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From a free-body diagram of the ring, the equations of equilibrium are

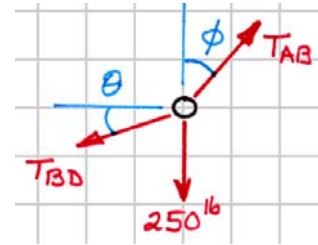
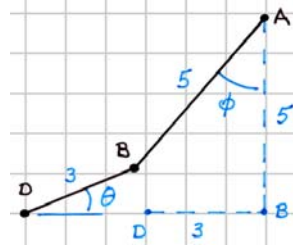
$$\rightarrow \Sigma F_x = 0: \quad T_{AB} \sin \phi - T_{BD} \cos \theta = 0$$

$$\uparrow \Sigma F_y = 0: \quad T_{AB} \cos \phi - T_{BD} \sin \theta - 250 = 0$$

where

$$\phi = \sin^{-1} \frac{b}{5}$$

$$\theta = \sin^{-1} \frac{5(1 - \cos \phi)}{3}$$



Therefore

$$T_{AB} = \frac{T_{BD} \cos \theta}{\sin \phi}$$

$$T_{BD} = \frac{250 \sin \phi}{\cos \theta \cos \phi - \sin \theta \sin \phi} \text{ lb}$$

$$T_{AB} = \frac{250 \cos \theta}{\cos \theta \cos \phi - \sin \theta \sin \phi} \text{ lb}$$

- (a) b_{\max} occurs when T_{BD} goes negative (after it goes to infinity);

$$b_{\max} \cong 3.90 \text{ ft} \quad \text{Ans.}$$

(At this point, the rope will straight from D to B to A.)

- (c) To pull further to the side, the worker needs a longer rope to pull on or he needs to attach his rope lower - closer to the crate. Ans.

