**Average Velocity**

Average velocity = \( \frac{\text{Displacement}}{\text{Elapsed time}} \)

\[ \vec{v} = \frac{\Delta \vec{x}}{\Delta t} = \frac{x_f - x_i}{\Delta t} \]

Unit of velocity: Distance/time = meter/second

**Problem : Chapter 2**

5. The data in the following table describe the initial and final positions of a moving car. The elapsed time for each of the three pairs of positions listed in the table is 0.50 s. Determine the average velocity (magnitude and direction) for each of the three pairs. Note that the algebraic sign of your answers will convey the direction.

<table>
<thead>
<tr>
<th>Initial position ( x_0 )</th>
<th>Final position ( x )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 2.0 m</td>
<td>6.0 m</td>
</tr>
<tr>
<td>(b) 6.0 m</td>
<td>2.0 m</td>
</tr>
<tr>
<td>(c) -3.0 m</td>
<td>7.0 m</td>
</tr>
</tbody>
</table>

**Example: average velocity**

Andy Green in the car Thrust SSC set a world record of 341.1 m/s in 1997. To establish such a record, the driver makes two runs through the course, one in each direction, to nullify wind effects. From the data, determine the average velocity for each run.

**Clicker question 1- Chapter 2**

A particle travels along a curved path between two points P and Q as shown. The displacement of the particle does not depend on

A. the location of P  
B. the location of Q  
C. the distance traveled from P to Q  
D. the shortest distance between P and Q  
E. the direction of Q from P

**Clicker question 2- Chapter 2**

For which one of the following situations will the path length equal the magnitude of the displacement?

A. A toy train is traveling around a circular track.  
B. A ball is rolling down an inclined plane.  
C. A train travels 5 miles east before it stops. It then travels 2 miles west.  
D. A ball rises and falls after being thrown straight up from the earth's surface.  
E. A ball on the end of a string is moving in a vertical circle.
Problem: Chapter 2

12. A car makes a trip due north for three-fourths of the time and due south one-fourth of the time. The average northward velocity has a magnitude of 27 m/s, and the average southward velocity has a magnitude of 17 m/s. What is the average velocity (magnitude and direction) for the entire trip?

Acceleration

A nonzero acceleration implies that the velocity is changing with time.

Unit of acceleration: Distance/time = meter/second$^2$

<table>
<thead>
<tr>
<th>Time</th>
<th>Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 s</td>
<td>2 m/s</td>
</tr>
<tr>
<td>1 s</td>
<td>4 m/s</td>
</tr>
<tr>
<td>2 s</td>
<td>6 m/s</td>
</tr>
<tr>
<td>3 s</td>
<td>8 m/s</td>
</tr>
<tr>
<td>4 s</td>
<td>10 m/s</td>
</tr>
<tr>
<td>5 s</td>
<td>12 m/s</td>
</tr>
<tr>
<td>6 s</td>
<td>14 m/s</td>
</tr>
</tbody>
</table>

Equations of kinematics

\[ v = v_0 + at \]
\[ a = \frac{v - v_0}{t} \]
\[ \bar{v} = \frac{v + v_0}{2} \]
\[ \bar{v} = \frac{x - x_0}{t} \]
\[ x = v_0 t + \frac{1}{2}at^2 \]
\[ v^2 = \bar{v}^2 + 2ax \]

Constant acceleration

\[ v = v_0 + at \]
\[ t = \frac{v - v_0}{a} \]
\[ \bar{v} = \frac{v + v_0}{2} \]
\[ \bar{v} = \frac{x - x_0}{t} \]
\[ x = \bar{v}t \]

The above Equation does not contain time.