

# Homework No. 02 (Spring 2021)

## PHYS 205A: University Physics

Due date: Monday, 2021 Feb 1, 11:55 AM, on D2L

### Instructions

- Describe your thought process in detail and organize it clearly. Make sure your answer has the correct units and the right number of significant digits.
- After completion, scan the pages as a single PDF file, and submit the file on D2L (under Assesments → Assignments).

### Problems

1. **(10 points.)** Motion of an object moving with uniform velocity is described by the equation

$$x = vt, \tag{1}$$

where  $x$  is the position of the object,  $v$  is the velocity of the object, and  $t$  is time.

- (a) Plot  $x$  versus  $t$  for  $v = 3.0$  m/s. Give a real life example that is described by this scenario.
  - (b) Plot  $x$  versus  $t$  for  $v = -3.0$  m/s. Give a real life example that is described by this scenario.
  - (c) What is the acceleration of the object for these cases?
2. **(10 points.)** Motion of an object moving with uniform acceleration, with intial velocity  $v_0$ , is described by the equation

$$x = v_0t + \frac{1}{2}at^2, \tag{2}$$

where  $x$  is the position of the object,  $a$  is the acceleration of the object, and  $t$  is time.

- (a) Plot  $x$  versus  $t$  for  $v_0 = 0$  and  $a = 2.0$  m/s<sup>2</sup>.
- (b) Plot  $x$  versus  $t$  for  $v_0 = 0$  and  $a = -2.0$  m/s<sup>2</sup>.
- (c) Plot  $x$  versus  $t$  for  $v_0 = +1.0$  m/s and  $a = 2.0$  m/s<sup>2</sup>.
- (d) Plot  $x$  versus  $t$  for  $v_0 = +1.0$  m/s and  $a = -2.0$  m/s<sup>2</sup>.
- (e) Plot  $x$  versus  $t$  for  $v_0 = -1.0$  m/s and  $a = 2.0$  m/s<sup>2</sup>.
- (f) Plot  $x$  versus  $t$  for  $v_0 = -1.0$  m/s and  $a = -2.0$  m/s<sup>2</sup>.

3. (10 points.) A particle's velocity is given by

$$v(t) = v_0 + a_0t + \frac{1}{2}b_0t^2. \quad (3)$$

- (a) Determine the particle's acceleration as a function of time.
- (b) Determine the particle's rate of change of acceleration as a function of time.
- (c) Given the particle starts from rest at  $t = 0$ , determine the velocity of the particle when the instantaneous acceleration of the particle is zero.
4. (10 points.) While standing on a 50.0 m tall building you throw a stone straight upwards at a speed of 15 m/s.
- (a) How long does the stone take to reach the ground?
- (b) How high above the building does the stone reach?
5. (10 points.) A fish is dropped by a pelican that is rising steadily at a speed 4.0 m/s. Determine the time taken for the fish to reach the water 15.0 m below. How high above the water is the pelican when the fish reaches the water?
6. (10 points.) A car is traveling at 10.0 m/s, and the driver sees a traffic light turn red. After 0.500 s (the reaction time), the driver applies the brakes, and the car decelerates at  $8.00 \text{ m/s}^2$ . What is the stopping distance of the car, as measured from the point where the driver first sees the red light?
7. (10 points.) A speeding car is moving at a constant speed of  $v = 80.0$  miles/hour (35.8 m/s). A police car is initially at rest. As soon as the speeder crosses the police car the cop starts chasing the speeder at a constant acceleration of  $a = 2.0 \text{ m/s}^2$ . Determine the time it takes for the cop to catch up with the speeder. Determine the distance traveled by the cop in this time.
8. (10 points.) A key falls from a bridge that is 50.0 m above the water. It falls directly into a boat that is moving with constant velocity, that was 10.0 m from the point of impact when the key was released. What is the speed of the boat?