

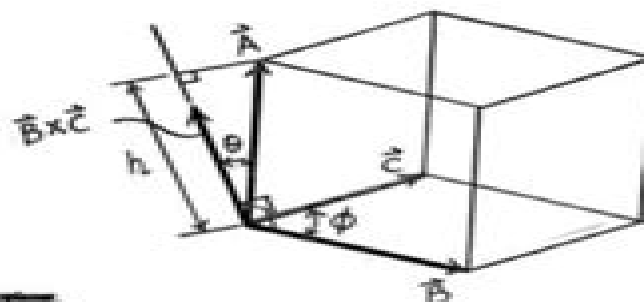
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4-3. Given the three nonzero vectors $\mathbf{A}$, $\mathbf{B}$, and $\mathbf{C}$, show that if $\mathbf{A} \cdot (\mathbf{B} \times \mathbf{C}) = 0$, then these vectors must lie in the same plane.

Consider

$$\begin{aligned} |\mathbf{A} \cdot (\mathbf{B} \times \mathbf{C})| &= |\mathbf{A}| |\mathbf{B} \times \mathbf{C}| \cos \theta \\ &= |\mathbf{A}| |\sin \phi| |\mathbf{B} \times \mathbf{C}| \\ &= |\mathbf{A}| |\mathbf{B} \times \mathbf{C}| \\ &= |\mathbf{B} \times \mathbf{C}| |\sin \phi| \\ &= \text{volume of parallelepiped.} \end{aligned}$$

If $\mathbf{A} \cdot (\mathbf{B} \times \mathbf{C}) = 0$, then the volume equals zero, so that $\mathbf{A}$, $\mathbf{B}$, and $\mathbf{C}$ are coplanar.



4-4. Two men exert forces of $P = 80$ lb and $P' = 50$ lb on the ropes. Determine the moment of each force about A . Which way will the pole rotate, clockwise or counterclockwise?

$$\zeta^+ \curvearrowleft M_{A/B} = 80 \left(\frac{3}{4} \right) (12) = 720 \text{ lb} \cdot \text{ft} \quad \text{Ans}$$

$$\zeta^+ \curvearrowleft M_{A/C} = 50 (\sin 45^\circ) (18) = 636 \text{ lb} \cdot \text{ft} \quad \text{Ans}$$

Since $M_{A/B} > M_{A/C}$

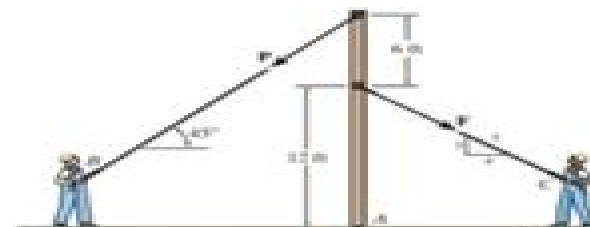
Counterclockwise Ans



4-5. If the man at B exerts a force of $P = 30$ lb on his rope, determine the magnitude of the force F the man at C must exert to prevent the pole from rotating, i.e., so the resultant moment about A of both forces is zero.

$$\zeta^+ \curvearrowleft 30 (\sin 45^\circ) (18) - F \left(\frac{3}{4} \right) (12) = 0$$

$$F = 39.3 \text{ lb} \quad \text{Ans}$$



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