20-R-KM-DK-23

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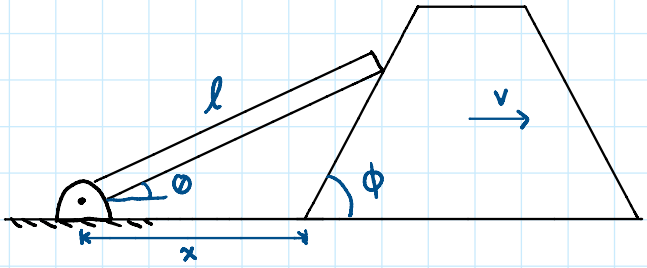
20-R-KM-DK-23 Intermediate Time Derivative

Inspiration: 16-53 Hibbeler

A ***? m*** plank rests on a wedge that moves at a constant velocity of ***v = ? m/s*** to the right. If the plank makes an angle ***theta = ? degrees*** with the ground and rests on the wedge with an incline ***phi = ? degrees***, determine the angular velocity of the plank at this instant.



$$\frac{A}{\sin a} = \frac{B}{\sin b} = \frac{C}{\sin c} \qquad \frac{x}{\sin(\phi-\theta)} = \frac{L}{\sin(180-\phi)} = \frac{C}{\sin\theta}$$

$$x = \frac{L\sin(\phi-\theta)}{\sin(180-\phi)} \qquad \sin(180-\phi) = \sin\phi \Rightarrow x = \frac{L\sin(\phi-\theta)}{\sin\phi}$$

$$\frac{dx}{dt} = \frac{d}{dt}\frac{L\sin(\phi-\theta)}{\sin\phi}$$

L is constant, ϕ is constant, θ changes

$$\hookrightarrow v = \frac{L\cos(\phi-\theta)(-\dot{\theta})}{\sin\phi}$$

Same as velocity given because it is on the wedge

$$\dot{\theta} = \frac{-v\sin\phi}{L\cos(\phi-\theta)}$$