Entry #: _____

Lesson 4.1: Interpreting Derivatives in Context

Interpretations of Derivatives

There are three primary interpretations of derivatives:

1. The instantaneous rate of change with respect to its _____ .
2. Rates of change in applied contexts.
3. Straight-Line Motion

Instantaneous Rate of Change **(Review)**

The instantaneous rate of change is given by the slope of the _____ to a function at a given point:

Example: Find the instantaneous rate of change of the following function at $z = 3$

$$R(z) = \sqrt{5z - 8}$$

Rates of Change (In Real-World Context)

Using derivatives, we can see when a function is _____ or _____ .

This is often useful when using functions to model real world situations.

Example:

Suppose the amount of water in a holding tank at t minutes is given by $V(t) = 2t^2 - 16t + 35$. Determine each of the following:

a. Is the volume of water in the tank increasing or decreasing at $t = 1$ minute?

b. Is the volume of water in the tank increasing or decreasing at $t = 5$ minutes?

c. Is the volume of water in the tank changing faster at $t = 1$ or $t = 5$ minutes?

d. Is the volume of water in the tank ever not changing? If so, when?

Straight Line Motion: Position, Velocity & Acceleration

Key Vocabulary:

Position Function	
Velocity Function	
Acceleration Function	
Initial Position	
Initial Velocity	
Speed	
Displacement	
Total Distance	

Example: If $s(t) = t^3 + t$, find $v(t)$ and $a(t)$.

Practice Problems:

1. Use the position function $s(t) = 16t^3 - 36t^2 + 24$ of an object moving on a horizontal line for the following problems. Distance units are measured in feet and time units are measured in seconds.

    a. What is the initial position of the object?

    b. What is the velocity of the object at $t = 1$ second?

    c. What is the speed of the object at $t = 1$ second?

    d. What is the acceleration of the object at $t = 1$ second?

    e. When is the object at rest?

    f. When is the object moving right?

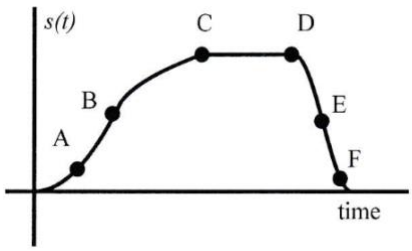
    g. When is the object moving left?

    h. When is the velocity of the object equal to $54 \frac{ft}{sec}$?

    i. What is the displacement of the object between $t = 0$ and $t = 2$ seconds?

    j. What is the total distance traveled by the object between $t = 0$ and $t = 2$ seconds?

2. The graph shows the position of a radio controlled model car. Answer these questions and explain.



   a. When was the car stopped?

   b. At which point was the car's velocity the greatest?

   c. At which point was the car's speed the greatest?

Vertical Motion Examples

3. Suppose $s(t) = -16t^2 + 48t + 160$ gives the position (in feet) above the ground for a ball thrown into the air from the top of a high cliff (where time is measured in seconds).

   a. Find the initial velocity.

   b. At what timed does the ball hit the ground?

   c. At what time does the ball reach its maximum height?