**2.4 Using Rates of Change to Create a Graphical Model**

Change in displacement – can mean a change distance, height or depth

A decreasing line indicates that displacement \_\_\_\_\_\_\_\_\_\_\_\_\_\_ as time increases

An increasing line indicates that displacement \_\_\_\_\_\_\_\_\_\_\_\_\_\_ as time increases

When the rate of change of displacement is variable, an increasing curve indicates that displacement \_\_\_\_\_\_\_\_\_\_\_\_\_\_ as time increases.

A horizontal line indicates there is \_\_\_\_ change in displacement as time increases

When the rate of change of displacement is variable, an increasing curve indicates that displacement \_\_\_\_\_\_\_\_\_\_\_\_\_\_ as time increases.

A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ curve indicates that displacement decreases as time increases.

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**Example 1:** Ayoub is watching Rami run. He notices that Rami starts fast at 12 m/s. Then he begins to slow down at a constant rate and 15 seconds later, he is at a speed of 7 m/s. He continues to slow down at a different constant speed and finally comes to a stop one minute later.

a) Sketch a graph of speed versus time.

b) What is the average rate of change of Rami's speed in the first 15 seconds?

c) Estimate the instantaneous rate of change in speed at 10 s.

**Example 2:** Nadia and Leema go for a bike ride. They start their bike ride 50 m south of school and ride at a constant speed for 2 minutes until they are 500 m south of school. They stop at a light for 1 minute and then continue their bike ride but this time they start off at a faster speed than they were biking previously and speed up over 3 minutes until they are 2000 m from school. They stop for 60 seconds. Then they turn around and bike back to school but their speed is decreasing all the way back to school.

a) Draw a distance (distance from school) versus time graph for the girl's bike ride.

b) What was the average rate of change in their distance in the first 2 minutes?

c) What were the instantaneous rates of change at t=60 seconds and t=90 seconds.

d) What was the average rate of change from minute 3 to 6?

e) What was the instantaneous rate of change at t=150s

f) What were the instantaneous rates of change at 7 and 8 minutes?

g) Draw a speed versus time graph for the bike ride.

**Example 3:** The two containers are being filled with water at a constant rate. Draw a graph of the water level versus time for each container.

a) Pop bottle b) Vase

**Homework: pg 103-105 #1,2,4,5,6,7,8,10**

**REMINDER:** Use the difference quotient to estimate the instantaneous rate of change at for the function f

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