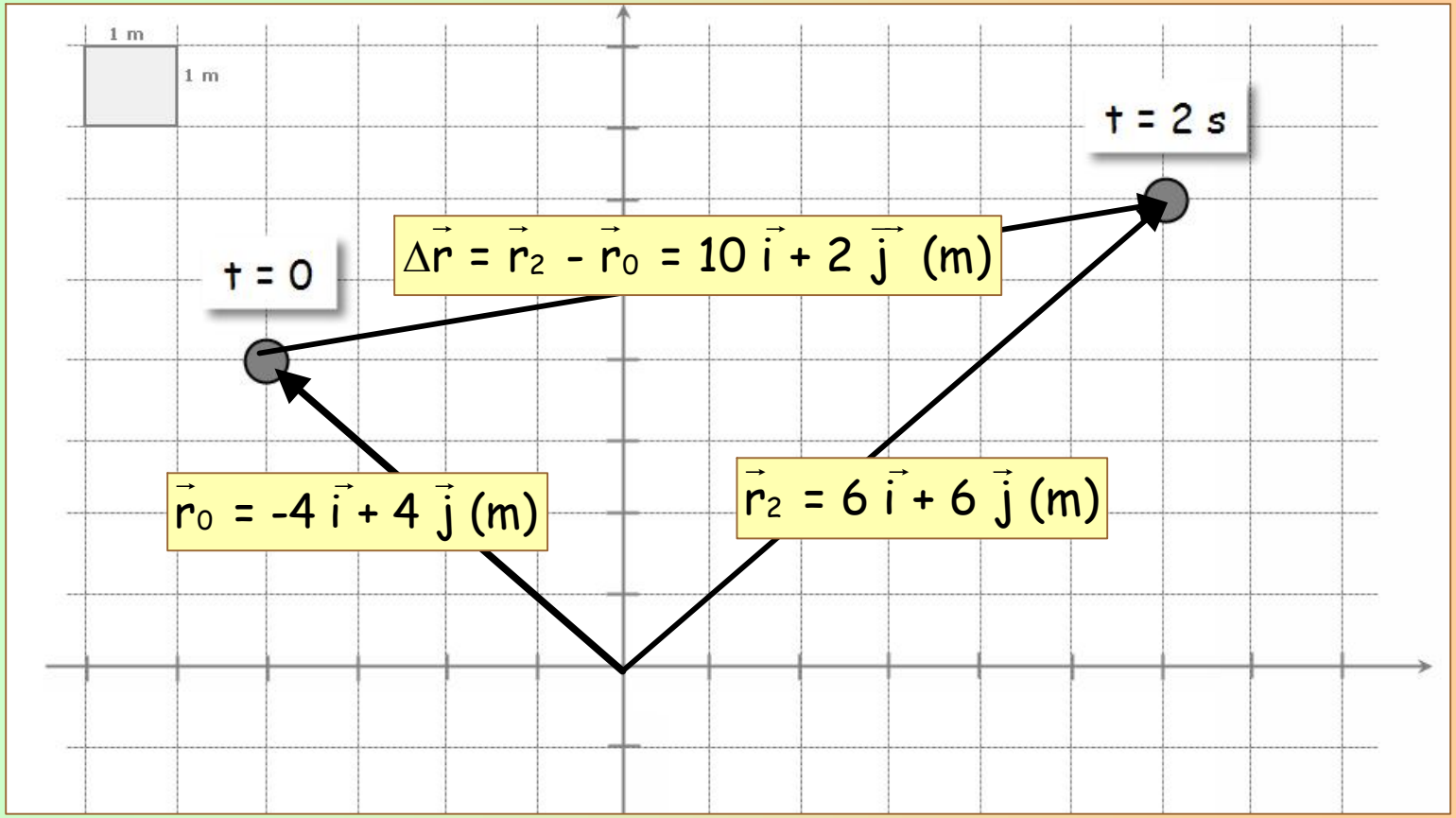
Rafa Muñoa
Lizardi Institutua
Zarautz

Kinematics

EXERCISE #1

The body moves at constant velocity.

1) Draw and write the expressions of: $\vec{r}_0$, $\vec{r}_2$, $\Delta\vec{r}$
2) Write the equation of the position vector
3) Determine the position of the body at t = 2.25 s
4) Draw the velocity and write its expression
5) Determine the modulus and angle of velocity



Rafa Muñoa
Lizardi Institutua
Zarautz

Kinematics

EXERCISE #1

The body moves at constant velocity.

1) Draw and write the expressions of: $\vec{r}_0$, $\vec{r}_2$, $\Delta\vec{r}$
2) Write the equation of the position vector
3) Determine the position of the body at t = 2.25 s
4) Draw the velocity and write its expression
5) Determine the modulus and angle of velocity

2) Equation of the position vector

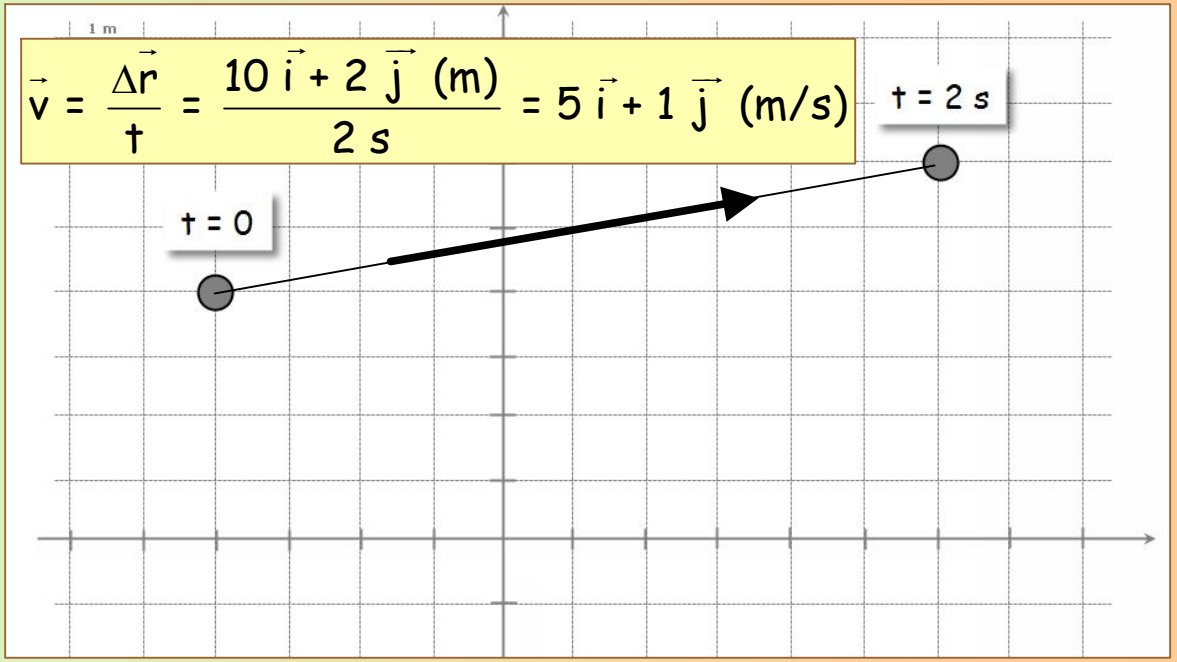
$$\vec{r} = (-4 + 5\,t)\,\vec{i} + (4 + t)\,\vec{j}\ (m)$$

3) Position at t = 2,25 s

$$\vec{r}_{\,t=2.25\,s} = 7.25\,\vec{i} + 6.25\,\vec{j}\ (m)$$

4) Expression of velocity

$$\vec{v} = \frac{\Delta\vec{r}}{t} = \frac{10\,\vec{i} + 2\,\vec{j}\ (m)}{2\ s} = 5\,\vec{i} + 1\,\vec{j}\ (m/s)$$



5) Modulus and angle of velocity

$$\left|\vec{v}\right| = \sqrt{5^2 + 1} = 5.1\ m/s$$

$$\alpha = \tan^{-1}\frac{1}{5} = 11.3\ °$$

Rafa Muñoa
Lizardi Institutua
Zarautz

Kinematics

EXERCISE #2

The body moves at constant velocity.

1) Draw and write the expressions of: $\vec{r}_0, \vec{r}_4, \Delta\vec{r}$
2) Write the equation of the position vector
3) Determine the position of the body at t = 3 s
4) Draw the velocity and write its expression
5) Determine the modulus and angle of velocity

2) Equation of the position vector

$$\vec{r} = (4 - 2\,t)\,\vec{i} + (1.25\,t)\,\vec{j}\ (m)$$

3) Position at t = 3 s

$$\vec{r}_{\,t=3\,s} = -2\,\vec{i} + 3.75\,\vec{j}\ (m)$$

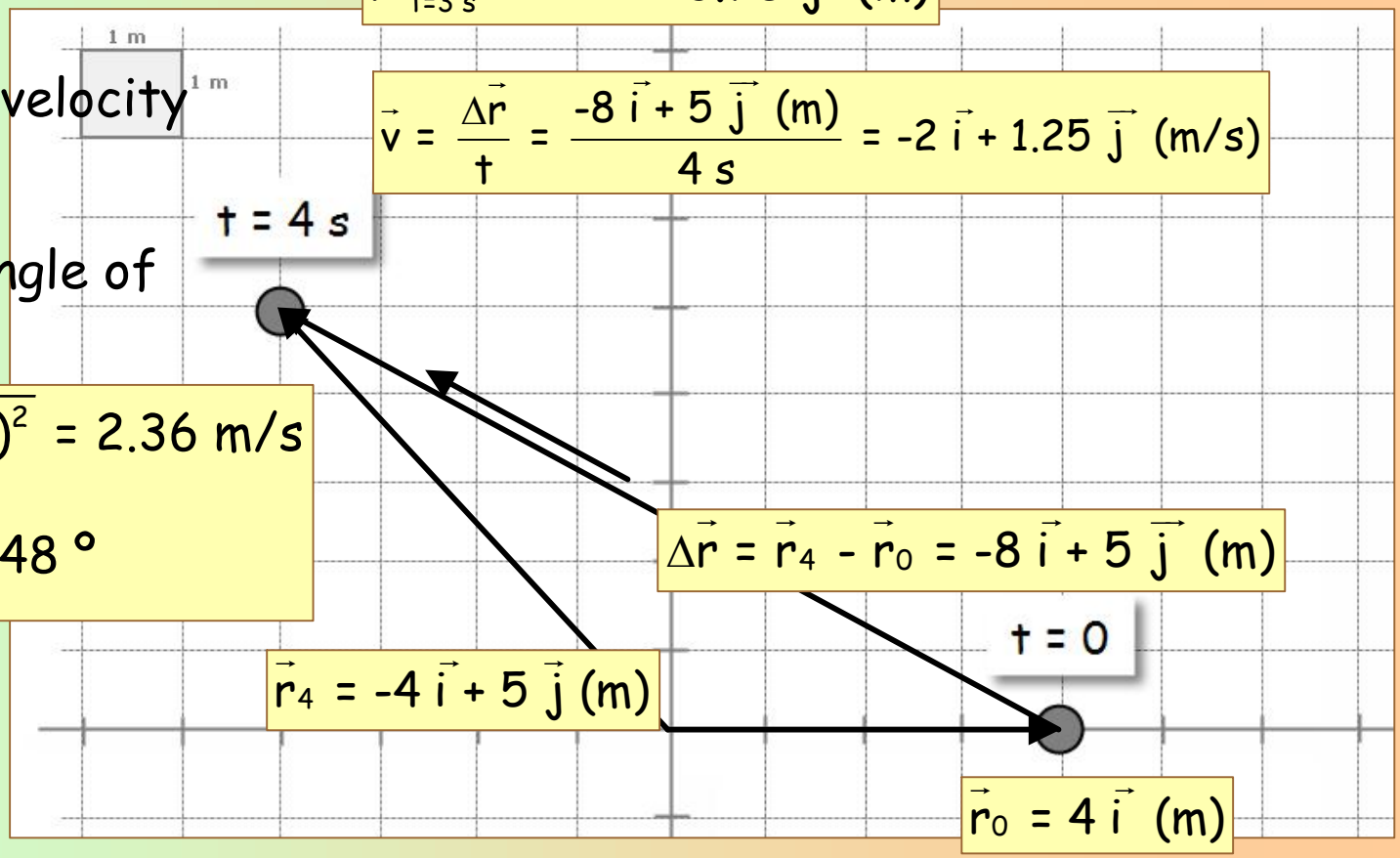
4) Expression of velocity

$$\vec{v} = \frac{\Delta\vec{r}}{t} = \frac{-8\,\vec{i} + 5\,\vec{j}\ (m)}{4\ s} = -2\,\vec{i} + 1.25\,\vec{j}\ (m/s)$$

5) Modulus and angle of velocity

$$|\vec{v}| = \sqrt{(-2)^2 + (1.25)^2} = 2.36\ m/s$$

$$\alpha = \tan^{-1}\frac{1.25}{-2} = 148\ °$$



Rafa Muñoa
Lizardi Institutua
Zarautz

Kinematics

EXERCISE #3

The body moves at constant velocity

1) Write the equation of the position vector
2) Determine the position of the body at t = 3 s
3) Determine the vertical position of the body when its horizontal position is x = 10 (m).
4) Determine the modulus and angle of velocity

1) Equation of the position vector

$$\vec{r} = (-4 + 3\,t)\,\vec{i} + t\,\vec{j}\ \text{(m)}$$

2) Position at t = 3 s

$$\vec{r}_{\,t=3\,s} = 5\,\vec{i} + 3\,\vec{j}\ \text{(m)}$$

3) Vertical position

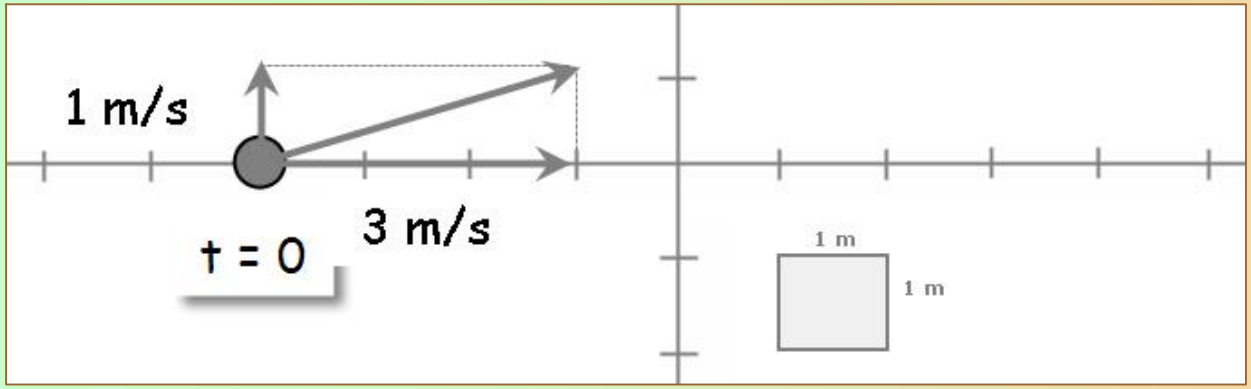
$$x = -4 + 3\,t = 10 \rightarrow t = 14 / 3 = 4.67\ s$$

$$y = t \rightarrow y = 4.67\ \text{(m)}$$

4) Modulus and angle of velocity

$$\left|\vec{v}\right| = \sqrt{(3)^2 + (1)^2} = 3.16\ \text{m/s}$$

$$\alpha = \tan^{-1}\frac{1}{3} = 18.4\ ^{\circ}$$



Rafa Muñoa
Lizardi Institutua
Zarautz

Kinematics

EXERCISE #4

The motion is accelerated.

1) Write the expression of the initial velocity, final velocity, change in velocity and acceleration.
2) Draw the previous magnitudes
3) Write the equation of the velocity.
4) Determine the velocity when t = 2.5 s

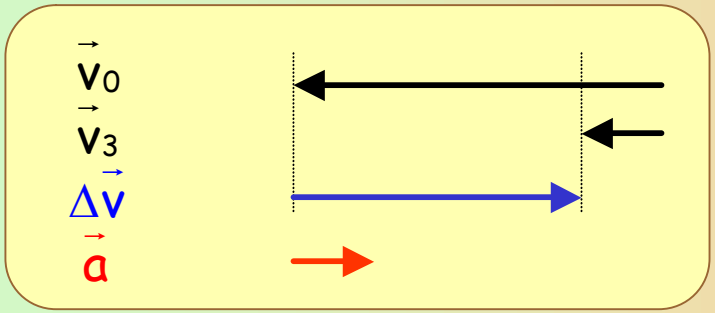
1) Expressions

$\vec{v}_0 = -5\,\vec{i}$ (m/s); $\vec{v}_3 = -\,\vec{i}$ (m/s)

$\Delta\vec{v} = \vec{v}_3 - \vec{v}_0 = 4\,\vec{i}$ (m/s)

$$\vec{a} = \frac{\Delta\vec{v}}{t} = 1.33\,\vec{i}\ (m/s^2)$$

2) Graphic

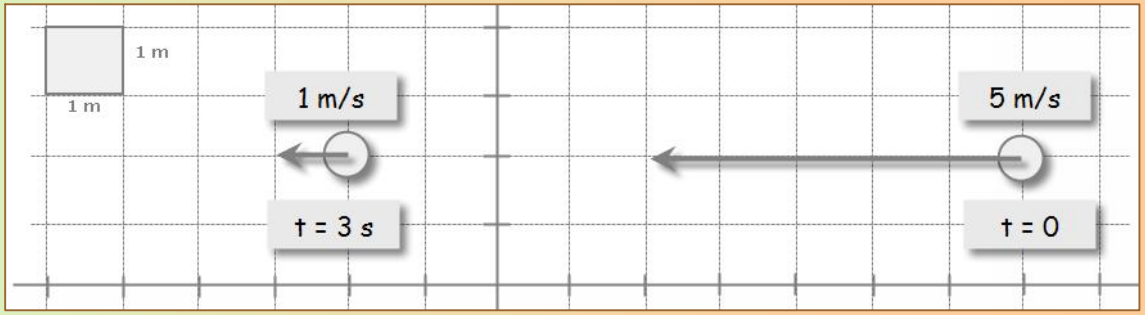


3) Expression of velocity

$\vec{v} = (-5 + 1.33\,t)\,\vec{i}$ (m/s)

4) Velocity at t = 2.5 s

$\vec{v} = -1.68\,\vec{i}$ (m/s)



Rafa Muñoa
Lizardi Institutua
Zarautz

Kinematics

EXERCISE #5

The motion is accelerated

1) Write the expression of the initial velocity, final velocity, change in velocity and acceleration.
2) Draw the previous magnitudes

1) Expressions

$\vec{v}_0 = 20\,\vec{i}$ (m/s); $\vec{v}_3 = 20\,\vec{i} - 30\,\vec{j}$ (m/s)

$\Delta\vec{v} = \vec{v}_3 - \vec{v}_0 = -30\,\vec{j}$ (m/s)

$\vec{a} = \dfrac{\Delta\vec{v}}{t} = -10\,\vec{j}$ (m/s^2)

2) Graphic