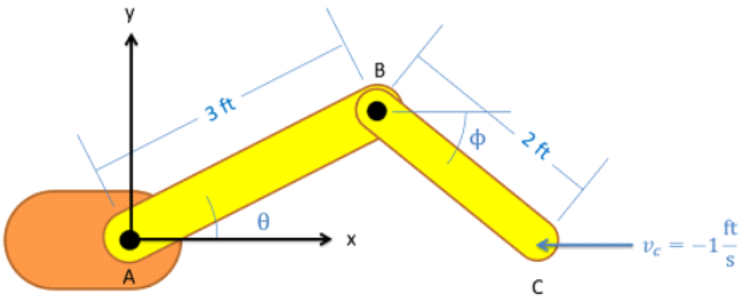
Problem 2

The robotic arm from the previous problem is in the configuration shown below. Assume that theta is currently 30 degrees and that point C currently lies along the x axis. If we want the end effector at C to travel 1 ft/s in the negative x direction, what should the angular velocities be at joints A and B?



$\theta = 30^\circ$

$\phi = ?$

$$X_c(t) = 3\cos(\theta) + 2\cos(\phi)$$

$$Y_c(t) = 3\sin(\theta) - 2\sin(\phi)$$

$$y_c = 0 = 3\sin(30) - 2\sin(\phi) \rightarrow \phi = 48.6^\circ$$

$$\dot{X}_c(t) = -3\sin(\theta)\dot{\theta} - 2\sin(\phi)\dot{\phi} = -1 \ ft/s$$

$$-1.5\dot{\theta} - 1.5\dot{\phi} = -1$$

$$\dot{\theta} = -\dot{\phi} + .667$$

$$\dot{Y}_c(t) = 3\cos(\theta)\dot{\theta} - 2\cos(\phi)\dot{\phi} = 0 \ ft/s$$

$$2.598\dot{\theta} - 1.3228 = 0$$

$$\dot{\theta} = .5092\dot{\phi}$$

$$.5092\dot{\phi} = -\dot{\phi} + .667$$

$$1.5092\dot{\phi} = .667 \longrightarrow \boxed{\dot{\phi} = .442 \text{ rad/s}}$$

$$\dot{\theta} = -\dot{\phi} + .667 \longrightarrow \boxed{\dot{\theta} = .225 \text{ rad/s}}$$