

# CINEMÁTICA

21) página 44 (20, pág. 38, según libro antiguo).

moto	policía	
$s_1 = 20t$		
$s_1 = 20 \cdot 10$	$s_2 = 1,5t^2$	
$s_1 = 200 \text{ m}$	$v_2 = 3t$	$s_1 = 200 + 20(t - 10)$
	$s_2 = 1,5 \cdot 10^2$	$s_2 = 150 + 30(t - 10)$
	$s_2 = 150 \text{ m}$	

$$s_1 = s_2 \implies 200 + 20(t - 10) = 150 + 30(t - 10) \implies 200 + 20t - 200 = 150 + 30t - 300$$

$$10t = 150 \implies \boxed{t = 15 \text{ s}}$$

$$s_1 = 200 + 20(15 - 10) \implies \boxed{s_1 = 300 \text{ m}}$$

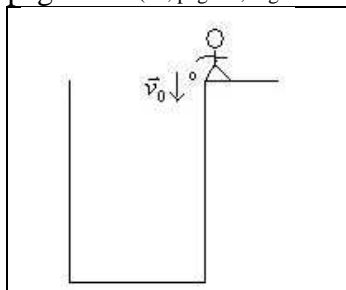
Se detienen (mrua):

$$\begin{array}{lll} \Delta s_1 = 20t + \frac{1}{2}a_1t^2 & v_1 = 20 + a_1t & 0 = 20 + a_1t \\ \Delta s_2 = 30t + \frac{1}{2}a_2t^2 & v_2 = 30 + a_2t & 0 = 30 + a_2t \end{array} \implies t = -\frac{20}{a_1} = -\frac{30}{a_2}$$

$$100 = 20\left(-\frac{20}{a_1}\right) + \frac{1}{2}a_1\left(-\frac{20}{a_1}\right)^2 = -\frac{400}{a_1} + \frac{200}{a_1} = -\frac{200}{a_1} \implies \boxed{a_1 = -2 \text{ m/s}^2}$$

$$100 = 30\left(-\frac{30}{a_2}\right) + \frac{1}{2}a_2\left(-\frac{30}{a_2}\right)^2 = -\frac{900}{a_2} + \frac{450}{a_2} = -\frac{450}{a_2} \implies \boxed{a_2 = -4,5 \text{ m/s}^2}$$

23) página 46 (22, pág. 40, según libro antiguo).



Piedra	Sonido
$\Delta h = -5t_1^2$	
$v = -10t_1$	$-\Delta h = 340(3 - t_1)$
	$-5t_1^2 = -340(3 - t_1)$

$$5t_1^2 + 340t_1 - 1020 = 0 \implies t_1^2 + 68t_1 - 240 = 0$$

$$t_1 = \frac{-68 \pm \sqrt{68^2 + 816}}{2} = \frac{-68 \pm 73,8}{2} \implies t_1 = \frac{5,8}{2} \implies \boxed{t_1 = 2,88 \text{ s}}$$

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$$\Delta h = -5 \cdot 2,88^2 \implies \Delta h = -41,5 \text{ m}$$

**Cuestión de decimales.**

$$\Delta h = -340(3 - 2,88) \implies \Delta h = -40,8 \text{ m}$$

26) página 53.

$$\begin{array}{c} \text{mru} \\ \hline \Delta t = 0,3 \text{ s} \end{array}$$

$$\Delta s_1 = 33,3t$$

$$\Delta s_1 = 33,3 \cdot 0,3$$

$$\Delta s_1 = 10 \text{ m}$$

$$\begin{array}{c} \text{mrua} \\ \hline \end{array}$$

$$\Delta s_2 = 33,3t + \frac{a}{2}t^2$$

$$v = 33,3 + at$$

$$\Delta s_1 + \Delta s_2 = 112 \text{ m}$$

$$0 = 33,3 + at \implies t = -\frac{33,3}{a}$$

$$10 + \Delta s_2 = 112 \implies \Delta s_2 = 102 \text{ m}$$

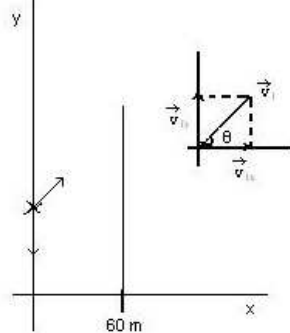
$$102 = 33,3\left(-\frac{33,3}{a}\right) + \frac{a}{2}\left(-\frac{33,3}{a}\right)^2 \implies 102 = \frac{33,3^2}{2a} - \frac{33,3^2}{a} \implies 2a \cdot 102 = 33,3^2 - 2 \cdot 33,3^2$$

$$204a = -1110 \implies \boxed{a = -5,4 \text{ m/s}^2}$$

$$t = \frac{-33,3}{-5,4} \implies t = 6,2 \text{ s}$$

$$t_{(total)} = 6,2 + 0,3 \implies \boxed{t_{(total)} = 6,5 \text{ s}}$$

27) página 71.



a)  $v_{1x} = 2,5 \cos \theta$   
 $v_{1y} = 2,5 \sin \theta$

eje x  $\{ x = 2,5t \cos \theta$   
 (mru)

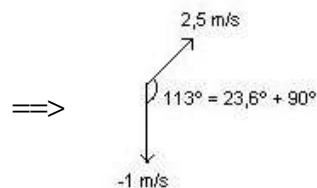
eje y  $\{ y = (2,5 \sin \theta - 1)t$   
 (mru)

Cuando la barca llega a la otra orilla:  $x = 60 \text{ m}$  e  $y = 0 \text{ m}$

$$60 = 2,5t \cos \theta \implies t = \frac{24}{\cos \theta}$$

$$0 = (2,5 \sin \theta - 1)t \implies 0 = (2,5 \sin \theta - 1) \frac{24}{\cos \theta}$$

$$\text{Soluciones} \left\{ \begin{array}{l} 0 = 2,5 \sin \theta - 1 \implies \theta = 23,6^\circ \\ 0 = \frac{24}{\cos \theta} \implies \text{no tiene solución} \end{array} \right\}$$



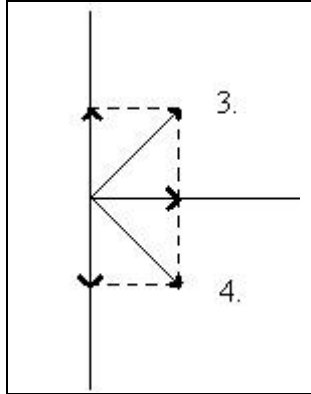
b)  $t = \frac{24}{\cos 23,6^\circ} \implies t = 26,19 \text{ s}$

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31)  $y_0 = 7 \text{ m}$   $v_0 = 10 \text{ m/s}$

1.  $y = 7 + 10t - 5t^2$   
 $v = 10 - 10t$

2.  $y = 7 - 10t - 5t^2$   
 $v = -10 - 10t$

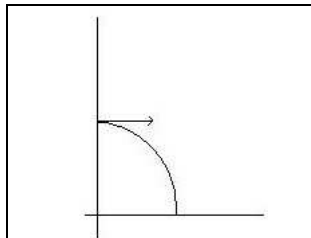


$v_{03x} = 10 \cos 30^\circ = v_{04x}$   
 $v_{03x} = v_{04x} = 8,7 \text{ m/s}$

3.  $x = 8,7t$   
 $y = 7 + 5t - 5t^2$   
 $v_y = 5 - 10t$

$v_{03y} = 10 \sin 30^\circ = -v_{04y}$   
 $v_{03y} = 5 \text{ m/s} = -v_{04y}$

4.  $x = 8,7t$   
 $y = 7 - 5t - 5t^2$   
 $v_y = -5 - 10t$



5.  $v_x = v_{0x} = 10 \text{ m/s}$   
 $x = 10t$   
 $y = 7 - 5t^2$   
 $v_y = -10t$

$v_{0y} = 0 \text{ m/s}$

31) página 71.

a) En el suelo:  $y = 0 \text{ m}$ .

1.  $0 = 5t^2 - 10t - 7$

$t = \frac{10 \pm \sqrt{100 + 140}}{10} \implies t_1 = 2,549 \text{ s}$

$v = 10 - 10 \cdot 2,549 \implies \vec{v}_1 = -15,49 \vec{j} \text{ m/s} \implies \boxed{v_1 = 15,49 \text{ m/s}}$

2.  $0 = 5t^2 + 10t - 7$

$t = \frac{-10 \pm \sqrt{100 + 140}}{10} \implies t_2 = 0,549 \text{ s}$

$v = -10 - 10 \cdot 0,549 \implies \vec{v}_2 = -15,49 \vec{j} \text{ m/s} \implies \boxed{v_2 = 15,49 \text{ m/s}}$

3.  $0 = 5t^2 - 5t - 7$

$t = \frac{5 \pm \sqrt{25 + 140}}{10} \implies t_3 = 1,78 \text{ s}$

$v_y = 5 - 10 \cdot 1,78 = -12,8 \text{ m/s} \implies \vec{v}_3 = (8,7 \vec{i} - 12,8 \vec{j}) \text{ m/s} \implies \boxed{v_3 = 15,48 \text{ m/s}}$

4.  $0 = 5t^2 + 5t - 7$

$t = \frac{-5 \pm \sqrt{25 + 140}}{10} \implies t_4 = 0,78 \text{ s}$

$v_y = -5 - 10 \cdot 0,78 = -12,8 \text{ m/s} \implies \vec{v}_4 = (8,7 \vec{i} - 12,8 \vec{j}) \text{ m/s} \implies \boxed{v_4 = 15,48 \text{ m/s}}$

5.  $0 = 5t^2 - 7$

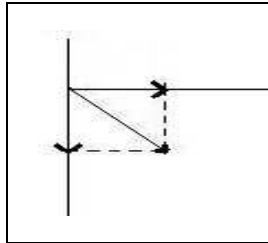
$t_5 = 1,18 \text{ s}$

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$$v_y = -10 \cdot 1,18 = -11,8 \text{ m/s} \implies \vec{v}_5 = (10\vec{i} - 11,8\vec{j}) \text{ m/s} \implies \boxed{v_5 = 15,47 \text{ m/s}}$$

b)  $t_2 = 0,549 \text{ s}; t_4 = 0,78 \text{ s}; t_5 = 1,18 \text{ s}; t_3 = 1,78 \text{ y } t_1 = 2,549 \text{ s}.$

32)



$$v_{0x} = 8 \cos 35^\circ \implies v_{0x} = 6,6 \text{ m/s}$$

$$x = 6,6t$$

$$v_{0y} = -8 \sin 35^\circ \implies v_{0y} = -4,6 \text{ m/s}$$

$$y = 27 - 4,6t - 5t^2$$

$$v_y = -4,6 - 10t$$

a)  $t = \frac{x}{6,6} \quad y = 27 - 4,6\left(\frac{x}{6,6}\right) - 5\left(\frac{x}{6,6}\right)^2 \implies y = 27 - 0,70x - 0,11x^2$

b)  $x_{\text{máx}} \implies y = 0 \text{ m} \implies 5t^2 + 4,6t - 27 = 0$

$$t = \frac{-4,6 \pm \sqrt{21,2 + 540}}{10} \implies t = 1,9 \text{ s c)}$$

$$x = 6,6 \cdot 1,9 \implies x_{\text{máx}} = 12,5 \text{ m (llega al suelo, y no a la pared)}$$

32) página 71.

d)  $v_y = -4,6 - 10 \cdot 1,9 \implies v_y = -23,6 \text{ m/s}$

$$\vec{v} = (6,6\vec{i} - 23,6\vec{j}) \text{ m/s} \implies \boxed{v = 24,5 \text{ m/s}}$$