Ch. 18 - Board Problems

1) Find the value of c that satisfy Mean Value Theorem.

a) $y = -x^3 + 4x^2 - 3 \quad [0, 4]$

b) $y = \dfrac{x^2}{2x - 4} \quad [-4, 1]$

2) Determine if function is even, odd, neither!

a) $f(x) = -x^3 + 5x - 2$

b) $f(x) = \sqrt{x^4 - x^2} + 4$

c) $f(x) = x^3 + 4x$

PHYSICS APPLICATIONS

$x(t)$ = DISTANCE (ft)

$x'(t)$ = VELOCITY $\frac{ft}{sec}$

$x''(t) = v'(t) = a(t)$ = ACCELERATION $\frac{ft}{sec^2}$

NOTE: $v(t)$ = velocity can be + or −
WITH SIGN INDICATING DIRECTION.
speed = $|v(t)|$

Example 1 - Joe has finished his last exam in his college career. He is so elated he opens his window (which is 10 m above the ground) and throws his pencil in the air with an initial velocity of 4 m/s. The distance formula for this problem is:

$$x(t) = -4.9t^2 + V_0 t + X_0$$

WHERE V_0 IS THE INITIAL VELOCITY AND
X_0 IS THE INITIAL DISTANCE

a. For how many seconds will the pencil travel upwards?

The pencil will travel upward until the velocity becomes zero. Then it will change direction and begin to fall.

$$x(t) = -4.9t^2 + V_0 t + X_0$$

b. What will be the maximum height that the pencil will achieve?

c. What is the total flight time for the pencil?

d. How long will it take for the pencil to fall to the ground?

e. What is the pencil's velocity when it hits the ground?

f. What is the pencil's acceleration when it hits the ground?

Note: Gravity's acceleration is -9.8 m/s2 or -32 ft/sec2

Example 2

Susan was traveling at a constant speed of 24 m/sec when she missed a school zone sign. A police car accelerated from rest at a constant acceleration of 2 m/sec2 in order to catch up with her. The distance formula for the police care is given by:

a. How long will it take for the police car to catch up with Susan's car, assuming that Susan maintains a constant velocity of 24 m/sec?

b. How far did the police car travel in order to catch up with Susan?

c. What was the velocity of the police car when it reached Susan's car?

LESSON PRACTICE

18A

Find the answer.

1. It has been found that a body falling freely from rest in a vacuum near the earth's surface has the following distance formula: $d(t) = 16.1\ t^2$ where t = time in seconds and d = distance in feet.

   a. Find the velocity at any second.

   b. Find the acceleration function.

   c. Find the velocity at the end of 5 seconds.

2. Given that $d(t) = 16t^2 - 64t + 64$ is the distance formula (t is measured in seconds and d is measured in feet):

   a. Find the velocity function.

   b. Find the velocity after half a second.

   c. Find the acceleration function.

   d. What is the total time that this object is moving?

3. Mr. Notsmart dropped a penny from rest from the top of Willis Tower in Chicago (427 m in height). Find the speed with which the penny strikes the ground given the free-fall formula. Round the answer to two decimal places.

$d(t) = d_0 + v_0t - 4.9t^2$ where d_0 = initial height of the penny,
v_0 = initial velocity of the penny

4. A rock is shot from a slingshot from the top of a hotel so that the rock's height in meters after being released for t seconds is $s(t) = 40 + 30t - 5t^2$.

a. When will the rock reach its peak?

b. What is the maximum height achieved by the rock?

c. When will the rock hit the ground?

d. What will be the velocity when the rock hits the ground?

e. What is the acceleration of the rock?