

Chapter 12 Homework Problems

Problem 12.1

You are designing a bench grinder with an operating speed of 3600 rpm.

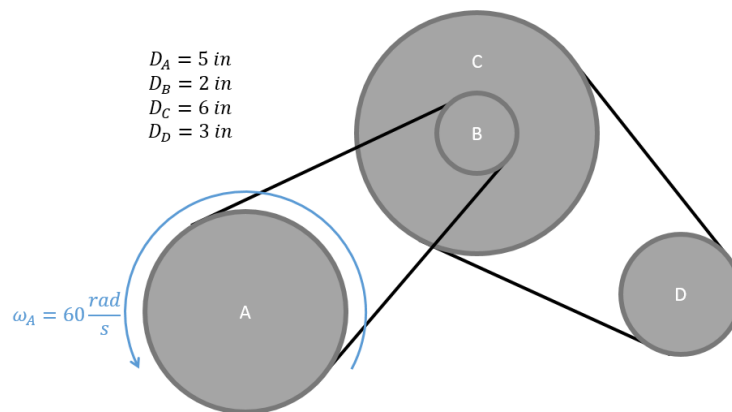
- If you want the grinder to reach its full operating speed in 4 seconds, what must the rate of angular acceleration be in radians per second squared?
- If the grinding wheel has a diameter of 8 inches, what will the speed of the surface of the wheel be?



(Solution: $\alpha = 94.25 \frac{rad}{s^2}$, $v = 125.67 \text{ ft/s}$)

Problem 12.2

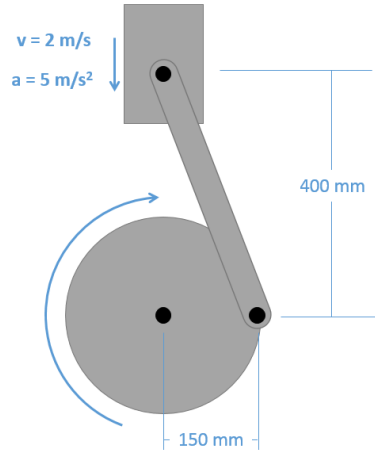
A belt driven system has an input at pulley A, which drives pulley B, which is attached with a solid shaft to pulley C, which drives pulley D. If the input is rotating at 60 rad/s counterclockwise, determine the angular velocity and direction of rotation for the output at D.



(Solution: $\omega_D = 300 \frac{rad}{s}$ counter-clockwise)

Problem 12.3

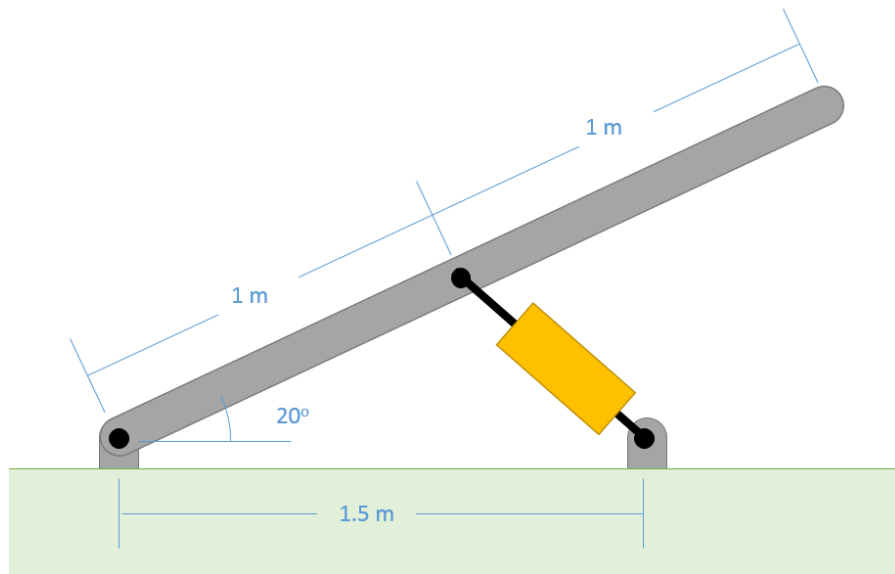
The piston in a piston and crank mechanism has the velocity and acceleration shown below. Using absolute motion analysis, determine the current angular velocity and angular acceleration for the crank.



(Solution: $\omega = 13.33 \frac{\text{rad}}{\text{s}}$ clockwise, $\alpha = 100.16 \frac{\text{rad}}{\text{s}^2}$ clockwise)

Problem 12.4

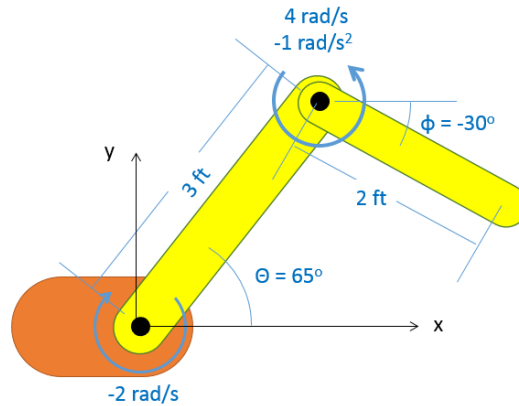
A trap door is being opened with a hydraulic cylinder extending at constant rate of $.7 \text{ m/s}$. Assuming the door is currently at a twenty-degree angle as shown below, use absolute motion analysis to find the current angular velocity and angular acceleration for the door?



(Solution: $\dot{\theta} = .896 \frac{\text{rad}}{\text{s}}$, $\ddot{\theta} = -1.246 \text{ rad/s}^2$)

Problem 12.5

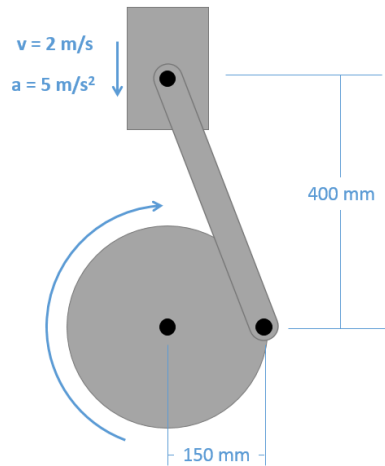
A robotic arm experiences the angular velocities and accelerations shown below. Based on this information, use relative motion analysis to determine the velocity and the acceleration of the end of the arm in the x and y directions.



(Solution: $v_x = 9.44 \text{ ft/s}$, $v_y = 4.39 \text{ ft/s}$, $a_x = -33.78 \text{ ft/s}^2$, $a_y = 3.39 \text{ ft/s}^2$)

Problem 12.6

The piston in a piston and crank mechanism has the velocity and acceleration shown below. Using relative motion analysis, determine the current angular velocity and angular acceleration for the crank.



(Solution: $\omega = 13.33 \frac{\text{rad}}{\text{s}}$ clockwise, $\alpha = 100.16 \frac{\text{rad}}{\text{s}^2}$ clockwise)