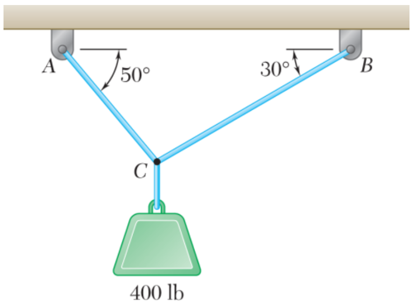
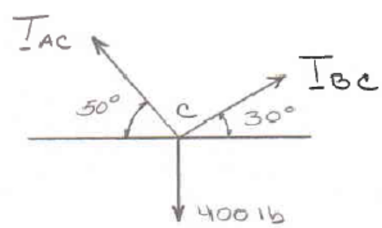


PROBLEM 2.43

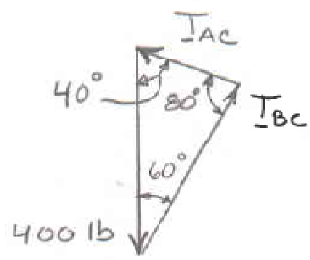
Two cables are tied together at C and are loaded as shown. Determine the tension (a) in cable AC, (b) in cable BC.

SOLUTION

Free-Body Diagram



Force Triangle

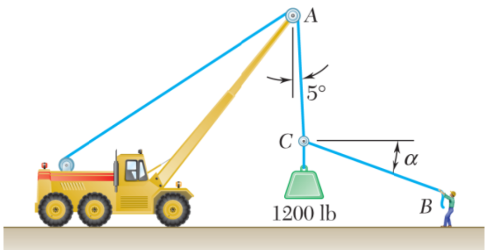


Law of sines:

$$\frac{T_{AC}}{\sin 60°} = \frac{T_{BC}}{\sin 40°} = \frac{400 \text{ lb}}{\sin 80°}$$

(a) $$T_{AC} = \frac{400 \text{ lb}}{\sin 80°}(\sin 60°)$$ $T_{AC} = 352$ lb ◀

(b) $$T_{BC} = \frac{400 \text{ lb}}{\sin 80°}(\sin 40°)$$ $T_{BC} = 261$ lb ◀

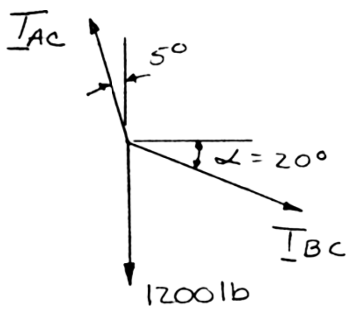


PROBLEM 2.48

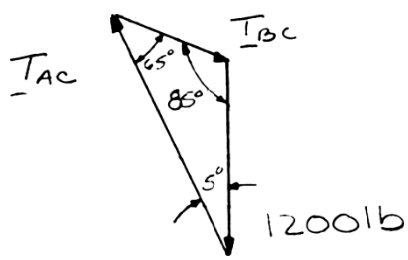
Knowing that $\alpha = 20°$, determine the tension (*a*) in cable *AC*, (*b*) in rope *BC*.

SOLUTION

Free-Body Diagram



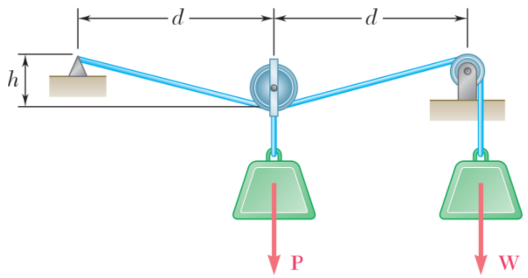
Force Triangle



Law of sines: $$\frac{T_{AC}}{\sin 110°} = \frac{T_{BC}}{\sin 5°} = \frac{1200 \text{ lb}}{\sin 65°}$$

(*a*) $$T_{AC} = \frac{1200 \text{ lb}}{\sin 65°} \sin 110°$$ $T_{AC} = 1244$ lb ◀

(*b*) $$T_{BC} = \frac{1200 \text{ lb}}{\sin 65°} \sin 5°$$ $T_{BC} = 115.4$ lb ◀

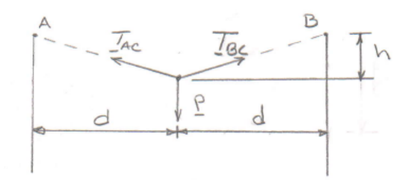


PROBLEM 2.62

For W = 800 N, P = 200 N, and d = 600 mm, determine the value of h consistent with equilibrium.

SOLUTION

Free-Body Diagram



$$T_{AC} = T_{BC} = 800 \text{ N}$$

$$AC = BC = \sqrt{(h^2 + d^2)}$$

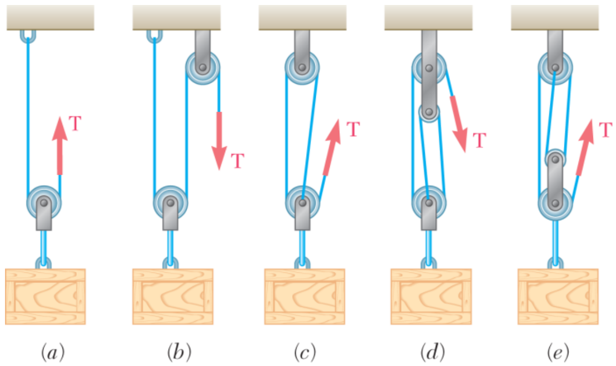
$$\Sigma F_y = 0: \quad 2(800 \text{ N})\frac{h}{\sqrt{h^2 + d^2}} - P = 0$$

$$800 = \frac{P}{2}\sqrt{1 + \left(\frac{d}{h}\right)^2}$$

Data: $P = 200$ N, $d = 600$ mm and solving for h

$$800 \text{ N} = \frac{200 \text{ N}}{2}\sqrt{1 + \left(\frac{600 \text{ mm}}{h}\right)^2}$$

$h = 75.6$ mm ◀



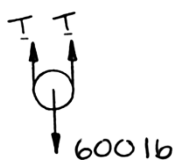
PROBLEM 2.67

A 600-lb crate is supported by several rope-and-pulley arrangements as shown. Determine for each arrangement the tension in the rope. (See the hint for Problem 2.66.)

SOLUTION

Free-Body Diagram of Pulley

(*a*)

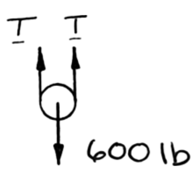


$$+\uparrow \Sigma F_y = 0: \quad 2T - (600 \text{ lb}) = 0$$

$$T = \frac{1}{2}(600 \text{ lb})$$

$$T = 300 \text{ lb} \blacktriangleleft$$

(*b*)

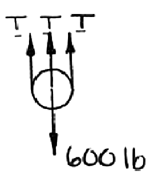


$$+\uparrow \Sigma F_y = 0: \quad 2T - (600 \text{ lb}) = 0$$

$$T = \frac{1}{2}(600 \text{ lb})$$

$$T = 300 \text{ lb} \blacktriangleleft$$

(*c*)

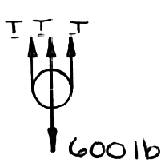


$$+\uparrow \Sigma F_y = 0: \quad 3T - (600 \text{ lb}) = 0$$

$$T = \frac{1}{3}(600 \text{ lb})$$

$$T = 200 \text{ lb} \blacktriangleleft$$

(*d*)

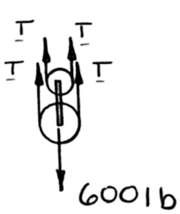


$$+\uparrow \Sigma F_y = 0: \quad 3T - (600 \text{ lb}) = 0$$

$$T = \frac{1}{3}(600 \text{ lb})$$

$$T = 200 \text{ lb} \blacktriangleleft$$

(*e*)



$$+\uparrow \Sigma F_y = 0: \quad 4T - (600 \text{ lb}) = 0$$

$$T = \frac{1}{4}(600 \text{ lb})$$

$$T = 150.0 \text{ lb} \blacktriangleleft$$