1.6 [libro] SOMMA DI DUE VETTORI

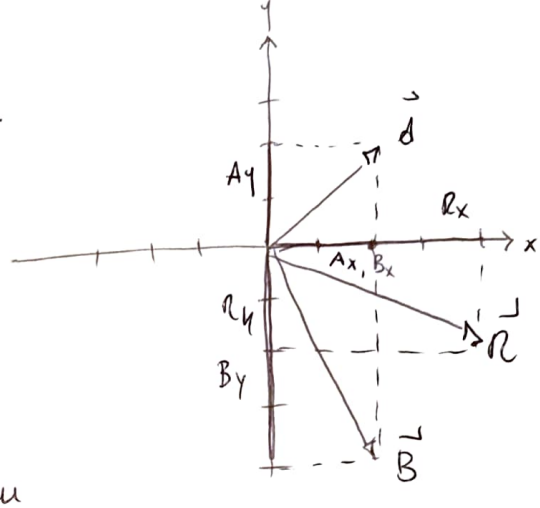
DATI

$\vec{A} = (2.0\hat{i} + 2.0\hat{j})$ m

$\vec{B} = (2.0\hat{i} - 4.0\hat{j})$ m

RICHIESTA

$\vec{R} = ?$



SOLUZIONE

$$R_x = A_x + B_x = 2.0 + 2.0 = 4.0$$

$$R_y = A_y + B_y = 2.0 - 4.0 = -2.0$$

$$\vec{R} = R_x\hat{i} + R_y\hat{j} = (4.0\hat{i} - 2.0\hat{j})\ \text{m}$$

1.7 [libro] SPOSTAMENTO RISULTANTE

DATI

$\Delta\vec{r}_1 = (15\hat{i} + 30\hat{j} + 12\hat{k})$ cm

$\Delta\vec{r}_2 = (23\hat{i} - 14\hat{j} - 5.0\hat{k})$ cm

$\Delta\vec{r}_3 = (-13\hat{i} + 15\hat{j})$ cm

RICHIESTE

$\Delta r_{TOT,x} = ?$

$\Delta r_{TOT,y} = ?$

$\Delta r_{TOT,z} = ?$

$|\Delta\vec{r}_T| = ?$

SOLUZIONE

$$\Delta r_{TOT,x} = \Delta r_{1,x} + \Delta r_{2,x} + \Delta r_{3,x} = 15 + 23 - 13 = 25\ \text{cm}$$

$$\Delta r_{TOT,y} = \Delta r_{1,y} + \Delta r_{2,y} + \Delta r_{3,y} = 30 - 14 + 15 = 31\ \text{cm}$$

$$\Delta r_{TOT,z} = \Delta r_{1,z} + \Delta r_{2,z} + \Delta r_{3,z} = 12 - 5 = 7.0\ \text{cm}$$

$$\Delta\vec{r}_{TOT} = \Delta r_{TOT,x}\hat{i} + \Delta r_{TOT,y}\hat{j} + \Delta r_{TOT,z}\hat{k} = (25\hat{i} + 31\hat{j} + 7.0\hat{k})\ \text{cm}$$

$$|\Delta\vec{r}_{TOT}| = \sqrt{\Delta r_{TOT,x}^2 + \Delta r_{TOT,y}^2 + \Delta r_{TOT,z}^2} = \sqrt{(25\ \text{cm})^2 + (31\ \text{cm})^2 + (7.0\ \text{cm})^2} = 40\ \text{cm}$$

1.8 [Libro] Facendo un'escursione

DATI

$|\vec{A}| = 25\ km$

$\alpha = -45°$

$|\vec{B}| = 40\ km$

$\beta = 60°$

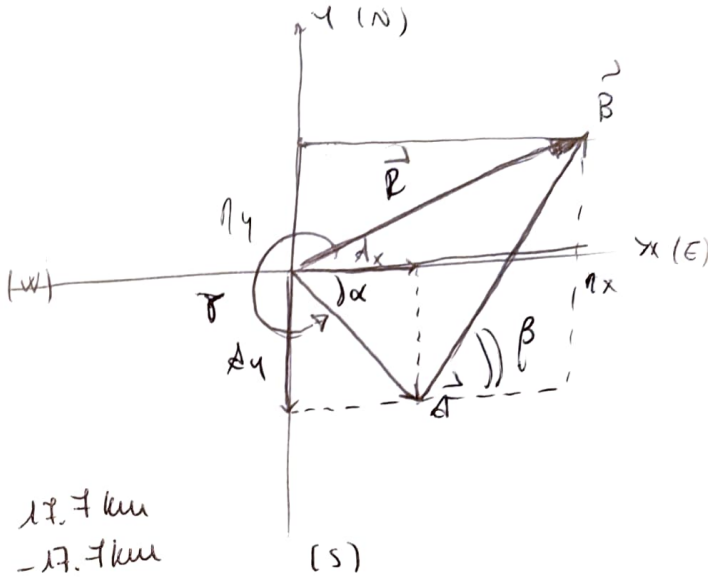
RICHIESTA

$A_x = ?$ $A_y = ?$

$B_x = ?$ $B_y = ?$

$R_x = ?$ $R_y = ?$

$\vec{R} = ?$



SOLUZIONE

$A_x = |\vec{A}| \cos\alpha = (25.0\ km)\cos(-45.0°) = 17.7\ km$

$A_y = |\vec{A}| \sin\alpha = (25.0\ km)\sin(-45.0°) = -17.7\ km$

$B_x = |\vec{B}| \cos\beta = (40.0\ km)\cos(60.0°) = 20.0\ km$

$B_y = |\vec{B}| \sin\beta = (40.0\ km)\sin(60.0°) = 34.6\ km$

$R_x = A_x + B_x = 17.7\ km + 20.0\ km = 37.7\ km$

$R_y = A_y + B_y = -17.7\ km + 34.6\ km = 17.0\ km$

$\vec{R} = R_x\hat{i} + R_y\hat{j} = (37.7\hat{i} + 17.0\hat{j})\ km$

ES PROF DEL BRANCO

DATI

$|\vec{v}_0| = 12\ m/s$

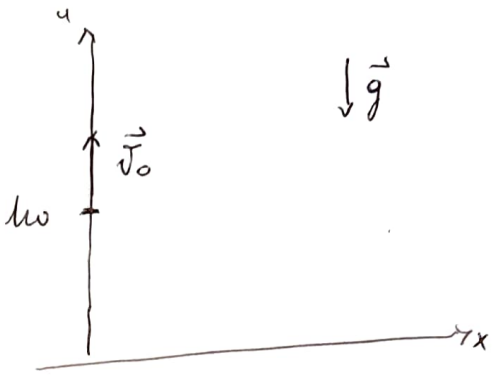
$h_0 = 4\ m$

RICHIESTE

$h_{max} = ?$

$\Delta t_{volo} = ?$

$v_f = ?$



SOLUZIONE

$$\begin{cases} \vec{v}_f = \vec{v}_0 + \vec{a}t \\ \vec{y}(t) = y_0 + \vec{v}_0 t + \frac{1}{2}\vec{a}t^2 \end{cases}$$

$$\begin{cases} v_f = v_0 - gt \\ h(t) = h_0 + v_0 t - \frac{1}{2}gt^2 \end{cases}$$

$h_{max} \rightarrow v_f = 0 \Rightarrow$

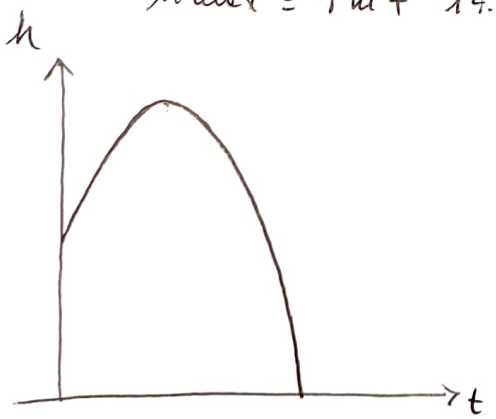
$0\ m/s = 12\ m/s - 9.81\ m/s^2\ t_1$

$9.81\ m/s^2\ t_1 = 12\ m/s$

$t_1 = \frac{12\ m/s}{9.81\ m/s^2} = 1.22\ s$

$h(t_1) = 4\ m + \left(12\ \frac{m}{s}\right) 1.2\ s - \frac{1}{2} 9.81\ \frac{m}{s^2} (1.2\ s)^2$

$h_{max} = 4\ m + 14.4\ m - 7.1\ m = 11.35\ m$



$[y = ax^2 + bx + c]$

① $0 = 4\ m + 12\ \frac{m}{s} t_v - \frac{1}{2} 9.81\ \frac{m}{s^2} t_v^2$

$\left(4.91\ \frac{m}{s^2}\right) t_v^2 - \left(12\ \frac{m}{s}\right) t_v - 4\ m = 0$

$\Delta = \left(12\ \frac{m}{s}\right)^2 - 4\left(4.91\ \frac{m}{s^2}\right)(-4\ m)$

$= 144\ \frac{m^2}{s^2} + 78.56\ \frac{m^2}{s^2}$

$= 222.56\ \frac{m^2}{s^2}$

$t_{v1}, t_{v2} = \frac{+12\ m/s \pm \sqrt{222.56\ m^2/s^2}}{2 \times 4.91\ m/s^2}$

$= \frac{+12\ m/s \pm 14.92\ m/s}{9.81\ m/s^2}$

$\rightarrow t_{v1} = 2.74\ s$

$\rightarrow t_{v2} < 0$ Non Acc

(2) SALTA + DISCESA

$t_V = t_S + t_D$ $\quad t_S = 1.22s$

$$0 = 11.3m - \frac{1}{2} 9.81 \frac{m}{s^2} t_D^2$$

$$t_D = \sqrt{\frac{2 \times 11.3m}{9.81 m/s^2}} = \sqrt{2.3 s^2} = 1.52 s$$

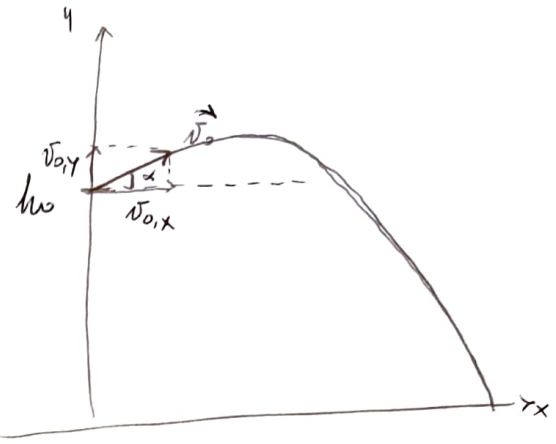
$t_V = 1.2s + 1.52s = 2.74s$

- $v_f = v_0 - g t$

(1) $v_f = 12 m/s - 9.81 \frac{m}{s^2} \cdot 2.74s \simeq -15 m/s$

(2) $v_f = 0 - 9.81 \frac{m}{s^2} \cdot 1.5 s = -15 m/s$

3.2 [Libro] Un bel lancio



DATI

$\alpha = 30°$

$|\vec{v}_0| = 20.0\ m/s$

$h_0 = 45.0\ m$

RICHIESTE

$\Delta t_{volo} = ?$

$\vec{v}_f = ?$

SOLUZIONE

$v_{0,x} = |\vec{v}_0| \cos\alpha = (20.0\ m/s)\cos(30°) = 17.3\ m/s$

$v_{0,y} = |\vec{v}_0| \sin\alpha = (20.0\ m/s)\sin(30°) = 10.0\ m/s$

ASSE x $\quad x(t) = x_0 + v_{0,x} t \rightarrow x(t) = (17.3\ m/s)\,t$

ASSE y $\quad y(t) = y_0 + v_{0,y} t - \frac{1}{2} g t^2 \rightarrow y(t) = 45.0\ m + 10\ \frac{m}{s} t - \frac{1}{2} \cdot 9.81\ \frac{m}{s^2} t^2$

$v_y(t) = v_{0,y} - g t \rightarrow v_y(t) = 10.0\ m/s - 9.81\ m/s^2\, t$

$0 = 45.0\ m + 10\ \frac{m}{s} t_v - \frac{1}{2} \cdot 9.81\ \frac{m}{s^2} t_v^2 \longmapsto \frac{9.81\ m/s^2}{2} t_v^2 - 10\ \frac{m}{s} t_v - 45.0\ m = 0$

$\Delta = (10\ m/s)^2 - 4\left(\frac{9.81\ m/s^2}{2}\right)(-45\ m) = 100\ \frac{m^2}{s^2} + 883\ \frac{m^2}{s^2} = 983\ m^2/s^2$

$t_{v1,v2} = \frac{10\ m/s \pm \sqrt{983\ m^2/s^2}}{9.81\ m/s^2} = \frac{10\ m/s \pm 31.4\ m/s}{9.81\ m/s^2}$

$t_{v1} = 4.22\ s$

$t_{v2} < 0$

$v_y(t_{v1}) = 10\ m/s - 9.81\ m/s^2\,(4.22\ s) = -31.4\ m/s \equiv v_{f,y}$

$\vec{v}_f = v_{f,x}\,\hat{i} + v_{f,y}\,\hat{j} = (17.3\ m/s)\,\hat{i} - (31.4\ m/s)\,\hat{j}$

$|\vec{v}_f| = \sqrt{v_{f,x}^2 + v_{f,y}^2} = 35.8\ m/s$

3.31 [Libro] Distanza percorsa nel salto dal trampolino sulla neve

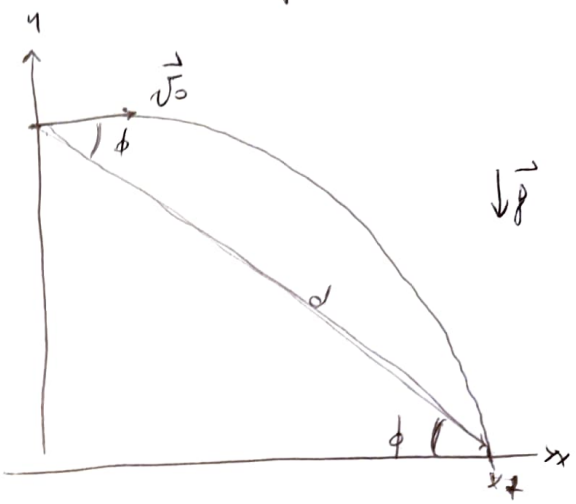
DATI

$v_0 = 25.0 \frac{m}{s}\,\hat{i}$

$\phi = 35.0°$

RICHIESTA

$x_f = ?$



SOLUZIONE

ASSE x $x(t) = x_0 + v_0 t$

$x(t) = 25.0 \frac{m}{s} t$

ASSE Y $y(t) = y_0 + v_{0,y} t - \frac{1}{2} g t^2$

$v_y(t) = v_{0,y} - g t$

$0 = y_0 - \frac{1}{2} g t_f^2 \rightarrow y_0 = \frac{1}{2} g t_f^2$

$y_0 = d \sin\phi$

$x_f = d \cos\phi$

$d \sin\phi = \frac{1}{2} g t_f^2$

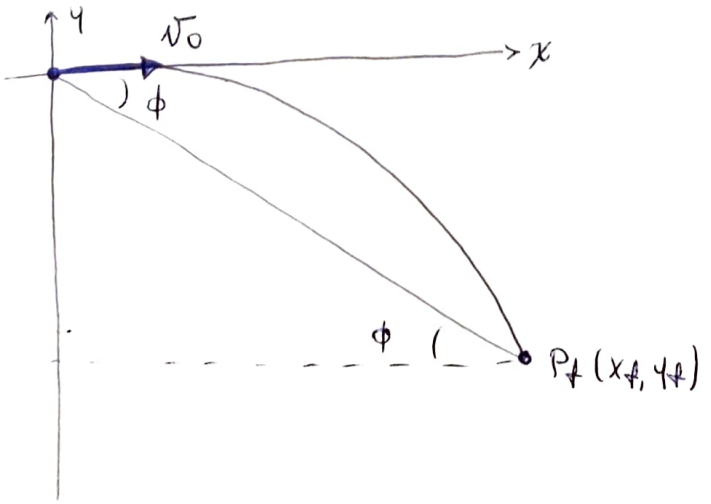
$d \cos\phi = v_0 t_f$

$\rightarrow \frac{d \sin\phi}{d \cos\phi} = \frac{g t_f^2}{2 v_0 t_f}$

$$t_f = \frac{2 v_0 \tan\phi}{g} = \frac{2 \times (25.0\ m/s)\ \tan(35.0°)}{9.81\ m/s^2} = 3.57\ s$$

$x(t_f) = 25.0 \frac{m}{s} \cdot 3.57\ s = \mathbf{89.3\ m}$

ESERCIZIO PER CASA PROVATE A SVOLGERE LO STESSO PROBLEMA CAMBIANDO SISTEMA DI RIFERIMENTO:



(ORA y_0 È NOTA, MA y_f NO!)