6.10.1 Problem Solving with Quadratic Graphs-
Interpreting Parabolas

1. The graph below shows the height, in meters, of a diver jumping off a springboard versus time, in seconds.
   a) What is the initial height of the jumper? What is this called in math terminology?
      \[ \text{initial height} = 2.5 \text{ m} \]
   b) Label and write the ordered pair of the vertex. What does this mean in real life?
      \[ \text{vertex} = (1,7) \]
      highest dive pt. is 7 m at
   c) Label and write the ordered pairs of the roots/zeros. What do these points mean in real life?
      \[ \text{zeros} = (2.3,0), (6.5,0) \]
      2.3 s to get in water
      May Min.
2. The graph below shows the height of a toy rocket after it is launched.

   a) How many seconds is the rocket in the air?
   b) What math concept did you use to determine this?
   c) What is the maximum height of the rocket?
   d) At what time does the maximum height occur?
   e) At what times is the rocket 120 meters above the earth?
      Between 1 & 7 s.
   f) Complete the table of values below with first and second differences.

<table>
<thead>
<tr>
<th>Time</th>
<th>Height</th>
<th>First Diff</th>
<th>Second Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   g) What pattern did you observe in the second differences from the table? How does this prove that the relationship is quadratic?
6.10.2 Applying Quadratic Relationships

There are many relationships that turn out to be quadratic. One of the most common is the relationship between the height of something (or someone) flying through the air and time.

1. A football player kicks a ball of a football tee. The height of the ball, \( h \), in metres after \( t \) seconds can be modelled using the formula \( h = -5t^2 + 20t \).
   a) Graph the relationship using your graphing calculator. Remember that you need to set your window settings. Record the window settings you used.
   b) Sketch your graph in the window at right. Make sure to label your axes.

   ![Graph of quadratic equation]

   ![Table setup]

   c) You can get the table of values for this relationship. Press [2ND] and [TABLE] to access the table setup screen. Make sure your screen looks like the one given.

   ![Table of values]

   d) Now press [2ND] and [GRAPH]. Fill in the window with the values you see.

   ![Filled table]

   e) For which times does the height not make sense? Why?

   f) What is the initial height of the ball? _________

   g) Where do you look in the table and the graph to determine the answer?

   h) Why does this make sense?