

## Lesson 3 – Modeling Situations

Objective:

I can interpret graphs that model real-world situations and write descriptions using the terms, linear, nonlinear, increasing, decreasing, rate of change, continuous, domain, range, independent variable and dependent variable.

Linear vs.  
Nonlinear

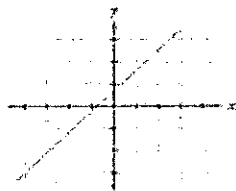
What does the word LINEAR mean to you? What do you think a LINEAR graph would look like?

What does the word NONLINEAR mean to you? What do you think a NONLINEAR graph would look like?

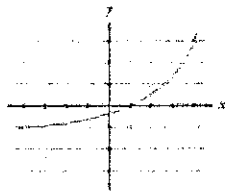
Increasing  
Functions

Step 1: These are graphs of *increasing functions*.

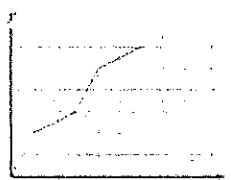
Graph A



Graph B



Graph C



What do the three graphs have in common?

They are all increasing, they are functions, they all have a positive rate of change

How would you describe the rate of change in each?

A - Constant rate of change

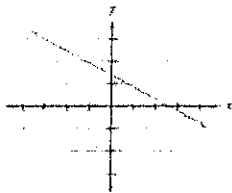
B - Starts slowly and increases rapidly over time

C - constant at specific intervals

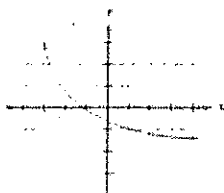
Decreasing  
Functions

Step 2: These are graphs of *decreasing functions*.

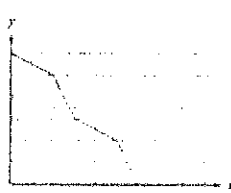
Graph D



Graph E



Graph F



What do the three graphs have in common?

They all decrease, negative trend in data, functions

How are they different from the graphs in Step 1?

They decrease

How would you describe the rate of change in each?

D - constant negative rate of change

E decreases rapidly then slows

F negative constant rate of change over specific intervals

Describing  
Situations

Step 3: For each situation below, identify the independent and dependent variables, then describe what the graph of each situation will look like.

Situation A: During the first few years, the number of deer on the island increased by a steady percentage. As food became less plentiful, the growth rate started slowing down. Now, the number of births and deaths is about the same.

Independent Variable:

amount of food

Dependent Variable:

deer population

Description of Graph:

The line increases at a constant positive rate of change, then the line increases at a slower positive rate of change, then the line flattens

Situation B; In the Northern Hemisphere the amount of daylight increases slowly from January through February, faster until mid-May, and then slowly until the maximum in June. Then it decreases slowly through July, faster from August until mid-November, and then slowly until the year's end.

Independent Variable: months	Dependent Variable: daylight
Description of Graph: The line increases slowly, then more rapidly until it reaches the maximum, then it slowly decreases, then more rapidly, then slowly.	

Situation C: If you have a fixed amount of fencing, the width of your rectangular garden determines its area. If the width is very short, the garden won't have much area. As the width increases, the area also increases. The area increases more slowly until it reaches a maximum. As the width continues to increase, the area becomes smaller more quickly until it is zero.

Independent Variable: width	Dependent Variable: area
Description of Graph: The line increases then reaches its maximum, then decreases.	

Situation D; Your cup of tea is very hot. The difference between the tea temperature and the room temperature decreases quickly at first as the tea starts to cool to room temperature. But when the two temperatures are close together, the cooling rate slows down. It actually takes a long time for the tea to finally reach room temperature

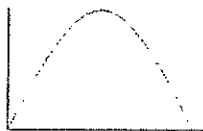
Independent Variable: time	Dependent Variable: temperature
Description of Graph: The line will decrease quickly, then slow down then even out.	

Modeling  
Situations w/  
Graphs

Step 4: Match each graph to the situation that it models from the situations above (two graphs won't be matched).

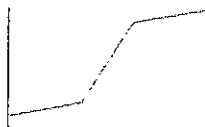
Step 5: Label the independent and dependent variable on the appropriate axis for each matched graph.

Graph 1



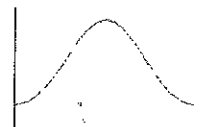
Situation: C

Graph 2



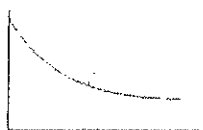
Situation:     

Graph 3



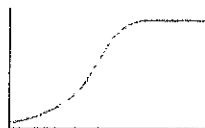
Situation: B

Graph 4



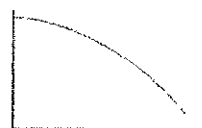
Situation: D

Graph 5



Situation: A

Graph 6



Situation:     

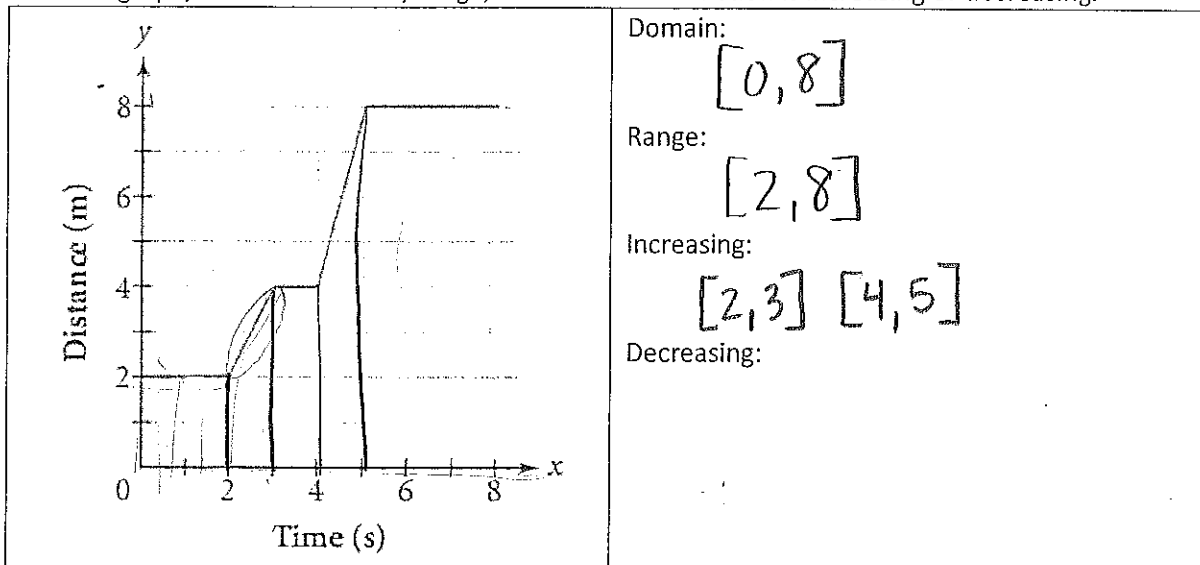
Domain &  
Range

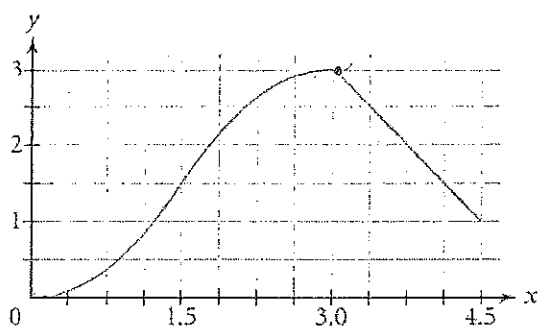
When we write the domain and range of a **graph**, we don't list every number.

This is because there are an **infinite** number of domain and range values.

We write the domain, range, increasing, and decreasing sections as **intervals**.

For each graph, write the domain, range, and where the function is increasing or decreasing.





Domain:

$[0, 4.5]$

Range:

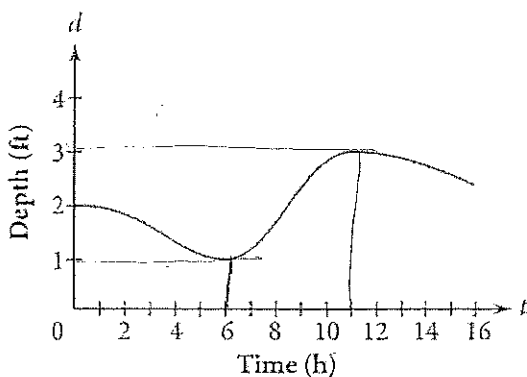
$[0, 3]$

Increasing:

$[0, 3]$

Decreasing:

$[3, 4.5]$



Domain:

$[0, 16]$

Range:

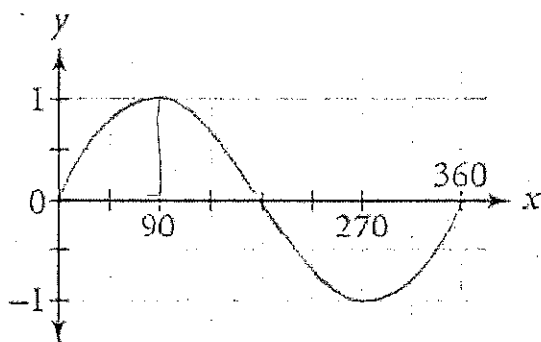
$[1, 3]$

Increasing:

$[6, 11]$

Decreasing:

$[0, 6]$   $[11, 16]$



Domain:

$[0, 360]$

Range:

$[-1, 1]$

Increasing:

$[0, 90]$   $[270, 360]$

Decreasing:

$[90, 270]$