MOVING BODIES

OBJECTIVES

You have to answer the following questions, among others:

How do bodies move? What is the trajectory? How are movements represented? What is a uniform movement? What is an accelerated movement?

If you already know what the following are: a trajectory, a vector, a data table, how you represent time graphs and what shape s/t and v/t graphs have, you can go straight to the following pages:

Trajectory and displacement

Rectilinear movement

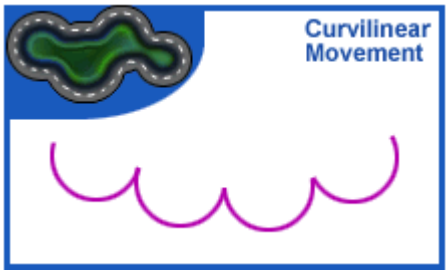
1.1 Bodies can move describing different paths

The path the body describes with its movement is called **TRAJECTORY**

You can see below different types of trajectories:

The bicycle always followed a rectilinear trajectory

The motorbike continually followed the bends of the circuit

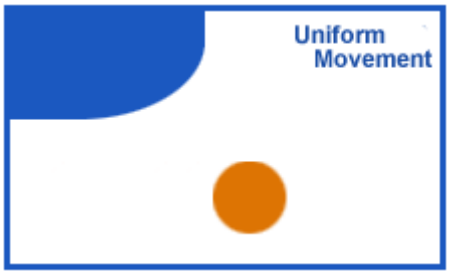


1.1.2 Bodies do not always move at the same speed

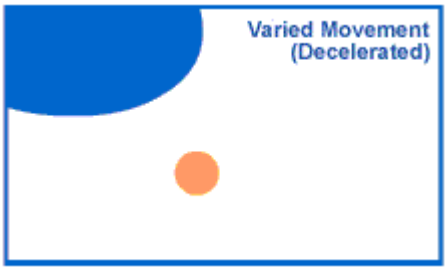
When bodies move at a constant speed we say that they have a **UNIFORM** movement

If the speed at which the bodies move is not constant, we say they have a **VARIED** or NON-UNIFORM movement.
We can also say the movement is ACCELERATED or DECELERATED

It always goes at the same speed: UNIFORM



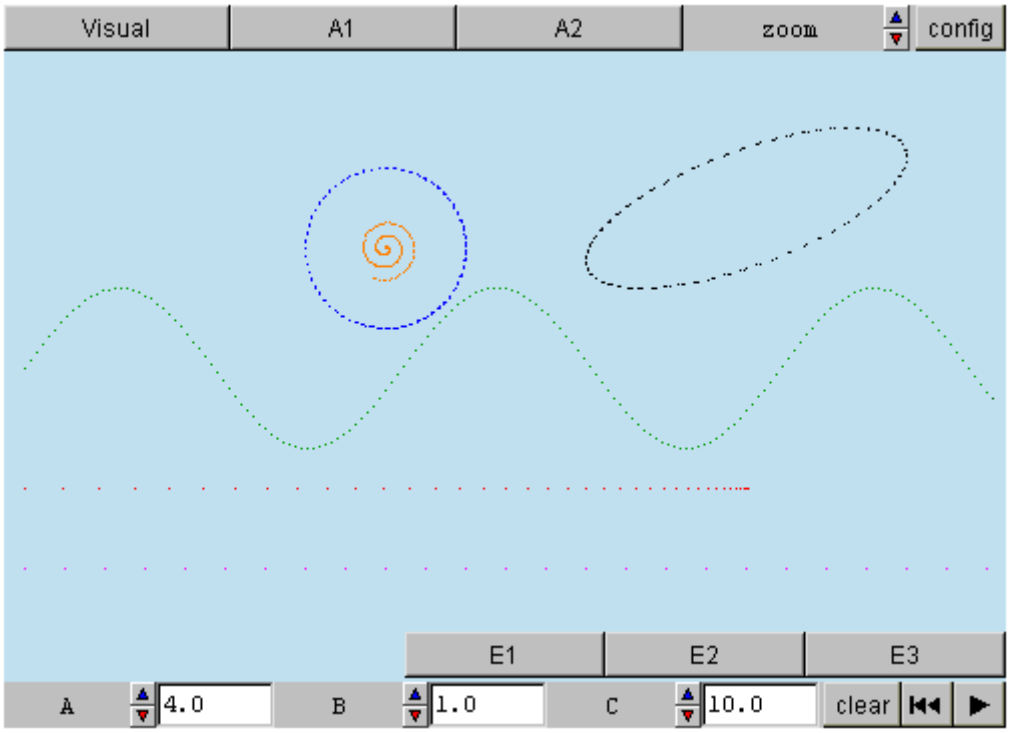
It goes slower and slower: VARIED (it decelerates)



1.1.3 How to classify moving bodies

This visual represents six moving bodies. Look at how each one moves and classify its movement according to its trajectory and to whether or not its speed varies.

trajectory: Path described by a moving body ***speed:*** Constant or variable



VISUAL: Different bodies in movement. What characteristics do they have? is it like a wave? like a circle? is it a line?

A1: Click on animate and you will be able to see the tracks left by the bodies. If you observe the distance between two consecutive tracks you will be able to see if the body moves with constant speed or variable speed.

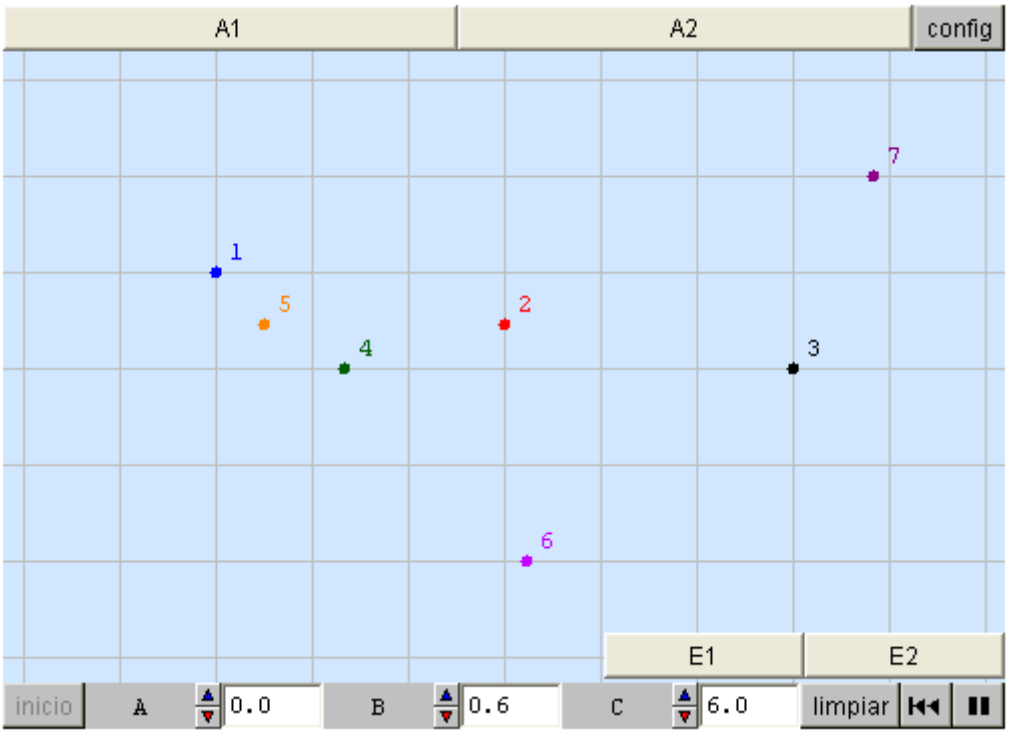
A2: Modify the values of A, B and C by clicking.

E1: Copy, paste, complete and save it in the notepad.

1.2 The different types of movement that bodies can demonstrate are classified as follows:

According to the trajectory		***According to whether the speed is constant or not***	
rectilinear		constant speed	
circular		variable speed	
curvilinear			

1.2.2 Classify the movement of these bodies. The trails are hidden. Carefully observe the shape of the trajectories and the speed at which they move

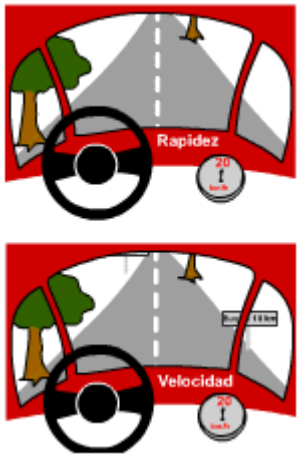


FALTAN VENTANAS

2.1 Is speed the same as velocity?

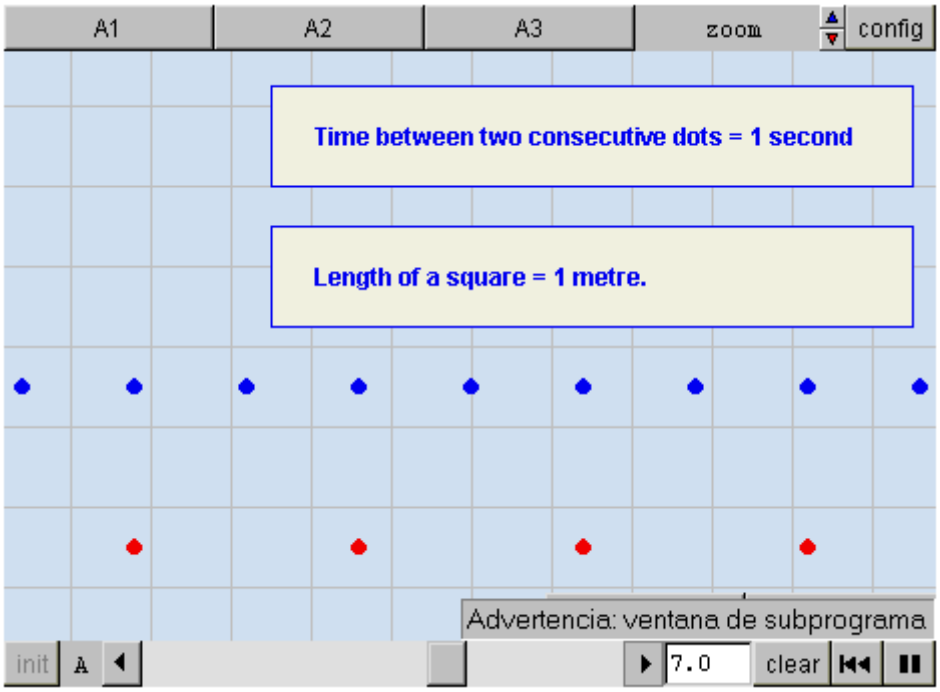
The terms speed and velocity are sometimes confused although they have different meanings:

	What is it?	How is it measured?
speed	Distance covered by a body per unit of time	It is shown on the speedometer of a car, e.g.: **20 km/h**
velocity	Distance covered by a body per unit of time una determined direction and with a determined orientation.	Its is shown by the speedometer of the car and by **the situation on the road:** e.g.: **20 km/h** on the E90 highway going **towards Madrid**



2.1.1 Speed and velocity are similar terms

In this visual we can see the tracks that are left by bodies moving at a constant speed: imagine that they are cars which are leaking a drop of oil every second.



A1: ...When A is higher?

A2: ...when A is lower?

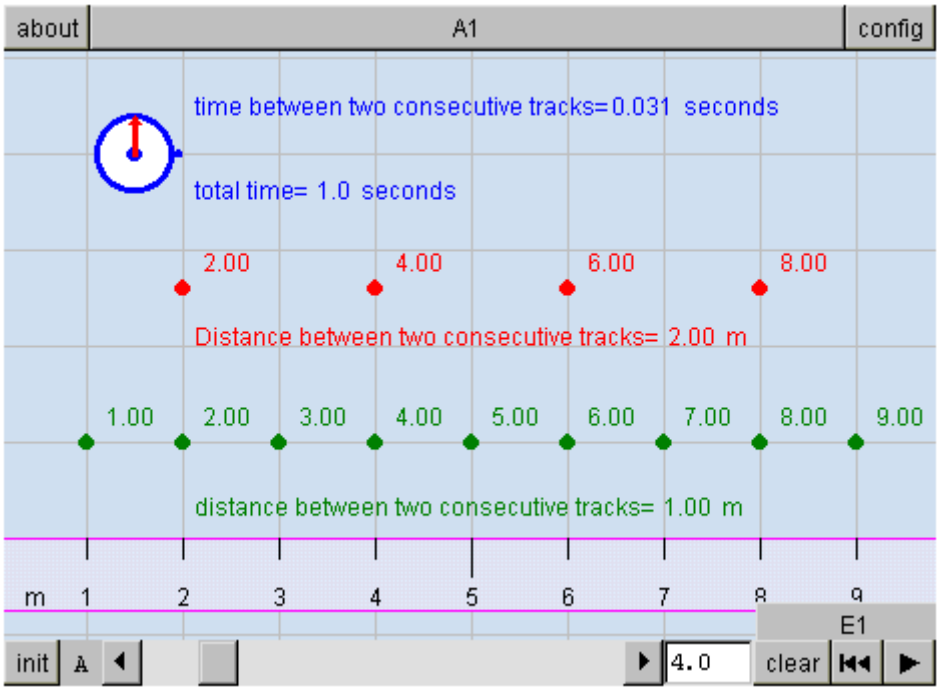
A3: ...the points coincide with the vertical lines. How many values of A satisfy this condition?

E1: Double the speed? Triple the speed? The red one at double the speed of the blue one?

E2: ...How many meters does the blue body move in a second? How many meters does the red body move in a second?

2.2 How fast is it going?

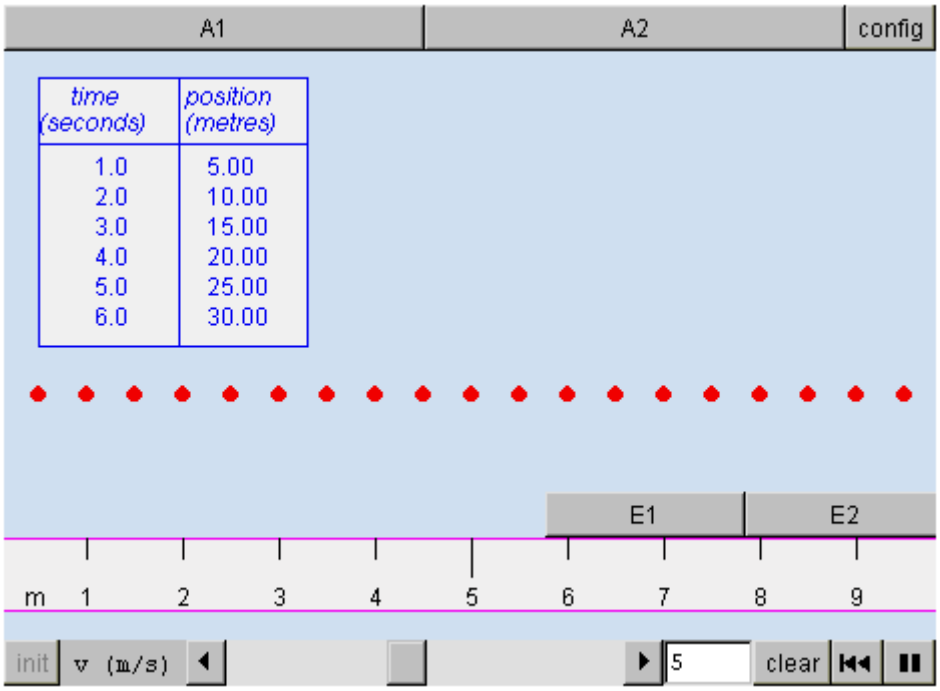
A watch and a tape measure are all you need to answer the question



A1: ...Calculate the speed at which each body moves. You only need to calculate the distance that it moves in a second.

2.3 The data tables are used to organize how bodies move

The **Data Tables** are a more organized and abbreviated way of representing the movements



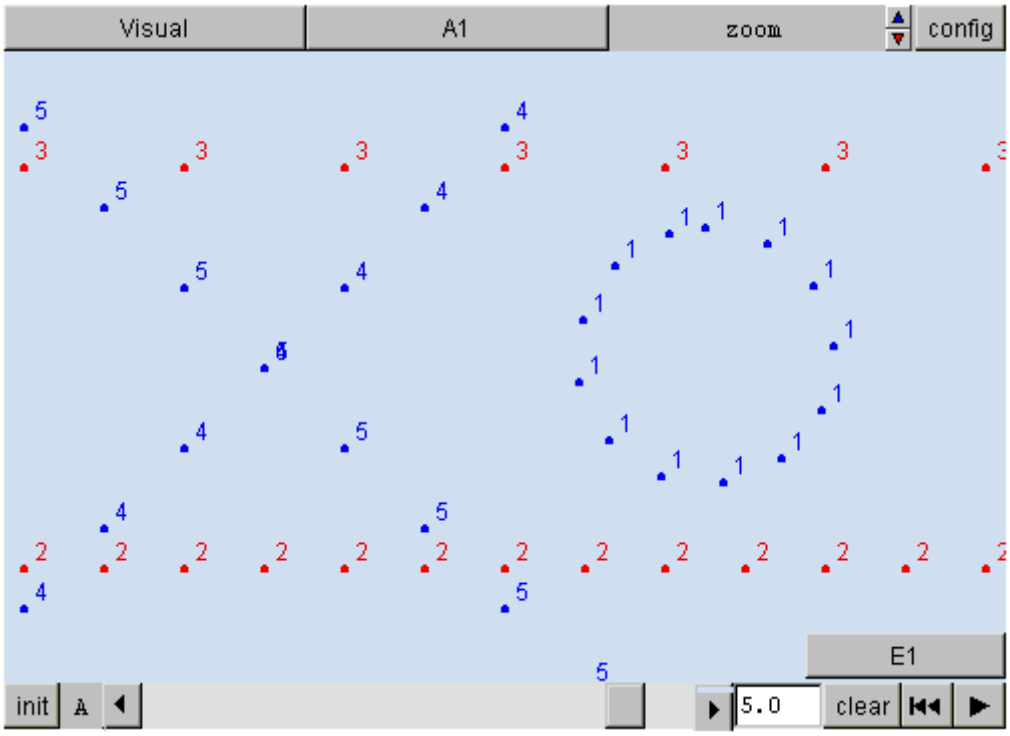
A1: If you modify v you will observe how the speed varies.

A2: When A is equal to the maximum and minimum values, the data tables also have very different values.

E1: When v=2 m/s... The space covered each second is... And the space covered every half second is...

2.4 Uniform and also Circular Movements

Here are several very different movements, although they are all uniform. When the trajectory described is a circumference and the body moves at a constant speed we say that it demonstrates a UNIFORM CIRCULAR MOVEMENT.



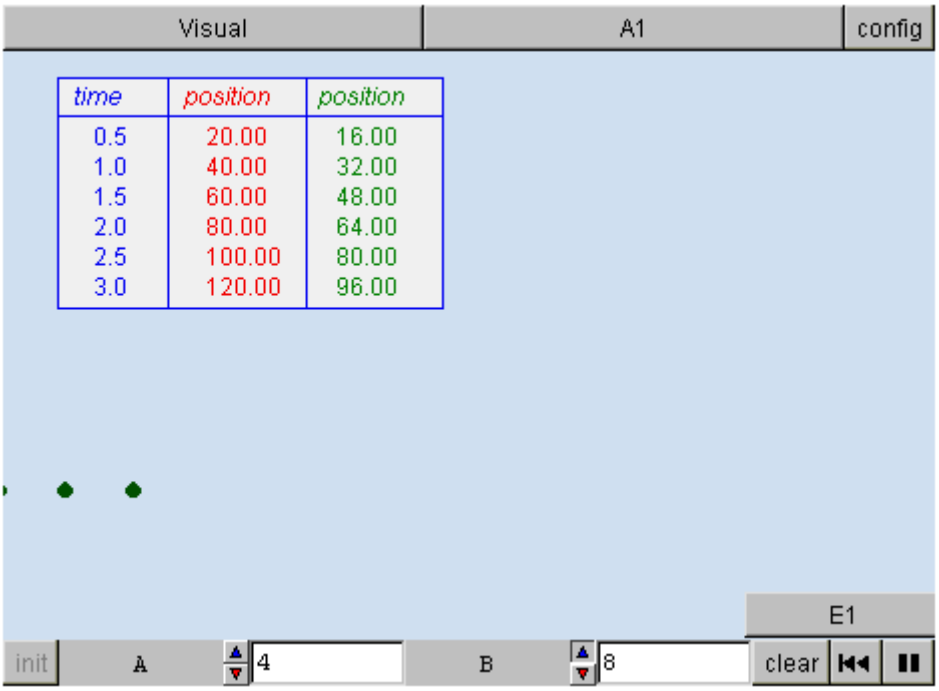
VISUAL: ...Before changing the values of A we advise you to click on init.

A1: ...By changing the value of A it is possible to observe the speed at which the bodies vary their movement.

E1: The fastest is... The slowest is... When A is 2.5, does the classification vary?

2.5 Compare the speed

With just one data table you can compare the distances covered by each body per second



VISUAL: ...Before changing the values of A we advise you to click on init.

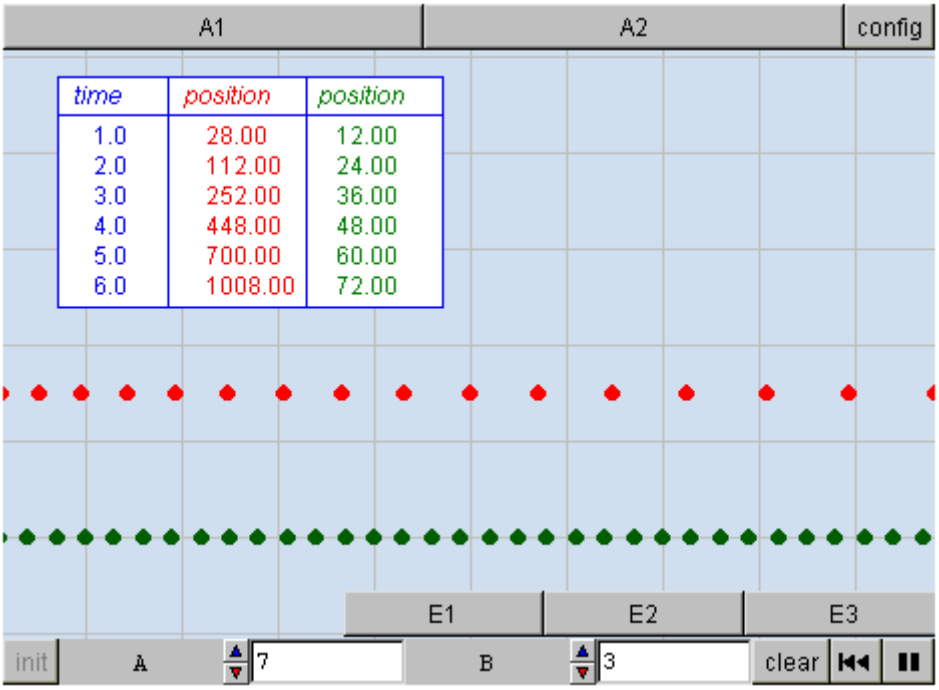
A1: ...By changing the value of A it is possible to observe the speed at which the bodies vary their movement.

E1: ...you can calculate the velocity of A and B. For example, when A equals 4, its speed is... m/s. When B equals 4 its speed is... m/s

3.1 Varied movements. How fast is it going?

It is difficult to answer this question in the case of a varied movement. We can say that it is going faster and faster.

The tracks tell us a lot about the movement of bodies; the data tables tell us much more.



A1: ...If you vary the values of A and B you will observe how the distances are modified between two consecutive dots on the tracks...

A2: ...When the values of A and B are modified, you can observe how the distances covered per second vary.

E1: ...The colour of the body that moves faster and faster is ...

E2: ...The distance covered by A after the first second... The distance covered in the second second is... The distance covered... The...

E3: ...The distance covered by B after the first second... The distance covered in the second second is... The distance covered... The...

4.1 Vectors

Velocity is often represented by an arrow called a **vector** pointing in the direction of the movement. The drawn arrow obeys the following rules:

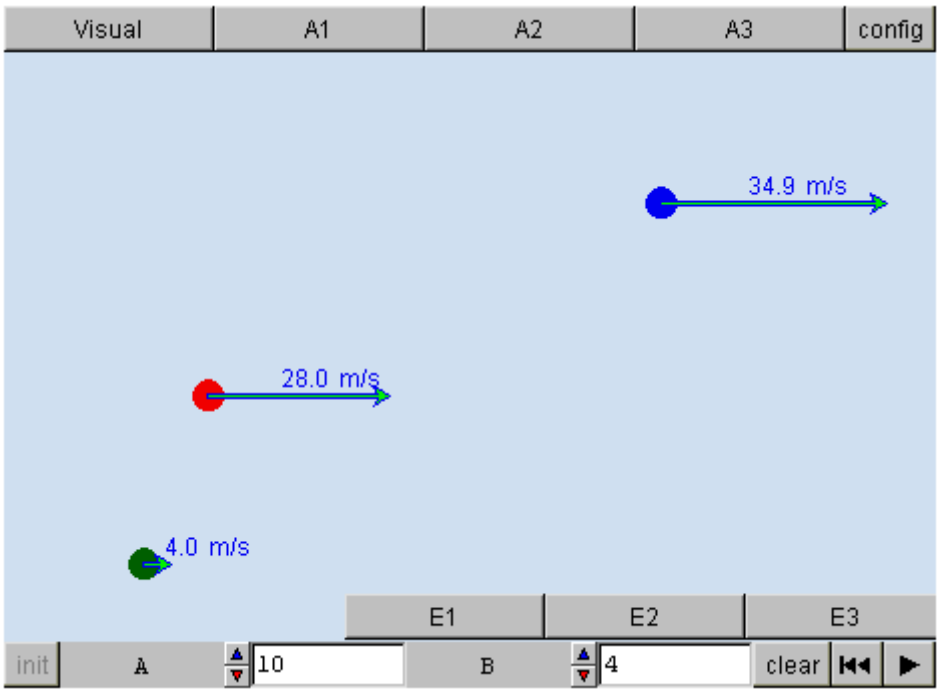
How to represent a vector	
Where is it drawn?	On the moving body
How long	To scale. The greater the speed, the longer

is it?	the vector	
What shape is it?	It is always straight	If the movement is rectilinear, it is on the straight line of the movement If the movement is curvilinear it is a tangent to the trajectory
Where does the arrow point?	In the direction of the movement	

Velocity is represented by a vector, speed by a number (which can be positive or negative).

4.1.1 Vectors

Velocity is represented by a **vector**, speed by a **number** (which can be positive or negative).



VISUAL: ...Press the init button frequently to pause the visual.

A1: ...You can find out what letter controls the movement of each body.

A2: ...You can observe what B controls.

A3: You can see what A controls.

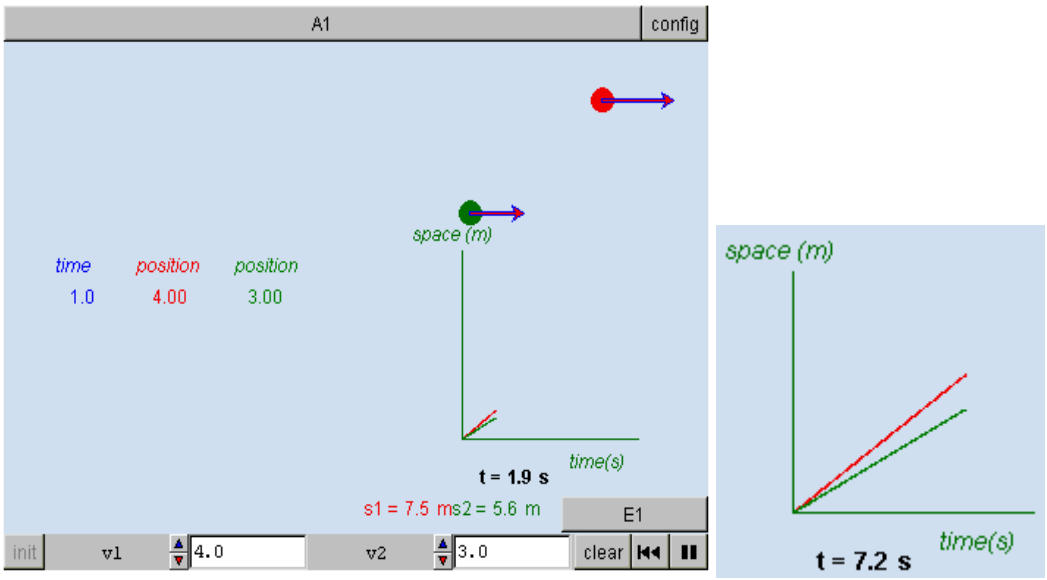
E1: The blue ball's movement is... The red ball's movement is.... The green ball's movement is...

E2: When B=10: The green ball enters the visual at a velocity of... m/s. The red ball enters at ... m/s. The blue ball... enters at a velocity of ... m/s.

E3: It initially moves as... and after that...

4.2 Tables and graphs of Uniform Movements

When space is represented versus time in Uniform Movements the graphs are straight lines.

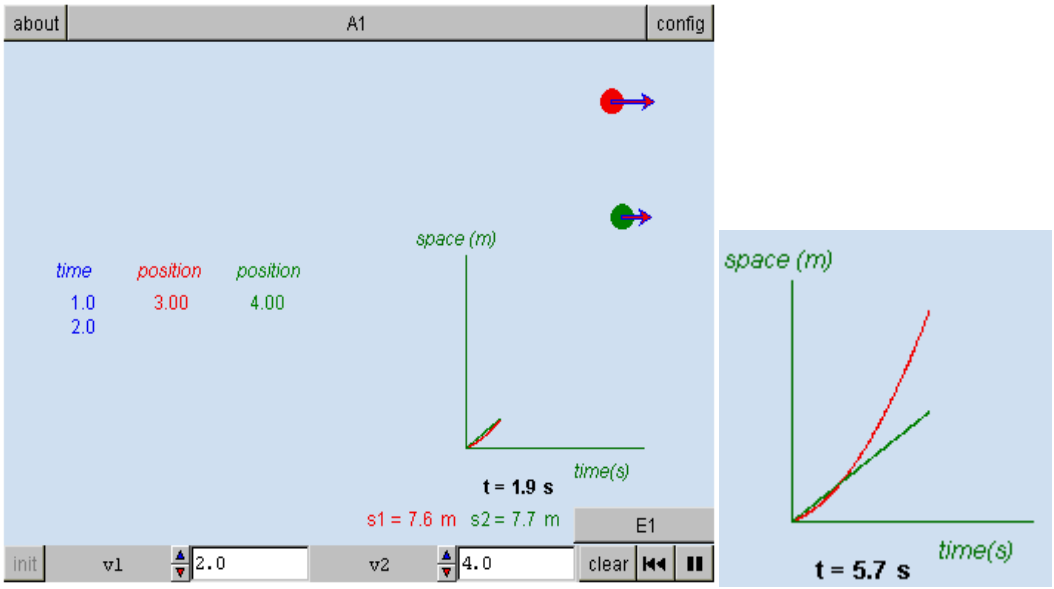


A1: Try to make the graphs as separated as possible.

E1: When the velocity increases? When does the velocity vary?

4.3 Tables and graphs of Varied Movements

In varied movements s/t graphs are curved. If the curves are parabolas, it is a uniformly accelerated movement.



A1: Modify the values of v1 and v2. Observe the corresponding changes in the data tables and graphs. Pause frequently.

E1: Do the average velocities of the two bodies vary in time? What is this variation like?

Evaluation

Do you know how to classify bodies according to their movements?

Do you know what a trajectory is ? How do we represent movements? What is a uniform movement? What is an accelerated movement?

Do you know what a vector is, what a data table is, how time graphs are represented and what shape s/t and v/t graphs are?

Find out what you know at **Evaluation**

1 If we modify control A in the visual **1.1.3**:

- [ ] All the movements can be made rectilinear
- [ ] All the movements can be made uniform
- [ ] All the movements can be made curvilinear
- [ ] All the movements can be made varied

2 At the start of the visual **1.1.3**, the only bodies in uniform motion are:

- [ ] The blue one and the purple one
- [ ] The red one and the black one
- [ ] The black one and the purple one
- [ ] The blue one, the black one and the purple one
- [ ] The red one and the green one

3 In the visual **4.2**, the greater the slope of the straight line:

- [ ] the longer it takes to stop
- [ ] the higher the speed of the body
- [ ] the lower the speed of the body
- [ ] the less time it takes to stop

4 The space-time graph of a uniformly accelerated movement is

- [ ] any type of curve
- [ ] a parabola
- [ ] a straight line
- [ ] either a parabola or a straight line

5 When A is equal to 5, what is the speed of the green body in the visual **2.2**?

- [ ] 5.04 m/s
- [ ] 12.6 m/s
- [ ] 1.26 m/s
- [ ] 50.4 m/s

6 Only one of the following statements about the visual **2.2** is TRUE:

- [ ] The velocity of the red body remains constant
- [ ] The velocity of the green body remains constant
- [ ] The green body is going faster and faster
- [ ] The blue body displays a uniform movement

7 Movements of bodies can be classified according to their trajectory as:

- [ ] rectilinear, curvilinear, accelerated and uniform
- [ ] rectilinear and curvilinear
- [ ] accelerated, decelerated and uniform

8 Only one of the following statements about what happens when this visual **1.2.2** is loaded is true

- [ ] Body number 7 is accelerating
- [ ] Body number 5 displays a circular movement
- [ ] Body number 7 displays a circular movement
- [ ] Body number 6 displays a decelerated movement

9 The fastest moving body in the visual **2.4** is body number:

- [ ] 4
- [ ] 2
- [ ] 1
- [ ] 3
- [ ] 5

10 Only one of the following statements about the visual **3.1** is correct

- [ ] The green body covers equal distances in equal time intervals
- [ ] The red body covers less and less distance as time passes
- [ ] The red body covers the same distance in equal time intervals
- [ ] The green body covers more and more distance in the same amount of time

11 Body B enters the visual **4.1.1** at:

- [ ] less than 25 m/s
- [ ] at more than 30 m/s
- [ ] more than 40 m/s
- [ ] less than 10 m/s

12 If a body moves at a speed of 2 m/s as in the visual **2.3**, then:

- [ ] In 1 second it covers 1 m
- [ ] In half a second it covers 4m
- [ ] In half a second it covers 1 m
- [ ] In 2 seconds it covers 3 m

13 Which of the following statements about the movement of bodies is FALSE?

- [ ] In uniform movements, speed can vary
- [ ] In uniform movements, bodies always have the same speed
- [ ] In decelerated movements, speed varies
- [ ] In varied movements, speed varies

14 When A is equal to 5, what is the speed of the red body in m/s in the visual **2.2**?

- [ ] 12.6 m/s
- [ ] 10 m/s
- [ ] 1.26 m/s
- [ ] 25.1 m/s
- [ ] 100 m/s
- [ ] 2.51 m/s

15 The space-time graph of a uniform movement is

- [ ] a straight line
- [ ] a parabola
- [ ] either a parabola or a straight line
- [ ] any type of curve