

Q1.

The velocity of a particle is time dependent and is given by the equation: $v = At^2 + \frac{B}{A}$.

Where, t is time and A and B are unknown quantities. Find the dimension of B .

- A) L^2/T^4
- B) T/L
- C) T^3/L^3
- D) L/T^4
- E) L^2T^2

Q2.

When can we be certain that the average velocity of an object is always equal to its instantaneous velocity?

- A) only when the velocity is constant
- B) never
- C) always
- D) only when the acceleration is constant
- E) only when the acceleration is changing at a constant rate

Q3.

A person walks first at a constant speed of 18.0 km/h along a straight line from point A to point B and then back along the line from B to A at a constant speed of 10.8 km/h. The values of **average velocity** and **average speed** over the entire trip are **respectively**:

- A) 0 and 3.75 m/s
- B) 3.75 m/s and 4.25 m/s
- C) 4.00 m/s and 0
- D) 0 and 1.35 m/s
- E) 2.67 m/s and 2.67 m/s

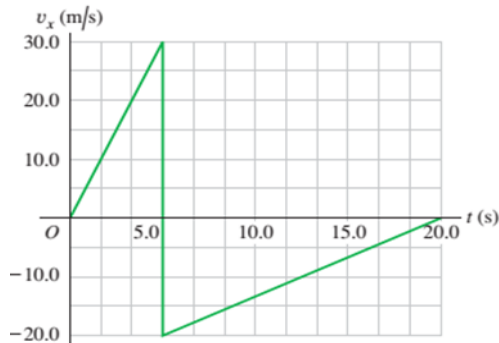
Q4.

Starting from the origin, a body moves from rest along the positive x-axis. It accelerates with 6.00 m/s^2 for the first 4.00s, and then travels with constant speed for another 4.00s. The total distance covered by the particle is:

- A) 144 m
- B) 319 m
- C) 96.5 m
- D) 912 m
- E) 588 m

Q5.

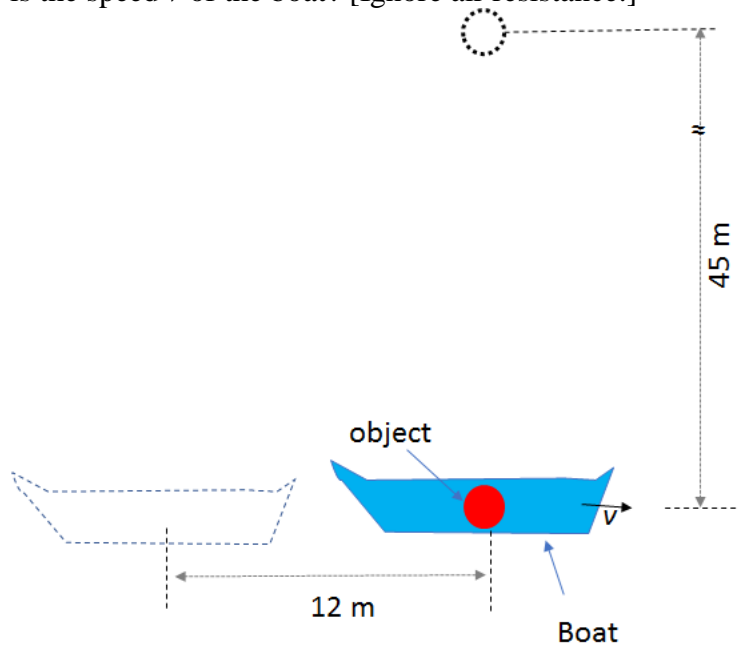
A rigid ball traveling in a straight line along the positive x -axis hits a solid wall and suddenly rebounds during a brief instant. The ball's velocity as a function of time is shown in **Figure 1**. Find the displacement of the ball for the first 20.0s.



- A) -75.0 m
- B) 150 m
- C) 25.0 m
- D) -150 m
- E) 325 m

Q6.

An object falls from a bridge that is 45 m above the water. It falls directly into a small boat, moving with constant speed v as shown in **Figure 2**. The boat was 12 m away from the point of impact (the point at which the object falls on the boat) when the object was released. What is the speed v of the boat? [Ignore air resistance.]



- A) 4.0 m/s
- B) 8.0 m/s
- C) 6.0 m/s
- D) 5.0 m/s
- E) 2.5 m/s

Q7.

A horse in an open field runs 12.0 m east and then 28.0 m in a direction 50.0° west of north. How far and in what direction must the horse then run to end up 10.0 m south of its original starting point?

- A) 29.6 m and 18.6° east of south
- B) 33.0 m and 18.6° east of south
- C) 28.0 m and 28.6° east
- D) 42.0 m and 28.6° south
- E) 39.0 m and 18.6° east of south

Q8.

Consider two non-zero vectors \vec{A} and \vec{B} . If $|\vec{A} - \vec{B}| = |\vec{A}| + |\vec{B}|$, then:

- A) \vec{A} and \vec{B} are parallel and in the opposite direction
- B) \vec{A} and \vec{B} are parallel and in the same direction
- C) the angle between \vec{A} and \vec{B} is 45°
- D) the angle between \vec{A} and \vec{B} is 60°
- E) \vec{A} is perpendicular to \vec{B}

Q9.

Consider vectors $\vec{A} = 5.0\hat{i} - 6.5\hat{j}$ and $\vec{B} = -3.5\hat{i} + 7.0\hat{j}$. A third vector \vec{C} lies in the xy -plane and is perpendicular to the vector \vec{A} . If the scalar product of \vec{C} with \vec{B} is 15.0, find the vector \vec{C} .

- A) $8.0\hat{i} + 6.1\hat{j}$
- B) $3.0\hat{i} + 4.3\hat{j}$
- C) $7.2\hat{i} + 1.4\hat{j}$
- D) $1.0\hat{i} + 1.0\hat{j}$
- E) $4.5\hat{i} + 9.3\hat{j}$

Q10.

Vector \vec{A} has magnitude of 12.0 units and vector \vec{B} has magnitude 16.0 units. If $\vec{A} \cdot \vec{B} = 90.0$ units, what is the magnitude of the vector product between these two vectors?

- A) 170
- B) 180
- C) 120
- D) 140
- E) 130

Q11.

A particle moves so that its position (in meters) as a function of time (in seconds) is: $\vec{r} = 3.0t^2 \hat{i} + 2.0t^3 \hat{j} + 5.0t \hat{k}$. Find the magnitude of average acceleration for the interval $t = 0$ s to $t = 3.0$ s.

- A) 19 m/s²
- B) 27 m/s²
- C) 6.0 m/s²
- D) 12 m/s²
- E) 8.1 m/s²

Q12.

A particle starts from the origin at time $t = 0$ s with a velocity $\vec{v} = 7.0\hat{i}$ m/s. It moves in the xy -plane with a constant acceleration $\vec{a} = (-9.0\hat{i} + 3.0\hat{j})$ m/s². At the time the particle reaches the maximum x -coordinate, what is its position vector?

- A) $(2.7\hat{i} + 0.91\hat{j})$ m
- B) $(3.5\hat{i} + 1.1\hat{j})$ m
- C) $(-9.0\hat{i} + 3.0\hat{j})$ m
- D) $7.0\hat{i}$ m
- E) $(2.7\hat{i} + 3.0\hat{j})$ m

Q13.

A ball is thrown horizontally from a height of 26 m and hits the ground with a speed that is three times its initial speed. What is the initial speed of the ball? [Ignore air resistance.]

- A) 8.0 m/s
- B) 3.0 m/s
- C) 11 m/s
- D) 26 m/s
- E) 5.3 m/s

Q14.

A particle undergoes a uniform circular motion. Which one of the following statements is **False** in regards to the particle and its motion?

- A) The velocity is constant.
- B) The velocity and acceleration are always perpendicular to each other.
- C) The acceleration is always directed towards the center.
- D) The magnitude of change in velocity in half time-period is two times the speed.
- E) The displacement for half time-period is maximum.

Q15.

A person walks up a stalled (not moving) escalator of length L in 90 s. When standing on the same escalator, now moving, the person is carried up in 60 s. How much time would it take that person to walk up the moving escalator?

- A) 36 s
 - B) 25 s
 - C) 46 s
 - D) 57 s
 - E) 19 s
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