Question: Determine the force in each member of the pratt bridge truss sh...

Determine the force in each member of the pratt bridge truss shown. State whether each member is in tension or compression.

6.15 Determine the force in each member of the Pratt bridge truss shown. State whether each member is in tension or compression.

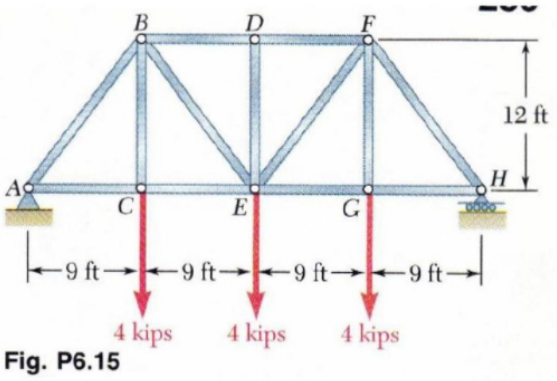

Fig. P6.15

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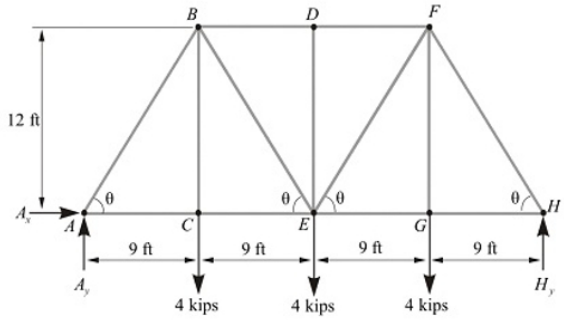
Expert Answer

Henry Miller answered this
1,149 answers

Free body diagram of the Pratt bridge truss:



Due to symmetrical loading on the truss,
Vertical components of the reaction at A and H are equal.
Force in the members AB and FH are equal.
Force in the members AC and GH are equal.
Force in the members BC and FG are equal.
Force in the members CE and EG are equal.
Force in the members BE and EF are equal.
Force in the members BD and DF are equal.

Calculate the angle from the free body diagram,

$$\theta = \tan^{-1}\left(\frac{12}{9}\right)$$
$$= \tan^{-1}(1.3333)$$
$$= 53.13^\circ$$

Consider the forces acting along the horizontal direction,

$$\sum F_x = 0$$
$$A_x = 0$$

Consider the forces acting along the vertical direction,

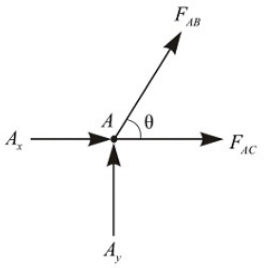
$\sum F_y = 0$

$A_y + H_y - 4 - 4 - 4 = 0$

$A_y + A_y - 12 = 0 \qquad [\text{Due to symmetry, } A_y = H_y]$

$A_y = 6 \text{ kips} = H_y$

Free body diagram at joint A.



Apply the force equilibrium equation along y-direction.

$\sum F_y = 0$

$F_{AB} \sin\theta + A_y = 0$

$F_{AB} \sin 53.13° + 6 = 0$

$F_{AB} = -7.5 \text{ kips} = 7.5 \text{ kips (C)} = F_{FH}$

Apply the force equilibrium equation along x-direction.

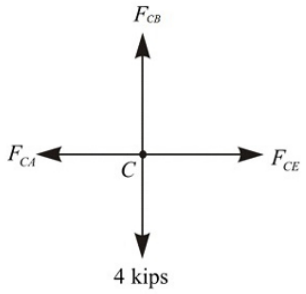
$\sum F_x = 0$

$F_{AC} + F_{AB} \cos\theta - A_x = 0$

$F_{AC} + (-7.5)\cos 53.13° - 0 = 0$

$F_{AC} = 4.5 \text{ kips (T)} = F_{GH}$

Free body diagram at joint C.



Apply the force equilibrium equation along x-direction.

$\sum F_x = 0$

$F_{CE} - F_{CA} = 0$

$F_{CE} - 4.5 = 0$

$F_{CE} = 4.5 \text{ kips (T)} = F_{EG}$

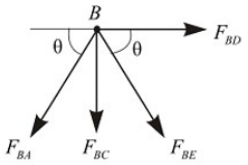
Apply the force equilibrium equation along y-direction.

$\sum F_y = 0$

$F_{CB} - 4 = 0$

$F_{CB} = 4 \text{ kips (T)} = F_{GF}$

Free body diagram at joint B.



Apply the force equilibrium equation along y-direction.

$\sum F_y = 0$

$-F_{BA} \sin\theta - F_{BC} - F_{BE} \sin\theta = 0$

$-(-7.5)\sin 53.13° - (4) - F_{BE} \sin 53.13° = 0$

$6 - 4 - 0.8F_{BE} = 0$

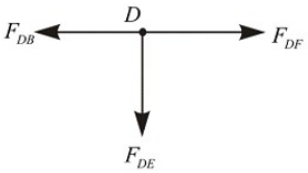
$F_{BE} = 2.5 \text{ kips (T)} = F_{EF}$

Apply the force equilibrium equation along x-direction.

$\sum F_x = 0$

$$F_{BD} + F_{BE}\cos\theta - F_{BA}\cos\theta = 0$$
$$F_{BD} + (2.5)\cos 53.13° - (-7.5)\cos 53.13° = 0$$
$$F_{BD} + 1.5 + 4.5 = 0$$
$$F_{BD} = -6 \text{ kips} = 6 \text{ kips(C)} = F_{DF}$$

Free body diagram at joint D.



Apply the force equilibrium equation along y-direction.

$$\sum F_y = 0$$
$$-F_{DE} = 0$$
$$F_{DE} = 0$$

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A: See answer

Q: determine the force in each member of the Pratt bridge truss shown. state whether each member is in tension or compression.

A: See answer

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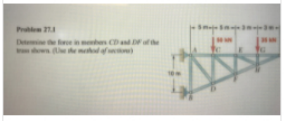
Problem 27.1 Determine the force in members CD and DF of the truss shown. (Use the method of sections) 50 kN ...



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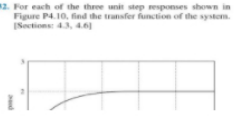

See answer

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Q: Determine the force in members CD and DF of the truss shown.

A: See step-by-step answer 100% (14 ratings)

Q: Determine the force in each member of the Pratt bridge truss shown. State whether each member is in tension or compression. Begin by determining obvious zero-force members.

A: See answer

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