

HW for Week 4
Physics 215, Fall 2019

OpenStax
Section 4: 52, 64, 67, 72, 83
Section 10: 30, 40, 42, 47, 109

Your goal is to build an electric car that can move with a speed of 60 mph (This means that you want the edge of the tire where it hits the ground to have a linear velocity of 60 mph.) You also want the car to be able to accelerate from 0 to 60 in 9s.

- a) Convert 60 mph to inches per second.
- b) If your tires are 15" in diameter, how fast (in rpms -- revolutions per minute) will the motor have to be able to turn the car axels to make the edge of the tire travel with a linear velocity of 60 mph?
- c) What is the angular velocity in rad/s of the wheel when the car is moving at 60 mph?
- d) Now imagine that the tire is undergoing constant angular acceleration, starting from rest. Write down an equation that describes the angular velocity as a function of time.
- e) What is the value of the angular acceleration needed to allow the car to accelerate from 0 to 60 mph in 9 s? Assume constant angular acceleration. (Remember, if the car has a linear speed of 60 mph, that means that the edge of the tire that hits the road has a linear speed of 60 mph.)
- f) For the angular acceleration you found in part (e), how many revolutions does the wheel undergo in 9 s if it started from rest?