

AP Calculus BC

Topic: Integral as Net Change

Instructions

Solve the following problems. Show all your work clearly and include units in your answers where appropriate.

Practice Problems

1. Velocity and Displacement:

- (a) $v(t) = 4t^2 12t + 8, \ 0 \le t \le 4.$
 - i. Determine when the particle is moving to the right, left, or stopped.
 - ii. Find the particle's displacement over the interval [0, 4] if s(0) = 5.
 - iii. Calculate the total distance traveled by the particle.
- (b) $v(t) = 3\sin(\pi t), \ 0 \le t \le 2.$
 - i. Find the times when the velocity is zero.
 - ii. Compute the displacement and total distance traveled over [0, 2].

2. Acceleration and Velocity:

- (a) A car accelerates from rest at a rate a(t) = 2t + 1 m/s². Find:
 - i. Its velocity after 6 seconds.
 - ii. The total distance traveled in the first 6 seconds.
- (b) A projectile is launched straight upward with an initial velocity of 60 m/s. The acceleration due to gravity is $a(t) = -9.8 \text{ m/s}^2$. Find:
 - i. The velocity after t seconds.
 - ii. The height of the projectile after 5 seconds.

- iii. The total time it takes to return to the ground.
- 3. Graph-Based Problems: For the following velocity graphs, answer the questions below:



i. Find the displacement of the particle over [0, 4].



- i. Determine the displacement of the particle over [0, 5].
- ii. Calculate the total distance traveled.
- ii. Compute the total distance traveled.

Multiple Choice Questions

- 1. A particle moves along a straight line with velocity v(t) = 6t 2. Find the displacement of the particle over $t \in [0, 4]$.
 - a. 16 m
 - b. 12 m
 - c. $18\ \mathrm{m}$
 - d. 14 m
- 2. A particle moves along a straight line with velocity $v(t) = t^2 4t + 3$. What is the total distance traveled by the particle over $t \in [0, 3]$?
 - a. 4 m
 - b. 5 m
 - c. 6 m
 - d. 7 m

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