Section #5.1 – Accumulated Change
MATH 2313

We know that when given the distance of something, we can find the velocity at any point by finding the derivative or instantaneous rate of change at that point. Now we are going to look at it the other way around. When given the velocity or rate of change, we will be able to estimate the distance traveled.

How do we Measure Distance Traveled?

We know if the velocity of a moving object is \( v \) and the object has traveled \( t \) units of time, the total distance traveled is given by:

\[
\text{Distance} = \text{velocity} \times \text{time} = v \times t
\]

Example

1. If a car travels at 60 mph, then after 2 hrs the total distance traveled is:

2. What if the velocity is not constant? 40 mph the first half hour, 70 mph the next hour and 55 mph the last half hour. What is the total distance traveled?

3. A car accelerates from a stop to highway speed. The velocity \( v(t) \) of the car in meters per second, at \( t \) seconds after it starts, is measured and given in the following table. Estimate the distance the car has traveled over the first 6 seconds.

<table>
<thead>
<tr>
<th>( t )</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>( v(t) )</td>
<td>0</td>
<td>4</td>
<td>7</td>
<td>12</td>
</tr>
</tbody>
</table>

Lower estimate:

Upper estimate:
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4. The rate of sales (in games per week) of a new video game is shown in the table below. Assuming that the rate of sales increased throughout the 20-week period, estimate the total number of games sold during this period.

<table>
<thead>
<tr>
<th>Time (weeks)</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of sales (games per week)</td>
<td>0</td>
<td>585</td>
<td>892</td>
<td>2350</td>
<td>1875</td>
</tr>
</tbody>
</table>

Lower estimate: Left Sum

Upper estimate: Right Sum

Total:

5. The following figure shows the graph of the velocity, \( v \), of an object (in meters/sec). Estimate the total distance the object traveled between \( t = 0 \) and \( t = 3 \).

6. The following figure shows the graph of the velocity, \( v \), of an object (in meters/sec). Estimate the total distance the object traveled between \( t = 0 \) and \( t = 5 \).