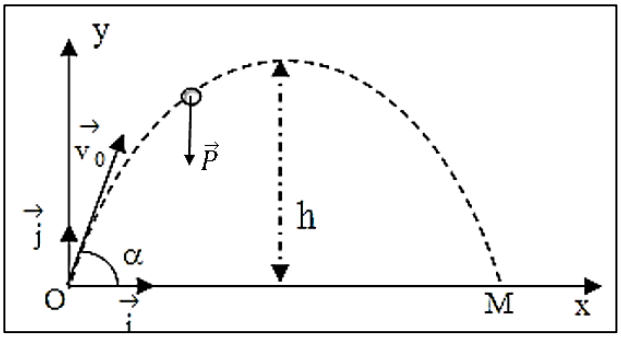
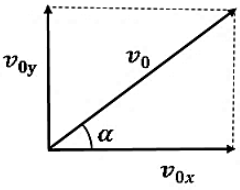


الشروط الابتدائية: تختلف الشروط الابتدائية حسب الحركة المدروسة.

$x_0 = 0$

$y_0 = 0$



$$\cos\alpha = \frac{v_{0x}}{v_0} \Rightarrow v_{0x} = v_0\cos\alpha$$

$$\sin\alpha = \frac{v_{0y}}{v_0} \Rightarrow v_{0y} = v_0\sin\alpha$$

$$\begin{cases} v_x = v_B\cos\alpha \\ v_y = -gt + v_B\sin\alpha \end{cases}$$

-1

$$\sum \vec{F} = m\vec{a} \Rightarrow \vec{P} = m\vec{a} \Rightarrow \vec{g} = \vec{a}$$

$$\Rightarrow \begin{cases} a_x = 0 \\ a_y = -g \end{cases} \Rightarrow \begin{cases} \frac{dv_x}{dt} = 0 \\ \frac{dv_y}{dt} = -g \end{cases} \Rightarrow \begin{cases} \frac{d^2x}{dt^2} = 0 \\ \frac{d^2y}{dt^2} = -g \end{cases}$$

- $a_x = 0 \qquad (ox)$
- (oy)

-2

$$\sum \vec{F} = m\vec{a} \Rightarrow \vec{P} = m\vec{a} \Rightarrow \vec{g} = \vec{a}$$

$$\Rightarrow \begin{cases} a_x = 0 \\ a_y = -g \end{cases}$$

- $$\Rightarrow \begin{cases} v_x = v_{0x} \\ v_y = at + v_{0y} \end{cases} \Rightarrow \begin{cases} v_x = v_0\cos\alpha \\ v_y = -gt + v_0\sin\alpha \end{cases}$$

- $$\Rightarrow \begin{cases} x = v_{0x}t + x_0 \\ y = \frac{1}{2}at^2 + v_{0y}t + y_0 \end{cases} \Rightarrow \begin{cases} x = v_0\cos\alpha\, t \\ y = -\frac{1}{2}gt^2 + v_0\sin\alpha\, t \end{cases}$$

-3

$$x = v_0\cos\alpha\, t \Rightarrow t = \frac{x}{v_0\cos\alpha}$$

$$\Rightarrow y = -\frac{1}{2}gt^2 + v_0\sin\alpha\, t \Rightarrow y = -\frac{1}{2}g\left(\frac{x}{v_0\cos\alpha}\right)^2 + v_0\sin\alpha\left(\frac{x}{v_0\cos\alpha}\right)$$

$$\Rightarrow y = -\frac{gx^2}{2{v_0}^2cos^2\alpha} + tan\,\alpha\, x$$

-4

- $v_y = 0$

$$v_y = -gt + v_0\sin\alpha = 0 \Rightarrow t = \frac{v_0\sin\alpha}{g}$$

- $y = 0$

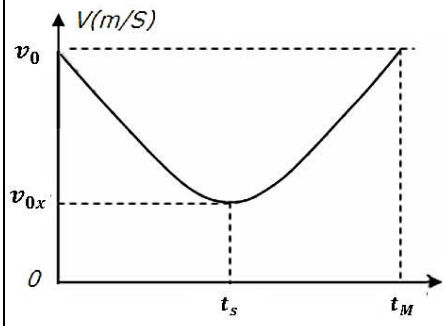
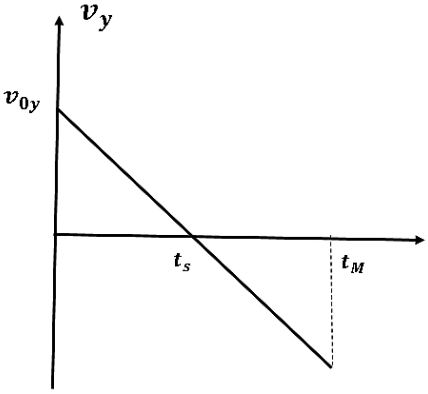
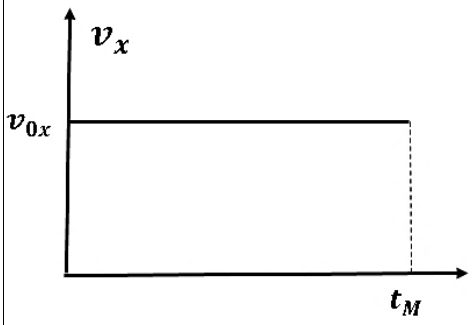
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$$y = -\frac{gd^2}{2{v_0}^2 cos^2\alpha} + tan\,\alpha\, d = 0 \Rightarrow \frac{gd}{2{v_0}^2 cos^2\alpha} = tan\,\alpha \Rightarrow d = \frac{2{v_0}^2 cos^2\alpha \times tan\,\alpha}{g}$$

$$\Rightarrow d = \frac{2{v_0}^2 \cos\alpha \times \sin\alpha}{g} \Rightarrow \boldsymbol{d = \frac{{v_0}^2 \sin 2\alpha}{g}}$$

$\alpha = 45°$ $\quad 2\alpha = 90°$ $\quad \sin 2\alpha = 1$ -

-5

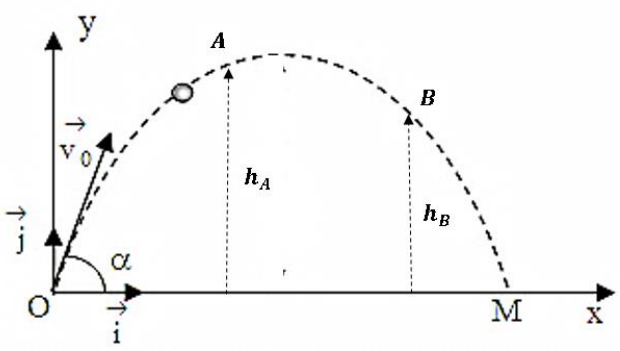
v	v_y	v_x
	 . t_s - -	 -

v_0 α

$$v_0{}^2 = v_{0x}{}^2 + v_{0y}{}^2$$

$$sin\,\alpha = \frac{v_{0y}}{v_0} \qquad \cos\alpha = \frac{v_{0x}}{v_0} \qquad tan\,\alpha = \frac{v_{0y}}{v_{0x}}$$

-6



$$v_B{}^2 - v_A{}^2 = 2gh_{AB}$$ •

.B A •

$$E_{CA} + E_{PPA} = E_{CB} + E_{PPB}$$

$$\Rightarrow \frac{1}{2}mv_A{}^2 + mgh_A = \frac{1}{2}mv_B{}^2 + mgh_B$$

$$\Rightarrow mgh_A - mgh_B = \frac{1}{2}mv_B{}^2 - \frac{1}{2}mv_A{}^2$$

$$\Rightarrow gh_A - gh_B = \frac{1}{2}v_B{}^2 - \frac{1}{2}v_A{}^2$$

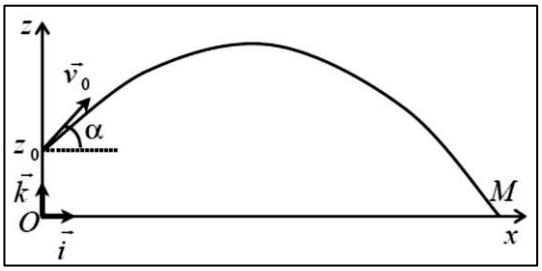
$$\Rightarrow \boldsymbol{{v_B}^2 - {v_A}^2 = 2g(h_A - h_B)}$$

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$oz_0 = h = 2.0m$ $t = 0$

$g = 9.8m \times s^{-1}$ $\alpha = 35°$ $v_0 = 13.7\,m/s$

-



-

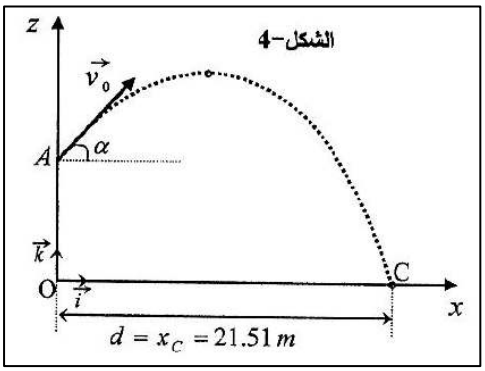
-

$z = f(t)$ -

M -

-

v_0



$d = 21.51m$

v_0

$h_A = 2m$ A -

$\alpha = 45°$ $\vec{v}_0$

$t = 0$ $(O, \vec{i}, \vec{k})$

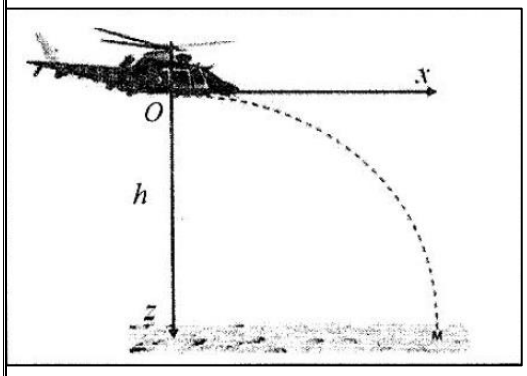
A

$z = h(t)$ $x = f(t)$ -

v_0 g α h_A $z = g(t)$ -

d g α h_A v_0 -

-



$v_0 = 50\,m/s$ h ___

$t = 0$ G

M $\vec{v}_0$ O

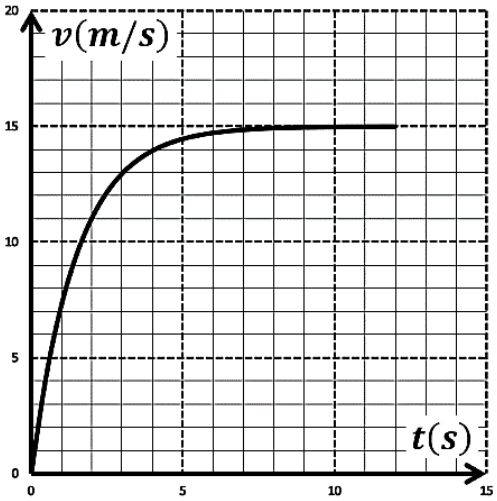
-

$z(t)$ $x(t)$ -

$z(x)$ -

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M -



M h

$t = 0$

$\vec{v}$ $\vec{f} = -100 \times \vec{v}$

t

-

t -

v_l -

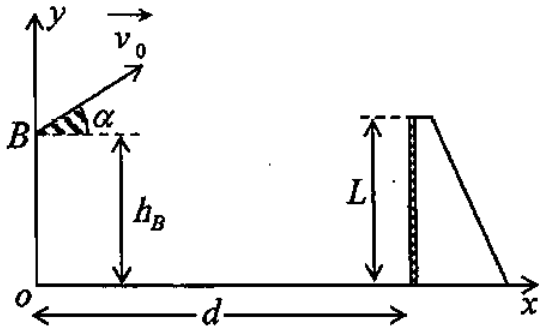
$t = 10s$ $t = 0$ -

$m = 150kg$ $h = 405m$ $g = 9.8m \times s^{-2}$

$v_0 = 10m/s$ $g = 10m/s^2$

$\overrightarrow{v_0}$ B $t = 0$

$h_B = 2m$ B $\alpha = 30°$



-1

(Ox, Oy)

$y(t)$ $x(t)$ -

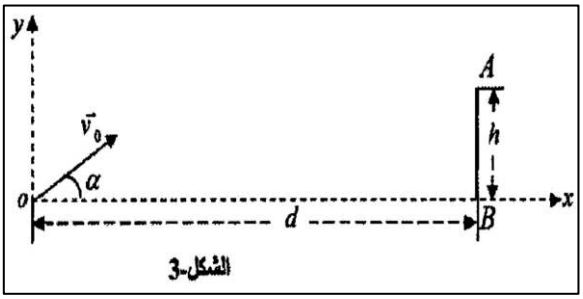
$y = f(x)$ -

-

$L = 2{,}44m$ $d = 10m$ -2

y x -

-



$g = 10m \times s^{-2}$

O

$d = 25m$

$\vec{v}_0$ $h = AB = 2.44m$

$\alpha = 30°$

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$(\overrightarrow{ox}, \overrightarrow{oy})$ -

-

A v_0 -

A

B v'_0 -

$0.92\ m$ $8.23\ m$ $23.8\ m$

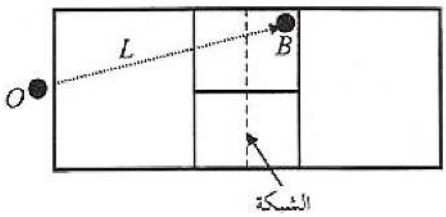
$6.4\ m$

$OB = L = 18.7m$ B

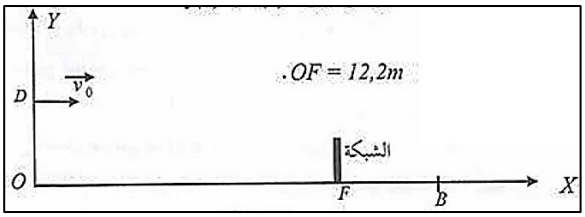
O $h = 2.2m$ D

$v_0 = 126km/h$ D

$g = 9.8m/s^2$



B D -



$y(t)$ $x(t)$ -

-

$OF = 12.2m$ -

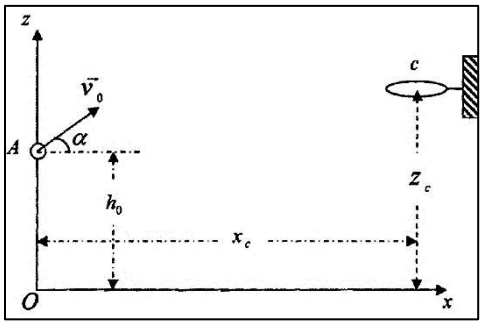
-

$h_0 = 2.10m$ A

$(x_c = 4.5m, z_c)$ C G $37°$ $v_0 = 8\,m/s$

$(\overrightarrow{ox}, \overrightarrow{oy})$

$(\overrightarrow{ox}, \overrightarrow{oy})$ -



z_c -

β $\vec{v}_c$ -

$g = 9.8\,m/s^2$ β v_c

$21.69\ m$

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$h = 2.62\ m$

$\alpha = 43°$ $v_0 = 13.7\ m \times s^{-1}$

$v_y(t)$ $v_x(t)$

.

ox -

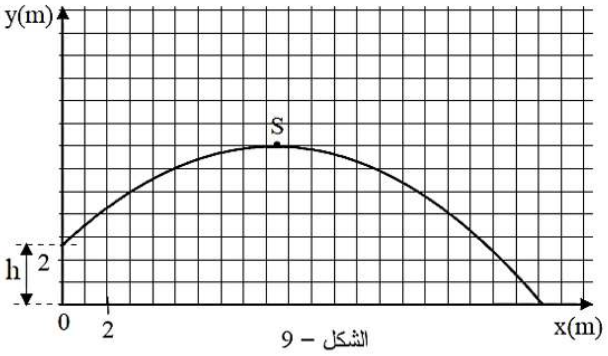
v_{0y} -

v_0

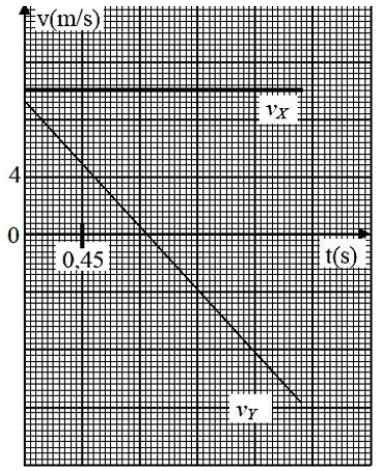
$\alpha = 43°$ $v_0 = 13.7\ m \times s^{-1}$

S $\vec{v}_s$ -

.



الشكل – 9



الشكل – 10

$\rho = 7.1 \times 10^3\ kg/m^3$ V

$\rho = 1.29\ kg/m^3$

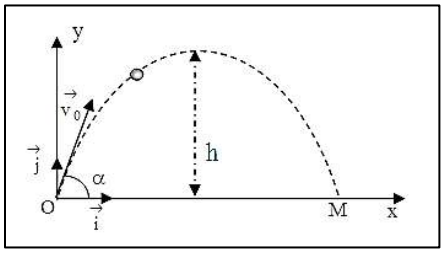
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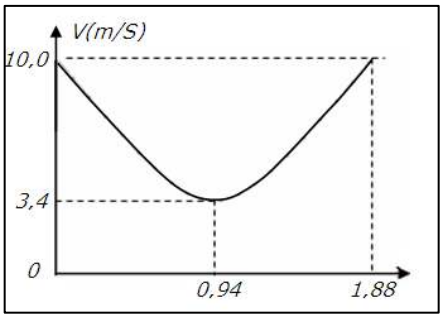
-

O $\vec{v}_0$ m $t = 0$

$(O, \vec{i}, \vec{j})$



M O



$\vec{v}_0$ v_0 -

$\vec{v}_0$ v_{0x} -

v_{0y} α

$(0 \le t \le 1{,}88)s$ $v_y(t)$ $v_x(t)$

h OM

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$v_0 =$ Z_0 $m = 58g$

$Z_0 = 0.9m$ $12m$ $28\,m/s$

$g = 9.8m \times s^{-2}$ $(ox; oz)$

$z = f(x)$

$10cm$ Z_0

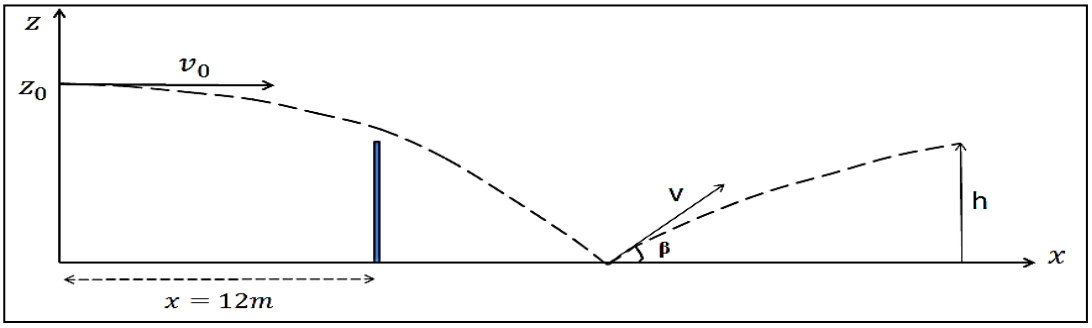
$24m$

v

$\beta = 15°$ v

$24m$

h

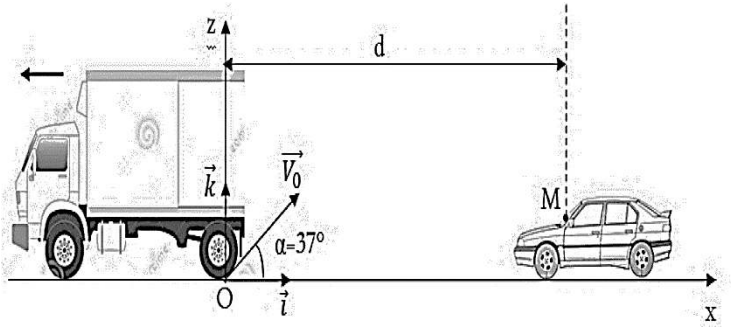


$g = 9{,}8m/s^2$

O $t = 0$

M $\alpha = 37°$ $v_0 = 12m/s$

$t = 0$ $90km/h$



$d = 44m$ M O

$(O, \vec{i}, \vec{j})$ -1

$z(t)$ $x(t)$

$z = f(x)$ -2

M $x_M(t)$ -3

$(O, \vec{i}, \vec{j})$

M h t_M -4

-5

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