Mecánica y Termodinámica
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Práctica N° 1: cinemática

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

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) $\mathbf{v}_1 = (80, 0)\ \frac{\text{km}}{\text{h}}$
   $\mathbf{v}_2 = (-50, 0)\ \frac{\text{km}}{\text{h}}$

   c) $x_1(t) = 0\ \text{km} + 80\ \frac{\text{km}}{\text{h}}(t - 1\ \text{h})$
   $x_2(t) = 300\ \text{km} - 50\ \frac{\text{km}}{\text{h}} t$
   $t_e = 2.92\ \text{h} = 2\ \text{h}\ 55\ \text{min}\ 12\ \text{s}$

   d) Ver Figura 1.

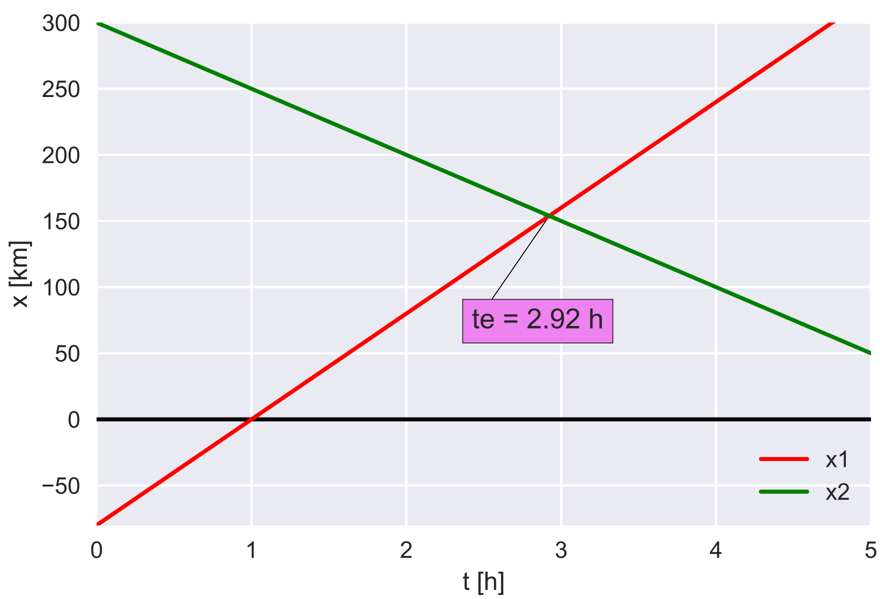

Figura 1: Problema 1. $x(t)$.

   e) Ver Figura 2.

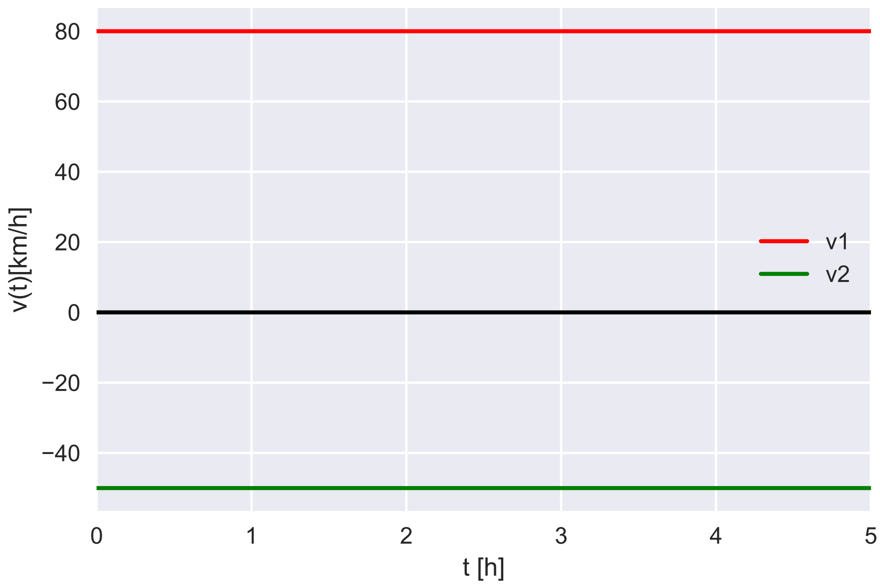

Figura 2: Problema 1. $v(t)$.

2) $a = 4.56\ \frac{\mathrm{m}}{\mathrm{s}^2}$

3) a) $t_{\mathrm{reposo}} = 10$ s, $x(t_{\mathrm{reposo}}) = 50$ m

   b) $t_b = 20$ s

   c) Ver Figuras 3, 4 y 5.

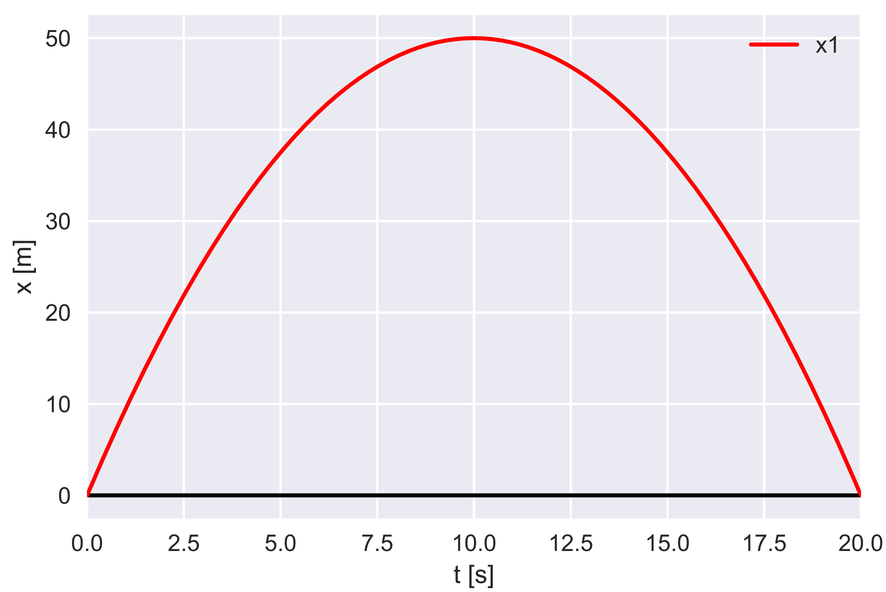

Figura 3: Problema 3. $x(t)$.

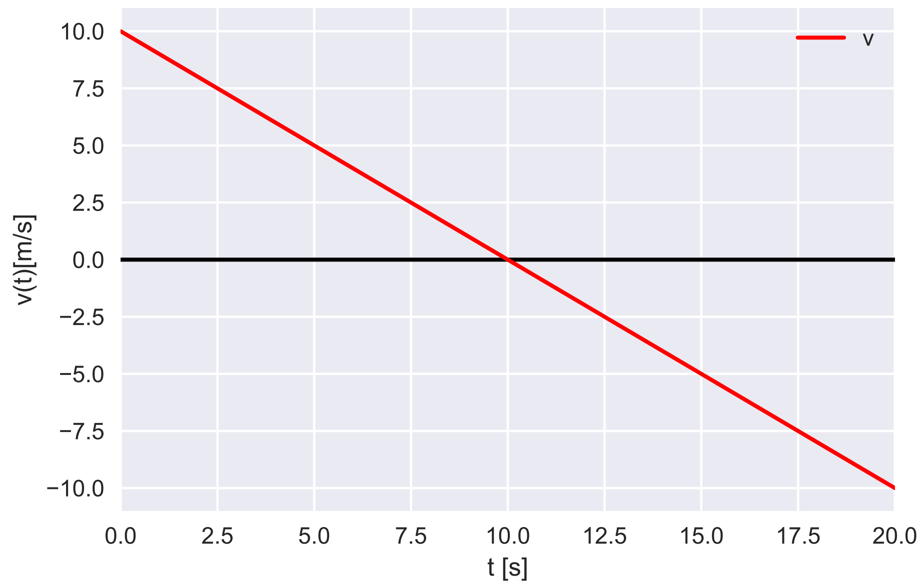

Figura 4: Problema 3. $v(t)$.

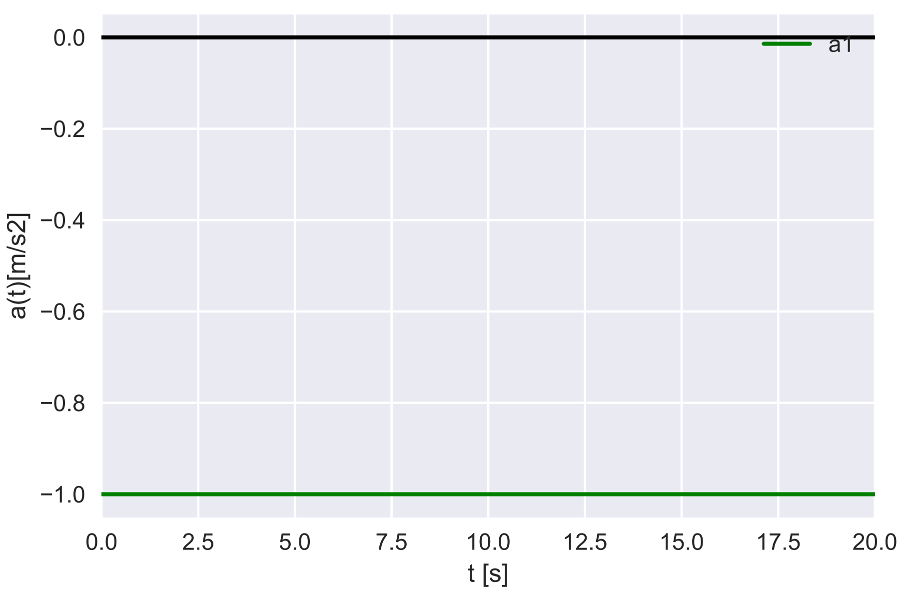

Figura 5: Problema 3. $a(t)$.

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)
$x_3(t) = 450\ \text{m} + 30\ \frac{\text{m}}{\text{s}}(t - 20\ \text{s}) - 2\ \frac{\text{m}}{\text{s}^2}(t - 20\ \text{s})^2$

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

b) Ver Figuras 6 y 7.

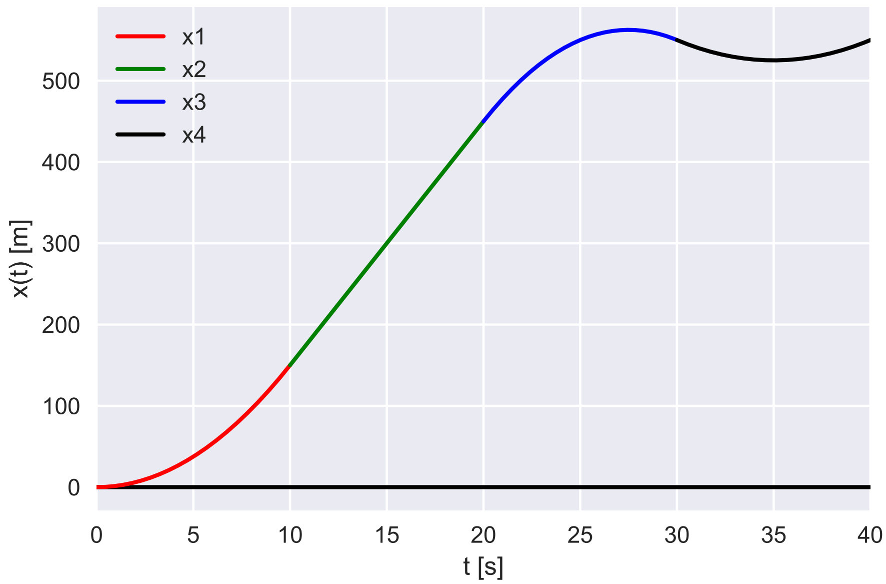

Figura 6: Problema 4. $x(t)$.

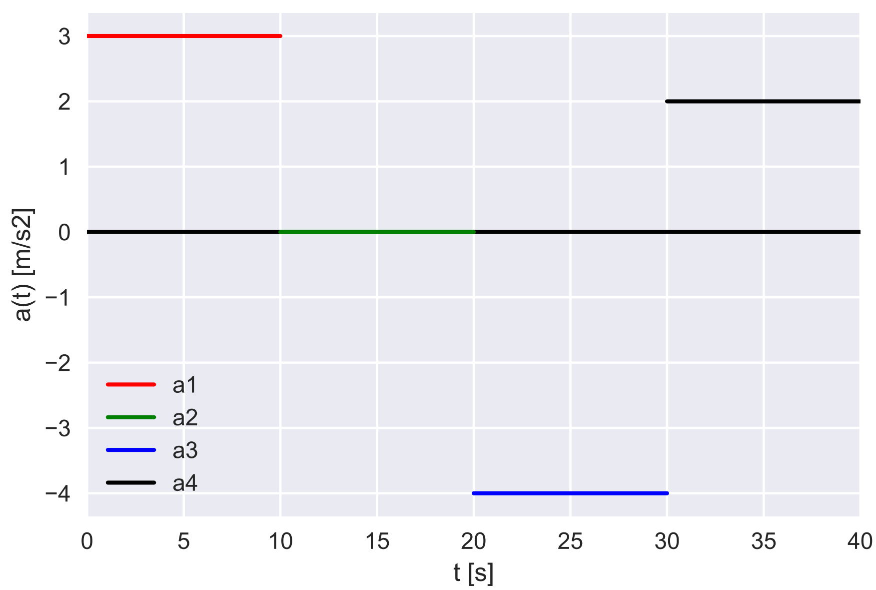

Figura 7: Problema 4. $a(t)$.

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

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

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

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

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

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

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

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

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

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

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

e) Ver Figuras 8, 9 y 10.

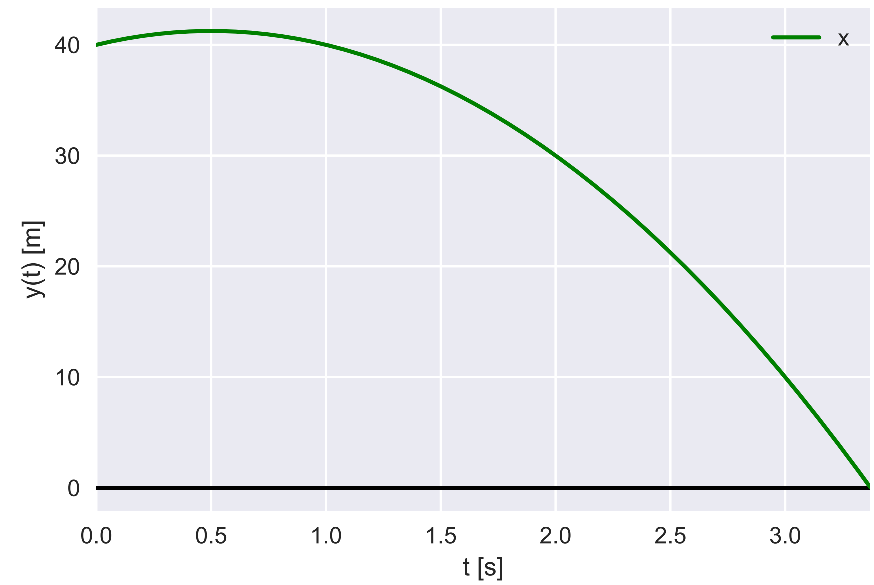

Figura 8: Problema 7. $y(t)$.

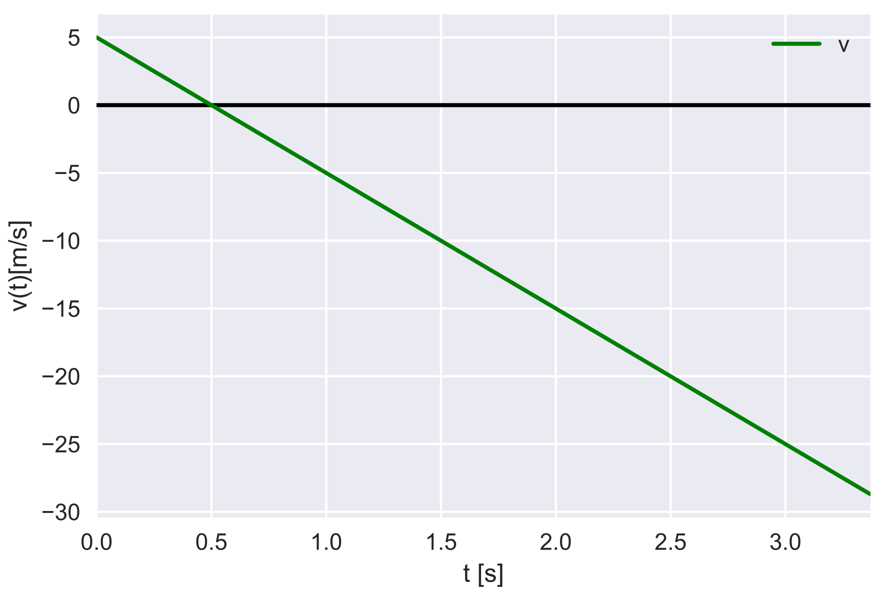

Figura 9: Problema 7. $v(t)$.

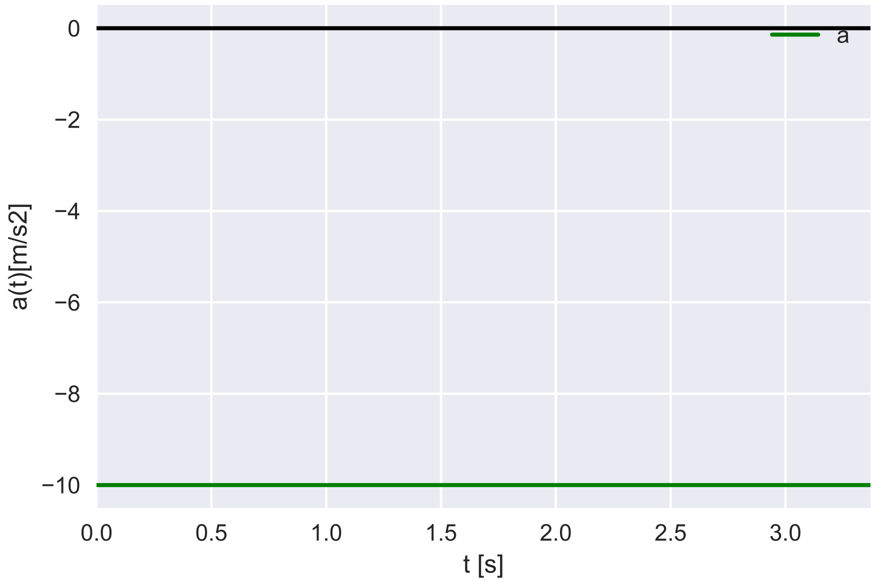

Figura 10: Problema 7. $a(t)$.

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

$\mathbf{v}(0\ \mathrm{s}) = (2, -2, 0)\ \frac{\mathrm{m}}{\mathrm{s}}$
$\mathbf{v}(\pi/6\ \mathrm{s}) = (\pi^2/12 + 2, -2e^{\pi/3}, -3)\ \frac{\mathrm{m}}{\mathrm{s}}$

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

$|\mathbf{v}(0\ \mathrm{s})| = \sqrt{8}\ \frac{\mathrm{m}}{\mathrm{s}}$
$|\mathbf{v}(\pi/6\ \mathrm{s})| = \sqrt{\pi^4/144 + \frac{\pi^2}{3} + 4 + 4e^{2\pi/3} + 9}\ \frac{\mathrm{m}}{\mathrm{s}}$

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

$\mathbf{a}(0\ \mathrm{s}) = (0, -4, -9)\ \frac{\mathrm{m}}{\mathrm{s}^2}$
$\mathbf{a}(\pi/6\ \mathrm{s}) = (\pi, -4e^{\pi/3}, 0)\ \frac{\mathrm{m}}{\mathrm{s}^2}$

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

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

$x(1\ \mathrm{s}) = -1\ \mathrm{m}$
$y(1\ \mathrm{s}) = 0\ \mathrm{m}$

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

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

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

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

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

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.

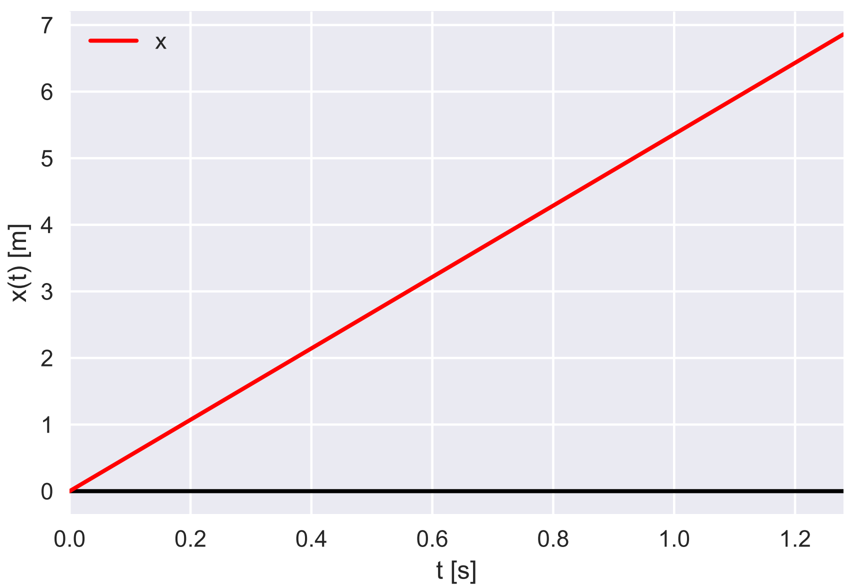

Figura 11: Problema 11. $x(t)$.

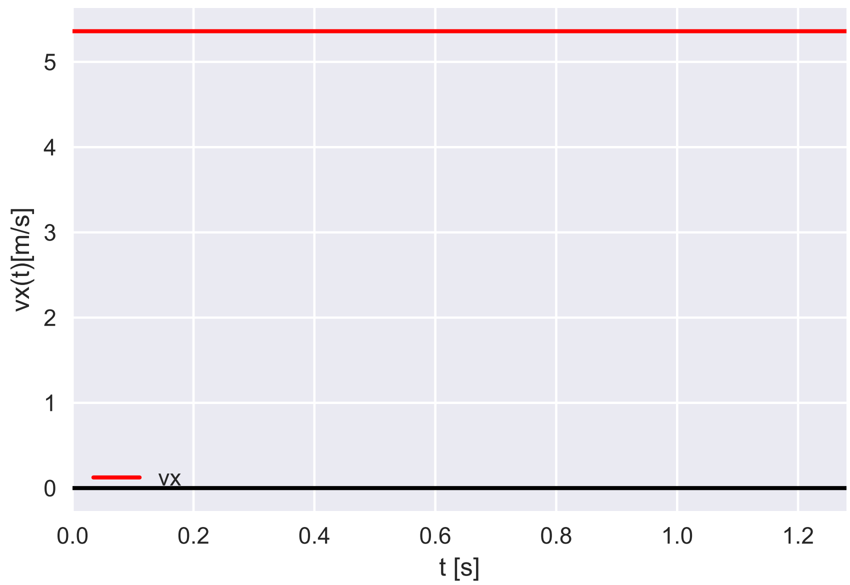

Figura 12: Problema 11. $v_x(t)$.

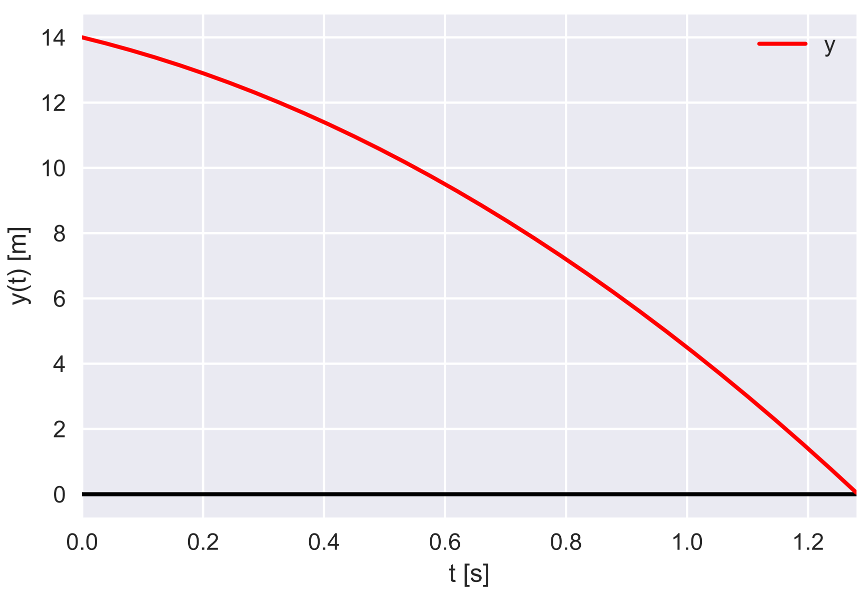

Figura 13: Problema 11. $y(t)$.

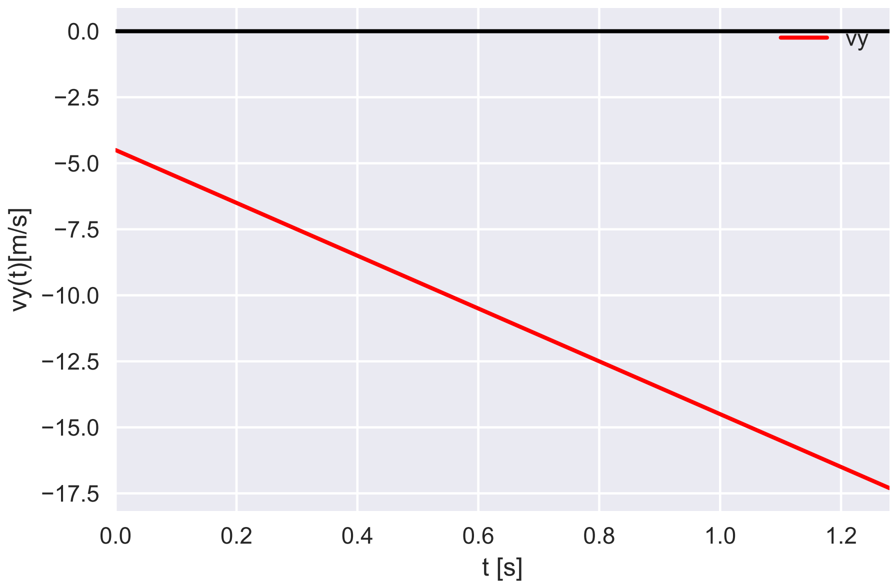

Figura 14: Problema 11. $v_y(t)$.

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