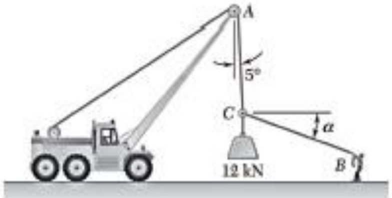
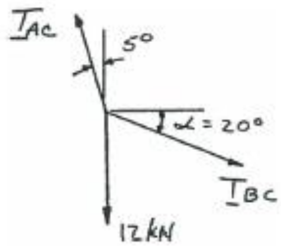


PROBLEM 2.45

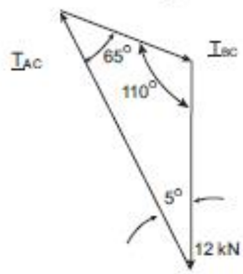
Knowing that $\alpha = 20°$, determine the tension (*a*) in cable *AC*, (*b*) in rope *BC*.

SOLUTION

Free-Body Diagram



Force Triangle



Law of sines:

$$\frac{T_{AC}}{\sin 110°} = \frac{T_{BC}}{\sin 5°} = \frac{12 \text{ kN}}{\sin 65°}$$

(*a*)

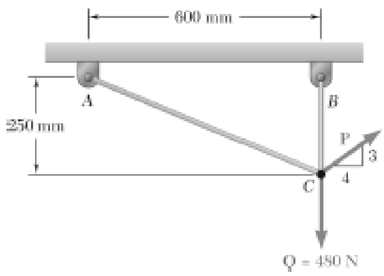
$$T_{AC} = \frac{12 \text{ kN}}{\sin 65°} \sin 110°$$

$T_{AC} = 12$ kN ◀

(*b*)

$$T_{BC} = \frac{12 \text{ kN}}{\sin 65°} \sin 5°$$

$T_{BC} = 1.15$ kN ◀

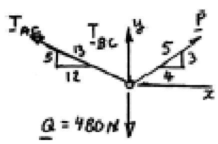


PROBLEM 2.52

Two cables are tied together at C and loaded as shown. Determine the range of values of P for which both cables remain taut.

SOLUTION

Free Body: *C*



$$\Sigma F_x = 0: \quad -\frac{12}{13}T_{AC} + \frac{4}{5}\mathbf{P} = 0$$

$$T_{AC} = \frac{13}{15}P \qquad (1)$$

$$\Sigma F_y = 0: \quad \frac{5}{13}T_{AC} + T_{BC} + \frac{3}{5}P - 480\text{ N} = 0$$

Substitute for T_{AC} from (1):

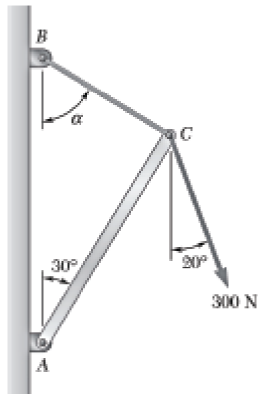
$$\left(\frac{5}{13}\right)\left(\frac{13}{15}\right)P + T_{BC} + \frac{3}{5}P - 480\text{ N} = 0$$

$$T_{BC} = 480\text{ N} - \frac{14}{15}P \qquad (2)$$

From (1), $T_{AC} > 0$ requires $P > 0$.

From (2), $T_{BC} > 0$ requires $\frac{14}{15}P < 480\text{ N}, \quad P < 514.29\text{ N}$

Allowable range: $0 < P < 514\text{ N}$ ◀



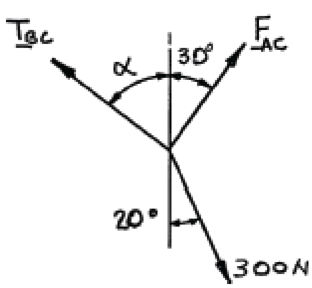
PROBLEM 2.60

For the structure and loading of Problem 2.46, determine (*a*) the value of α for which the tension in cable BC is as small as possible, (*b*) the corresponding value of the tension.

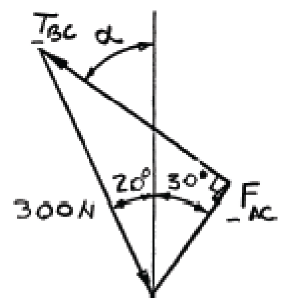
SOLUTION

T_{BC} must be perpendicular to F_{AC} to be as small as possible.

Free-Body Diagram: *C*



Force Triangle is a right triangle

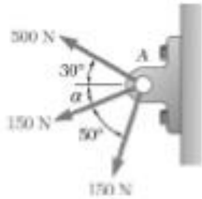


To be a minimum, T_{BC} must be perpendicular to F_{AC}.

(*a*) We observe: $\alpha = 90° - 30°$ $\alpha = 60.0°$ ◀

(*b*) $T_{BC} = (300\text{ N})\sin 50°$

or $T_{BC} = 229.81\text{ N}$ $T_{BC} = 230\text{ N}$ ◀

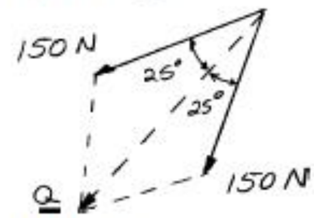


PROBLEM 2.65

Three forces are applied to a bracket as shown. The directions of the two 150-N forces may vary, but the angle between these forces is always 50°. Determine the range of values of α for which the magnitude of the resultant of the forces acting at A is less than 600 N.

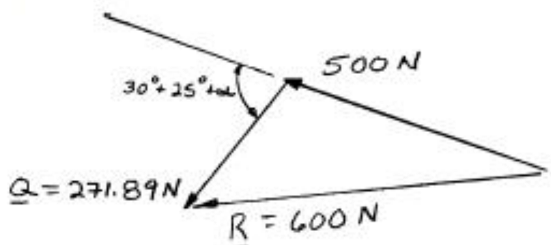
SOLUTION

Combine the two 150-N forces into a resultant force Q:



$$Q = 2(150 \text{ N})\cos 25°$$
$$= 271.89 \text{ N}$$

Equivalent loading at A:



Using the law of cosines:

$$(600 \text{ N})^2 = (500 \text{ N})^2 + (271.89 \text{ N})^2 + 2(500 \text{ N})(271.89 \text{ N})\cos(55° + \alpha)$$
$$\cos(55° + \alpha) = 0.132685$$

Two values for α: $55° + \alpha = 82.375$

$$\alpha = 27.4°$$

or $55° + \alpha = -82.375°$

$$55° + \alpha = 360° - 82.375°$$
$$\alpha = 222.6°$$

For $R < 600$ N: $27.4° < \alpha < 222.6$ ◀