Mortgages The balance owed $y$ on a $50,000 mortgage after $x$ monthly payments is shown in the table that follows. The function that models the data is \[ y = 4700\sqrt{110 - x} \]

<table>
<thead>
<tr>
<th>Monthly Payments</th>
<th>Balance Owed ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>47,243</td>
</tr>
<tr>
<td>24</td>
<td>44,136</td>
</tr>
<tr>
<td>48</td>
<td>36,693</td>
</tr>
<tr>
<td>72</td>
<td>27,241</td>
</tr>
<tr>
<td>96</td>
<td>15,239</td>
</tr>
<tr>
<td>108</td>
<td>8074</td>
</tr>
</tbody>
</table>

a. Is this a shifted root function?

Let’s take a look at the data and the given function, \( y = 4700\sqrt{110 - x} \).

From this we can see that basic function for this graph is \( y = \sqrt{x} \) and we can say, yes, this is a shifted square root function.

b. What is the domain of the function in the context of this application?

The domain of the function is all values that \( x \) can take on while still making sense in the context of the application. Since \( x \) represents the number of monthly payments, we can say that \( x \) is zero or more. That is, \( x \geq 0 \).

But, we also want the radicand, \( 110 - x \), to be non-negative and algebraically we say,

\[
110 - x \geq 0 \\
-x \geq -110 \\
x \leq 110
\]

So \( x \) is restricted to values greater than or equal to 0 and, at the same time, less than or equal to 110 and we can write, \( 0 \leq x \leq 110 \).

The domain of the function in the context of this application is \([0, 110]\).

---

\(^1\)Harshbarger/Yocco, *College Algebra In Context*, 5e, p. 261, #64.
c. Describe the transformations needed to obtain the graph from the graph of \( y = \sqrt{x} \).

Let’s start with the graph of \( y = \sqrt{x} \) and transform it to get the graph of \( y = 4700\sqrt{110-x} \).

\[
\begin{align*}
  y &= \sqrt{x} & \text{The basic function. Shown in green dots.} \\
  y &= \sqrt{-(x)} & \text{Reflection across the y-axis. Shown in red dashes.} \\
  y &= \sqrt{-(x-110)} & \text{Shift 110 units to the right. Shown in solid orange.}
\end{align*}
\]

Finally, \( y = \sqrt{-(x-110)} \) is stretched vertically by a factor of 4700. I had to change the scale on the y-axis so the graph would show and the resulting equation,

\[
y = 4700\sqrt{-(x-110)},
\]

is shown below in solid blue.

In short, the transformations are: a reflection across the y-axis, a horizontal shift 110 units to the right, and a vertical stretch using a factor of 4700.