

Motion in one dimension Assignment 1

Question 1

A particle moves in a straight line according to the relation

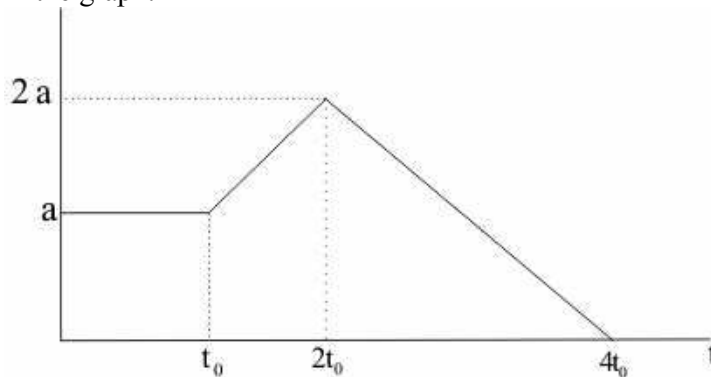
$$x = t^3 - 4t^2 + 3t$$

Find the acceleration of the particle at displacement equal to zero.

- (a) (-8,-2,-10)
- (b) (-1,-2,10)
- (c) (8,2,10)
- (d) (1,2,10)

Question 2

A body starts at initial velocity v_0 in a straight line with acceleration as shown below in the graph.



Find the maximum velocity reached.

- (a) $v_0 + 4at_0$
- (b) $v_0 + 9/2(at_0)$
- (c) $v_0 - 9/2(at_0)$
- (d) $v_0 - 4at_0$

Question 3

A particle moves in a straight line with acceleration described by equation given below

$$a = mx - (v_0^2/x_0)$$

If the initial velocity and displacement are $(v_0, 0)$ and at any time t_0 velocity and displacement are $(0, x_0)$ the value of constant m is

- (a) $\frac{v_0^2}{x_0^2}$
- (b) $-\frac{v_0^2}{x_0^2}$
- (c) $\frac{2v_0^2}{x_0^2}$
- (d) $-\frac{2v_0^2}{x_0^2}$

Question 4

The radius vector of point x relative to origin varies with time as

$$\mathbf{r} = a \cos(kt)\mathbf{i} + b \sin(kt)\mathbf{j}$$

where a and b are constants and \mathbf{i} and \mathbf{j} are vectors along x and y axis. Which one of the following is the mean velocity vector

- (a) $[a \cos(kt)\mathbf{i} - b \sin(kt)\mathbf{j}]/t$
- (b) $[a \cos(kt)\mathbf{i} + b \sin(kt)\mathbf{j}]$
- (c) $[a \cos(kt)\mathbf{i} - b \sin(kt)\mathbf{j}]$
- (d) $[a \cos(kt)\mathbf{i} + b \sin(kt)\mathbf{j}]/t$

Question 5

A boat moves with the stream of water from point A and B and it return back with the same speed. Velocity of boat relative to water is η times the velocity of the water.

Velocity of the water is 1m/sec. Find out the average speed in the whole ternary

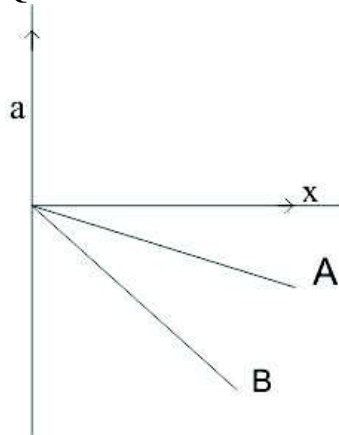
- a. $\eta^2 - 1$
- b. $\eta^2 + 1$
- c. η^2
- d. None of these

Question 6

A body is freely falling under the action of gravity. It covers half the total distance in the last second of its fall. If it falls for n second, then the value of n is

- (a) 2
- (b) $2 + \sqrt{2}$
- (c) 3
- (4) $2 - \sqrt{2}$

Question 7



Two particle A and B start with the same velocity $v=v_0$ at $x=0$. They are accelerated per the graph shown above. Which particle has the maximum magnitude of the velocity at $x=x_0$

- a. A
- b. B
- c. A & B will have same velocity
- d. None of the above

Paragraph type question

A Man X drops a stone from the fifteen floor of the building .A Man Y ascending in an elevator at a constant speed $v=10$ m/s passed the Fifteen floor just as the stone is released

Question 8

Find the position, velocity of the stone as seen by the Man X at time $t=2$ sec

- a. (19m ,19m/s)
- b. (19.6m,19.6m/s)
- c. (10m,10m/s)
- d (11m,12m/s)

Question 9

Find the position, velocity of the stone relative to Man Y at 3 sec

- a. (39m, 70m/s)
- b. (19m, 70m/s)
- c. (70m, 39 m/s)
- d. (14 m, 29m/s)

Question 10

Find the acceleration of the stone with respect to Man X and Y.

- a. (9.8 m/s^2 , 9.8m/s^2)
- b. (9 m/s^2 , 10 m/s^2)
- c. (10 m/s^2 , 10m/s^2)
- d. None of these

Answers

- 1. (a)
- 2. (b)
- 3. (a)
- 4. (d)
- 5. (a)
- 6. (b)
- 7. (b)
- 8. (b)
- 9. (c)
- 10. (a)