PHYS 204 MECHANICS

Professor: Dr. Laszlo Kalman

Assignment #1 Part A

Q1

A child throws vertically a pebble into the air with initial speed v_i.
Another child drops a ball at the same instant. Compare the accelerations of the two objects while they are in flight.

Q2

Is it possible for the velocity and the acceleration of an object to have opposite signs? If not, state a proof. If so, give an example of such a situation and sketch a velocity vs. time graph to prove your point.

P1

The position of a pinewood derby car was observed at various times; the results are summarized in the following table. Find the average velocity of the car for (a) the first second, (b) the last 3 s, and (c) the entire period of observation.

t (s)	0	1.0	2.0	3.0	4.0	5.0
x (m)	0	2.3	9.2	20.7	36.8	57.5

P2

(a) Use the data in Problem P1 to construct a smooth graph of position versus time. (b) By constructing tangents to the $x(t)$ curve, find the instantaneous velocity of the car at several instants. (c) Plot the instantaneous velocity versus time and, from this, determine the average acceleration of the car. (d) What was the initial velocity of the car?

P3.

A sidewalk is to be constructed around a swimming pool that measures (10.0 ± 0.1) m by (17.0 ± 0.1) m. If the sidewalk is to measure (1.00 ± 0.01) m wide by (9.0 ± 0.1) cm thick, what volume of concrete is needed, and what is the approximate uncertainty of this volume?

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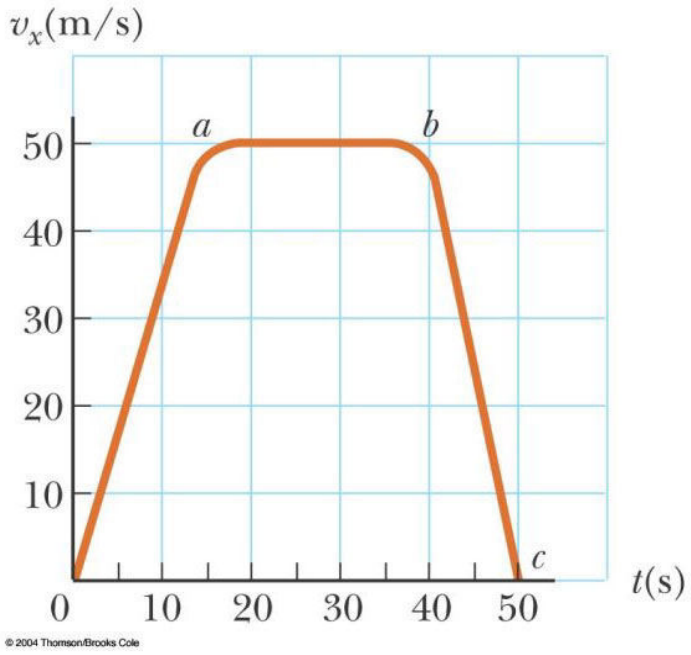
Assignment #1 Part B

P1. The figure on the right represents part of the performance data of a car owned by a student.
(a) Calculate from the graph the total distance traveled.
(b) What distance does the car travel between the times t = 10 s and t = 40 s?
(c) Draw a graph of its acceleration versus time between t = 0 and t = 50 s. (d) Write an equation for x as a function of time for each phase of the motion, represented by (i) 0a, (ii) ab, (iii) bc.
(e) What is the average velocity of the car between t = 0 and t = 50 s?

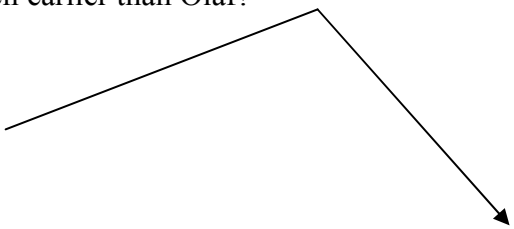


P2. A motorist drives along a straight road at a constant speed of 15.0 m/s. Just as she passes a parked motorcycle police officer, the officer starts to accelerate at 2.00 m/s^2 to overtake her. Assuming the officer maintains this acceleration,
(a) determine the time it takes the police officer to reach the motorist.
Find (b) the speed and (c) the total displacement of the officer as he overtakes the motorist.

P3. The speed of a bullet as it travels down the barrel of a rifle toward the opening is given by $v = (-5.00 \times 10^7)t^2 + (3.00 \times 10^5)t$, where v is in meters per second and t is in seconds. The acceleration of the bullet just as it leaves the barrel is zero.
(a) Determine the acceleration and position of the bullet as a function of time when the bullet is in the barrel.
(b) Determine the length of time the bullet is accelerated.
(c) Find the speed at which the bullet leaves the barrel.
(d) What is the length of the barrel?

P4. A novice golfer on the green takes three strokes to sink the ball. The successive displacements are 4.00 m to the north, 2.00 m northeast, and 1.00 m at 30.0° west of south. Starting at the same initial point, an expert golfer could make the hole in what single displacement?

P5. The biggest stuffed animal in the world is a snake 420 m long, constructed by Norwegian children. Suppose the snake is laid out in a park as shown in Figure below, forming two straight sides of a 105° angle, with one side 240 m long. Olaf and Inge run a race they invent. Inge runs directly from the tail of the snake to its head and Olaf starts from the same place at the same time but runs along the snake. If both children run steadily at 12.0 km/h, Inge reaches the head of the snake how much earlier than Olaf?



Q1 Under what circumstances would a nonzero vector lying in the *xy* plane have components that are equal in magnitude?

Q2. If **A**=**B** what can you conclude about the components of these two vectors?