

PHY121 Summer 2018

Problem Set #2

Due Thursday 5/24

1. A car manufacturer claims that its deluxe sports car will accelerate from rest to 55 m/s in 8 s.
 - (a) Determine the average acceleration of the car.
 - (b) Assume that the car moves with constant acceleration. Find the distance the car travels in the first 8 s.
 - (c) What is the speed of the car at 10 s if it can continue to move with the same acceleration as found in part a?
2. A swimmer leaves one corner of an equilateral triangular pool with sides of length L at $t = 0$ traveling in the x direction. She arrives at the next vertex at time t_1 . Her path then turns $\frac{\pi}{3}$ radians (equilateral triangle!) and she reaches the third vertex at time t_2 . Finally, her path turns another $\frac{\pi}{3}$ radians and she swims back to her starting point at time t_3 .
 - (a) Determine (symbolically) her average horizontal velocity during each leg of her trip.
 - (b) Determine her average vertical velocity during each leg of her trip.
 - (c) What is her average velocity for the complete journey? Her average speed?
3. Spider-Man is sitting upon a tall building and wishes to aim his web at a criminal walking away from its base before he gets away. If the criminal starts just at the base and is walking away from the building at 1 m/s, and Spider-Man's web shoots with an initial velocity of 10 m/s, at what (upward) angle must he shoot the web to successfully capture this no-goodnik? (Hint: Separate the x and y directions.)
4. You push a box in the absence of external forces with the following force:

$$\vec{F} = A\hat{x} + Be^{2t}\hat{y} + \frac{C}{t}\hat{z} \quad (1)$$

Determine the equation(s) of motion for this box, up to constants of integration.

5. An object of mass 1.5 kg is suspended from the ceiling of a truck by a string. Assuming that the truck is accelerating at 5 m/s^2 , determine:

- (a) The angle θ that the string makes with the vertical.
- (b) The tension in the string.

