4. [15 points] Elana goes on an amusement park ride that moves straight up and down. Let $v(t)$ model Elana’s velocity (in meters/second) $t$ seconds after the ride begins (where $v(t)$ is positive when the ride is moving upwards, and negative when the ride is moving downwards). A graph of $v(t)$ for $0 < t < 12$ is shown below. Assume that $v(t)$ is piecewise linear for $0 < t < 6$ and $6 < t < 10$, and that the area of the shaded region is 10, as indicated on the graph.

\[ y = v(t) \]

a. [4 points] Write an integral that gives Elana’s average velocity, in meters/second, from 2 seconds into the ride until 4 seconds into the ride. Then compute the exact value of this integral.

**Answer:** $\frac{\int_2^4 v(t) \, dt}{4 - 2} = \frac{\text{Area of shaded region}}{\text{Time interval}}$

Let $h(t)$ be Elana’s height (in meters) above the ground $t$ seconds after the ride begins. Assume that $h$ is continuous, and suppose Elana is at a height of 10 meters above the ground when the ride begins.

b. [6 points] Fill in the exact values of $h(t)$ in the table below.

<table>
<thead>
<tr>
<th>$t$</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h(t)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(c. [5 points] Using your work from part b., sketch a detailed graph of $h(t)$ for $0 < t < 12$. In your sketch, be sure that you pay close attention to each of the following:

- where $h$ is increasing, decreasing, or constant
- where $h$ is/is not differentiable
- the values of $h(t)$ you found in part b. above
- the concavity of the graph of $y = h(t)$

\[ y = h(t) \]