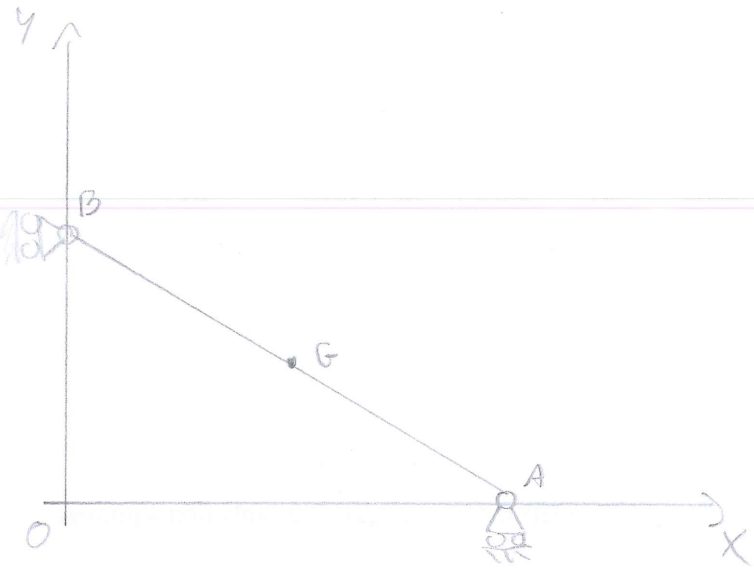
ESERCIZIO "SCALA CHE SCIVOLA



NOTO:

$AB = 700\ mm$

$X_A = 606.2\ mm$

$v_A = 5\ m/s$

$a_A = 0.3\ m/s^2$

? $\vec{v}_B$, $\vec{v}_G$

? $\vec{a}_B$, $\vec{a}_G$

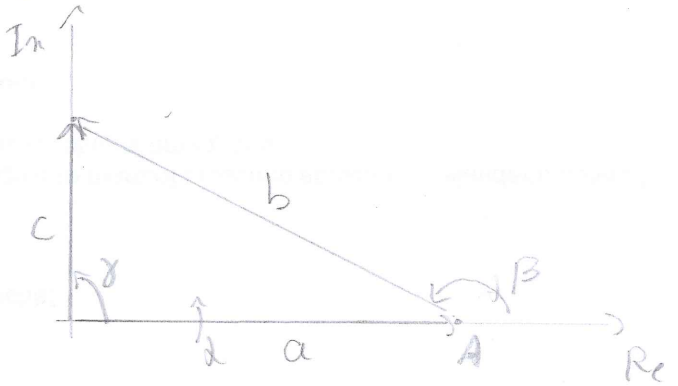
SOLUZIONE CON I NUMERI COMPLESSI:

$$(B-O) = (B-A) + (A-O)$$

$$c e^{i\gamma} = b e^{i\beta} + a e^{i\alpha}$$

cost	γ	b	α
VAR	c	β	a

$$i c = b e^{i\beta} + a$$



$$\begin{cases} 0 = b\cos\beta + a \\ c = b\,\mathrm{sen}\,\beta \end{cases} \Rightarrow \text{ricavo} \quad \begin{matrix} \beta = 150° \\ c = 350\ mm \end{matrix}$$

velocità

$$i\dot{c} = i b \dot{\beta} e^{i\beta} + \dot{a}$$

$$\begin{cases} 0 = -b\dot{\beta}\,\mathrm{sen}\,\beta + \dot{a} \\ \dot{c} = b\dot{\beta}\cos\beta \end{cases} \qquad \begin{bmatrix} b\,\mathrm{sen}\,\beta & 0 \\ -b\cos\beta & 1 \end{bmatrix} \begin{Bmatrix} \dot{\beta} \\ \dot{c} \end{Bmatrix} = \begin{Bmatrix} \dot{a} \\ 0 \end{Bmatrix} \quad (\dot{a} = v_A)$$

SISTEMA LINEARE

$$\Rightarrow \quad \dot{\beta} = 14.28\ rad/s \qquad \dot{c} = -8.66\ m/s$$

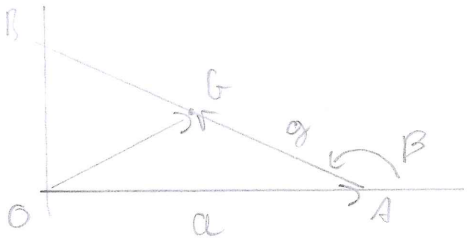
accelerazione

$$i\ddot{c} = i b \ddot{\beta} e^{i\beta} + \ddot{a}$$

$$\begin{cases} 0 = -b\ddot{\beta}\,\mathrm{sen}\,\beta - b\dot{\beta}^2\cos\beta + \ddot{a} \\ \ddot{c} = b\ddot{\beta}\cos\beta - b\dot{\beta}^2\,\mathrm{sen}\,\beta \end{cases} \qquad \begin{bmatrix} b\,\mathrm{sen}\,\beta & 0 \\ -b\cos\beta & 1 \end{bmatrix} \begin{Bmatrix} \ddot{\beta} \\ \ddot{c} \end{Bmatrix} = \begin{Bmatrix} -b\dot{\beta}^2\cos\beta + \ddot{a} \\ -b\dot{\beta}^2\,\mathrm{sen}\,\beta \end{Bmatrix} \quad (\ddot{a} = a_A)$$

$$\Rightarrow \quad \ddot{\beta} = 354.2\ rad/s^2 \qquad \ddot{c} = -286.2\ m/s^2$$

STUDIO IL MOTO DI G



$$(G-O) = (G-A) + (A-O)$$

$$(G-O) = g e^{i\beta} + a$$

$$\begin{cases} x_G = g\cos\beta + a \\ y_G = g \operatorname{sen}\beta \end{cases}$$

velocità

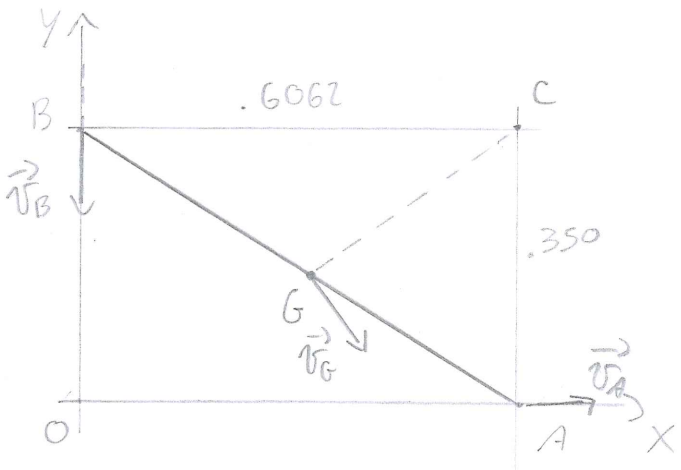
$$\begin{cases} \dot{x}_G = -g\dot{\beta}\operatorname{sen}\beta + \dot{a} \\ \dot{y}_G = g\dot{\beta}\cos\beta \end{cases} \Rightarrow \quad \dot{x}_G = 2.5 \text{ m/s} \qquad |\vec{v}_G| = \sqrt{\dot{x}_G^2 + \dot{y}_G^2} = 5 \text{ m/s}$$

$$\dot{y}_G = -4.33 \text{ m/s}$$

accelerazione

$$\begin{cases} \ddot{x}_G = -g\ddot{\beta}\operatorname{sen}\beta - g\dot{\beta}^2\cos\beta + \ddot{a} \\ \ddot{y}_G = g\ddot{\beta}\cos\beta - g\dot{\beta}^2\operatorname{sen}\beta \end{cases} \qquad \ddot{x}_G = 0.15 \text{ m/s}^2 \qquad |\vec{a}_G| = \sqrt{\ddot{x}_G + \ddot{y}_G} = 143.1 \text{ m/s}$$

$$\ddot{y}_G = -143 \text{ m/s}^2$$



C È CIR DELL'ASTA

- RIVALS

$$\vec{v}_P = \vec{v}_Q + \vec{\omega} \wedge (P-Q)$$

SE SCELGO IL CIR COME PUNTO NOTO

$$\vec{v}_P = \vec{v}_C^{\,0} + \vec{\omega} \wedge (P-C)$$

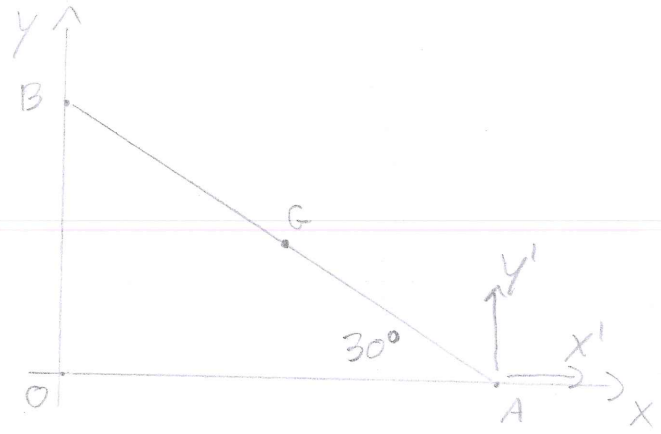
$$\vec{v}_A = \vec{\omega} \wedge (A-C) \qquad v_A = \omega AC \qquad \omega = \frac{v_A}{AC} = 14.28 \text{ rad/s}$$

$$\vec{v}_B = \vec{\omega} \wedge (B-C) \qquad v_B = \omega BC = 8.66 \text{ m/s}$$

$$\vec{v}_G = \vec{\omega} \wedge (G-C) \qquad v_G = \omega GC = 5 \text{ m/s}$$

$GC = AB/2$

SOLUZIONE CON TERNA MOBILE



TERNA MOBILE TRASLANTE IN A
$X_1 A Y_1$
STUDIO IL MOTO DI B

ASSOLUTO : RETTILINEO // Y
TRASCINAMENTO : RETTILINEO // X
RELATIVO : CIRCOLARE CENTRO A

velocità

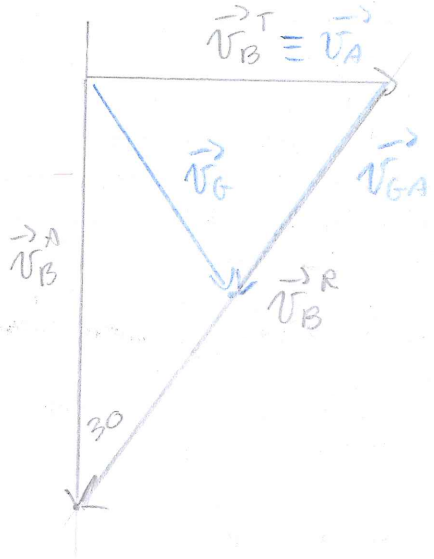
$$\vec{v}_B = \underbrace{\vec{v}_A + \vec{\omega}_{x'} \wedge (B-A)}_{\vec{v}_B^{\,T}} + \vec{v}_{B\,rel}^{\,R}$$

$$\vec{v}_{B\,rel}^{\,R} = \vec{\omega} \wedge (B-A)$$

$\vec{v}_B^{\,A}$	$=$	$\vec{v}_B^{\,T}$	$+$	$\vec{v}_B^{\,R}$
?		v_A		ω_{AB} ?
// Y		// X		$\perp AB$

$v_B = v_A / \tan 30 = 8.66$ m/s

$v_B^R = 10$ m/s $\Rightarrow \omega = 14.3$ r/s ↺



CALCOLO $\vec{v}_G$ CON RIVALS

$$\vec{v}_G = \vec{v}_A + \vec{v}_{GA}$$

$\vec{v}_G$	$=$	$\vec{v}_A$	$+$	$\vec{v}_{GA}$
?		v_A		ω_{GA}
?		// X		$\perp AB$

$$\vec{v}_G = \vec{v}_A + \vec{\omega} \wedge (G-A)$$

accelerazione

$$\vec{a}_B = \underbrace{\vec{a}_A + \vec{\omega}_x \wedge (B-A) - \omega_x^2 (B-A)}_{\vec{a}_B^{\,T}} + \underbrace{2\,\vec{\omega}_x \wedge \vec{v}_{B\,rel}^{\,R}}_{\vec{a}_B^{\,C}} + \vec{a}_{B\,rel}^{\,R}$$

$$\vec{a}_{B\,rel}^{\,R} = \underbrace{\vec{\omega} \wedge (B-A)}_{\vec{a}_{B,t}^{\,R}} - \underbrace{\omega^2 (B-A)}_{\vec{a}_{B,n}^{\,R}}$$

$\vec{a}_B^{\,A}$	$=$	$\vec{a}_B^{\,T}$	$+$	$\vec{a}_{B,t}^{\,R}$	$+$	$\vec{a}_{B,n}^{\,R}$
?		a_A		$\dot{\omega}_{AB}$?		ω^2_{AB}
// Y		// X		$\perp AB$		// AB
(2.5)		0.3		(248)		143

$a_B = 286.5 \ m/s^2$

$\dot{\omega} = 354 \ r/s^2$

CALCOLO $\vec{a}_G$ CON RIVALS

$$\vec{a}_G = \vec{a}_A + \vec{a}_{GA} = \vec{a}_A + \underbrace{\dot{\vec{\omega}} \wedge (G-A)}_{\vec{a}_{GA,t}} \underbrace{- \omega^2 (G-A)}_{\vec{a}_{GA,n}}$$

$\vec{a}_G$	$= \vec{a}_A$	$+ \vec{a}_{GA,t}$	$+ \vec{a}_{GA,n}$
?	a_A	$\dot{\omega} AG$	$\omega^2 AG$
?	// x	$\perp AB$	// AB
	.3	123.9	71.5

$a_G = 143 \ m/s^2$