

## Práctica N° 1: cinemática

Todos los resultados se obtuvieron usando  $g = 10 \frac{m}{s^2}$ .

- 1) a) Por ejemplo: origen en A, es decir,  $x_A = 0$  km y  $t_0$  como el tiempo en el que sale el primer móvil (el móvil 2, que va de B hacia A).
- b)  $\mathbf{v}_1 = (80, 0) \frac{km}{h}$   
 $\mathbf{v}_2 = (-50, 0) \frac{km}{h}$
- c)  $x_1(t) = 0 \text{ km} + 80 \frac{km}{h}(t - 1 \text{ h})$   
 $x_2(t) = 300 \text{ km} - 50 \frac{km}{h}t$   
 $t_e = 2.92 \text{ h} = 2 \text{ h } 55 \text{ min } 12 \text{ s}$
- d) Ver Figura 1.

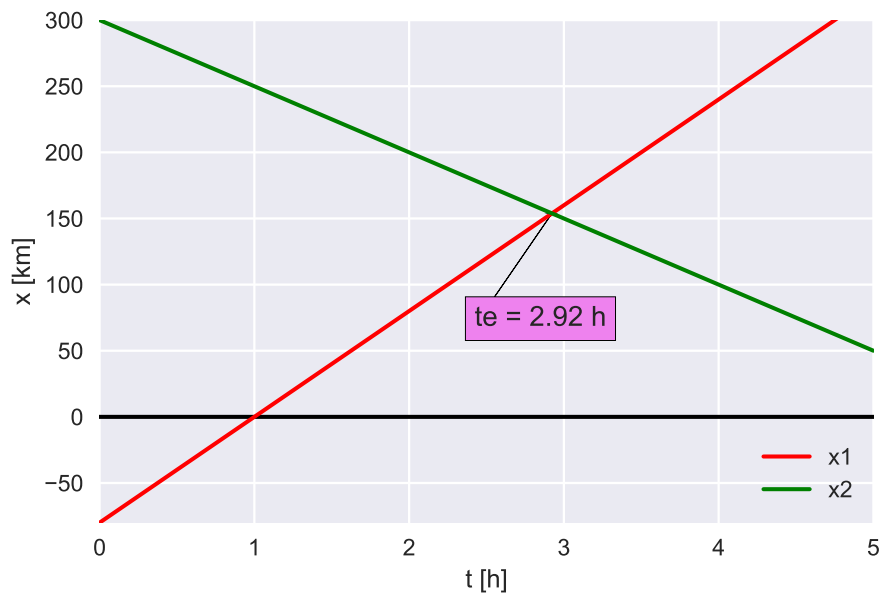


Figura 1: Problema 1.  $x(t)$ .

- e) Ver Figura 2.

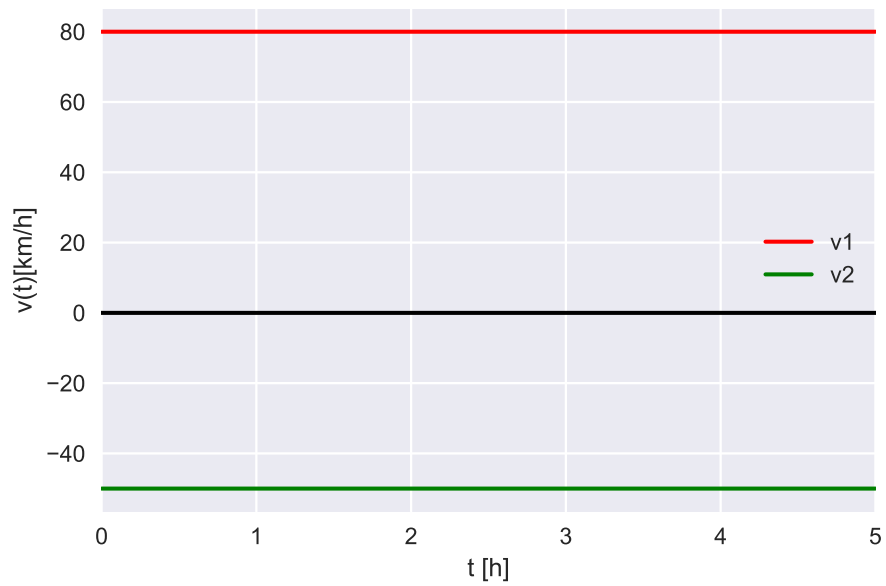


Figura 2: Problema 1.  $v(t)$ .

- 2)  $a = 4.56 \frac{\text{m}}{\text{s}^2}$   
 3) a)  $t_{\text{reposo}} = 10 \text{ s}$ ,  $x(t_{\text{reposo}}) = 50 \text{ m}$   
 b)  $t_b = 20 \text{ s}$   
 c) Ver Figuras 3, 4 y 5.

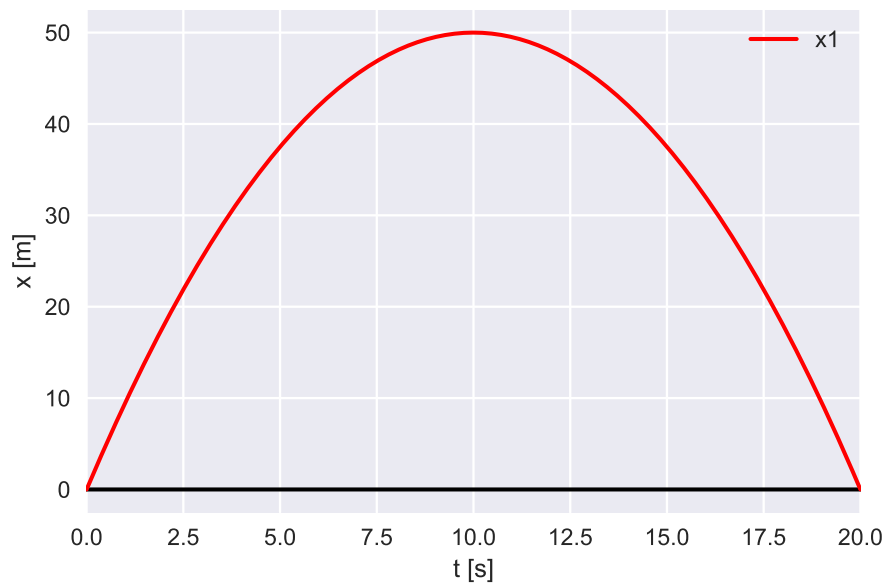


Figura 3: Problema 3.  $x(t)$ .

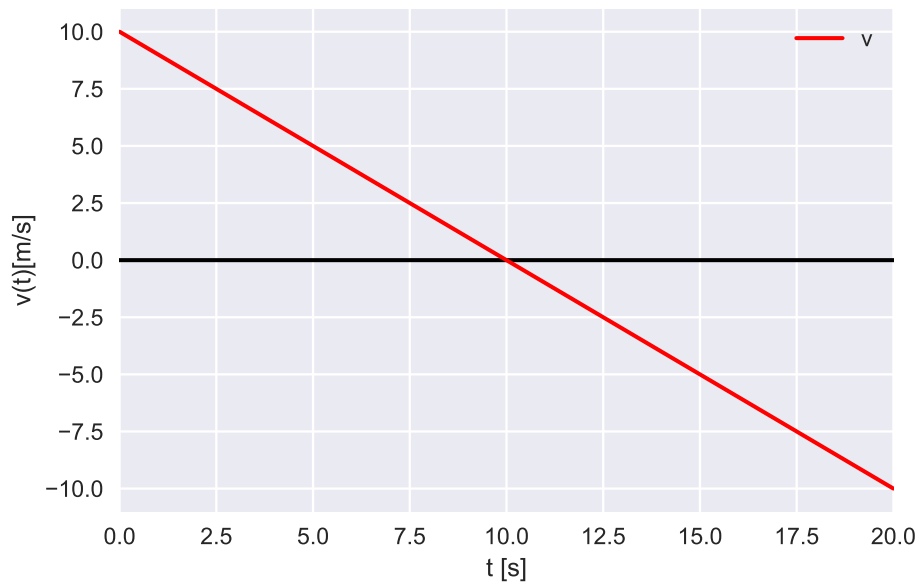


Figura 4: Problema 3.  $v(t)$ .

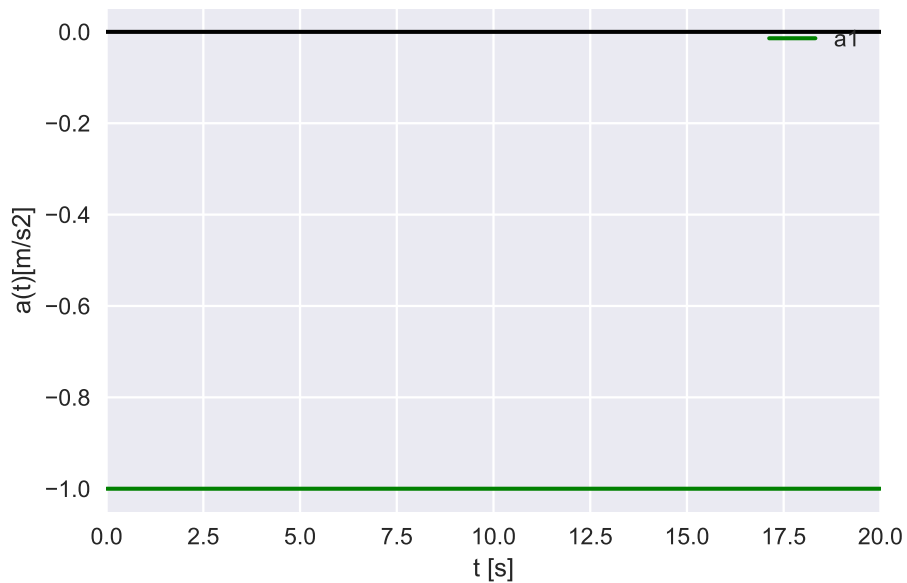


Figura 5: Problema 3.  $a(t)$ .

4) a)  $x_1(t) = \frac{3}{2} \frac{\text{m}}{\text{s}^2} t^2$   
 $x_2(t) = 150 \text{ m} + 30 \frac{\text{m}}{\text{s}} (t - 10 \text{ s})$  (MRU)  
 $x_3(t) = 450 \text{ m} + 30 \frac{\text{m}}{\text{s}} (t - 20 \text{ s}) - 2 \frac{\text{m}}{\text{s}^2} (t - 20 \text{ s})^2$

$$x_4(t) = 550 \text{ m} - 10 \frac{\text{m}}{\text{s}}(t - 30 \text{ s}) + 1 \frac{\text{m}}{\text{s}^2}(t - 30 \text{ s})^2$$

b) Ver Figuras 6 y 7.

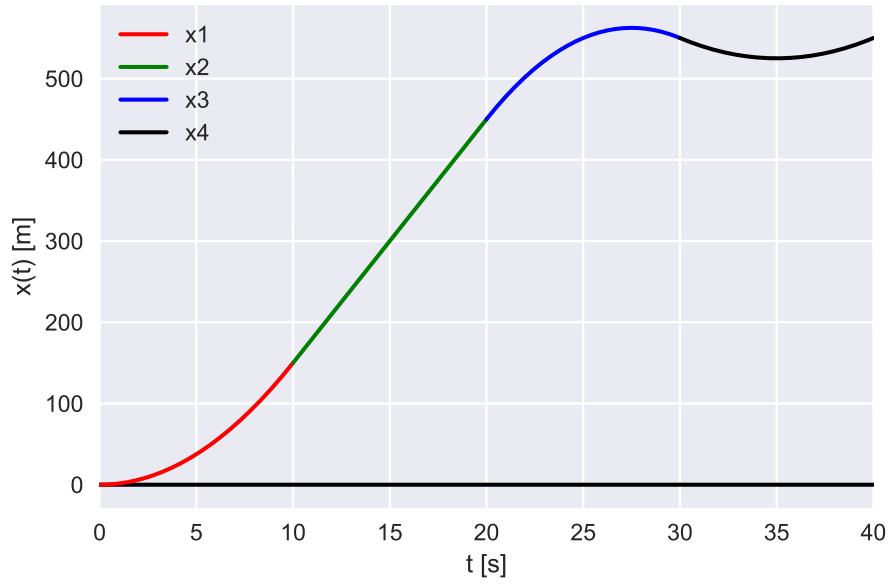


Figura 6: Problema 4.  $x(t)$ .

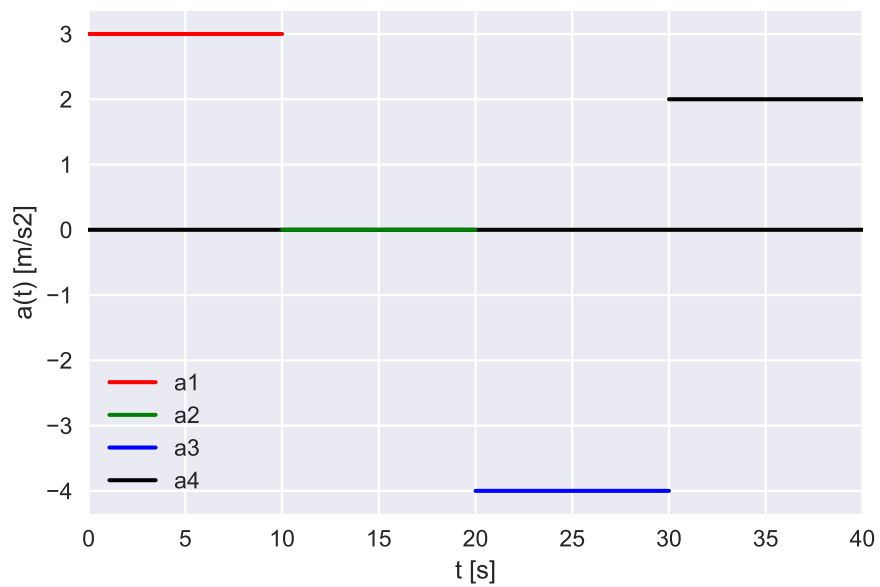


Figura 7: Problema 4.  $a(t)$ .

c)  $x(5 \text{ s}) = x_1(5 \text{ s}) = 37.5 \text{ m}$   
 $v(5 \text{ s}) = 15 \frac{\text{m}}{\text{s}}$   
 $a(5 \text{ s}) = a_1 = 3 \frac{\text{m}}{\text{s}^2}$

$x(25 \text{ s}) = 550 \text{ m}$   
 $v(25 \text{ s}) = 10 \frac{\text{m}}{\text{s}}$   
 $a(25 \text{ s}) = a_3 = -4 \frac{\text{m}}{\text{s}^2}$

5) a)  $x(t) = 10 \frac{\text{m}}{\text{s}}t - \frac{1}{6} \frac{\text{m}}{\text{s}^4}t^4$   
 $v(t) = 10 \frac{\text{m}}{\text{s}} - \frac{2}{3} \frac{\text{m}}{\text{s}^4}t^3$

b)  $x(3 \text{ s}) = 16.5 \text{ m}$   
 $v(3 \text{ s}) = -8 \frac{\text{m}}{\text{s}}$

6) a)  $t = 2 \text{ s}$

b)  $x = 10 \text{ m}$

7) a)  $y(0.25 \text{ s}) = 40.94 \text{ m}$   
 $v(0.25 \text{ s}) = 2.5 \frac{\text{m}}{\text{s}}$

$y(1 \text{ s}) = 40 \text{ m}$   
 $v(1 \text{ s}) = -5 \frac{\text{m}}{\text{s}}$

b)  $t_p = 3.37 \text{ s}$

c)  $v(t_p) = -28.72 \frac{\text{m}}{\text{s}}$

d)  $y_{\text{max}} = y(t_{\text{max}}) = y(\frac{1}{2} \text{ s}) = 41.25 \text{ m}$

e) Ver Figuras 8, 9 y 10.

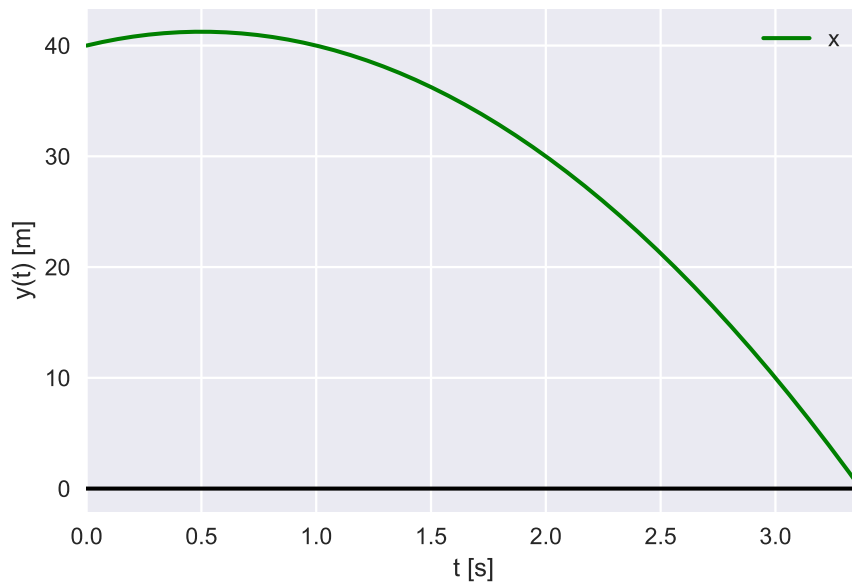


Figura 8: Problema 7.  $y(t)$ .

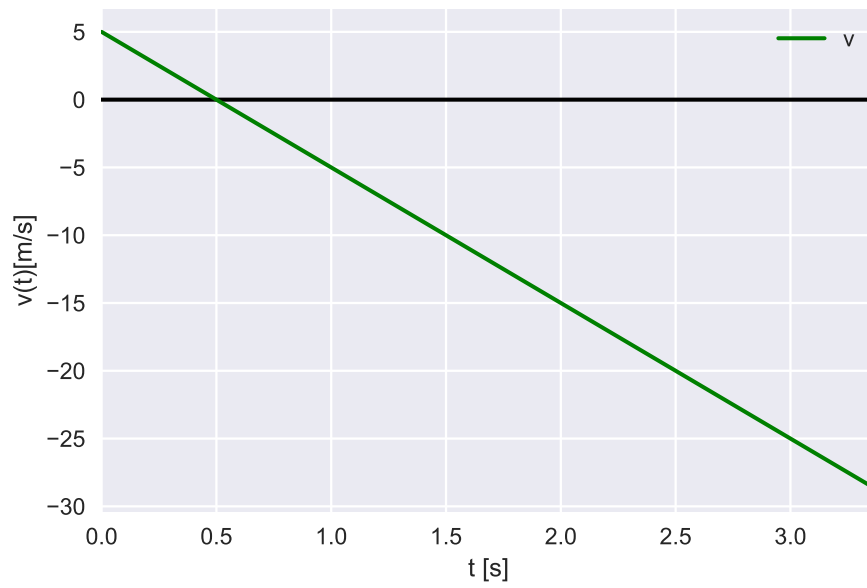


Figura 9: Problema 7.  $v(t)$ .

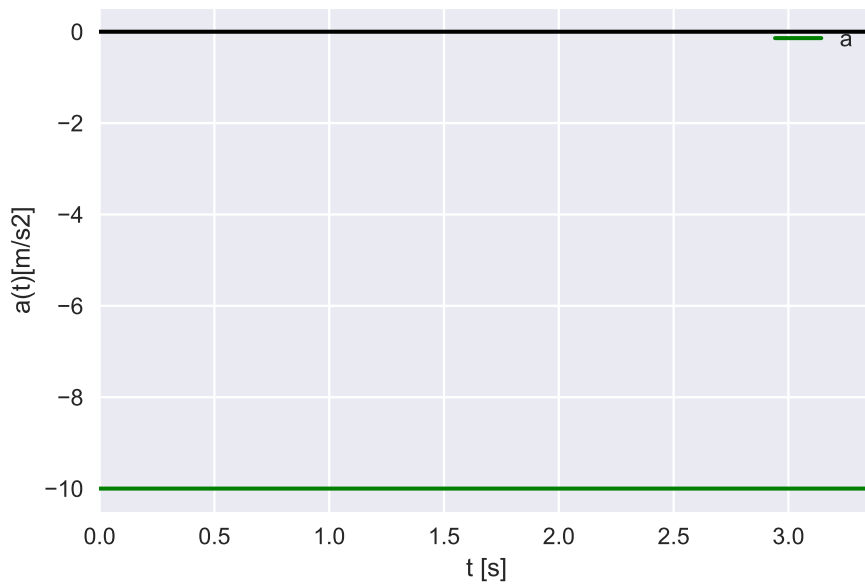


Figura 10: Problema 7.  $a(t)$ .

8) a)  $\mathbf{v}(t) = (3t^2 + 2, -2e^{2t}, -3 \sin(3t))$

$$\mathbf{v}(0 \text{ s}) = (2, -2, 0) \frac{\text{m}}{\text{s}}$$

$$\mathbf{v}(\pi/6 \text{ s}) = (\pi^2/12 + 2, -2e^{\pi/3}, -3) \frac{\text{m}}{\text{s}}$$

b)  $|\mathbf{v}(t)| = \sqrt{9t^4 + 12t^2 + 4 + 4e^{4t} + 9 \sin^2(3t)}$

$$|\mathbf{v}(0 \text{ s})| = \sqrt{8} \frac{\text{m}}{\text{s}}$$

$$|\mathbf{v}(\pi/6 \text{ s})| = \sqrt{\pi^4/144 + \pi^2/3 + 4 + 4e^{2\pi/3} + 9} \frac{\text{m}}{\text{s}}$$

c)  $\mathbf{a}(t) = (6t, -4e^{2t}, -9 \cos(3t)) \frac{\text{m}}{\text{s}^2}$

$$\mathbf{a}(0 \text{ s}) = (0, -4, -9) \frac{\text{m}}{\text{s}^2}$$

$$\mathbf{a}(\pi/6 \text{ s}) = (\pi, -4e^{\pi/3}, 0) \frac{\text{m}}{\text{s}^2}$$

9) a)  $\mathbf{r}(t) = (x(t), y(t))$

$$x(t) = 2 \frac{\text{m}}{\text{s}^3} t^3 - 3 \frac{\text{m}}{\text{s}^2} t^2$$

$$y(t) = 1 \frac{\text{m}}{\text{s}^3} t^2 - 2 \frac{\text{m}}{\text{s}} t + 1 \text{ m}$$

$$x(1 \text{ s}) = -1 \text{ m}$$

$$y(1 \text{ s}) = 0 \text{ m}$$

b)  $\mathbf{v}(t) = (v_x(t), v_y(t))$

$$v_x(t) = 6 \frac{\text{m}}{\text{s}^3} t^2 - 6 \frac{\text{m}}{\text{s}^2} t$$

$$v_y(t) = 2 \frac{\text{m}}{\text{s}^2} t - 2 \frac{\text{m}}{\text{s}}$$

$$\mathbf{a}(t) = (a_x(t), a_y(t))$$

$$a_x(t) = 12 \frac{\text{m}}{\text{s}^3} t - 6 \frac{\text{m}}{\text{s}^2}$$

$$a_y(t) = 2 \frac{\text{m}}{\text{s}^2}$$

c) En  $t = 1$  s,  $\mathbf{v}(1 \text{ s}) = (0, 0) \frac{\text{m}}{\text{s}}$

10)  $v_{\text{avion}} = 35.36 \frac{\text{m}}{\text{s}}$   
 $y(x = 100 \text{ m}) = y(2.83 \text{ s}) = 960 \text{ m}$

11) a)  $x(t_p) = x(1.28 \text{ s}) = 6.86 \text{ m}$

b) Ver Figuras 11, 12, 13 y 14.

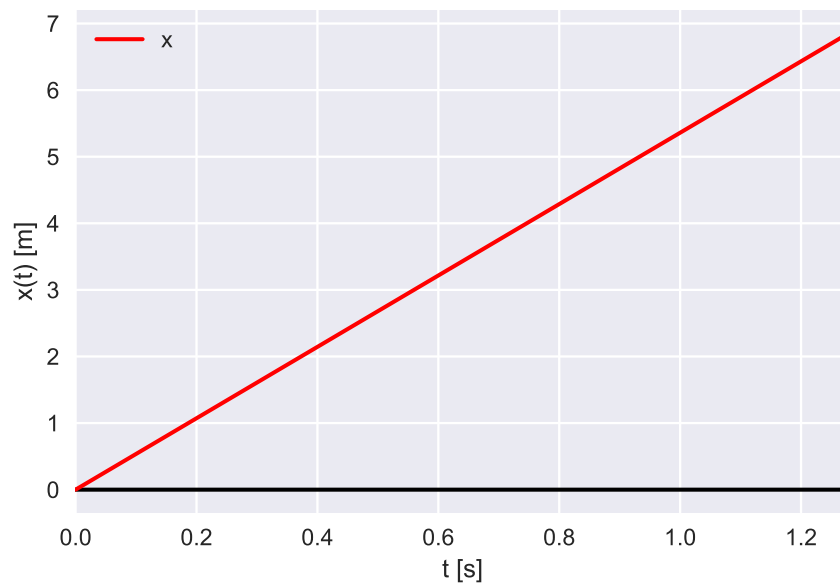


Figura 11: Problema 11.  $x(t)$ .



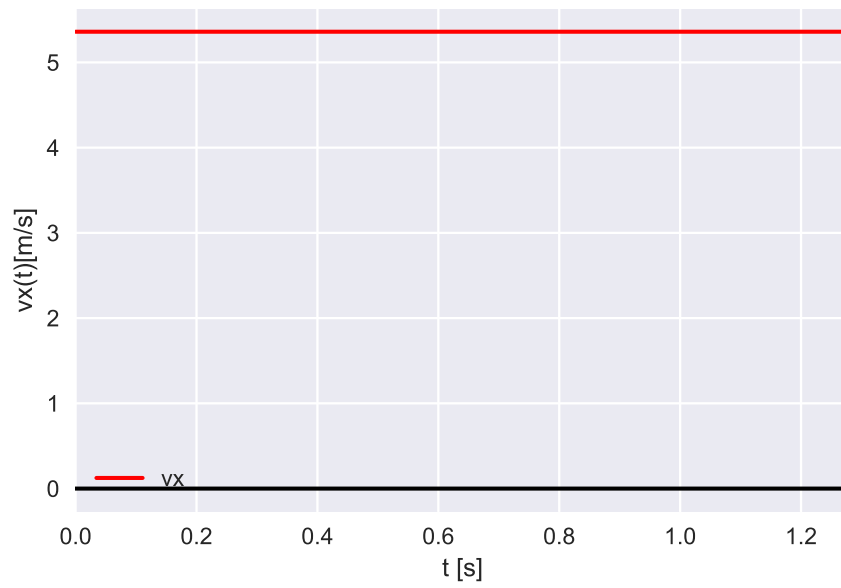


Figura 12: Problema 11.  $v_x(t)$ .

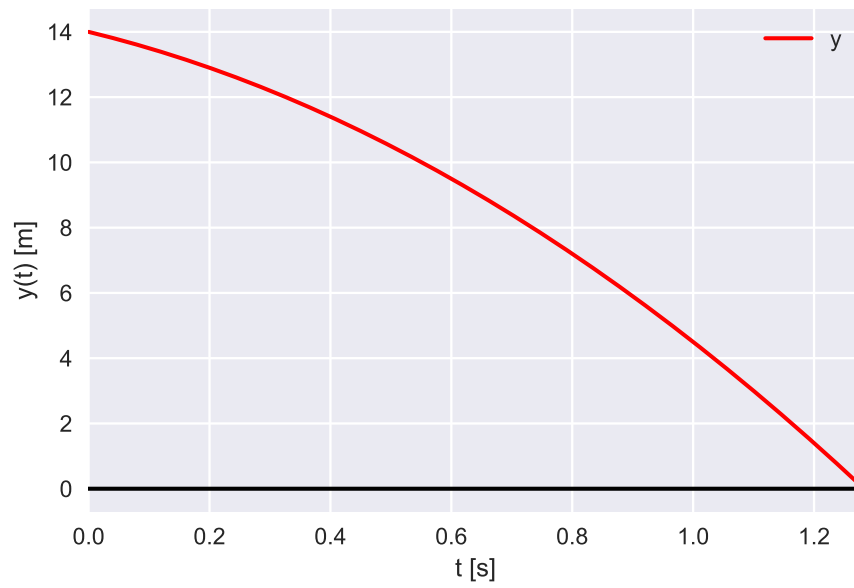


Figura 13: Problema 11.  $y(t)$ .

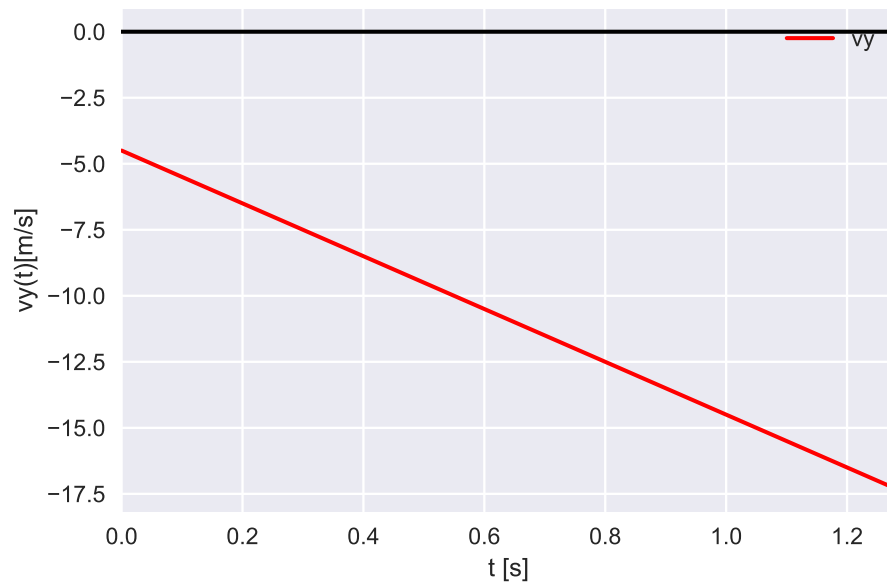


Figura 14: Problema 11.  $v_y(t)$ .

- c) No, porque  $x(y = 1.9 \text{ m}) = x(t_h = 1.17 \text{ s}) = 6.27 \text{ m}$ . Es decir, recién está a la altura del hombre a una distancia de 6.27 m del granero.