National University of Computer & Emerging Sciences, Karachi
Fall -2024
ASSIGNMENT NO.1 (Motion 1D)
12th September 2024

Course Code: NS(1001)	**Course Name: Applied Physics**
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Student Roll No & Section	**Submission deadline 18-09-2024**

Instructions for Submission:

1. *Soft copy only*
2. *You are required to Submit Assignment in softcopy on Google classroom.*
3. ***Strictly follow the deadline***

1. An automobile travels on a straight road for 40 km at 30 km/h. It then continues in the same direction for another 40 km at 60 km/h. (a) What is the average velocity of the car during the full 80 km trip? (Assume that it moves in the positive x direction.) (b) What is the average speed? (c) Graph x versus t and indicate how the average velocity is found on the graph.

2. An object is launched vertically upward with an initial velocity of 30 m/s. Calculate the time it takes for the object to reach its maximum height, and then calculate the total time it spends in the air before hitting the ground. (Assume g = 9.8 m/s²)

3. The position of an object moving along an x axis is given by
   $X = 3t - 4t^2 + t^3$,
   where x is in metres and t in seconds. Find the position of the object at the following values of t: (a) 1 s, (b) 2 s,(c) 3 s, and (d) 4 s. (e) What is the object's displacement between t _ 0 and t _ 4 s? (f) What is its average velocity for the time interval from t _ 2 s to t _ 4 s? (g) Graph x versus t for 0 _ t _ 4 s and indicate how the answer for (f) can be found on the graph.

4. In Fig : 1, particle A moves along the line y = 30 m with a constant velocity V of magnitude 3.0 m/s parallel to x -axis. At the instant particle A passes the y – axis, particle B leaves the origin with a constant acceleration of magnitude 0.40 m/s . What angle Θ between acceleration a and the positive direction of the y-axis would result in a collision.

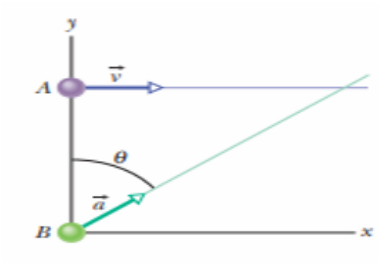


Fig : `1

5. The position vector r of a particle moving in an xy plane is given by

$$\vec{r} = (2.00t^3 - 5.00t)\hat{i} + (6.00 - 7.00t^4)\hat{j}$$

With vector r in metres and t in seconds. In unit vector notation, calculate (a) vector r (b) vector v, and vector a for t = 2.00 s. (d) What is the angle between the positive direction of the x axis and a line tangent to the particle' s path at 2 = 2.00 s?

6. A boy whirls a stone in a horizontal circle of radius 1.5 m and at height 2.0 m above level ground. The string breaks, and the stone flies off horizontally and strikes the ground after travelling a horizontal distance of 10 m. What is the magnitude of the centripetal acceleration of the stone during the circular motion?

7. The acceleration of a motorcycle is given by $a(t) = At - Bt^2$, where A = 1.50 m/s^3 and B = 0.12 m/s^4. The motorcycle is at rest at the origin at time t=0. (a) Find its position and velocity as function of time (b) calculate the maximum velocity it attains.

8. A student throws a water balloon vertically downward from the top of a building. The balloon leaves the thrower's hand with a speed of 6 m/s. Air resistance may be ignored, so the water balloon is in free fall after it leaves the thrower's hand. (a) what is its speed after falling for 2.00 s? (b) How far does it fall in 2 s? (c) what is the magnitude of its velocity after falling 10 m?

9. In a relay race, each contestant runs 25 m while carrying an egg balanced on a spoon, turns around, and comes back to the starting point. Edith runs the first 25 m in 20 seconds. On the return trip she is more confident and takes only 15 seconds. What is the magnitude of her average velocity for (a) the first 25 m? (the return trip? (c) What is her average velocity for the entire round trip? (d) what is her average speed for the round trip?

10. Here are four descriptions of the position (in metres) of puck as it moves in an xy plane:

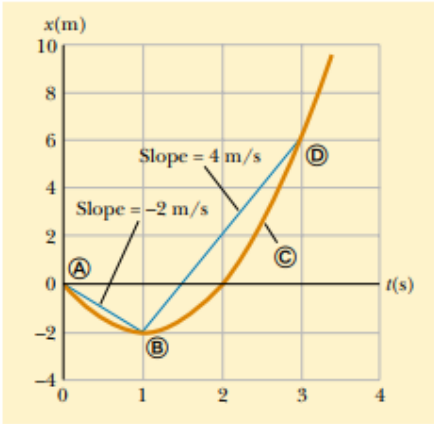
(1) $x = -3t^2+4t-2$ and $y=6t^2-4t$
(2) $X = -3t^3-4t$ and $y = -5t^2+6$
(3) $r=2t^2i-(4t+3)j$
(4) $r=(4t^3-2t) + 3j$

Are the x and y acceleration components constant? Is acceleration a constant?

11. A car is driving east at 60km/h, it then makes a turn and travels north at 50km/h. If it takes 2 sec to make the turn, what is the average acceleration of the car over this 2 second interval?

12. A student drives to college 15 km away from home in half an hour. After classes, he returns home in 20 min. Find (a) the average speed on his way to college, (b) the average speed for the round trip and (c)his average velocity for the entire trip.

13. A particle moves along the x axis. Its x coordinate varies with time according to the expression where x is in meters and t is in seconds. The position–time graph for this motion is shown in Figure. Note that the particle moves in the negative x direction for the first second of motion, is at rest at the moment t=1s, and moves in the positive x direction for .



a. Determine the displacement of the particle in the time intervals t=0 to t =1s and t=1s to t=3s.

b. Calculate the average velocity during these two time intervals.

c. Find the instantaneous velocity of the particle at t=2.5 s.

14. A stone thrown from the top of a building is given an initial velocity of 20.0 m/s straight upward. The building is 50.0 m high, and the stone just misses the edge of the roof on its way down, as shown in Figure. Using as the time the stone leaves the thrower's hand at position, determine

(a) the time at which the stone reaches its maximum height,

(b) the maximum height

(c) the time at which the stone returns to the height from which it was thrown

15. An Alaskan rescue plane drops a package of emergency rations to a stranded party of explorers. If the plane is travelling horizontally at 40.0 m/s and is 100 m above the ground, where does the package strike the ground relative to the point at which it was released?