I. $v_{01} = 2t$

$v_{14} = 2$

$v_{46} = 6 - t$

$$\frac{dr}{dt} = v \Rightarrow \int_0^6 dr = \int_0^6 v\,dt$$

$$\Rightarrow r_6 - r_0 = \int_0^6 v\,dt$$

en $r_0 = 0$

met $$\int_0^6 v\,dt = \int_0^1 v_{01}\,dt + \int_1^4 v_{14}\,dt + \int_4^6 v_{46}\,dt$$

$$\Rightarrow \int_0^1 v_{01}\,dt = \int_0^1 2t\,dt = 2\frac{t^2}{2}\Big|_0^1 = 1\,m$$

en $$\int_1^4 v_{14}\,dt = \int_1^4 2\,dt = 2t\Big|_{1}^{4} = 6\,m$$

en $$\int_4^6 v_{46}\,dt = \int_4^6 (6-t)\,dt = 6 - \frac{t^2}{2}\Big|_4^6$$

$$= 18 - 16 = 2\,m$$

$$\Rightarrow 1\,m + 6\,m + 2\,m = 9\,m$$

II.

$$\vec{r} = \begin{Bmatrix} t^3 \\ t^2 \\ 0 \end{Bmatrix} m$$

$$\vec{v} = \frac{d\vec{r}}{dt} = \begin{Bmatrix} 3t^2 \\ 2t \\ 0 \end{Bmatrix} \frac{m}{s}$$

$$\vec{a} = \frac{d\vec{v}}{dt} = \begin{Bmatrix} 6t \\ 2 \\ 0 \end{Bmatrix} \frac{m}{s^2}$$

METHODE 1

$$\vec{a}_t = \frac{dv}{dt} \cdot \vec{e}_t$$

$$\Rightarrow \quad v = \sqrt{(3t^2)^2 + (2t)^2}$$

$$= \sqrt{9t^4 + 4t^2}$$

$$\Rightarrow \frac{dv}{dt} = (36t^3 + 8t) \cdot \frac{1}{2} \cdot \frac{1}{\sqrt{9t^4 + 4t^2}}$$

$$\text{in } t = 1s \Rightarrow \quad 44 \cdot \frac{1}{2} \cdot \frac{1}{\sqrt{13}}$$

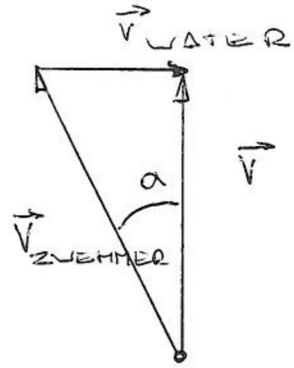
$$= \frac{22}{\sqrt{13}} \frac{m}{s^2}$$

METHODE 2 : De projectie v.d. versnelling volgens de snelheidsvector.

$$\|\vec{a}_t\| = \frac{\vec{a} \cdot \vec{v}}{\|\vec{v}\|} \quad (\text{in } t = 1s)$$

$$\Rightarrow \frac{\begin{Bmatrix} 6 \\ 2 \\ 0 \end{Bmatrix} \cdot \begin{Bmatrix} 3 \\ 2 \\ 0 \end{Bmatrix}}{\sqrt{9+4}} = \frac{22}{\sqrt{13}} \frac{m}{s^2}$$

IV.



$$\|\vec{v}\| = \frac{20\,m}{40\,s} = 0{,}5\,m/s$$

$$\tan\alpha = \frac{0{,}6}{0{,}5}$$

$$\Rightarrow \alpha = 50{,}2^\circ$$

IV. $\vec{M}_A = (\vec{r}_C - \vec{r}_A) \times \vec{F}_C + (\vec{r}_B - \vec{r}_A) \times \vec{F}_B$

$$\vec{M}_A = \begin{vmatrix} \vec{e}_x & \vec{e}_y & \vec{e}_z \\ 1 & -1 & 2 \\ 0 & 3 & 0 \end{vmatrix} + \begin{vmatrix} \vec{e}_x & \vec{e}_y & \vec{e}_z \\ 2 & -2 & 0 \\ 0 & 0 & 2 \end{vmatrix}$$

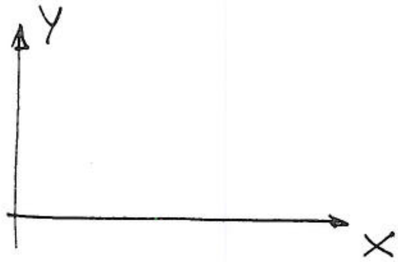
$$= 3\vec{e}_z - 6\vec{e}_x - 4\vec{e}_x - 4\vec{e}_y$$

$$= -10\vec{e}_x - 4\vec{e}_y + 3\vec{e}_z \text{ Nm}$$

V. $t_0 : (0;0)$

$t_1 : (10;2,5)$

$t_2 : (15;2,5)$



$$\frac{d\vec{v}}{dt} = \vec{g}$$

$$\Rightarrow d\vec{v} = \vec{g}\,dt \Rightarrow \int_0^t d\vec{v} = \int_0^t \vec{g}\,dt$$

$$= \vec{v}(t) - \vec{v}_0 = \vec{g}t$$

$$\Rightarrow \vec{v} = \vec{g}t + \vec{v}_0$$

$$\frac{d\vec{r}}{dt} = \vec{v}$$

$$\Rightarrow d\vec{r} = \vec{v}\,dt \Rightarrow \int_0^t d\vec{r} = \int_0^t \vec{v}\,dt \quad \text{en } \vec{v} = \vec{g}t + \vec{v}_0$$

$$\Rightarrow \int_0^t d\vec{r} = \int_0^t (\vec{g}t + \vec{v}_0)\,dt$$

$$\Rightarrow \vec{r} - \vec{r}_0 = \vec{g}\frac{t^2}{2} + \vec{v}_0 t$$

$$\Rightarrow \vec{r} = \vec{g}\frac{t^2}{2} + \vec{v}_0 t + \vec{r}_0$$

$$\Rightarrow \begin{Bmatrix} r_x \\ r_y \\ r_z \end{Bmatrix} = \begin{Bmatrix} 0 \\ -g \\ 0 \end{Bmatrix} \frac{t^2}{2} + \begin{Bmatrix} v_{0x} \\ v_{0y} \\ 0 \end{Bmatrix} t + \begin{Bmatrix} 0 \\ 0 \\ 0 \end{Bmatrix}$$

$$\Rightarrow r_x = v_{0x} t$$

$$r_y = -g\frac{t^2}{2} + v_{0y} t \quad \Rightarrow$$

$$r_z = 0$$

in t_1 : $10 = v_{0x} t_1$

$$2,5 = -g\frac{t_1^2}{2} + v_{0y} t_1$$

in t_2 : $15 = v_{0x} t_2$

$$2,5 = -g\frac{t_2^2}{2} + v_{0y} t_2$$

$$\Rightarrow t_1 = \frac{10}{v_{ox}}$$

$$2{,}5 = -\frac{g}{2}\,\frac{10^2}{v_{ox}^2} + v_{oy}\cdot\frac{10}{v_{ox}} \quad ①$$

$$\Rightarrow t_2 = \frac{15}{v_{ox}}$$

$$2{,}5 = -\frac{g}{2}\cdot\frac{15^2}{v_{ox}^2} + v_{oy}\cdot\frac{15}{v_{ox}} \quad ②$$

$$\Rightarrow ② - 1{,}5\,① \Rightarrow 2{,}5 - 1{,}5\cdot 2{,}5 = -\frac{g}{2}\cdot\frac{15^2}{v_{ox}^2} + 1{,}5\frac{g}{2}\cdot\frac{10^2}{v_{ox}^2}$$

$$\Rightarrow -1{,}25 = -\frac{g}{2}\cdot\frac{225}{v_{ox}^2} + 150\frac{g}{v_{ox}^2}$$

$$\Rightarrow -0{,}25\, v_{ox}^2 = -75$$

$$\Rightarrow v_{ox} = \sqrt{300} = 17{,}32\ \frac{m}{s}$$

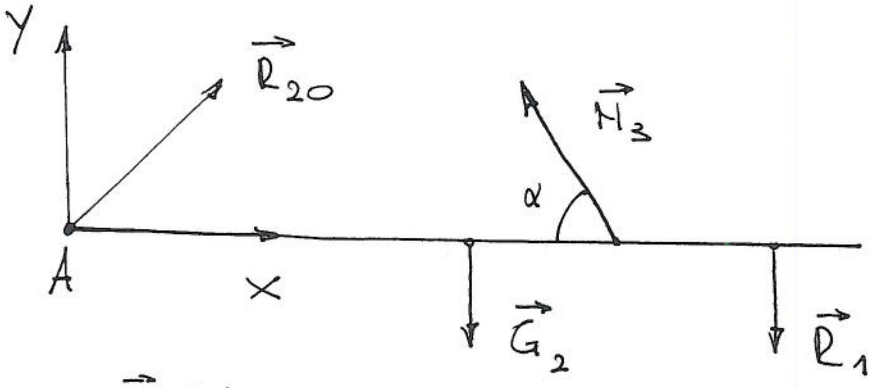
$\Rightarrow v_{oy}$:

mit ① : $$2{,}5 = -5\cdot\frac{100}{300} + v_{oy}\cdot\frac{10}{\sqrt{300}}$$

$$\Rightarrow \left(2{,}5 + \frac{5}{3}\right)\cdot\frac{\sqrt{300}}{10} = v_{oy}$$

$$\Rightarrow v_{oy} = 7{,}21\ \frac{m}{s}$$

VI.

1 

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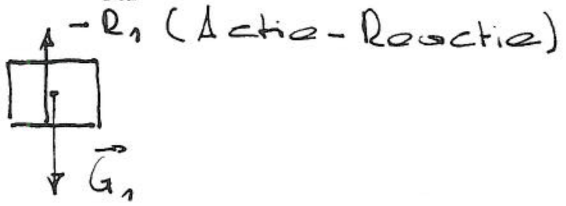
2 

WAGENTJE

uit 2 :
$$\begin{pmatrix} 0 \\ R_1 \\ 0 \end{pmatrix} + \begin{pmatrix} 0 \\ -G_1 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} \Rightarrow y: \; R_1 = G_1$$

M_A :
$$\vec{r}_{G_1} = \begin{pmatrix} l \\ 0 \\ 0 \end{pmatrix} \qquad \vec{G}_1 = \begin{pmatrix} 0 \\ -G_1 \\ 0 \end{pmatrix}$$
$$\vec{r}_{G_2} = \begin{pmatrix} \frac{L}{2} \\ 0 \\ 0 \end{pmatrix} \qquad \vec{G}_2 = \begin{pmatrix} 0 \\ -G_2 \\ 0 \end{pmatrix}$$
$$\vec{r}_{M_3} = \begin{pmatrix} \frac{H}{\tan\alpha} \\ 0 \\ 0 \end{pmatrix} \qquad \vec{M}_3 = \begin{pmatrix} -M_3\cos\alpha \\ M_3 \sin\alpha \\ 0 \end{pmatrix}$$

$\sum \vec{r}_i \times \vec{F}_i = \vec{0}$!
$$\vec{0} = \begin{vmatrix} \vec{e}_x & \vec{e}_y & \vec{e}_z \\ l & 0 & 0 \\ 0 & -G_1 & 0 \end{vmatrix} + \begin{vmatrix} \vec{e}_x & \vec{e}_y & \vec{e}_z \\ \frac{L}{2} & 0 & 0 \\ 0 & -G_2 & 0 \end{vmatrix}$$
$$+ \begin{vmatrix} \vec{e}_x & \vec{e}_y & \vec{e}_z \\ \frac{H}{\tan\alpha} & 0 & 0 \\ -M_3\cos\alpha & M_3\sin\alpha & 0 \end{vmatrix}$$

$$\vec{0} = \frac{G_2 L}{2}\vec{e}_z - G_1 l \,\vec{e}_z + \frac{H}{\cancel{\sin\alpha}} \cdot \cos\alpha \cdot M_3 \cancel{\sin\alpha}\, \vec{e}_z$$

$$\Rightarrow M_3 = \frac{0{,}5\, G_2 L + G_1 l}{H \cos\alpha}$$

$$x: \; R_{20x} - M_3 \cos\alpha = 0$$

$$\Rightarrow R_{20x} = M_3 \cos\alpha$$

$$= \left(\frac{0{,}5\, G_2 L + G_1 \ell}{H \cos\alpha} \right) \cos\alpha$$

$$\Rightarrow R_{20x} = f(\ell)$$ en dus afhankelijk van de positie v.h. wagentje.