Rafa Muñoa
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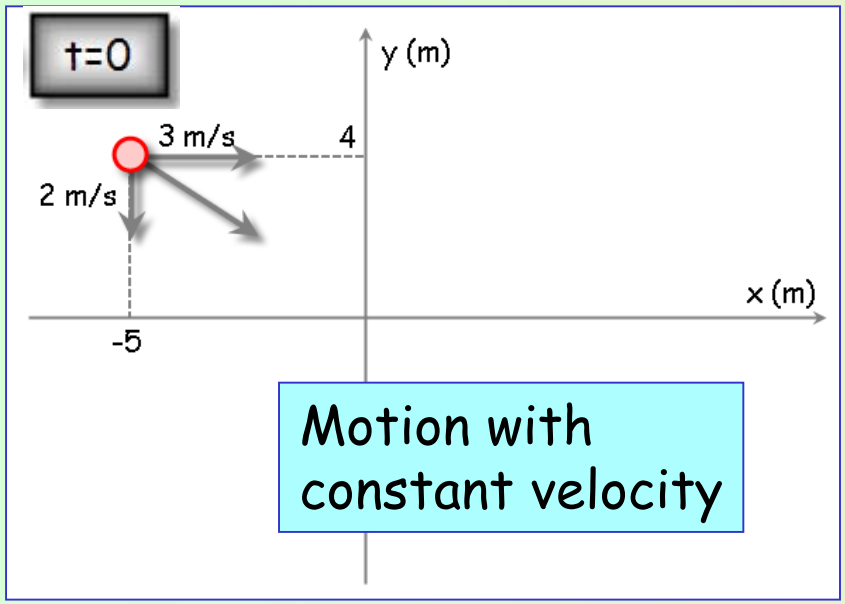
Kinematics: Equations

	Equation of position vector	Equation of velocity
General expressions	$\vec{r} = (x_0 + v_{0x} * t + \frac{1}{2} * a_x * t^2)\vec{i} + (y_0 + v_{0y} * t + \frac{1}{2} * a_y * t^2)\vec{j}$	$\vec{v} = (v_{0x} + a_x * t)\vec{i} + (v_{0y} + a_y * t)\vec{j}$

Write the equations for this particular motion, and determine the position and velocity when t=2.25 s:



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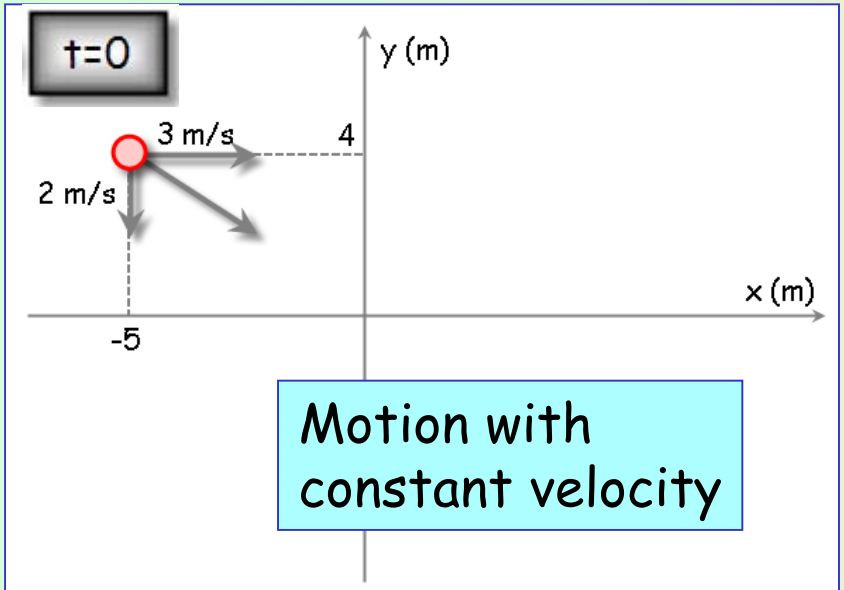


Motion with constant velocity

Solution:

The equations:

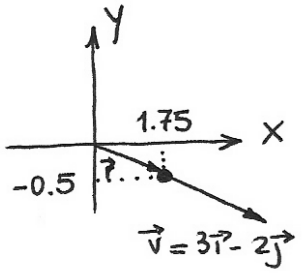
$\vec{r} = (-5 + 3t)\vec{i} + (4 - 2t)\vec{j}$ (m)

$\vec{v} = 3\vec{i} - 2\vec{j}$ (m/s)

When $t = 2.25$ s

$\vec{r} = 1.75\vec{i} - 0.5\vec{j}$ (m)

$\vec{v} = 3\vec{i} - 2\vec{j}$ (m/s)



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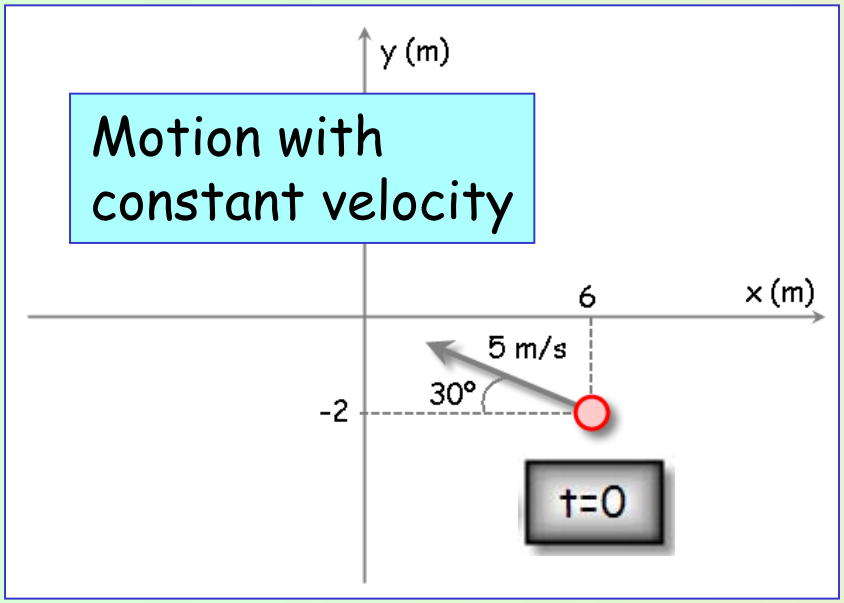
Kinematics: Equations

	Equation of position vector	Equation of velocity
General expressions	$\vec{r} = (x_0 + v_{0x} * t + \frac{1}{2} * a_x * t^2)\vec{i} + (y_0 + v_{0y} * t + \frac{1}{2} * a_y * t^2)\vec{j}$	$\vec{v} = (v_{0x} + a_x * t)\vec{i} + (v_{0y} + a_y * t)\vec{j}$

Write the equations for this particular motion, and determine the position and velocity when t=1.5 s:



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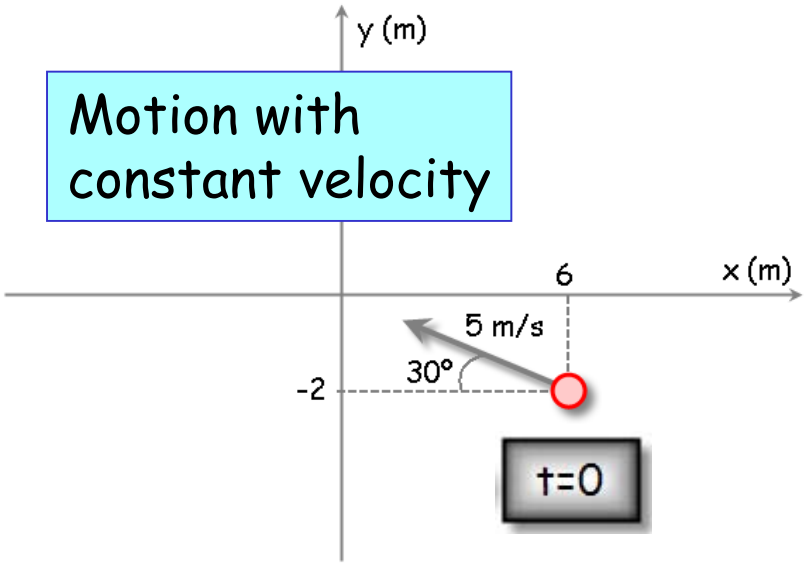
Kinematics: Equations

	Equation of position vector	Equation of velocity
General expressions	$\vec{r} = (x_0 + v_{0x} * t + \frac{1}{2} * a_x * t^2)\vec{i} + (y_0 + v_{0y} * t + \frac{1}{2} * a_y * t^2)\vec{j}$	$\vec{v} = (v_{0x} + a_x * t)\vec{i} + (v_{0y} + a_y * t)\vec{j}$

Write the equations for this particular motion, and determine the position and velocity when t=1.5 s:



Solution:

The equations:

$\vec{r} = (6 - 4.3\,t)\vec{i} + (-2 + 2.5\,t)\vec{j}$ (m)

$v_x = 5\frac{m}{s} \times \cos 30° \times (-1) = -4.3\frac{m}{s}$

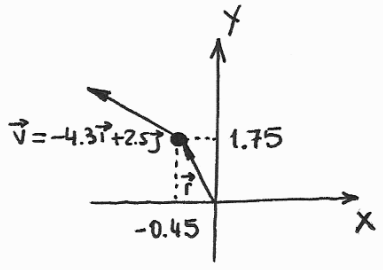
$v_y = 5\frac{m}{s} \times \sin 30° = 2.5\frac{m}{s}$

$\vec{v} = -4.3\,\vec{i} + 2.5\,\vec{j}$ (m/s)

When $t = 1.5$ s

$\vec{r} = -0.45\,\vec{i} + 1.75\,\vec{j}$ (m)

$\vec{v} = -4.3\,\vec{i} + 2.5\,\vec{j}$ (m/s)



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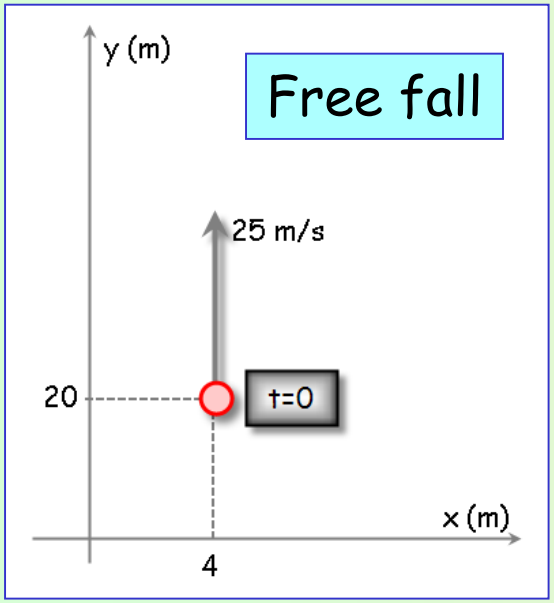
Kinematics: Equations

	Equation of position vector	Equation of velocity
General expressions	$\vec{r} = (x_0 + v_{0x} * t + \frac{1}{2} * a_x * t^2)\,\vec{i} + (y_0 + v_{0y} * t + \frac{1}{2} * a_y * t^2)\,\vec{j}$	$\vec{v} = (v_{0x} + a_x * t)\,\vec{i} + (v_{0y} + a_y * t)\,\vec{j}$

Write the equations for this particular motion, and determine the position and velocity when t=1.5 s:



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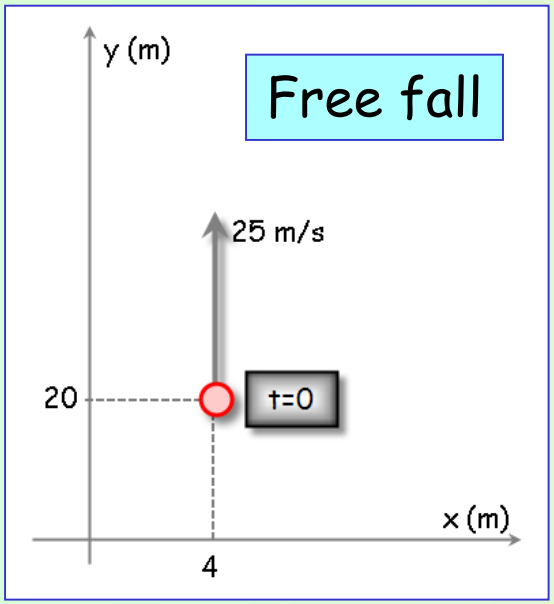
Kinematics: Equations

	Equation of position vector	Equation of velocity
General expressions	$\vec{r} = (x_0 + v_{0x} * t + \frac{1}{2} * a_x * t^2)\vec{i} + (y_0 + v_{0y} * t + \frac{1}{2} * a_y * t^2)\vec{j}$	$\vec{v} = (v_{0x} + a_x * t)\vec{i} + (v_{0y} + a_y * t)\vec{j}$

Write the equations for this particular motion, and determine the position and velocity when t=1.5 s:



Solution:

The equations:

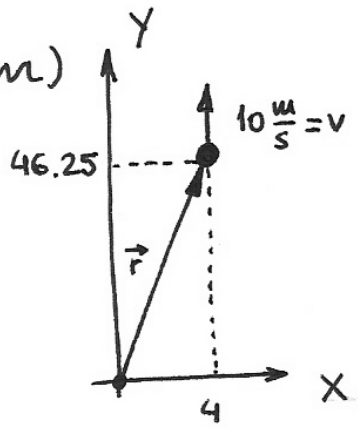
$\vec{r} = 4\vec{i} + (20 + 25t - 5t^2)\vec{j}$ (m)

$\vec{v} = (25 - 10t)\vec{j}$ (m/s)

When $t = 1.5$ s

$\vec{r} = 4\vec{i} + 46.25\vec{j}$ (m)

$\vec{v} = 10\vec{j}$ (m/s)



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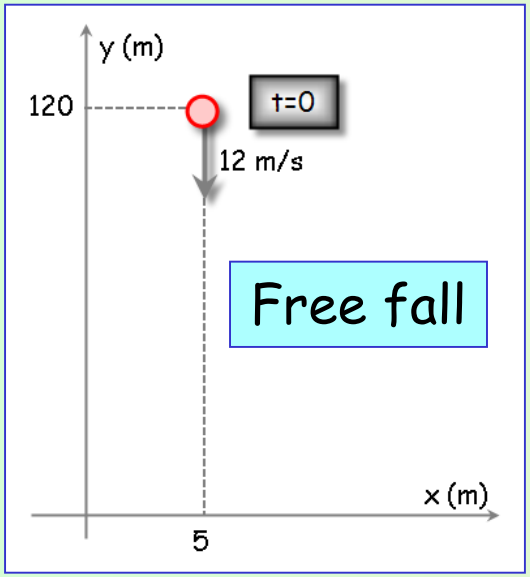
Kinematics: Equations

	Equation of position vector	Equation of velocity
General expressions	$\vec{r} = (x_0 + v_{0x} * t + \frac{1}{2} * a_x * t^2)\,\vec{i} + (y_0 + v_{0y} * t + \frac{1}{2} * a_y * t^2)\,\vec{j}$	$\vec{v} = (v_{0x} + a_x * t)\,\vec{i} + (v_{0y} + a_y * t)\,\vec{j}$

Write the equations for this particular motion, and determine the position and velocity when t=2 s:



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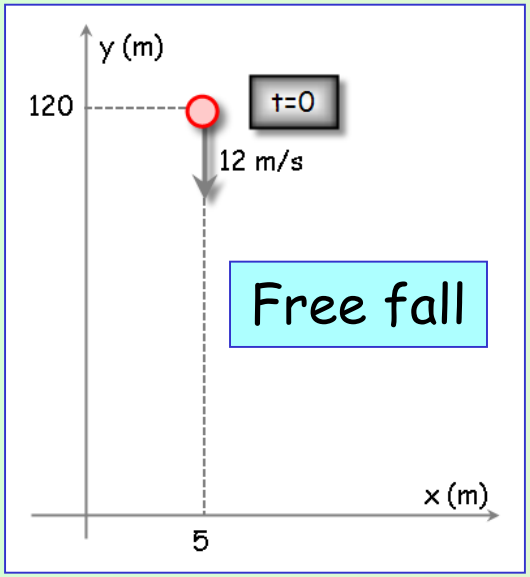
Kinematics: Equations

	Equation of position vector	Equation of velocity
General expressions	$\vec{r} = (x_0 + v_{0x} * t + \frac{1}{2} * a_x * t^2)\vec{i} + (y_0 + v_{0y} * t + \frac{1}{2} * a_y * t^2)\vec{j}$	$\vec{v} = (v_{0x} + a_x * t)\vec{i} + (v_{0y} + a_y * t)\vec{j}$

Write the equations for this particular motion, and determine the position and velocity when t=2 s:



Solution:

The equations:

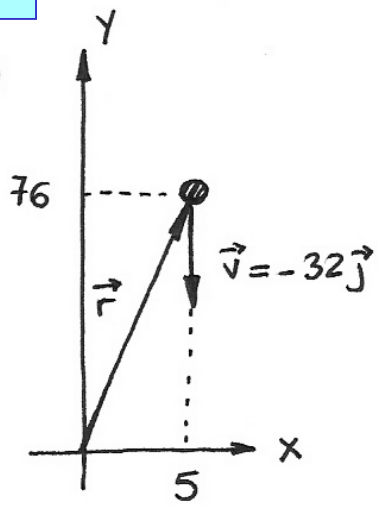
$\vec{r} = 5\vec{i} + (120 - 12t - 5t^2)\vec{j}$ (m)

$\vec{v} = (-12 - 10t)\vec{j}$ (m/s)

When t = 2s:

$\vec{r} = 5\vec{i} + 76\vec{j}$ (m)

$\vec{v} = -32\vec{j}$ (m/s)



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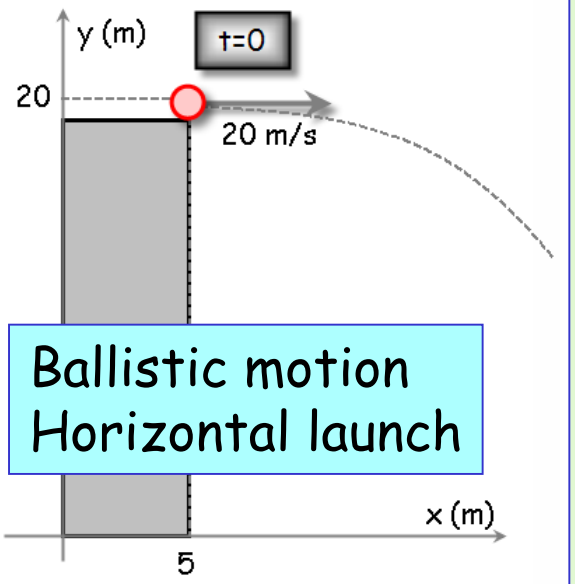
Kinematics: Equations

	Equation of position vector	Equation of velocity
General expressions	$\vec{r} = (x_0 + v_{0x} * t + \frac{1}{2} * a_x * t^2)\,\vec{i} + (y_0 + v_{0y} * t + \frac{1}{2} * a_y * t^2)\,\vec{j}$	$\vec{v} = (v_{0x} + a_x * t)\,\vec{i} + (v_{0y} + a_y * t)\,\vec{j}$

Write the equations for this particular motion, and determine the position and velocity when t=1 s:



Ballistic motion
Horizontal launch

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Kinematics: Equations

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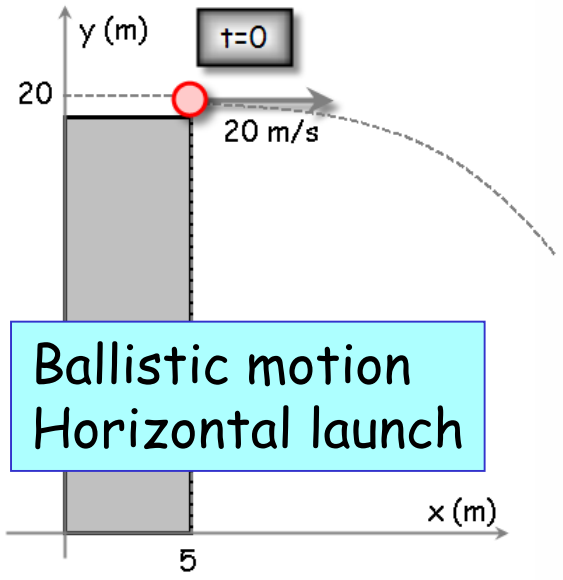
Write the equations for this particular motion, and determine the position and velocity when t=1 s:



Ballistic motion
Horizontal launch

Solution:

The equations:

$\vec{r} = (5 + 20\,t)\vec{i} + (20 - 5t^2)\vec{j}$ (m)

$\vec{v} = 20\,\vec{i} - 10\,t\,\vec{j}$ (m/s)

When t = 1s:

$\vec{r} = 25\,\vec{i} + 15\,\vec{j}$ (m)

$\vec{v} = 20\,\vec{i} - 10\,\vec{j}$ (m/s)