Lesson 2.2 – Types of Functions

**Do Now**
Use the graph shown to answer the questions that follow:

1) **What is the average rate of change from zero to four seconds?**

2) **Based on this rate, is it reasonable that a person might be going up a ladder?**

**Classwork**

1. Let’s examine some of the details in this video clip by answering the following questions:
   a. **How high do you think the man was at the top of the ladder?**
   b. **Were there periods of time when his elevation wasn’t changing?**
   c. **Did his elevation ever increase? Why?**

On the axes provided, draw the elevation vs. time graph depicted in the video. (make a sketch)

**PIECEWISE LINEAR FUNCTION**: A piecewise function is a function made up of more than one function.
2. Let’s examine some of the details in this video clip by answering the following questions:

   a. How high do you think the man was at the top of the diving board? ________________

   b. Is there a constant speed throughout Professor Slash’s jump or did his speed change at different points throughout his jump?

   c. Did his elevation ever increase? Why?

   d. On the axes provided, draw the elevation vs. time graph depicted in the video. (make a sketch)

   QUADRATIC FUNCTION
   A quadratic equation is a polynomials equation of degree two. The standard form is \( y = ax^2 + bx + c \). The graph is in the shape of a parabola.
3. Let’s examine some of the details in this video clip by answering the following questions:

a. How many bacteria did we start with? ___________________

b. What happened every second to the number of bacteria? ________________

c. Fill out the table below based on your findings.

<table>
<thead>
<tr>
<th>Time (sec)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td># of bacteria</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

d. Graph the number of bacteria versus time in seconds in accordance with the video.

![Graph of bacteria growth vs time](image)

Time (sec)

e. How would you graph change if time was in minutes?

**EXPONENTIAL FUNCTION**

An exponential function is a function in the form $y = ab^x$. There are two types of exponential functions, an exponential growth or an exponential decay.
4. Make up an elevation-versus-time graphing story for the following graph:

![Elevation versus time graph]

5. If you jumped in the air three times, what might the elevation versus time graph of that story look like? Label the axes appropriately.

![Elevation versus time graph]

6. Here is an elevation versus time graph of a ball rolling down a ramp. The first section of the graph is slightly curved. At what point is the speed of the ball the fastest, near the top of the ramp at the beginning of its journey or near the bottom of the ramp? Explain.

![Elevation versus time graph]
7. *Bacillus cereus* is a soil-dwelling bacterium that sometimes causes food poisoning. Each cell divides to form two new cells every 30 minutes. If a culture starts out with exactly 100 bacterial cells, how many bacteria will be present after 3 hours?

8. Below are three stories about the population of a city over a period of time and four population-versus-time graphs. Two of the stories each correspond to a graph. Match the two graphs and the two stories.

   Story 1: The population size grows at a constant rate for some time, then doesn’t change for a while, and then grows at a constant rate once again.
   Story 2: The population size grows somewhat fast at first, and then the rate of growth slows.
   Story 3: The population size declines to zero.

![Graphs](image)

9. Assume that a bacteria population doubles every hour. Which of the following three tables of data, with \( x \) representing time in hours and \( y \) the count of bacteria, could represent the bacteria population with respect to time? For the chosen table of data, plot the graph of that data. Label the axes appropriately with units.

   ![Tables](image)