| 1 | Mouvement rectiligne uniforme (MRU) |

Le Châtelard

1) Uniform linear motion

A rifle bullet, a full-speed train or a man running in a straight line are examples of ULM. Characteristics :

✔ straight trajectory
✔ constant speed
✔ no acceleration

2) Velocity

The velocity v of an object in uniform linear motion traversing a distance d in a time t verifies the formula :
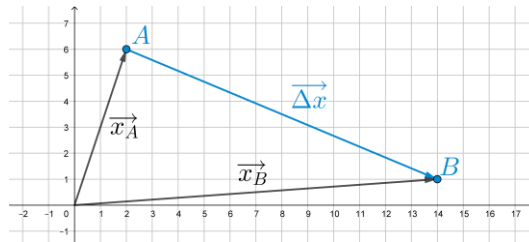
$$v = \frac{d}{t}$$

3) Position

The position x of an object in uniform linear motion starting from position x_0 verifies the formula :

$$x = vt + x_0$$

4) Two dimensional graph

In a two dimensional graph, the positions of the points A and B are given by :

$$\vec{x_A} = \begin{pmatrix} 2 \\ 6 \end{pmatrix} \qquad \vec{x_B} = \begin{pmatrix} 14 \\ 1 \end{pmatrix}$$

The displacement between A and B is given by :

$$\vec{\Delta x} = \vec{x_B} - \vec{x_A} = \begin{pmatrix} 14 \\ 1 \end{pmatrix} - \begin{pmatrix} 2 \\ 6 \end{pmatrix} = \begin{pmatrix} 12 \\ -5 \end{pmatrix}$$

If t is the elapsed time between A and B, the velocity is given by :

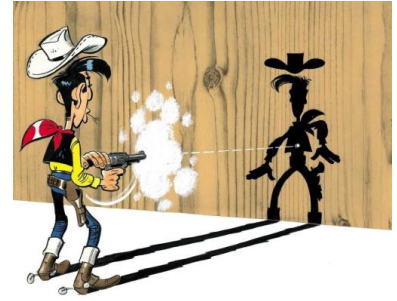$$\vec{v} = \frac{\vec{\Delta x}}{t} = \begin{pmatrix} \frac{12}{t} \\ -\frac{5}{t} \end{pmatrix}$$

The speed is then given by (in this example, we consider that $t = 1$) :

$$v = \|\vec{v}\| = \sqrt{12^2 + (-5)^2} = 13 \text{ m/s}$$

5) Exercises

Exercise 1

One says that the famous cowboy Lucky Luke shoots faster than his shadow. Knowing that the velocity of the light is 3×10^8 m/s and that Lucky Luke is 4 m from the wall, how many time does he need to trigger?

Exercise 2

Sound and light propagate at constant velocities of 343 m/s and 3×10^8 m/s respectively. At an outdoor show, if you are located 400 m from the stage, what will be the time lag between the vision of a pyrotechnic effect and the hearing of the noise produced by the explosion?

Exercise 3

Thomas decides to cross Canada by bike. 6200 km separate its point of departure from its point of arrival. He hopes to maintain an average velocity of 15 km/h. Knowing that he will pedal 9 hours a day, how many days will it take to complete this journey?

Exercise 4

Two athletes A and B run on a 400 m long circular track. They leave together and move at velocities of 10 m/s and 9 m/s respectively. After how many time will they be separated with exactly one lap ?

Exercise 5

A train leaves from station A and goes to station B at a constant velocity of 108 km/h. At the same time, a train leaves from station B and goes to station A at a constant velocity of 90 km/h. What is the distance between the two stations if the trains intersect after 40 minutes?

Exercise 6

A shooter shoots a target in front of him. The trajectory of the ball is considered to be uniform. The shooter hears the impact sound 1.5 seconds after firing. How far is the target, knowing that the velocity of the ball is 990 m/s and the velocity of sound in the air is 330 m/s?