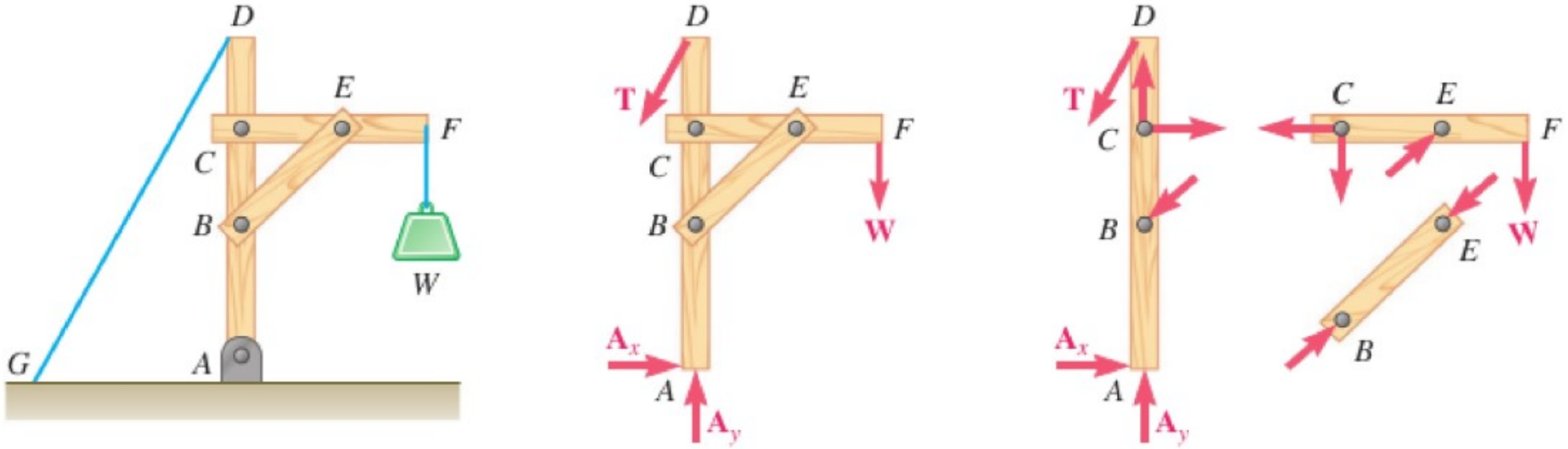
Deception Pass Bridge

6

Analysis of Structures

Trusses, such as this cantilever arch bridge over Deception Pass in Washington state, provide both a practical and an economical solution to many engineering problems.

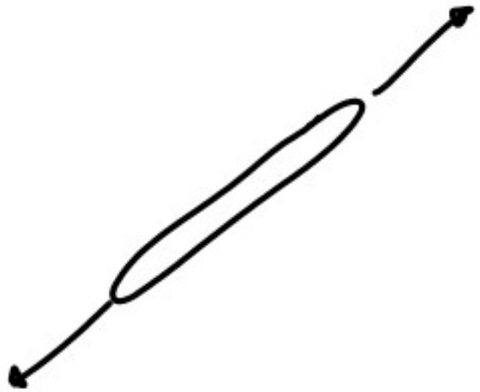

D
E
F
C
B
W
G
A
D
T
E
F
C
B
W
A_x
A
A_y
D
T
C
E
F
C
B
W
E
B
A_x
A
A_y

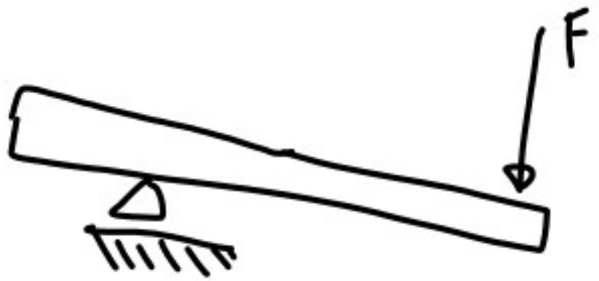
Structure classes

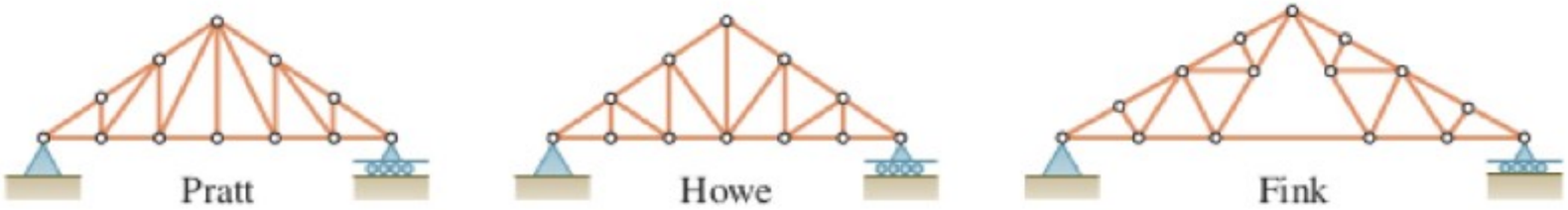
Trusses two force Members

Frames Multi-force members

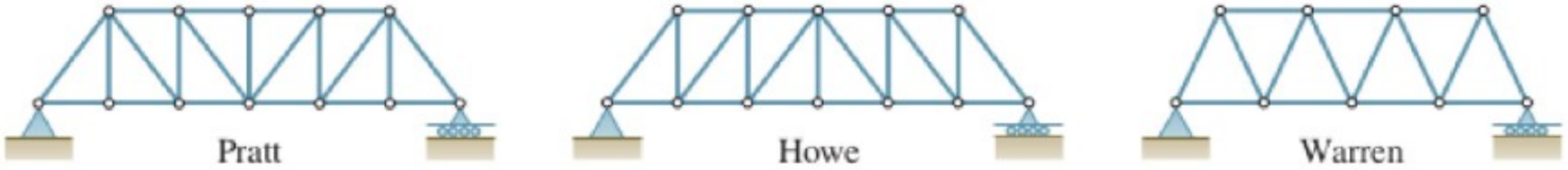
Machine transform a force

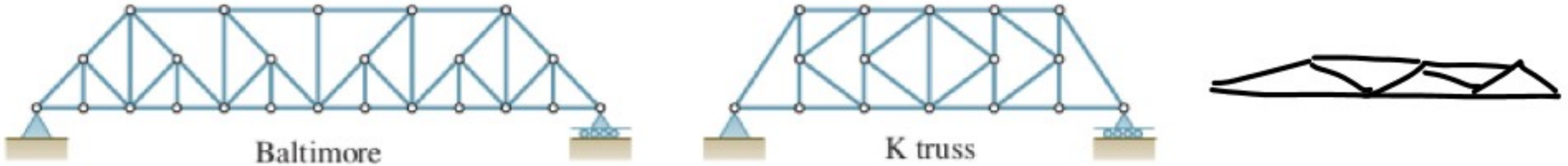




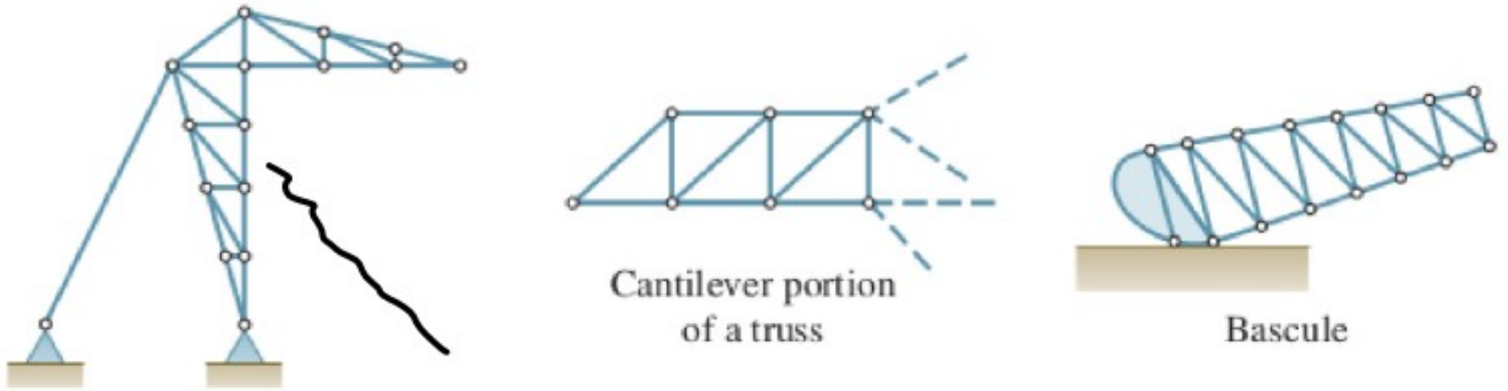


Typical Roof Trusses

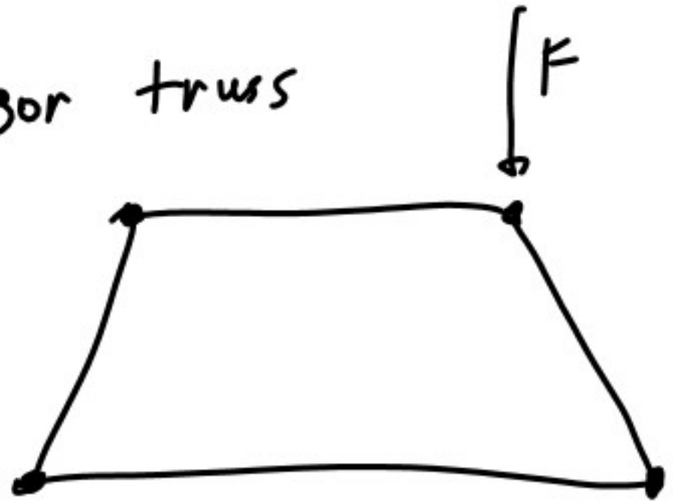


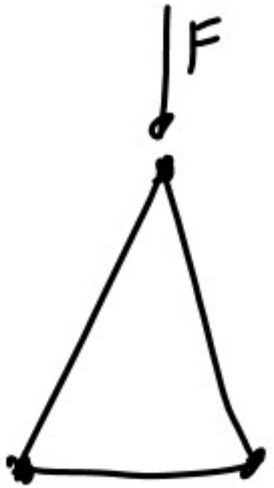


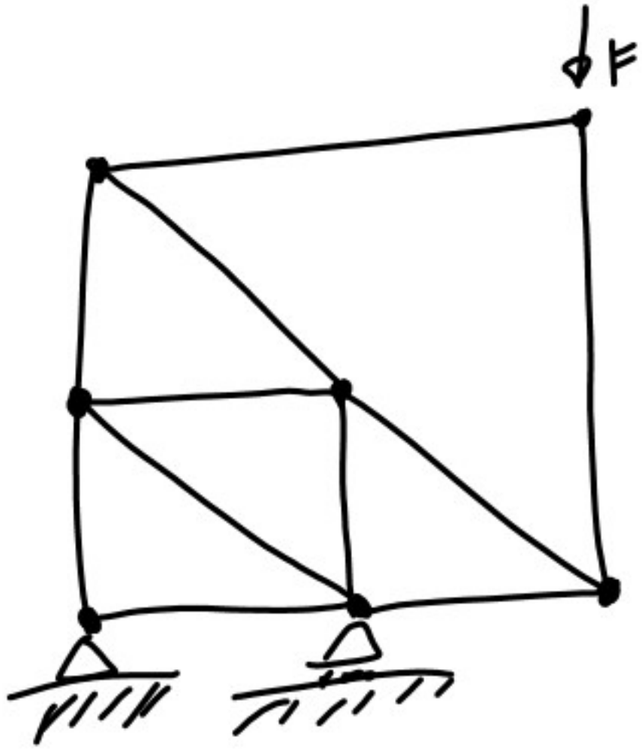
Typical Bridge Trusses

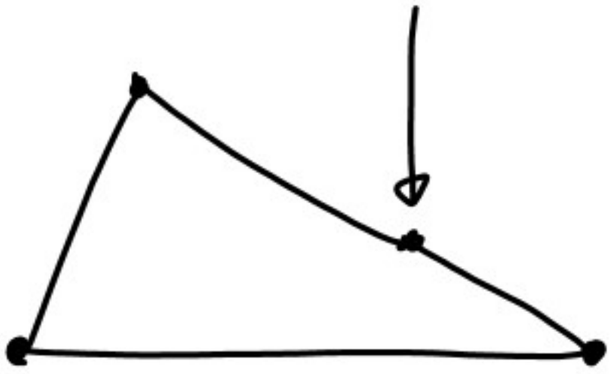


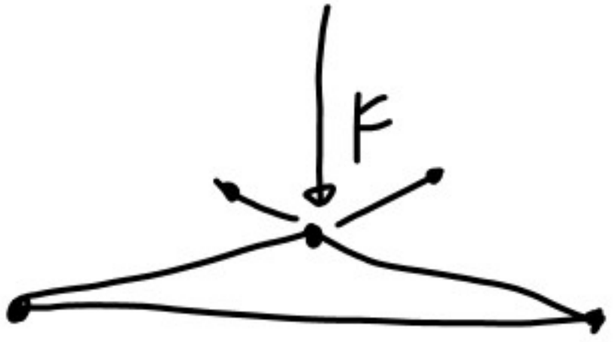
Poor truss



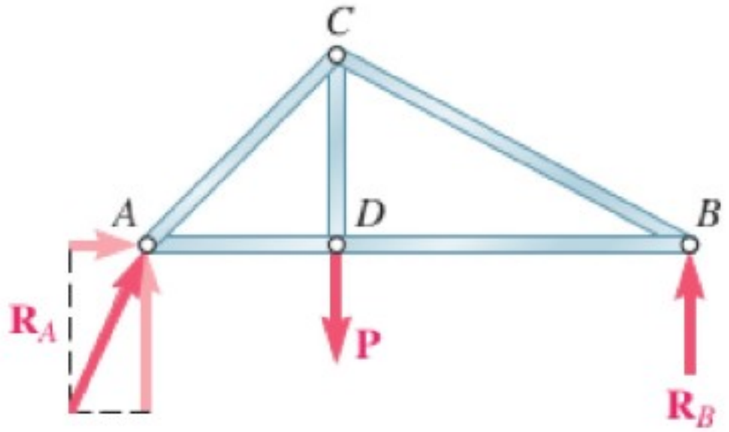




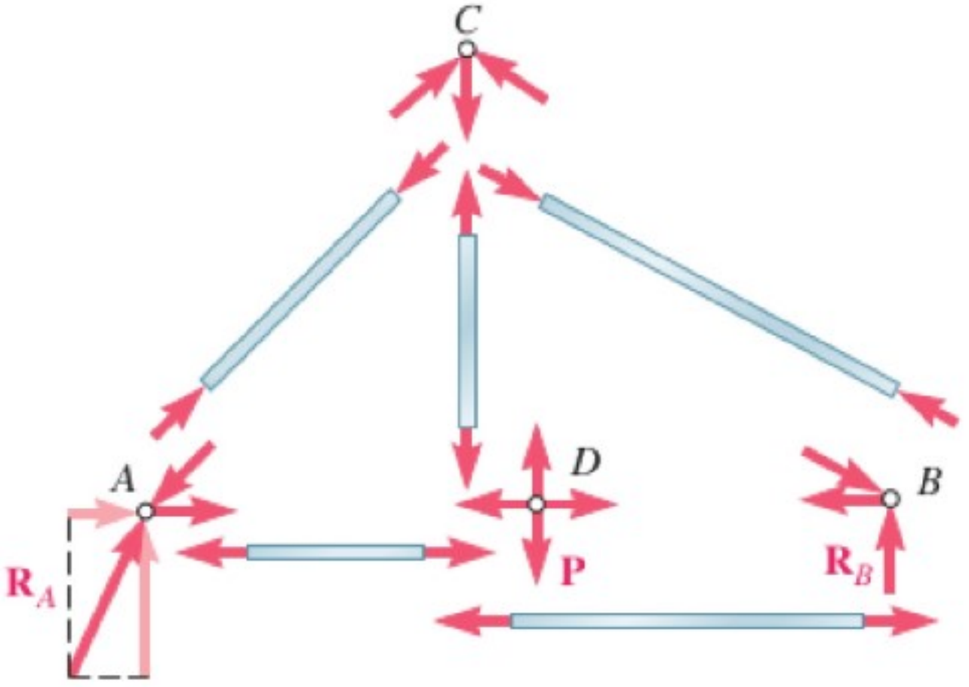




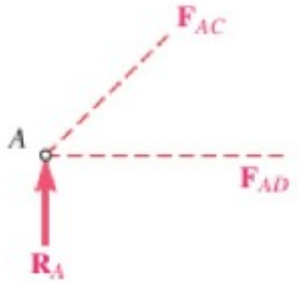
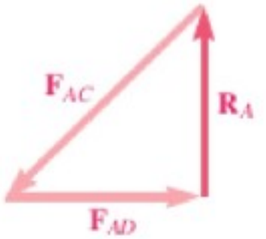
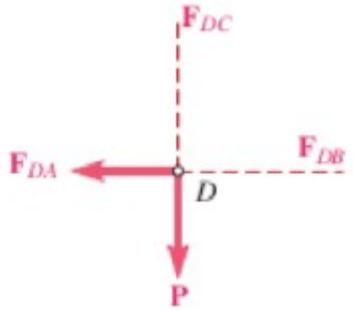
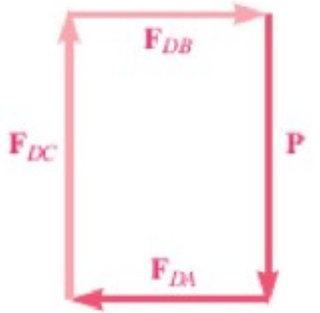
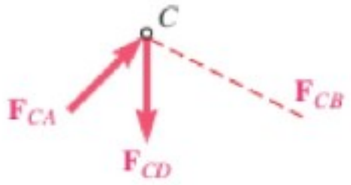
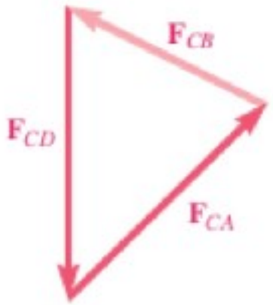
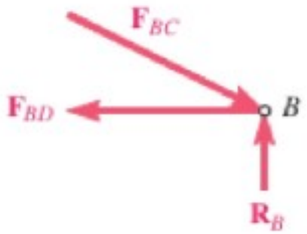
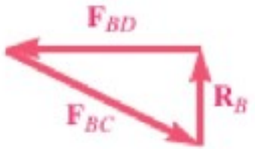
Method of Joints



(a)



(b)

	Free-body diagram	Force polygon
Joint A		
Joint D		
Joint C		
Joint B		

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

$\sum M_A = -4 \cdot 1800 + 12 R_B = 0$

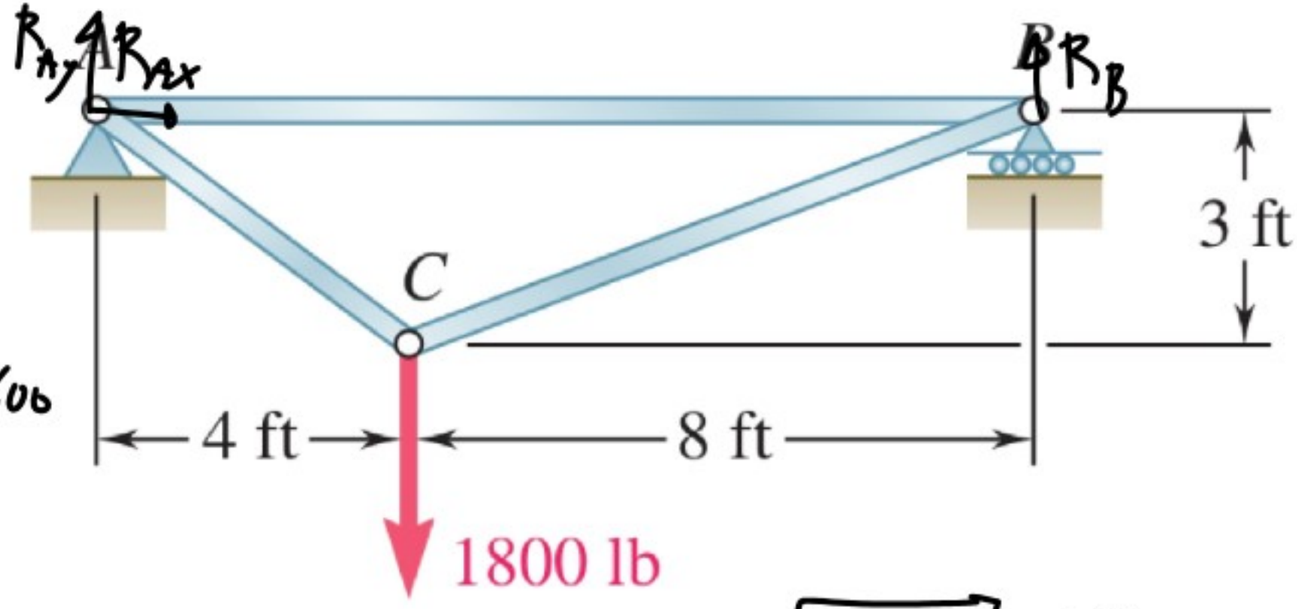
$R_B = \frac{4 \cdot 1800}{12} = 600\ \text{lb}$

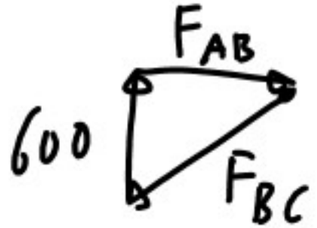
$\sum F_y = 0$

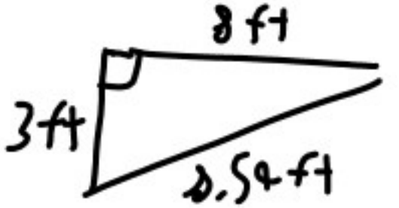
$R_{Ay} + R_B - 1800 = 0$

$R_{Ay} = 1800 - R_B = 1800 - 600$

$= 1200\ \text{lb}$







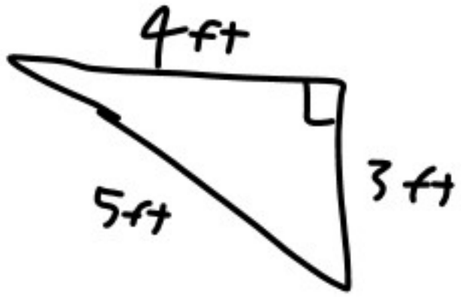
$\sqrt{3^2 + 8^2} = 8.54$

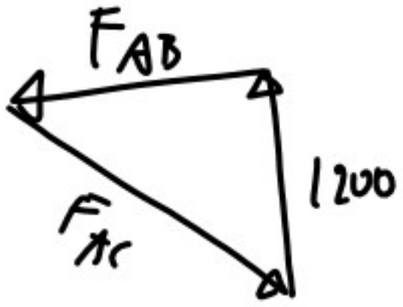
$\frac{F_{AB}}{600} = \frac{8}{3}$

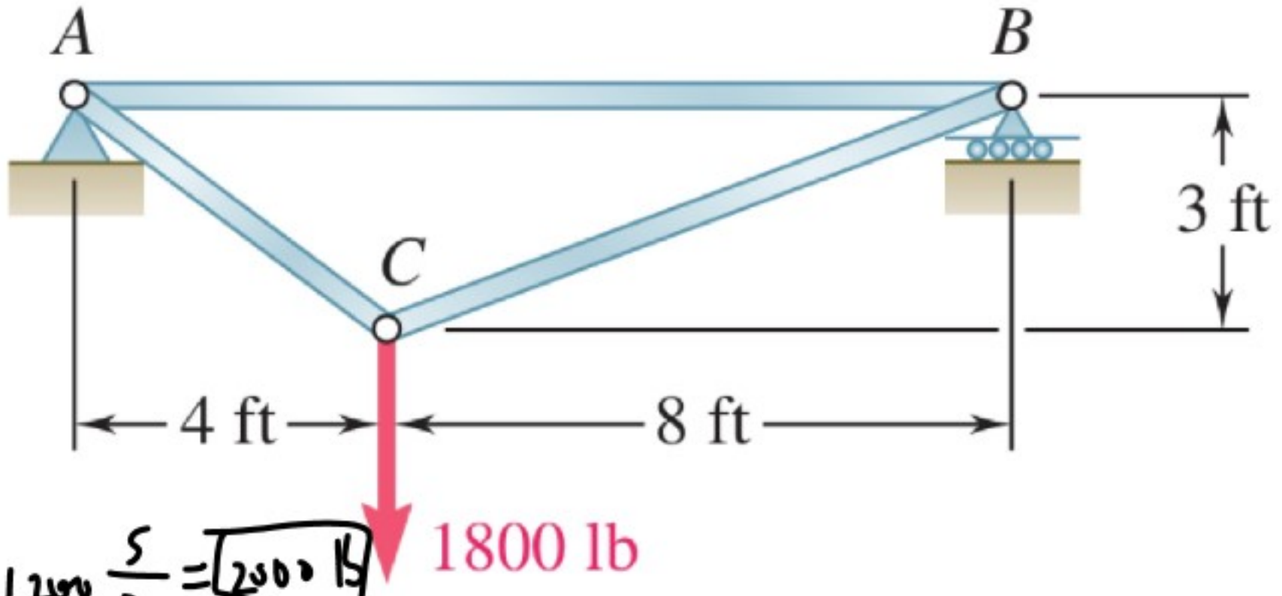
$\frac{F_{BC}}{600} = \frac{8.54}{3}$

$F_{BC} = 1709\ \text{lb}$

$F_{AB} = 600 \frac{8}{3} = 1600\ \text{lb}$

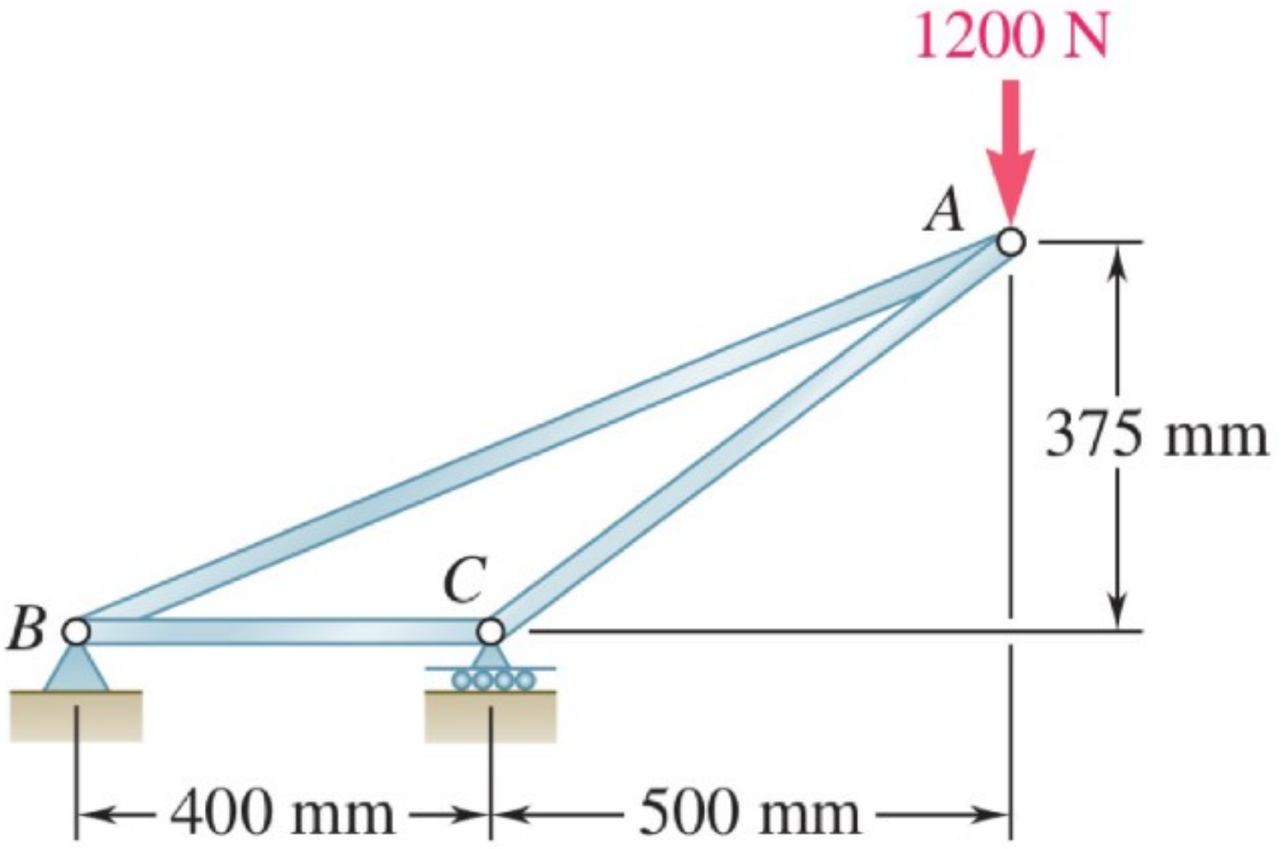






$$\frac{F_{AC}}{1200} = \frac{5}{3} \qquad F_{AC} = 1200\,\frac{5}{3} = 2000\ \text{lb}$$

$$\frac{F_{AC}}{F_{AB}} = \frac{5}{4} \qquad F_{AC} = 1600\,\frac{5}{4} = 2000\ \checkmark$$


1200 N
A
B
C
375 mm
400 mm
500 mm