

AP Calculus

2.6 Velocity and Acceleration

1. A particle moves horizontally according to the position function $s = 96t + 6t^2 - t^3$. (s in meters, t in seconds)
 - a) Find the velocity and acceleration functions.
 - b) Is the particle moving left or right at $t = 5$? $t = 9$?
 - c) When does the particle start to decelerate?
 - d) When does the deceleration start to become acceleration?
2. The height s at a time t of a silver dollar dropped from a building is given by $s(t) = -16t^2 + 1350$, where s is in feet and t is in seconds.
 - a) Find the average velocity on the interval $[1, 2]$.
 - b) Find the instantaneous velocity when $t = 1$ and $t = 2$.
 - c) How long will it take the dollar to hit the ground?
 - d) Find the velocity of the dollar when it hits the ground.
3. A ball is thrown vertically upward such that its height (in feet) after t seconds is $s = 80t - 16t^2$.
 - a) What is the initial velocity of the ball?
 - b) What is the maximum height reached by the ball?
 - c) What is the velocity of the ball when it is 96 ft. above the ground on its way up? on its way down?
4. A particle moves horizontally according to the position function $s = 2t^3 - 6t^2 + 18t$. (s in meters, t in seconds) Find:
 - a) the velocity when $t = 3$
 - b) the acceleration when $t = 2$
 - c) when the acceleration is equal to zero
 - d) the position when acceleration is zero
 - e) the velocity when acceleration is zero
5. The motion of a particle is described by the position function $s = t^3 - 15t^2 + 63t$. (s in meters, t in seconds).
 - a) When is the particle at rest?
 - b) When is the particle moving in a positive direction?
 - c) Draw a diagram to illustrate the motion of the particle.
 - d) Find the total distance traveled in the first 10 seconds.
6. If the position function of a particle is $s(t) = 3t^2 + 2t + 4$. Find the distance that the particle travels from $t = 1$ to $t = 5$.
7. The distance traveled by a car (in km) is given by $s = 160t^2 + 20t$ (t in hours). When did the velocity reach 100 km/h?
8. The position function of a particle is $s = t^3 - 12t$. (s in meters, t in seconds) Find the acceleration when the velocity is 0.

Answers

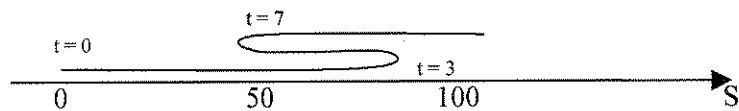
1. a) $v(t) = 96 + 12t - 3t^2$
 $a(t) = 12 - 6t$
 b) $t = 5$ - right
 $t = 9$ - left
 c) $t = 2$
 d) $t = 8$

2. a) -48 ft/sec
 b) $v(1) = -32$ ft/sec
 $v(2) = -64$ ft/sec
 c) $t = 9.2$ sec
 d) -294.4 ft/sec

3. a) 80 ft/sec
 b) 100 ft.
 c) up 16 ft/sec
 down -16 ft/sec

4. a) 36 m/s
 b) 12 m/s^2
 c) 1 sec
 d) 14 m
 e) 12 m/s

5. a) 3 sec or 7 sec
 b) $0 \leq t < 3, t > 7$
 c)



- d) 194 m

6. 80 m

7. 0.25 hours or 15 minutes

8. 12 m/s^2