angles

$$\angle DEF = \tan^{-1}\left[\frac{2.50}{3.00}\right]$$
$$= 39.806^\circ$$

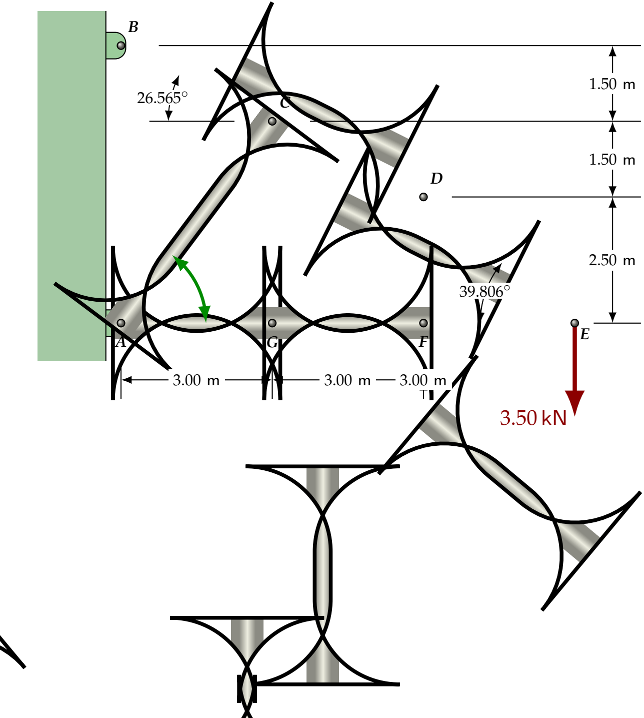
$$\theta = \tan^{-1}\left[\frac{1.50}{3.00}\right]$$




## Find the angles

$$\angle DEF = \tan^{-1}\left[\frac{2.50}{3.00}\right]$$
$$= 39.806^\circ$$

$$\theta = \tan^{-1}\left[\frac{1.50}{3.00}\right]$$
$$= 26.565^\circ$$

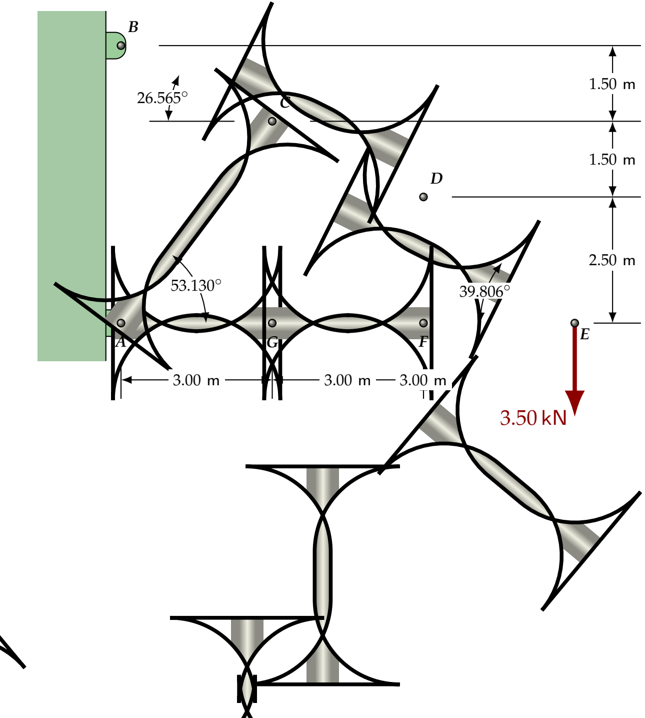



## Find the angles

$$\angle DEF = \tan^{-1}\left[\frac{2.50}{3.00}\right] = 39.806^\circ$$

$$\theta = \tan^{-1}\left[\frac{1.50}{3.00}\right] = 26.565^\circ$$

$$\angle CAG = \tan^{-1}\left[\frac{4.00}{3.00}\right]$$

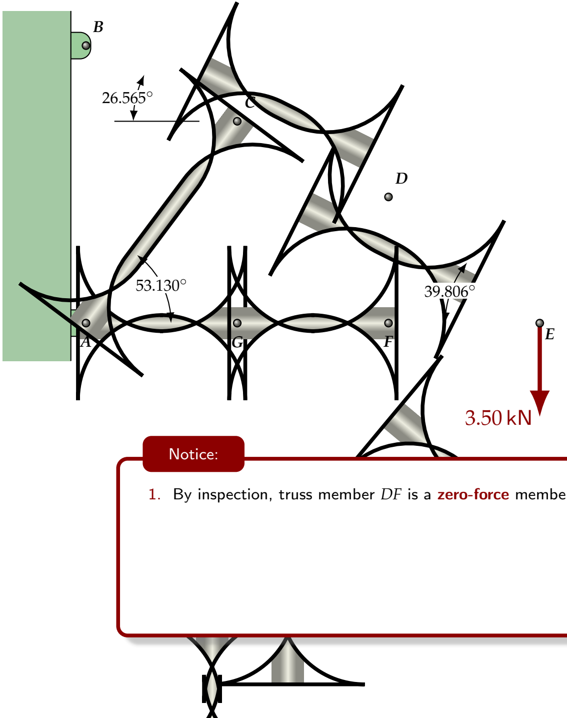



## Find the angles

$$\angle DEF = \tan^{-1}\left[\frac{2.50}{3.00}\right]$$
$$= 39.806^\circ$$

$$\theta = \tan^{-1}\left[\frac{1.50}{3.00}\right]$$
$$= 26.565^\circ$$

$$\angle CAG = \tan^{-1}\left[\frac{4.00}{3.00}\right]$$
$$= 53.130^\circ$$




## Find the angles

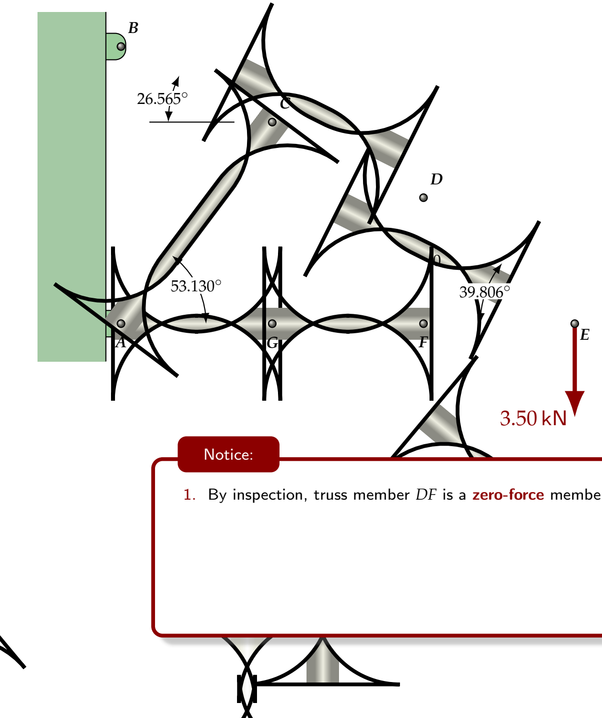
$$\angle DEF = \tan^{-1}\left[\frac{2.50}{3.00}\right]$$
$$= 39.806^\circ$$

$$\theta = \tan^{-1}\left[\frac{1.50}{3.00}\right]$$
$$= 26.565^\circ$$

$$\angle CAG = \tan^{-1}\left[\frac{4.00}{3.00}\right]$$
$$= 53.130^\circ$$

## Notice:

1. By inspection, truss member $DF$ is a **zero-force** member. (Consider the $y$-components acting at $F$.)




## Find the angles

$$\angle DEF = \tan^{-1}\left[\frac{2.50}{3.00}\right] = 39.806^\circ$$

$$\theta = \tan^{-1}\left[\frac{1.50}{3.00}\right] = 26.565^\circ$$

$$\angle CAG = \tan^{-1}\left[\frac{4.00}{3.00}\right] = 53.130^\circ$$

## Notice:

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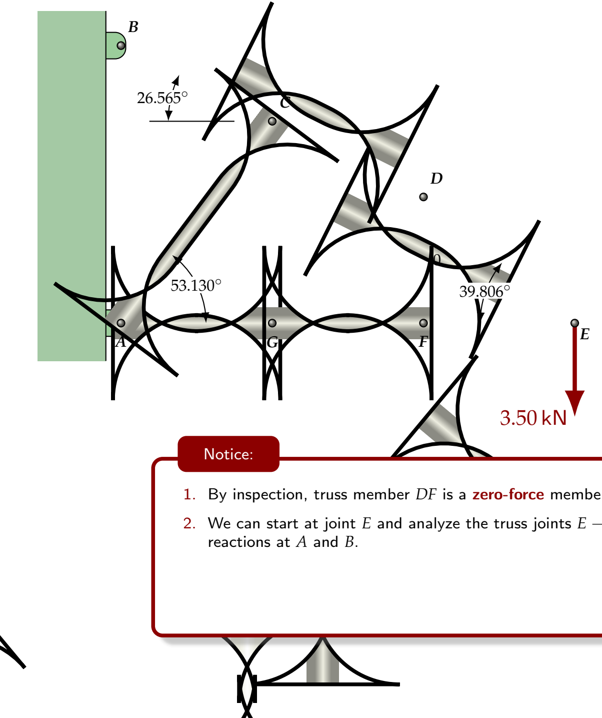



## Find the angles

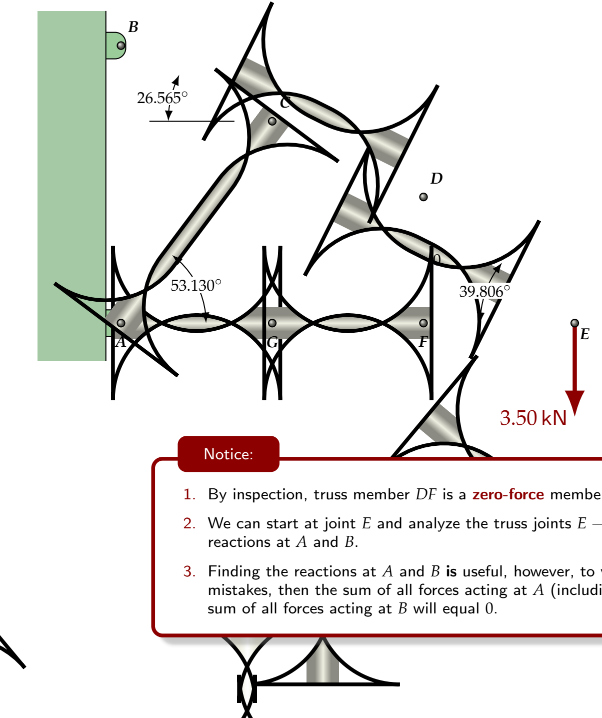
$$\angle DEF = \tan^{-1}\left[\frac{2.50}{3.00}\right] = 39.806^\circ$$

$$\theta = \tan^{-1}\left[\frac{1.50}{3.00}\right] = 26.565^\circ$$

$$\angle CAG = \tan^{-1}\left[\frac{4.00}{3.00}\right] = 53.130^\circ$$

## Notice:

1. By inspection, truss member $DF$ is a **zero-force** member. (Consider the $y$-components acting at $F$.)
2. We can start at joint $E$ and analyze the truss joints $E \to F \to D \to G \to C$, without calculating the reactions at $A$ and $B$.




## Find the angles

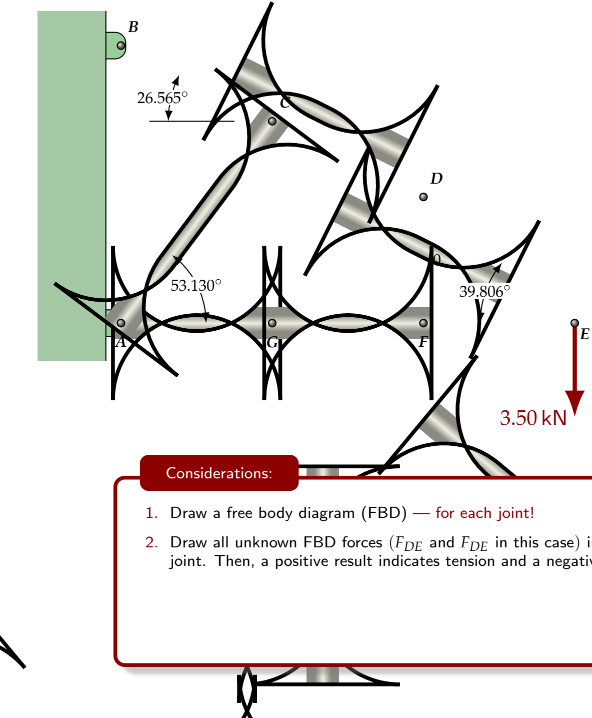
$$\angle DEF = \tan^{-1}\left[\frac{2.50}{3.00}\right]$$
$$= 39.806^\circ$$

$$\theta = \tan^{-1}\left[\frac{1.50}{3.00}\right]$$
$$= 26.565^\circ$$

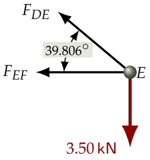
$$\angle CAG = \tan^{-1}\left[\frac{4.00}{3.00}\right]$$
$$= 53.130^\circ$$

## Notice:

1. By inspection, truss member $DF$ is a **zero-force** member. (Consider the $y$-components acting at $F$.)
2. We can start at joint $E$ and analyze the truss joints $E \to F \to D \to G \to C$, without calculating the reactions at $A$ and $B$.
3. Finding the reactions at $A$ and $B$ **is** useful, however, to verify our results; if we have not made mistakes, then the sum of all forces acting at $A$ (including the reaction) will equal $0$. Similarly, the sum of all forces acting at $B$ will equal $0$.

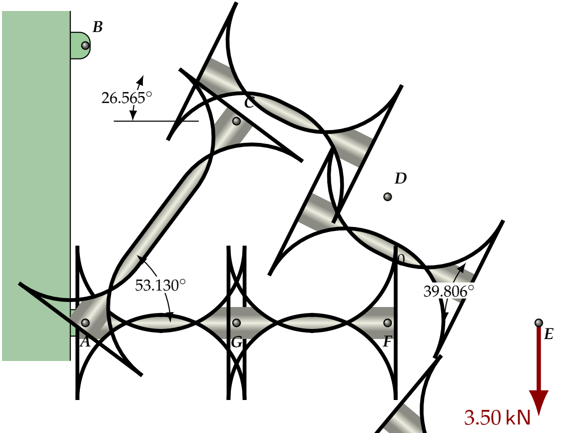



## Joint $E$

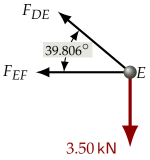



## Considerations:

1. Draw a free body diagram (FBD) — for each joint!
2. Draw all unknown FBD forces ($F_{DE}$ and $F_{DE}$ in this case) in tension, pointing away from the joint. Then, a positive result indicates tension and a negative result indicates compression.




## Joint $E$

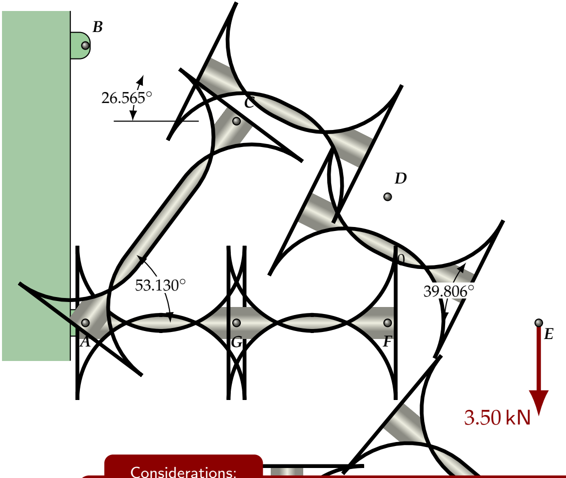



$$\sum F_y = F_{DE} \sin 39.806^\circ - 3.50\,\mathrm{kN} = 0$$

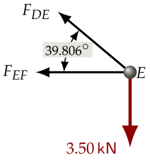
$$\Rightarrow F_{DE} = 5.4671\,\mathrm{kN}$$

## Considerations:

1. Draw a free body diagram (FBD) — for each joint!
2. Draw all unknown FBD forces ($F_{DE}$ and $F_{DE}$ in this case) in tension, pointing away from the joint. Then, a positive result indicates tension and a negative result indicates compression.
3. Sum the $y$-components first, so that we have only one variable ($F_{DE}$) and can find it directly.




## Joint $E$

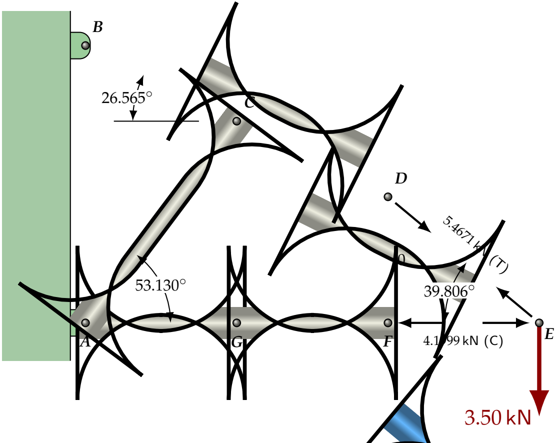



$$\sum F_y = F_{DE}\sin 39.806^\circ - 3.50\,\text{kN} = 0$$
$$\Rightarrow F_{DE} = 5.4671\,\text{kN}$$

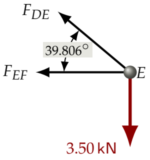
$$\sum F_x = -F_{DE}\cos 39.806^\circ - F_{EF} = 0$$
$$\Rightarrow F_{EF} = -5.4671\cos 39.806^\circ\,\text{kN}$$
$$= -4.1999\,\text{kN}$$

## Considerations:

1. Draw a free body diagram (FBD) — for each joint!
2. Draw all unknown FBD forces ($F_{DE}$ and $F_{DE}$ in this case) in tension, pointing away from the joint. Then, a positive result indicates tension and a negative result indicates compression.
3. Sum the $y$-components first, so that we have only one variable ($F_{DE}$) and can find it directly.




## Joint $E$




$$\sum F_y = F_{DE} \sin 39.806^\circ - 3.50\,\mathrm{kN} = 0$$

$$\Rightarrow F_{DE} = 5.4671\,\mathrm{kN}$$

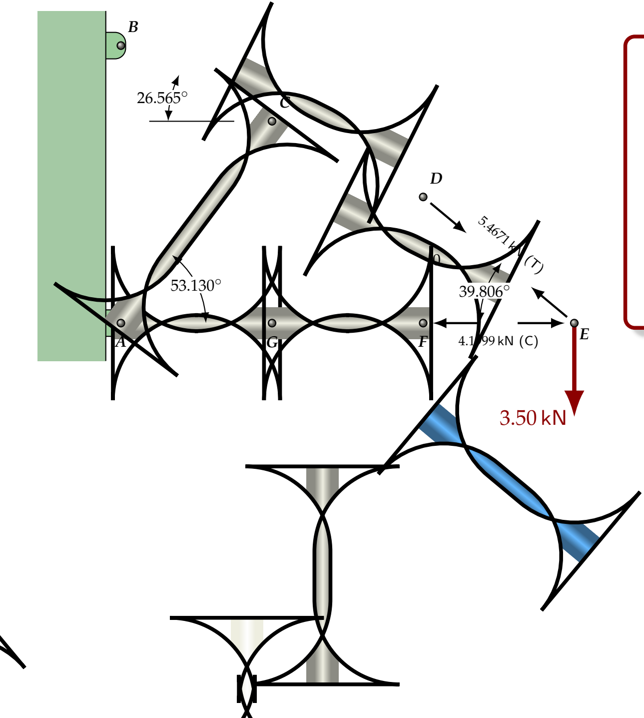
$$\sum F_x = -F_{DE} \cos 39.806^\circ - F_{EF} = 0$$

$$\Rightarrow F_{EF} = -5.4671 \cos 39.806^\circ\,\mathrm{kN}$$

$$= -4.1999\,\mathrm{kN}$$

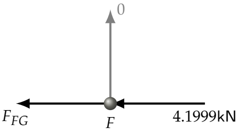
## Considerations:

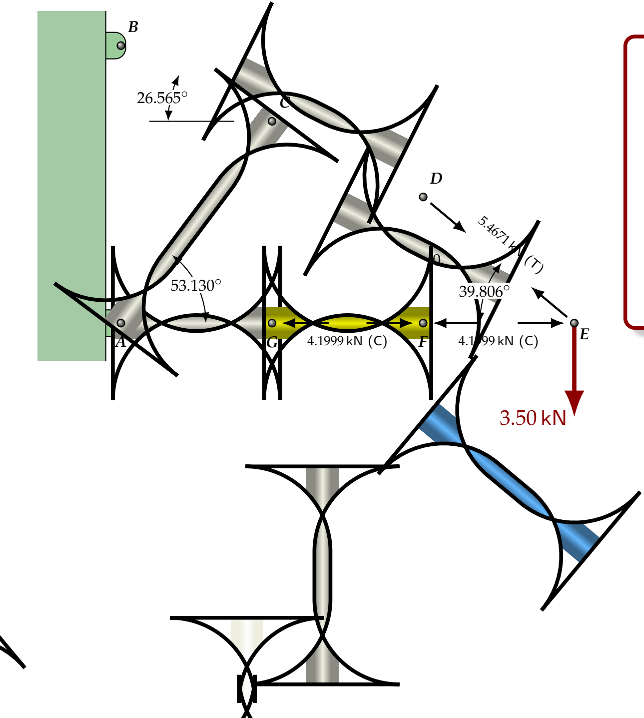
1. Draw a free body diagram (FBD) — for each joint!
2. Draw all unknown FBD forces ($F_{DE}$ and $F_{DE}$ in this case) in tension, pointing away from the joint. Then, a positive result indicates tension and a negative result indicates compression.
3. Sum the $y$-components first, so that we have only one variable ($F_{DE}$) and can find it directly.
4. Maintain all 5 working significant digits (or more) for now to reduce the accumulation of rounding errors.




## Joint $F$

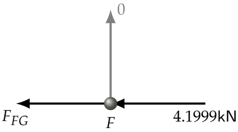
This one is easy!





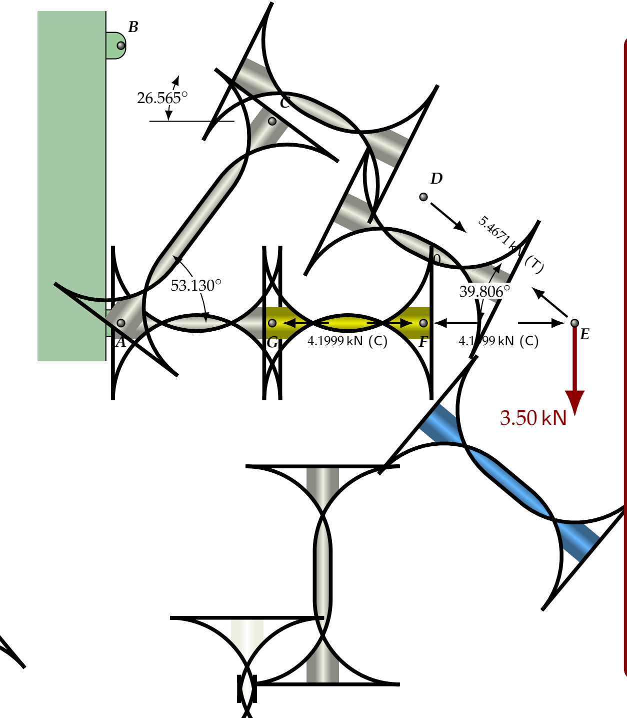

## Joint $F$

This one is easy!



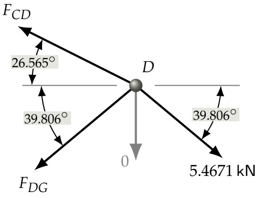

$$\sum F_x = -F_{FG} - 4.1999\,\mathrm{kN} = 0$$

$$\Rightarrow F_{FG} = -4.1999\,\mathrm{kN}$$

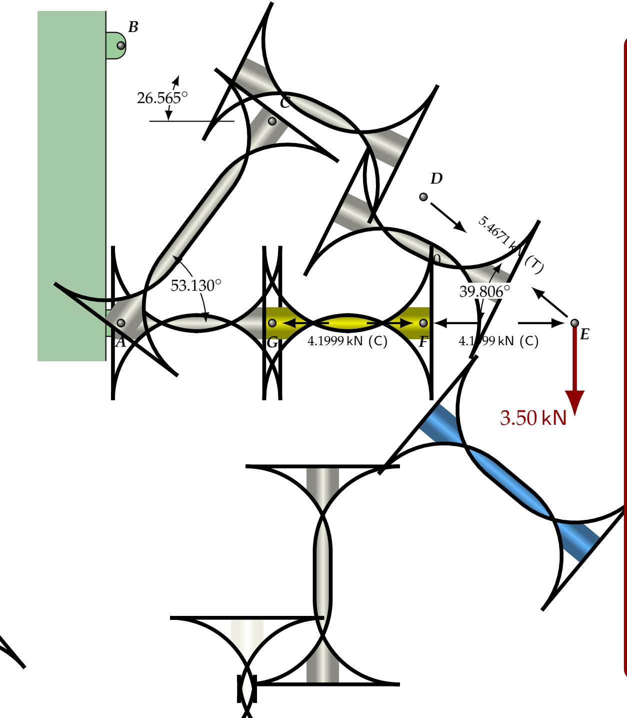


B
26.565°
C
D
5.4671 kN (T)
39.806°
53.130°
A
G
4.1999 kN (C)
F
4.1999 kN (C)
E
3.50 kN

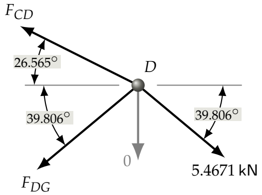

## Joint $D$



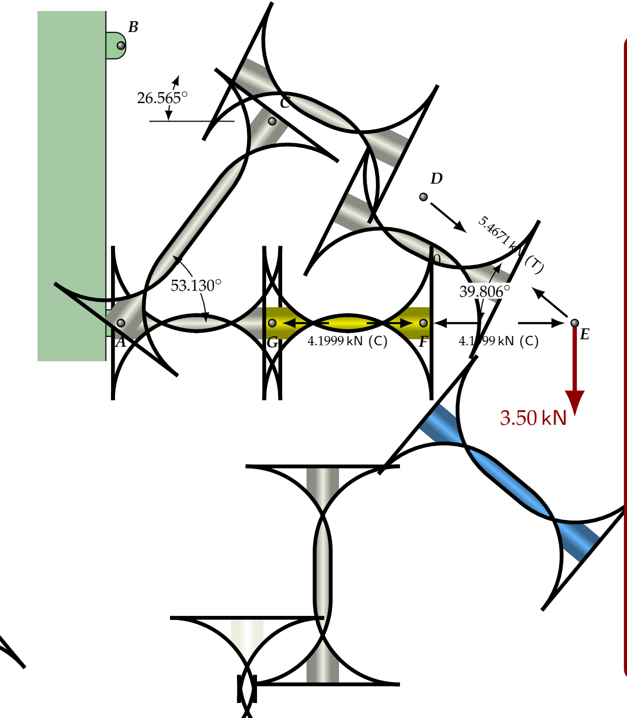
$F_{CD}$
26.565°
D
39.806°
39.806°
0
$F_{DG}$
5.4671 kN



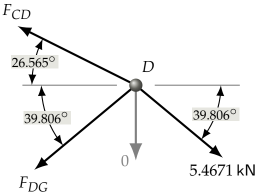

## Joint $D$




$$\begin{aligned}\sum F_x &= 5.4671 \cos 39.806^\circ \text{ kN} \\ &\quad - F_{CD} \cos 26.565^\circ \\ &\quad - F_{DG} \cos 39.806^\circ \\ &= 0\end{aligned}$$

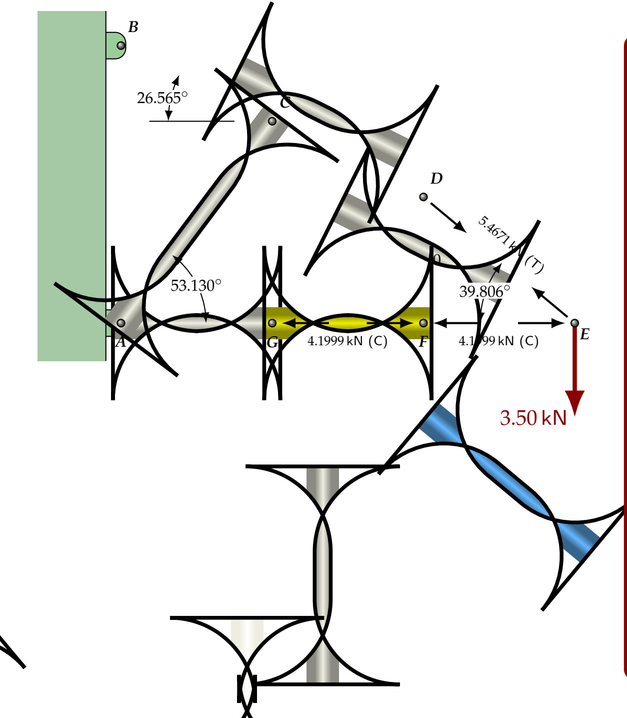



## Joint $D$

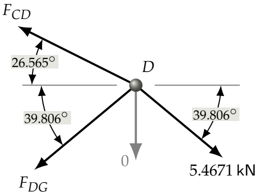



$$\sum F_x = 5.4671 \cos 39.806^\circ \text{ kN} - F_{CD} \cos 26.565^\circ - F_{DG} \cos 39.806^\circ = 0$$

$$\sum F_y = F_{CD} \sin 26.565^\circ - F_{DG} \sin 39.806^\circ - 5.4671 \sin 39.806^\circ \text{ kN} = 0$$



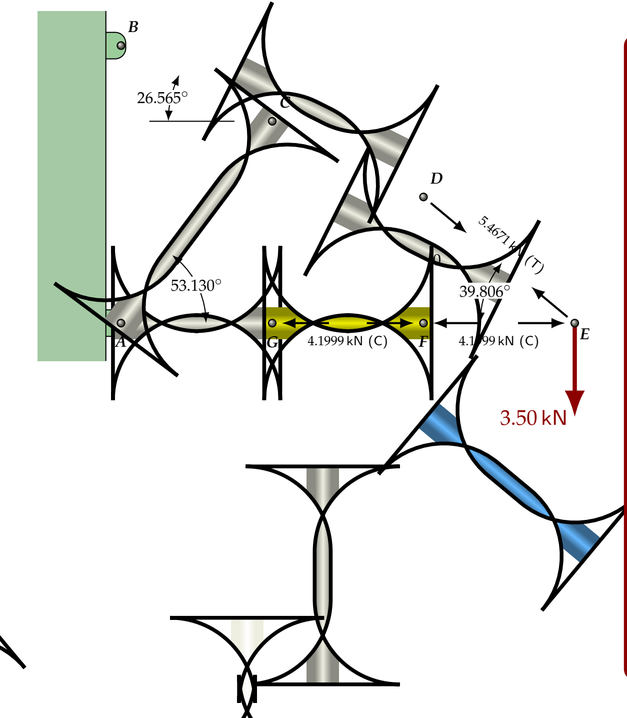

## Joint $D$



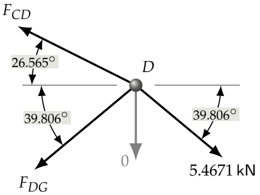

$$\sum F_x = 5.4671 \cos 39.806^\circ \text{ kN} - F_{CD} \cos 26.565^\circ - F_{DG} \cos 39.806^\circ = 0$$

$$\sum F_y = F_{CD} \sin 26.565^\circ - F_{DG} \sin 39.806^\circ - 5.4671 \sin 39.806^\circ \text{ kN} = 0$$

Now, use the **system-solver** on your calculator to solve these two equations for $F_{CD}$ and $F_{DG}$.




## Joint $D$

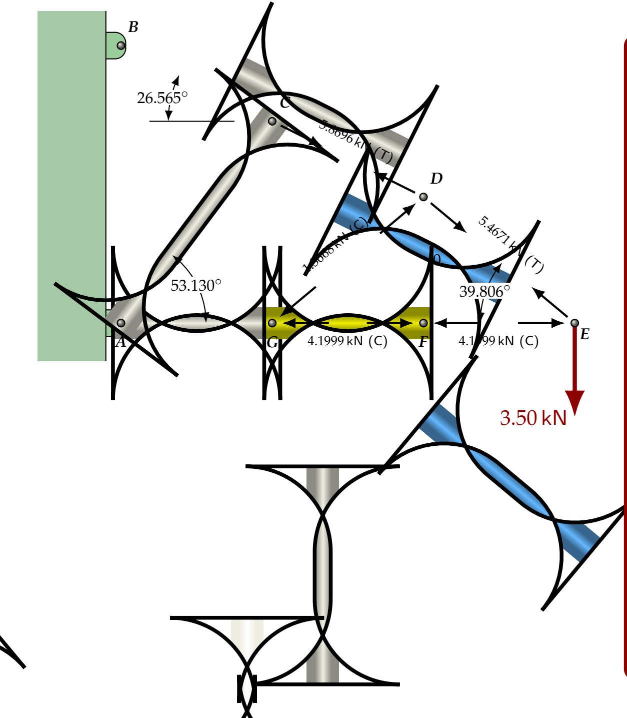



$$\sum F_x = 5.4671 \cos 39.806^\circ \text{ kN} - F_{CD} \cos 26.565^\circ - F_{DG} \cos 39.806^\circ = 0$$

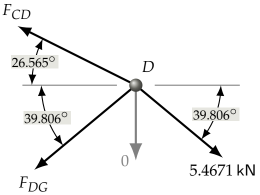
$$\sum F_y = F_{CD} \sin 26.565^\circ - F_{DG} \sin 39.806^\circ - 5.4671 \sin 39.806^\circ \text{ kN} = 0$$

Now, use the **system-solver** on your calculator to solve these two equations for $F_{CD}$ and $F_{DG}$.

$F_{CD} = 5.8696\,\text{kN},\ F_{DG} = -1.3668\,\text{kN}$




## Joint $D$

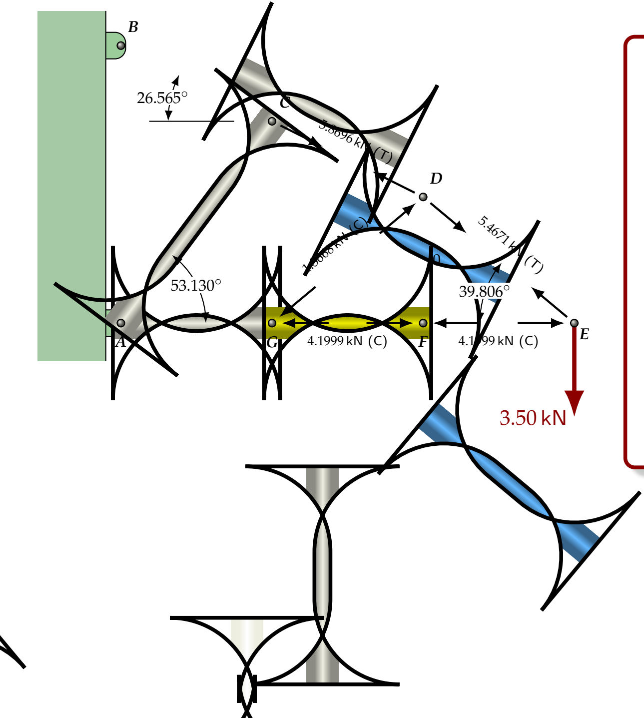



$$\sum F_x = 5.4671 \cos 39.806^\circ \text{ kN} - F_{CD} \cos 26.565^\circ - F_{DG} \cos 39.806^\circ = 0$$

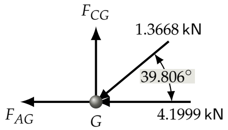
$$\sum F_y = F_{CD} \sin 26.565^\circ - F_{DG} \sin 39.806^\circ - 5.4671 \sin 39.806^\circ \text{ kN} = 0$$

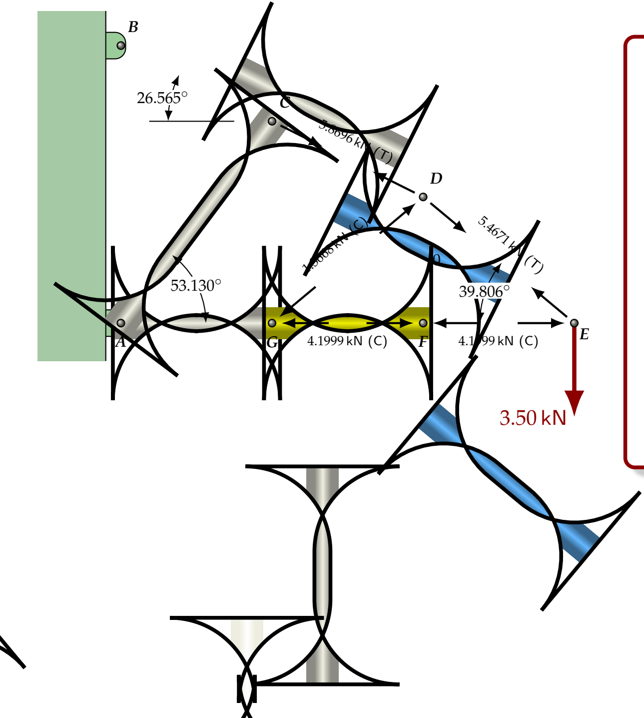
Now, use the **system-solver** on your calculator to solve these two equations for $F_{CD}$ and $F_{DG}$.

$$F_{CD} = 5.8696 \text{ kN}, \ F_{DG} = -1.3668 \text{ kN}$$

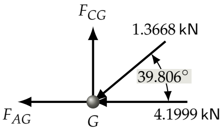

B
26.565°
C
5.8696 kN (T)
D
1.3668 kN (C)
5.4671 kN (T)
53.130°
39.806°
A
G
4.1999 kN (C)
F
4.1999 kN (C)
E
3.50 kN

## Joint $G$

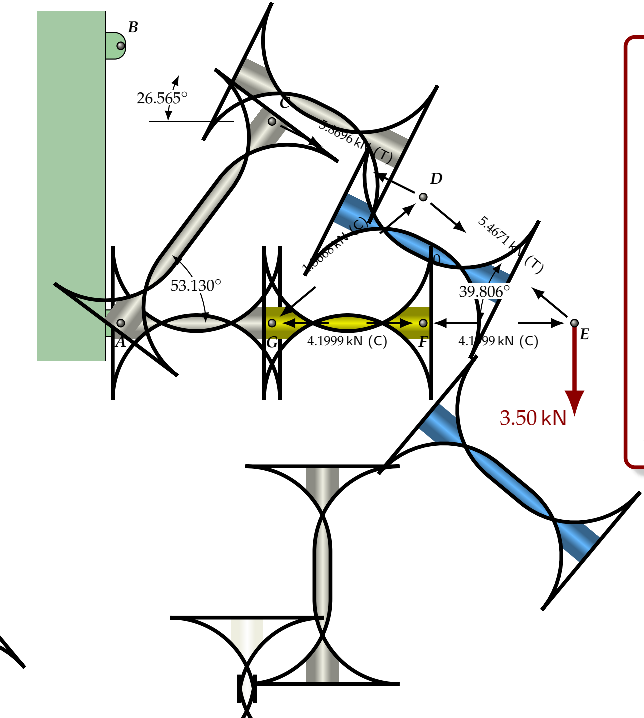

$F_{CG}$
1.3668 kN
39.806°
$F_{AG}$
G
4.1999 kN



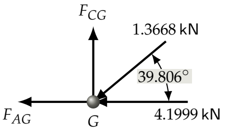

## Joint $G$




$$\sum F_y = F_{CG} - 1.3668 \sin 39.806^\circ \text{ kN}$$
$$= 0$$
$$\Rightarrow F_{CG} = 0.87501 \text{ kN}$$

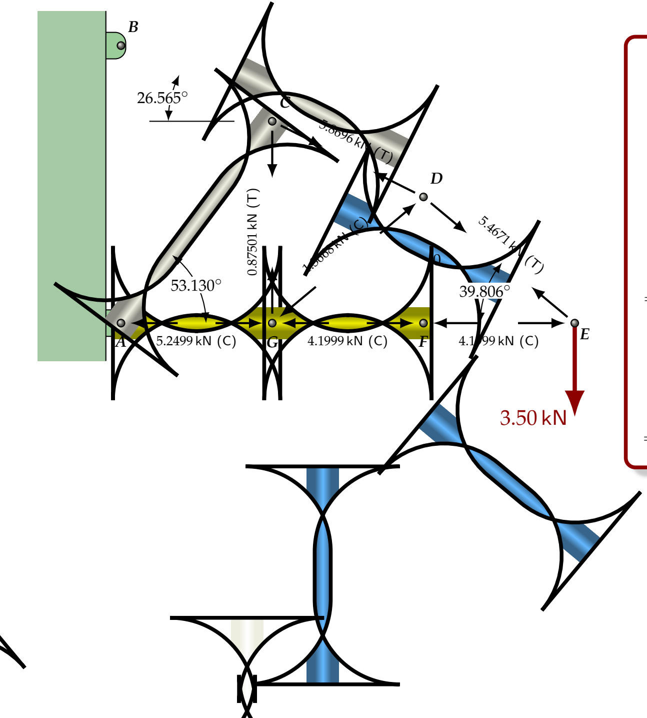



## Joint $G$

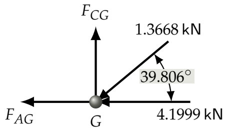



$$\sum F_y = F_{CG} - 1.3668 \sin 39.806^\circ \text{ kN}$$
$$= 0$$
$$\Rightarrow F_{CG} = 0.87501 \text{ kN}$$

$$\sum F_x = -4.1999 \text{ kN}$$
$$- 1.3668 \cos 39.806^\circ \text{ kN} - F_{AG}$$
$$= 0$$
$$\Rightarrow F_{AG} = -5.2499 \text{ kN}$$

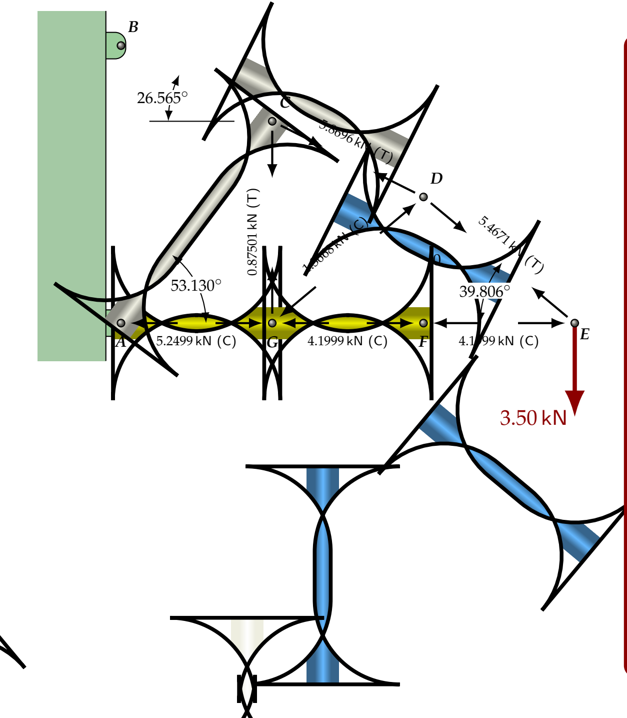



## Joint $G$

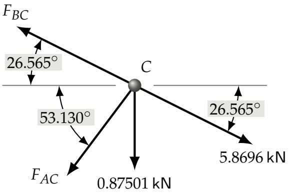


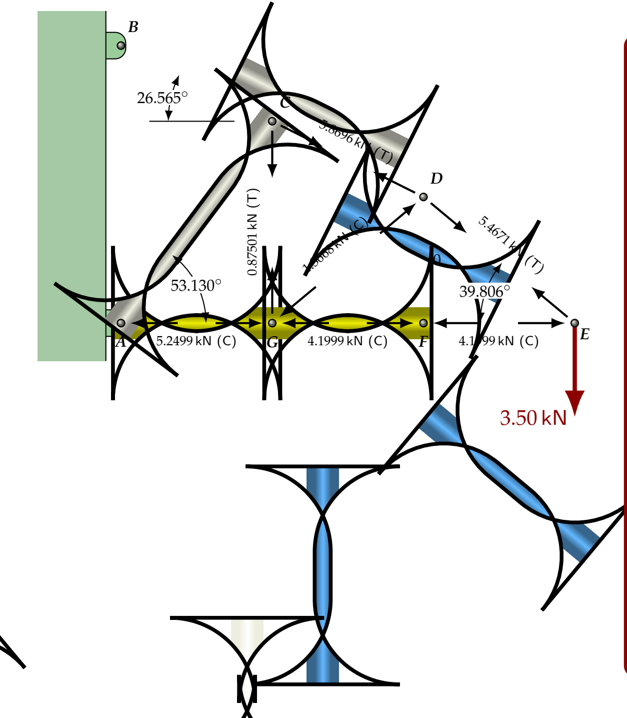

$$\begin{aligned}\sum F_y &= F_{CG} - 1.3668 \sin 39.806^\circ \text{ kN} \\ &= 0 \\ \Rightarrow F_{CG} &= 0.87501 \text{ kN}\end{aligned}$$

$$\begin{aligned}\sum F_x &= -4.1999 \text{ kN} \\ &\quad - 1.3668 \cos 39.806^\circ \text{ kN} - F_{AG} \\ &= 0 \\ \Rightarrow F_{AG} &= -5.2499 \text{ kN}\end{aligned}$$

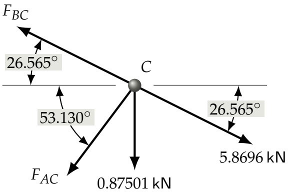

B
26.565°
C
5.8696 kN (T)
D
0.87501 kN (T)
1.5068 kN (C)
5.4671 kN (T)
53.130°
39.806°
E
A
5.2499 kN (C)
G
4.1999 kN (C)
F
4.1999 kN (C)
3.50 kN

## Joint $C$

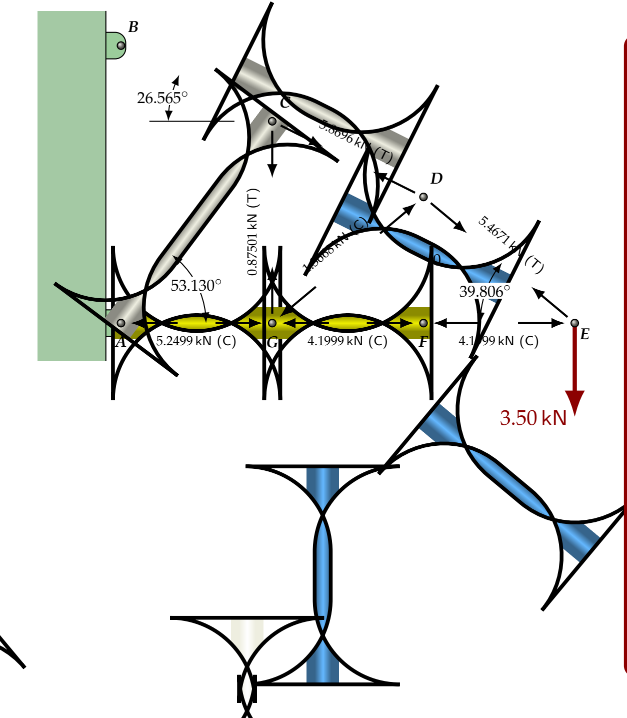

$F_{BC}$
26.565°
C
53.130°
26.565°
5.8696 kN
$F_{AC}$
0.87501 kN



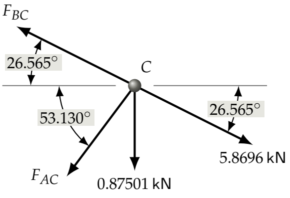

## Joint $C$




$$\sum F_x = 5.8696 \cos 26.565^\circ \text{ kN} - F_{BC} \cos 26.565^\circ - F_{AC} \cos 53.130^\circ = 0$$

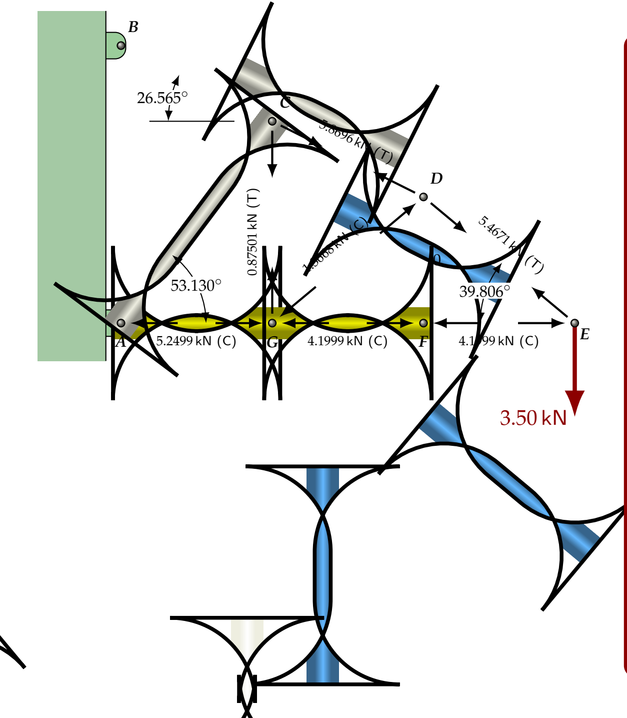



## Joint $C$

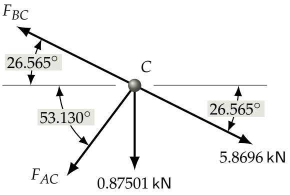



$$\begin{aligned}\sum F_x &= 5.8696\cos 26.565^\circ \text{ kN}\\ &\quad - F_{BC}\cos 26.565^\circ\\ &\quad - F_{AC}\cos 53.130^\circ\\ &= 0\end{aligned}$$

$$\begin{aligned}\sum F_y &= F_{BC}\sin 26.565^\circ\\ &\quad - F_{AC}\sin 53.130^\circ\\ &\quad - 5.8696\sin 26.565^\circ \text{ kN}\\ &\quad - 0.87501 \text{ kN}\\ &= 0\end{aligned}$$



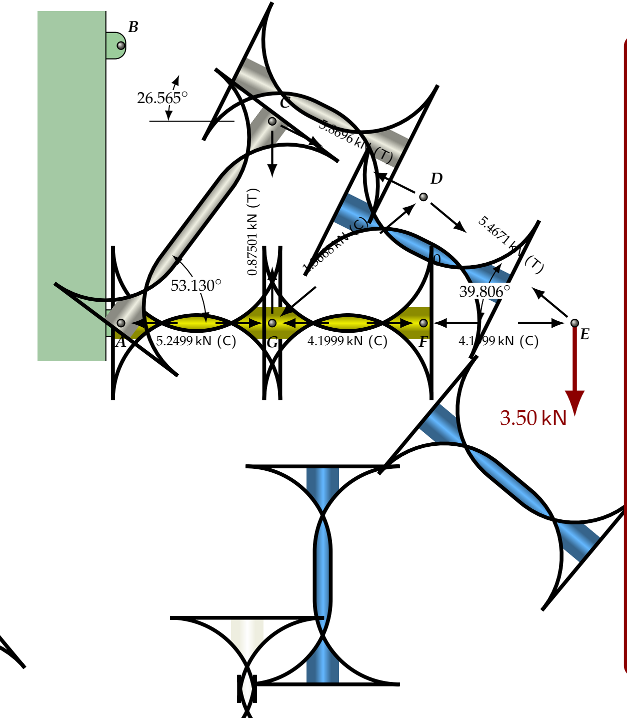

## Joint $C$



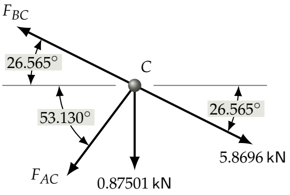

$$
\begin{aligned}
\sum F_x &= 5.8696 \cos 26.565^\circ \text{ kN} \\
&\quad - F_{BC} \cos 26.565^\circ \\
&\quad - F_{AC} \cos 53.130^\circ \\
&= 0
\end{aligned}
$$

$$
\begin{aligned}
\sum F_y &= F_{BC} \sin 26.565^\circ \\
&\quad - F_{AC} \sin 53.130^\circ \\
&\quad - 5.8696 \sin 26.565^\circ \text{ kN} \\
&\quad - 0.87501 \text{ kN} \\
&= 0
\end{aligned}
$$

Now, use the **system-solver** on your calculator to solve these two equations for $F_{AC}$ and $F_{BC}$.




## Joint $C$

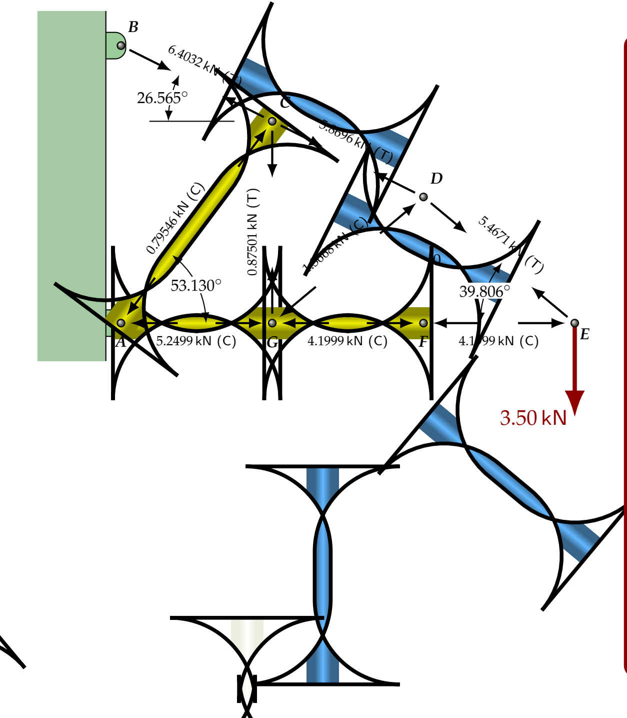



$$\begin{aligned}\sum F_x &= 5.8696 \cos 26.565^\circ \text{ kN} \\ &\quad - F_{BC} \cos 26.565^\circ \\ &\quad - F_{AC} \cos 53.130^\circ \\ &= 0\end{aligned}$$

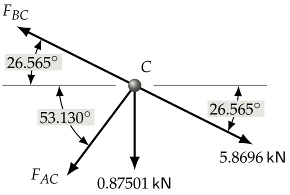
$$\begin{aligned}\sum F_y &= F_{BC} \sin 26.565^\circ \\ &\quad - F_{AC} \sin 53.130^\circ \\ &\quad - 5.8696 \sin 26.565^\circ \text{ kN} \\ &\quad - 0.87501 \text{ kN} \\ &= 0\end{aligned}$$

Now, use the **system-solver** on your calculator to solve these two equations for $F_{AC}$ and $F_{BC}$.

$$F_{AC} = -0.79546 \text{ kN}, \; F_{BC} = 6.4032 \text{ kN}$$




## Joint $C$

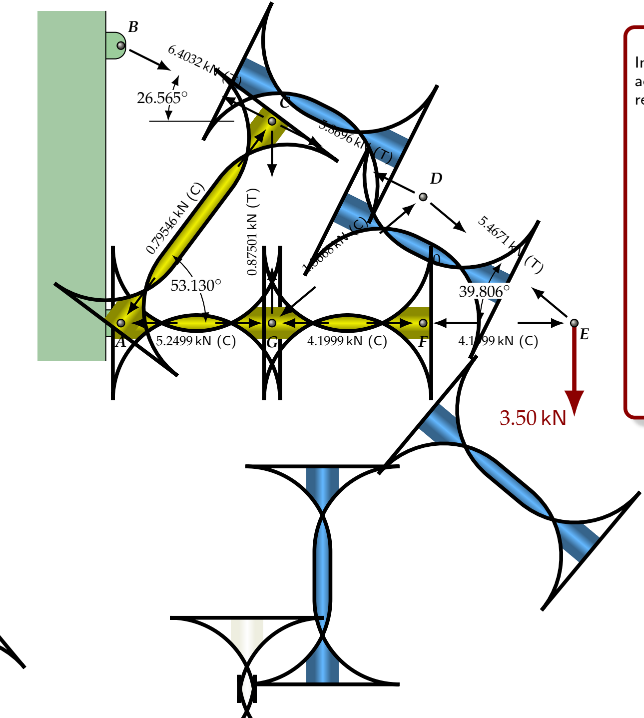



$$\sum F_x = 5.8696\cos 26.565^\circ\ \text{kN} - F_{BC}\cos 26.565^\circ - F_{AC}\cos 53.130^\circ = 0$$

$$\sum F_y = F_{BC}\sin 26.565^\circ - F_{AC}\sin 53.130^\circ - 5.8696\sin 26.565^\circ\ \text{kN} - 0.87501\ \text{kN} = 0$$

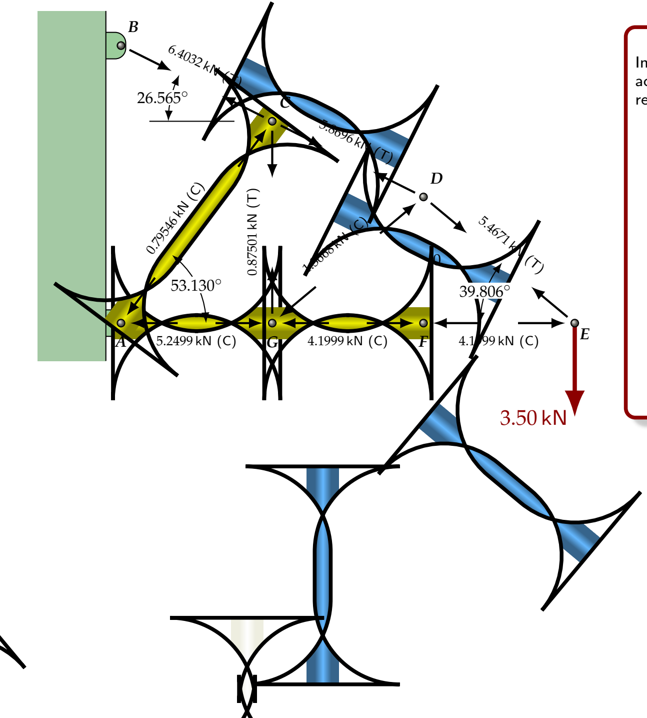
Now, use the **system-solver** on your calculator to solve these two equations for $F_{AC}$ and $F_{BC}$.

$F_{AC} = -0.79546\ \text{kN},\ F_{BC} = 6.4032\ \text{kN}$




## Finished . . . almost

Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:




## Finished . . . almost

Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

$AB = 0.795$ kN (Compression)

$AG = 5.25$ kN (Compression)

$BC = 6.40$ kN (Tension)

$CD = 5.87$ kN (Tension)

$CG = 0.875$ kN (Tension)

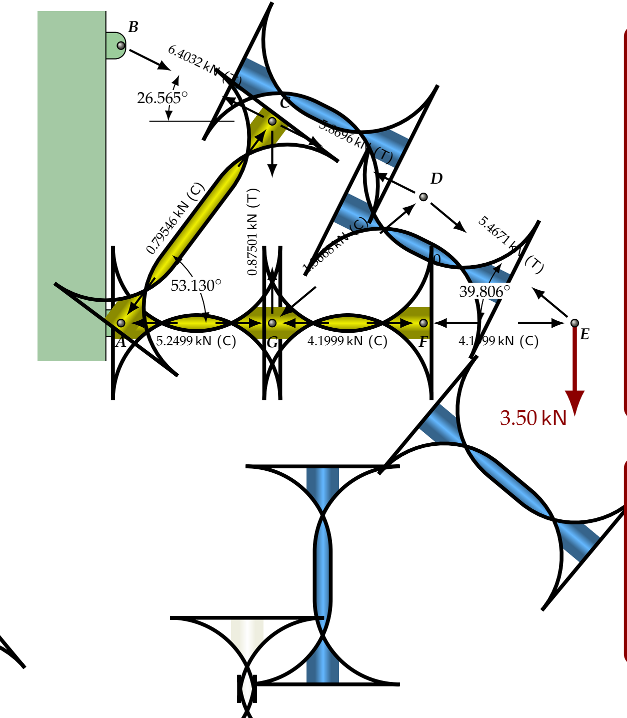
$DE = 5.47$ kN (Tension)

$DF = 0$

$DG = 1.37$ kN (Compression)

$EF = 4.20$ kN (Compression)

$FG = 4.20$ kN (Compression)




## Finished . . . almost

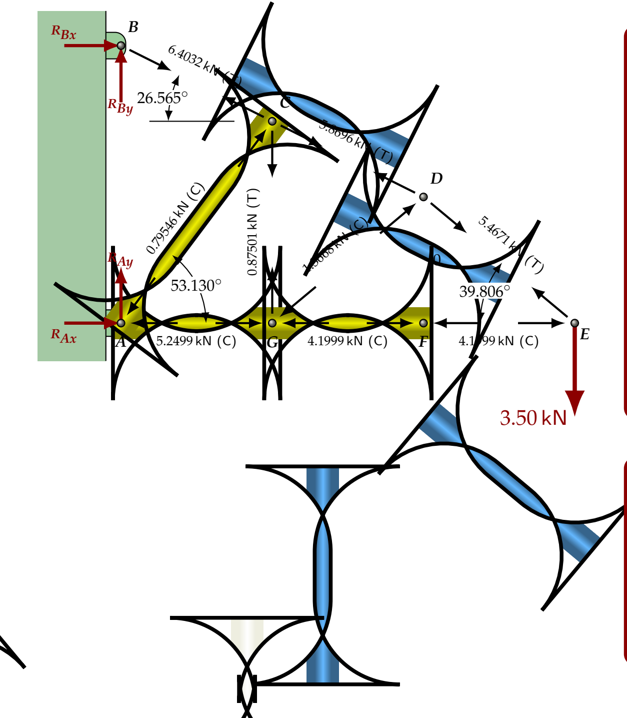
Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

$$AB = 0.795 \text{ kN (Compression)}$$
$$AG = 5.25 \text{ kN (Compression)}$$
$$BC = 6.40 \text{ kN (Tension)}$$
$$CD = 5.87 \text{ kN (Tension)}$$
$$CG = 0.875 \text{ kN (Tension)}$$
$$DE = 5.47 \text{ kN (Tension)}$$
$$DF = 0$$
$$DG = 1.37 \text{ kN (Compression)}$$
$$EF = 4.20 \text{ kN (Compression)}$$
$$FG = 4.20 \text{ kN (Compression)}$$

## But are these correct?

We could easily have made an error in a truss member calculation, causing most or all subsequent results to be incorrect.

**Let's do a check**. We can calculate the reactions at $A$ and $B$, then check that all external forces acting on the truss do actually sum to zero in the $x$ and $y$ directions.




## Finished . . . almost

Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

$$AB = 0.795 \text{ kN (Compression)}$$
$$AG = 5.25 \text{ kN (Compression)}$$
$$BC = 6.40 \text{ kN (Tension)}$$
$$CD = 5.87 \text{ kN (Tension)}$$
$$CG = 0.875 \text{ kN (Tension)}$$
$$DE = 5.47 \text{ kN (Tension)}$$
$$DF = 0$$
$$DG = 1.37 \text{ kN (Compression)}$$
$$EF = 4.20 \text{ kN (Compression)}$$
$$FG = 4.20 \text{ kN (Compression)}$$

## But are these correct?

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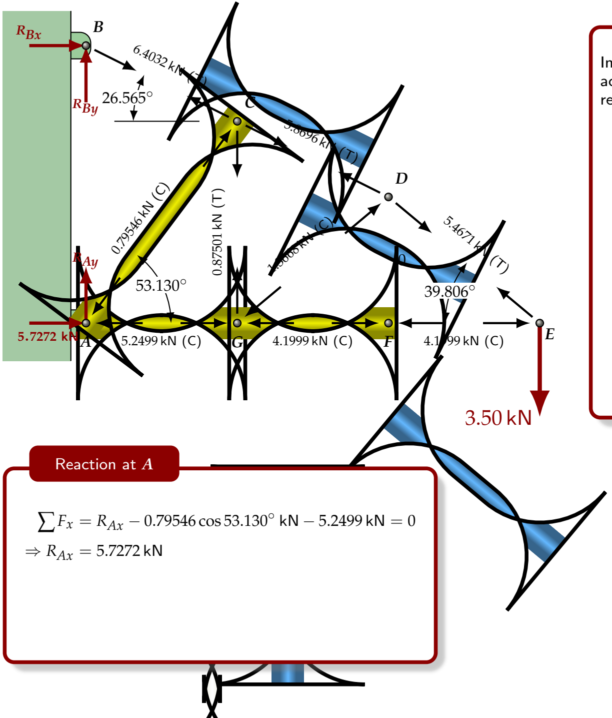
**Let's do a check**. We can calculate the reactions at $A$ and $B$, then check that all external forces acting on the truss do actually sum to zero in the $x$ and $y$ directions.



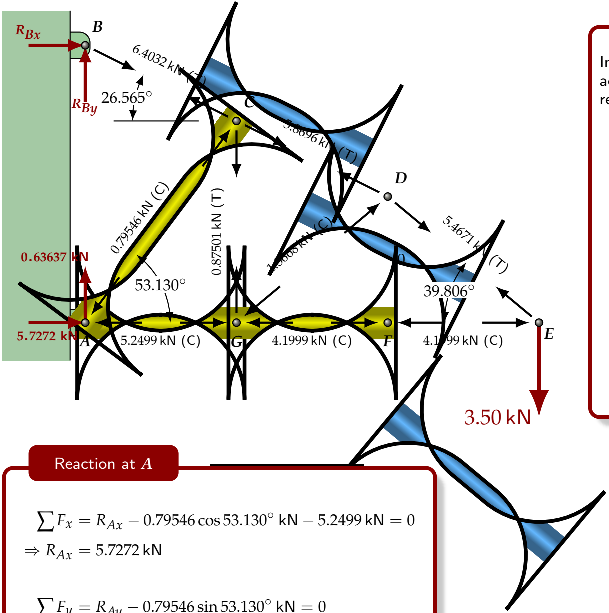

## Finished . . . almost

Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

$$AB = 0.795 \text{ kN (Compression)}$$
$$AG = 5.25 \text{ kN (Compression)}$$
$$BC = 6.40 \text{ kN (Tension)}$$
$$CD = 5.87 \text{ kN (Tension)}$$
$$CG = 0.875 \text{ kN (Tension)}$$
$$DE = 5.47 \text{ kN (Tension)}$$
$$DF = 0$$
$$DG = 1.37 \text{ kN (Compression)}$$
$$EF = 4.20 \text{ kN (Compression)}$$
$$FG = 4.20 \text{ kN (Compression)}$$

## Reaction at $A$

$$\sum F_x = R_{Ax} - 0.79546 \cos 53.130^\circ \text{ kN} - 5.2499 \text{ kN} = 0$$
$$\Rightarrow R_{Ax} = 5.7272 \text{ kN}$$




## Finished . . . almost

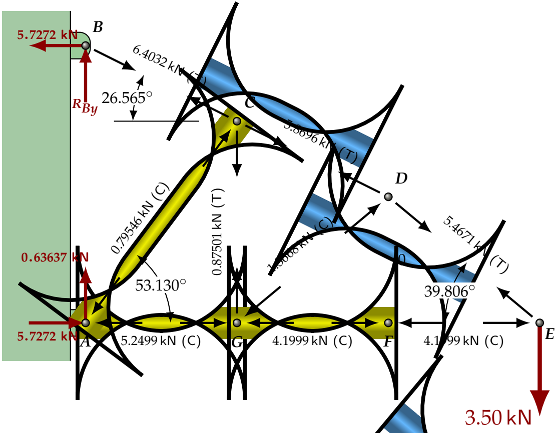
Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

$$AB = 0.795\ \text{kN (Compression)}$$
$$AG = 5.25\ \text{kN (Compression)}$$
$$BC = 6.40\ \text{kN (Tension)}$$
$$CD = 5.87\ \text{kN (Tension)}$$
$$CG = 0.875\ \text{kN (Tension)}$$
$$DE = 5.47\ \text{kN (Tension)}$$
$$DF = 0$$
$$DG = 1.37\ \text{kN (Compression)}$$
$$EF = 4.20\ \text{kN (Compression)}$$
$$FG = 4.20\ \text{kN (Compression)}$$

## Reaction at $A$

$$\sum F_x = R_{Ax} - 0.79546 \cos 53.130^\circ\ \text{kN} - 5.2499\ \text{kN} = 0$$
$$\Rightarrow R_{Ax} = 5.7272\ \text{kN}$$

$$\sum F_y = R_{Ay} - 0.79546 \sin 53.130^\circ\ \text{kN} = 0$$
$$\Rightarrow R_{Ay} = 0.63637\ \text{kN}$$




## Finished . . . almost

Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

$$AB = 0.795 \text{ kN (Compression)}$$
$$AG = 5.25 \text{ kN (Compression)}$$
$$BC = 6.40 \text{ kN (Tension)}$$
$$CD = 5.87 \text{ kN (Tension)}$$
$$CG = 0.875 \text{ kN (Tension)}$$
$$DE = 5.47 \text{ kN (Tension)}$$
$$DF = 0$$
$$DG = 1.37 \text{ kN (Compression)}$$
$$EF = 4.20 \text{ kN (Compression)}$$
$$FG = 4.20 \text{ kN (Compression)}$$

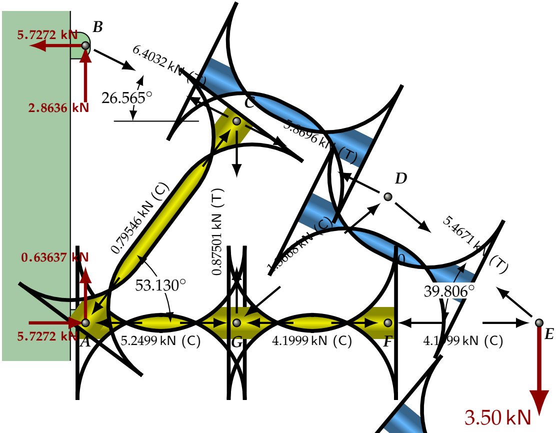
## Reaction at $A$

$$\sum F_x = R_{Ax} - 0.79546 \cos 53.130^\circ \text{ kN} - 5.2499 \text{ kN} = 0$$
$$\Rightarrow R_{Ax} = 5.7272 \text{ kN}$$

$$\sum F_y = R_{Ay} - 0.79546 \sin 53.130^\circ \text{ kN} = 0$$
$$\Rightarrow R_{Ay} = 0.63637 \text{ kN}$$

## Reaction at $B$

$$\sum F_x = R_{Bx} + 6.4032 \cos 26.565^\circ \text{ kN} = 0$$
$$\Rightarrow R_{Bx} = -5.7272 \text{ kN}$$




## Finished . . . almost

Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

$$AB = 0.795 \text{ kN (Compression)}$$
$$AG = 5.25 \text{ kN (Compression)}$$
$$BC = 6.40 \text{ kN (Tension)}$$
$$CD = 5.87 \text{ kN (Tension)}$$
$$CG = 0.875 \text{ kN (Tension)}$$
$$DE = 5.47 \text{ kN (Tension)}$$
$$DF = 0$$
$$DG = 1.37 \text{ kN (Compression)}$$
$$EF = 4.20 \text{ kN (Compression)}$$
$$FG = 4.20 \text{ kN (Compression)}$$

## Reaction at $A$

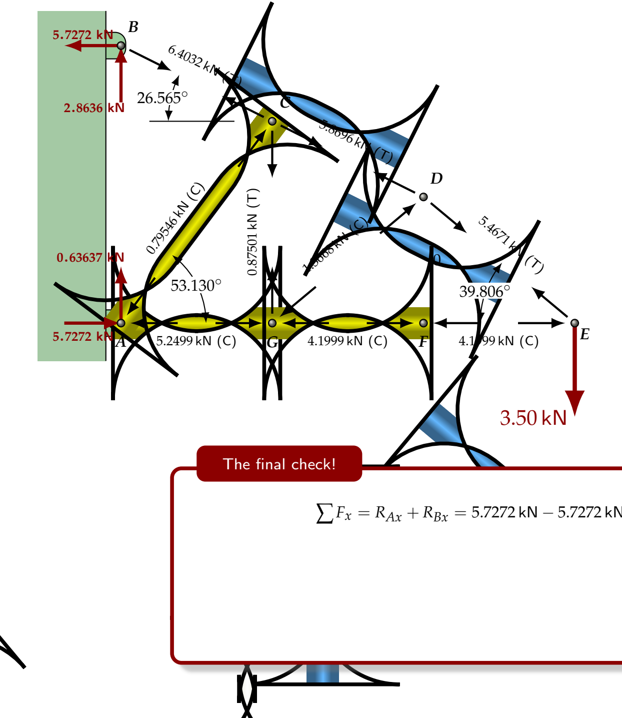
$$\sum F_x = R_{Ax} - 0.79546 \cos 53.130^\circ \text{ kN} - 5.2499 \text{ kN} = 0$$
$$\Rightarrow R_{Ax} = 5.7272 \text{ kN}$$

$$\sum F_y = R_{Ay} - 0.79546 \sin 53.130^\circ \text{ kN} = 0$$
$$\Rightarrow R_{Ay} = 0.63637 \text{ kN}$$

## Reaction at $B$

$$\sum F_x = R_{Bx} + 6.4032 \cos 26.565^\circ \text{ kN} = 0$$
$$\Rightarrow R_{Bx} = -5.7272 \text{ kN}$$

$$\sum F_y = R_{By} - 6.4032 \sin 26.565 \text{ kN} = 0$$
$$\Rightarrow R_{By} = 2.8636 \text{ kN}$$



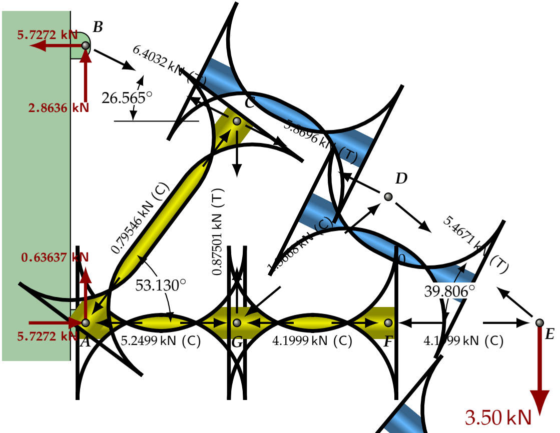

## Finished . . . almost

Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

$AB = 0.795$ kN (Compression)
$AG = 5.25$ kN (Compression)
$BC = 6.40$ kN (Tension)
$CD = 5.87$ kN (Tension)
$CG = 0.875$ kN (Tension)
$DE = 5.47$ kN (Tension)
$DF = 0$
$DG = 1.37$ kN (Compression)
$EF = 4.20$ kN (Compression)
$FG = 4.20$ kN (Compression)

## The final check!

$$\sum F_x = R_{Ax} + R_{Bx} = 5.7272\,\text{kN} - 5.7272\,\text{kN} = 0 \quad \checkmark$$




## Finished . . . almost

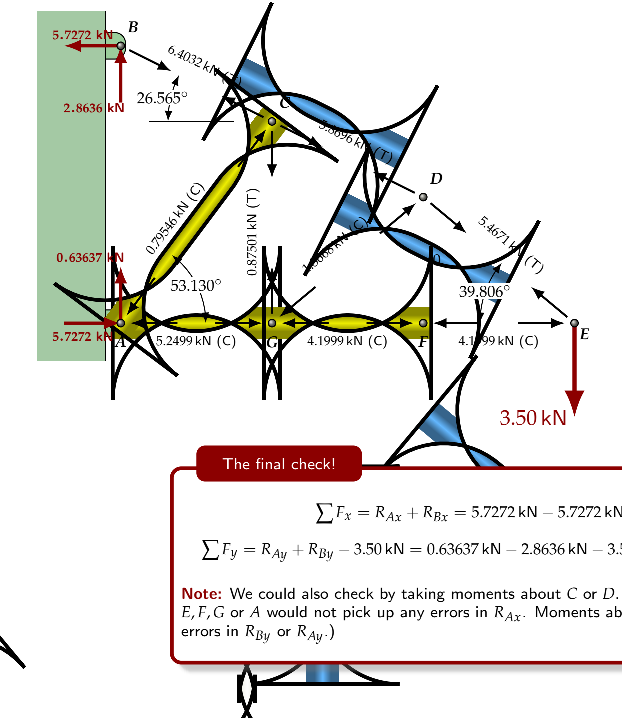
Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

$$
\begin{aligned}
AB &= 0.795\ \text{kN (Compression)}\\
AG &= 5.25\ \text{kN (Compression)}\\
BC &= 6.40\ \text{kN (Tension)}\\
CD &= 5.87\ \text{kN (Tension)}\\
CG &= 0.875\ \text{kN (Tension)}\\
DE &= 5.47\ \text{kN (Tension)}\\
DF &= 0\\
DG &= 1.37\ \text{kN (Compression)}\\
EF &= 4.20\ \text{kN (Compression)}\\
FG &= 4.20\ \text{kN (Compression)}
\end{aligned}
$$

## The final check!

$$\sum F_x = R_{Ax} + R_{Bx} = 5.7272\ \text{kN} - 5.7272\ \text{kN} = 0 \quad \checkmark$$

$$\sum F_y = R_{Ay} + R_{By} - 3.50\ \text{kN} = 0.63637\ \text{kN} - 2.8636\ \text{kN} - 3.50\ \text{kN} = -0.00003\ \text{kN} \quad \checkmark$$




## Finished ... almost

Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

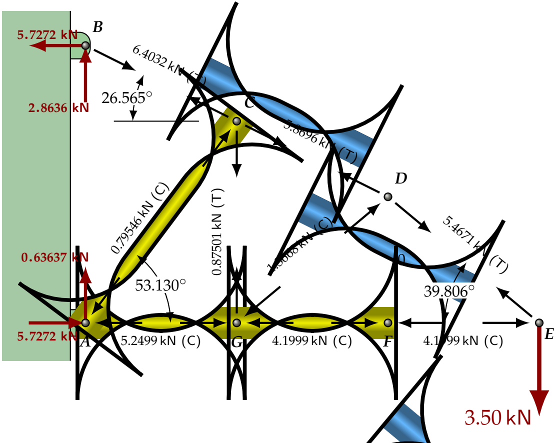
$$AB = 0.795 \text{ kN (Compression)}$$
$$AG = 5.25 \text{ kN (Compression)}$$
$$BC = 6.40 \text{ kN (Tension)}$$
$$CD = 5.87 \text{ kN (Tension)}$$
$$CG = 0.875 \text{ kN (Tension)}$$
$$DE = 5.47 \text{ kN (Tension)}$$
$$DF = 0$$
$$DG = 1.37 \text{ kN (Compression)}$$
$$EF = 4.20 \text{ kN (Compression)}$$
$$FG = 4.20 \text{ kN (Compression)}$$

## The final check!

$$\sum F_x = R_{Ax} + R_{Bx} = 5.7272\,\text{kN} - 5.7272\,\text{kN} = 0 \quad \checkmark$$

$$\sum F_y = R_{Ay} + R_{By} - 3.50\,\text{kN} = 0.63637\,\text{kN} - 2.8636\,\text{kN} - 3.50\,\text{kN} = -0.00003\,\text{kN} \quad \checkmark$$

**Note:** We could also check by taking moments about $C$ or $D$. (Taking moments about $E, F, G$ or $A$ would not pick up any errors in $R_{Ax}$. Moments about $A$ or $B$ would not pick up errors in $R_{By}$ or $R_{Ay}$.)




## Finished . . . almost

Inputs (lengths and the load at $E$) were accurate to 3 significant digits so our results can be no more accurate than this:

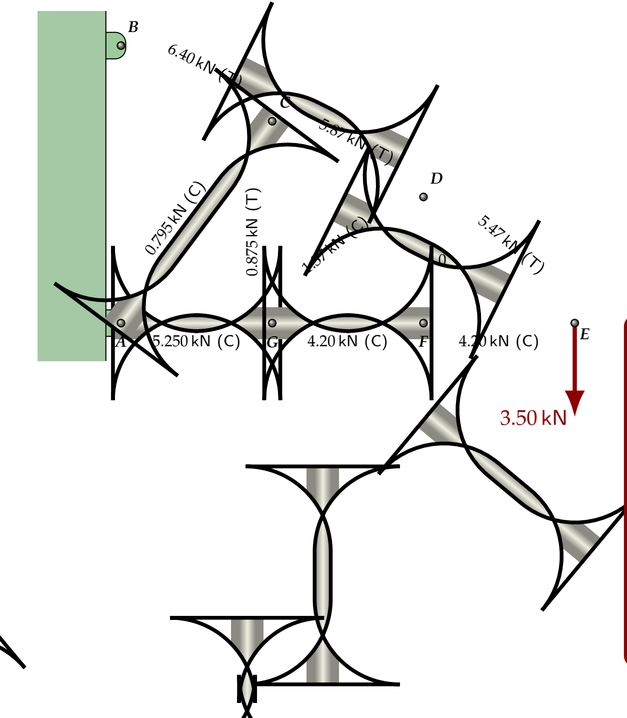
$$AB = 0.795 \text{ kN (Compression)}$$
$$AG = 5.25 \text{ kN (Compression)}$$
$$BC = 6.40 \text{ kN (Tension)}$$
$$CD = 5.87 \text{ kN (Tension)}$$
$$CG = 0.875 \text{ kN (Tension)}$$
$$DE = 5.47 \text{ kN (Tension)}$$
$$DF = 0$$
$$DG = 1.37 \text{ kN (Compression)}$$
$$EF = 4.20 \text{ kN (Compression)}$$
$$FG = 4.20 \text{ kN (Compression)}$$

## The final check!

$$\sum F_x = R_{Ax} + R_{Bx} = 5.7272\,\text{kN} - 5.7272\,\text{kN} = 0 \quad ✓$$

$$\sum F_y = R_{Ay} + R_{By} - 3.50\,\text{kN} = 0.63637\,\text{kN} - 2.8636\,\text{kN} - 3.50\,\text{kN} = -0.00003\,\text{kN} \quad ✓$$

**Note:** We could also check by taking moments about $C$ or $D$. (Taking moments about $E, F, G$ or $A$ would not pick up any errors in $R_{Ax}$. Moments about $A$ or $B$ would not pick up errors in $R_{By}$ or $R_{Ay}$.)




## The Results

$AB = 0.795\,\text{kN}$ (Compression)

$AG = 5.25\,\text{kN}$ (Compression)

$BC = 6.40\,\text{kN}$ (Tension)

$CD = 5.87\,\text{kN}$ (Tension)

$CG = 0.875\,\text{kN}$ (Tension)

$DE = 5.47\,\text{kN}$ (Tension)

$DF = 0$

$DG = 1.37\,\text{kN}$ (Compression)

$EF = 4.20\,\text{kN}$ (Compression)

$FG = 4.20\,\text{kN}$ (Compression)