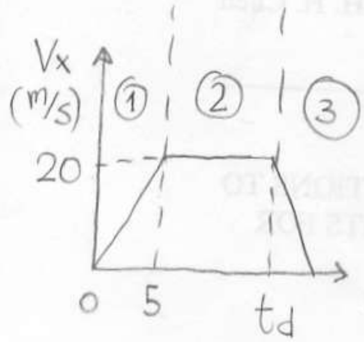
Problem 1 - Solution



(1) $\Delta x_1 = \text{Area } 1$ $\qquad \boxed{\Delta t_1 = 5\,s}$

$$= \frac{20\,\tfrac{m}{s} \cdot 5\,s}{2} = \boxed{50\,m}$$

(2) $\boxed{\Delta x_2 = 2400\,m}$

$$\Delta x_2 = v_{x2}\Delta t_2 \Rightarrow \frac{\Delta x_2}{v_{x2}} = \Delta t_2 = \frac{2400\,m}{20\,m/s} = \boxed{120\,s}$$

(3) $\boxed{\Delta x_3 = 20\,m}$

$$\left.\begin{array}{l} v_{ix3} = 20\,m/s \\ v_{fx3} = 0 \end{array}\right\} \quad v_{fx3} = v_{ix3} + a_{x3}\Delta t_3$$

$$-20\,m/s = a_{x3}\Delta t_3$$

$$a_{x3} = -\frac{20\,m/s}{\Delta t_3}$$

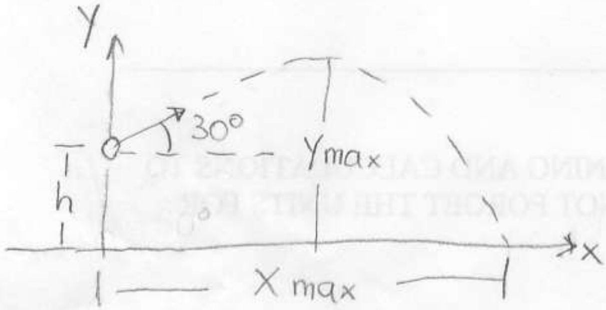
$$\Delta x_3 = v_{ix3}\Delta t_3 + \frac{1}{2}a_{x3}\Delta t_3^2 = 20\,m/s\,\Delta t_3 - 10\,m/s\,\Delta t_3$$

$$\Delta t_3 = \frac{20\,m}{10\,m/s} = \underline{2\,s}$$

a) $\Delta x = \Delta x_1 + \Delta x_2 + \Delta x_3 = \underline{2470\,m}$

b) $\Delta t = \Delta t_1 + \Delta t_2 + \Delta t_3 = \underline{127\,s}$

Problem 3 - Solution



$X_{max} = 70\,m$

$V_i = 30\,m/s$

$V_{ix} = V_i \cos 30° = 15\sqrt{3}\,m/s$

$V_{iy} = V_i \sin 30° = 15\,m/s$

$X_i = 0$

$Y_i = h$

$$\left.\begin{aligned} X_f - X_i &= V_{ix}\,\Delta t \\ Y_f - Y_i &= V_{iy}\,\Delta t - \tfrac{1}{2} g\,\Delta t^2 \\ V_{fy} &= V_{iy} - g\,\Delta t \end{aligned}\right\}$$

when $X_f = X_{max}$, $\Delta t = t_f$ (Time of flight)

$$\frac{X_{max}}{V_{ix}} = t_f$$

a) $$t_f = \frac{70\,m}{15\sqrt{3}\,m/s} = 2.7\,s$$

b) When $Y_f = 0$; $-h = V_{iy} t_f - \frac{1}{2} g t_f^2$

$$h = \frac{1}{2}(9.8\,m/s^2)(2.7\,s)^2 - (15\,m/s)(2.7\,s)$$

$$h = -4.8\,m$$

$V_{fy}^2 = V_{iy}^2 - 2g(Y_f - Y_i)$; when $V_{fy} = 0$, the ball is at the highest point, thus:

$$Y_{max} - h = \frac{V_{iy}^2}{2g} \Rightarrow Y_{max} = \frac{V_{iy}^2}{2g} + h$$

$$Y_{max} = \frac{(15\,m/s)^2}{2(9.8\,m/s^2)} - 4.8\,m = 6.7\,m$$