AP Calculus Derivative Applications & Initial Value Problems

Name: _____ **Date:** _____

Class Period: _____

Descriptions and Units

1. Suppose that a word problem contains the following sentence:

   "The height of a falling object is given by $h(t) = 80 - 4.9t^2$ with h in meters and t in seconds."

   a) What does the function h measure?

   b) What are the units of h?

   c) What are the units of the derivative?

   d) What does the derivative, $h(t)$ measure?

   e) What are the units of t?

2. Suppose that a word problem contains the following sentence:

   "The electric potential in a circuit is given by $V(t) = 135\sin(117t)$, with V in volts and t in seconds."

   a) What does the function V measure?

   b) What are the units of V

   c) What does $\frac{dV}{dt}$ measure?

   d) What are the units of $\frac{dV}{dt}$?

   e) What are the units of t?

Derivative Applications

Answer the following questions using correct units.

3. The height of an object launched straight up is

$$h(t) = 100 + 16t - 16t^2$$

where t is measured in seconds and h is measured in feet.

a) How high is the object when $t = 2$ seconds?

b) How fast is it moving when $t = 2$ seconds?

c) When is the height exactly 2 feet?

d) When is the velocity exactly 2 feet/second?

4. The electric potential in a circuit is given by

$$V(t) = 260e^{-2.1t}$$

where t is measured in seconds and V is measured in volts.

a) When is the potential equal to 130 volts?

b) How fast is V changing at that instant in time?

c) When is the voltage changing at -60 volts per second?

IVPs

5. A ball is thrown straight upward from the edge of a 60-foot building with an initial velocity of 20 ft/s. Its acceleration due to gravity is given by

$$a(t) = -32.$$

Find the position function $s(t)$ if $s(0) = 60$ and $v(0) = 20$.

Write a sentence that accurately describes what $s(2)$ means in the context of the problem. Be sure to include units.

6. A car's acceleration (in feet per second squared) varies with time according to

$$a(t) = 6t - 4$$

If the car's initial velocity and position are $v(0) = 20$ ft/s and $s(0) = 5$ ft, find the velocity function $v(t)$ and the position function $s(t)$.

Write a sentence that accurately describes what $s(3)$ means in the context of the problem. Be sure to include units.

7. Consider a function f whose derivative is given by

$$f'(x) = x^2 - 6e^{-x}.$$

Find the function $f(x)$ such that $f(3) = 1$.

8. The rate of change of a population of bacteria is modeled by

$$\frac{dP}{dt} = 2te^{t^2},$$

where t is measured in hours. Find $P(t)$ if the initial population at $t = 0$ is $P(0) = 500$.

Write a sentence that accurately describes what $P(5)$ means in the context of the problem.