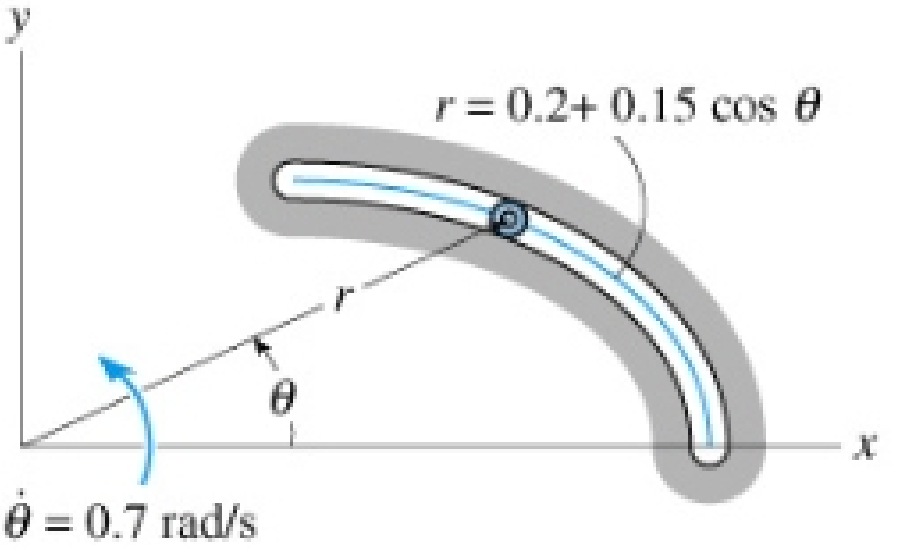
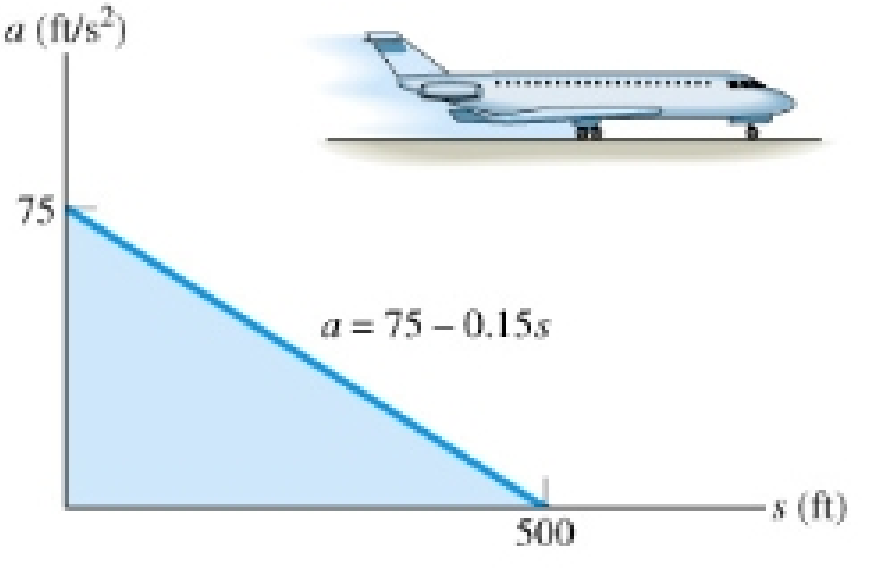
Sample Test 1 ME 201

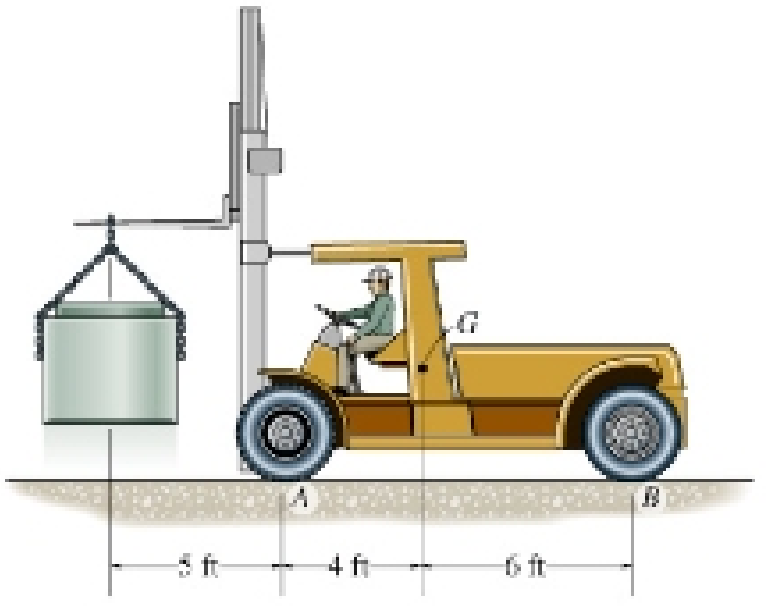
1. (18 pts) The pin follows the path described in polar coordinates as shown where r is in meters. Determine the magnitude of the velocity and acceleration of the pin at the instant when the radial line is at $\theta = 30^\circ$, angular velocity of the radial line is 0.7 rad/s, and the angular acceleration of the radial line is 0.5 rad/s^2. The size of the pin is negligible.



2. (20 pts) The jet aircraft starts from rest at position $s = 0$ and initiates takeoff, accelerating down the runway according to $a = 75 - 0.15\,s$ as shown, where position s is in feet and a is in ft/sec^2. Find the speed v as a function of position for the position for $s = 0$ to 500 ft. Evaluate the speed and time when $s = 250$ ft and $s = 500$ ft. Find the engine thrust required to produce the accelerations at these two locations if the aircraft weighs 200,000 lb and the drag force is 6.5 v^2 (where the force is in pounds and the speed v is in ft/sec) and rolling resistance is negligible.



3. (30 pts) The forklift and operator have a combined weight of 10,000 lb and center of gravity at G. The forklift is not moving and is used to lift the 2000-lb concrete pipe attached with a chain as shown.



   a. Find the force in the vertical part of the chain when the pipe is sationary.
   b. Find the vertical reactions under each of the two front wheels and each of the two rear wheels when the pipe is stationary.
   c. Find the force in the vertical part of the chain when the pipe is being accelerated upward at 5 ft/sec^2 assuming the forklift does not tip over.
   d. Find the vertical reactions under each of the two front wheels and each of the two rear wheels when the pipe is being accelerated upward at 5 ft/sec^2 assuming the forklift does not tip over.
   e. Based on your solution to (d), is the assumption of no tipping good or not good and why? Would if be possible to tip the forklift by accelerating the pipe too rapidly? Why or why not?