HW#2
Physics 215 Fall 2019
Manning

OpenStax University Physics
Chapter 3. Problems: 29, 32, 48, 53, 70, 90, 94, 114

Additional problems:

1. Radius of a black hole. Use dimensional analysis to find an equation for the radius of a black hole in terms of its mass M, Newton's gravitational constant G and the speed of light c. What is the approximate radius for a black hole with the mass of the sun?

2. Deepwater waves. Waves on the surface of a deep ocean travel with a speed v that depends on their wavelength λ, but not on their amplitude. Using dimensional analysis find how the wave speed should depend upon the wavelength and the density of the water.

3. A motorcycle traveling at 10 m/s passes a hospital crosswalk where the speed limit is 5 m/s. Just as the motorcyclist passes, a police officer starts off in pursuit with a constant acceleration. The two motions are shown in the figure.
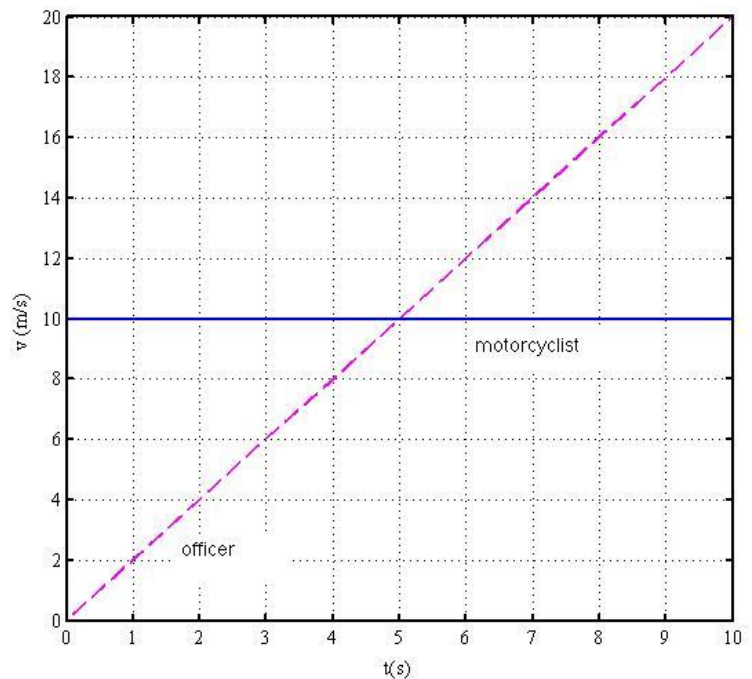
a) Convert the speed of the motorcyclist to mph.
b) Is there a time at which the officer and the motorcyclist have the same velocity?
c) What is the acceleration of the officer?
d) How much distance did the motorcyclist cover between t=0 and t=5 s? How much distance did the officer cover in that same time interval?
e) Assuming that the motions of the police officer and motorcyclist do not change, how much distance did the motorcyclist cover between t=0 and t=10? How much distance did the officer cover in that same time interval?
f) Does the officer catch up to the motorcyclist? If so, at what time does this happen?
g) Draw the two displacement vs. time graphs for the motorcycle and the police car. Your graphs can be sketches, but important features should be labeled.