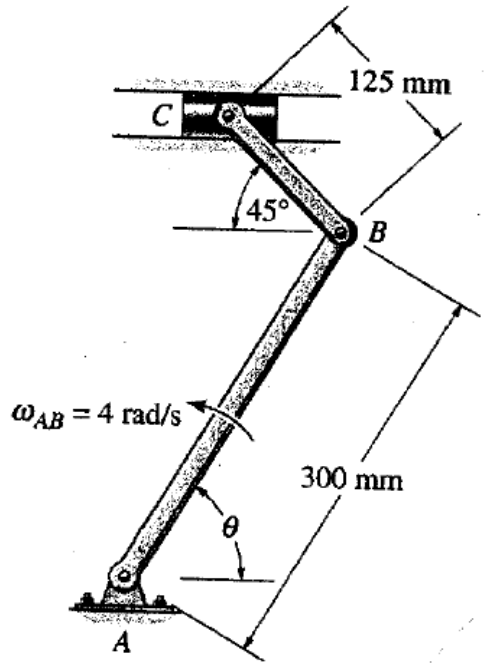
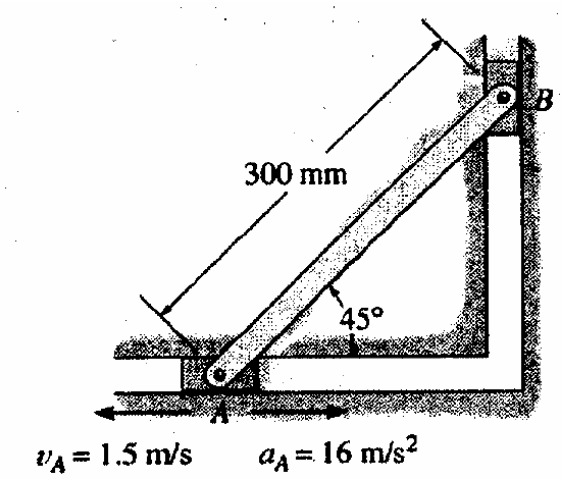
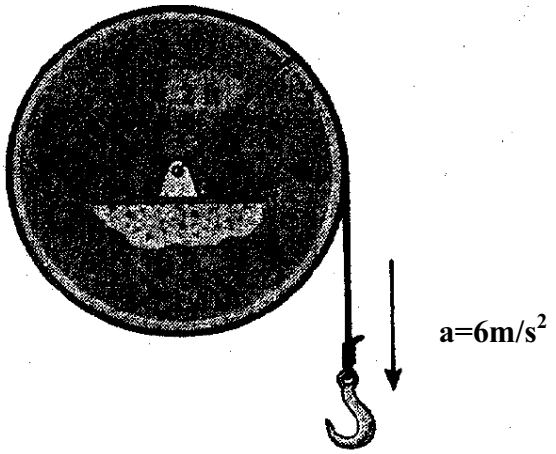
1.
Mehanizam sjekača ima spori hod sječenja i brzi povratni hod. Odrediti brzinu sjekača koji je pričvršćen na klizaču (tačka C) u trenutku kada je poluga AB pod uglom od $\theta=60°$. Poluga AB rotira ugaonom brzinom od 4 s^{-1}.



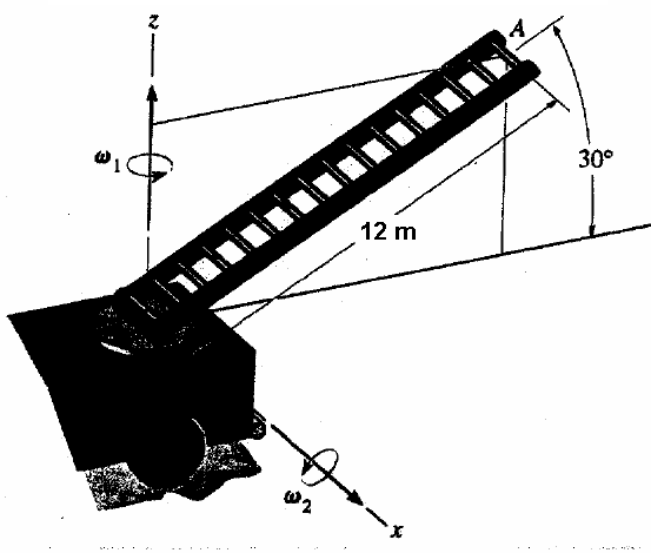
2.
U datom trenutku klizač A ima određenu brzinu i ubrzanje (prikazano na slici). U tom trenutku odrediti brzinu i ubrzanje klizača B, i ugaono ubrzanje poluge AB.



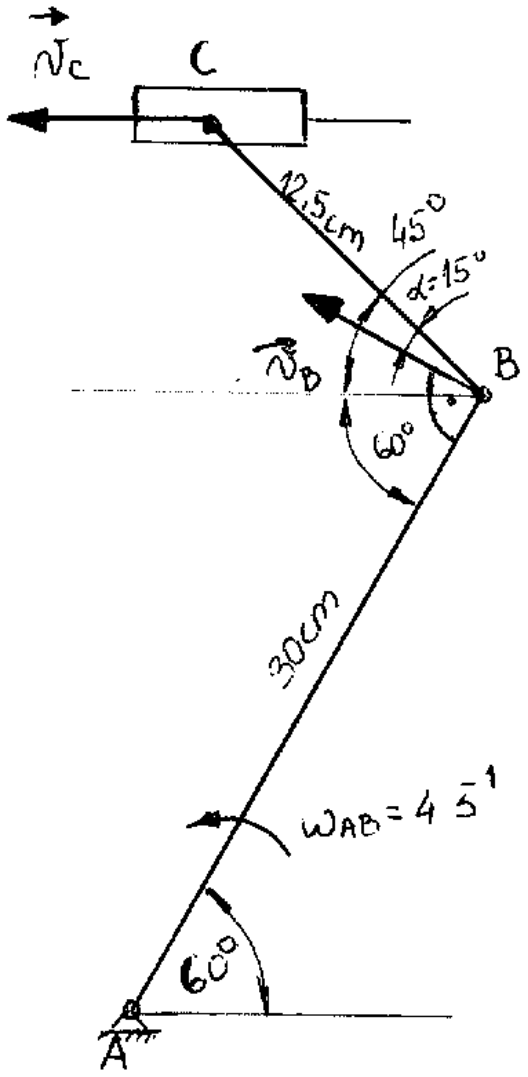
3.
Kuka kreće iz stanja mirovanja sa ubrzanjem $a=6m/s^2$. Kuka je vezana za uže koje je obmotano oko doboša. Odrediti ugaono ubrzanje doboša i ugaonu brzinu doboša u trenutku kada je doboš napravio 10 obrtaja. Koliko će još od tog trenutka u naredne četiri sekunde doboš napraviti obrtaja. R=0,6 m.



4.
Ljestve vatrogasnog vozila obrću se oko ose z sa ugaonom brzinom $\omega_1=0,15s^{-1}$. U isto vrijeme obrću se oko ose x prema naviše ugaonom brzinom $\omega_2=0,16s^{-1}$. Odrediti brzinu tačke A u prikazanom trenutku.



1.

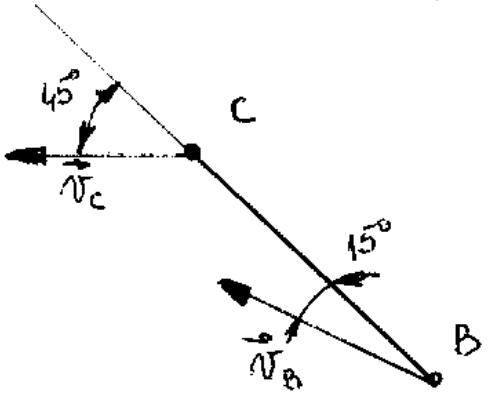


$\alpha = 60° + 45° - 90° = 15°$

$v_B = 30cm \cdot 4\,s^{-1}$

$v_B = 120\ \frac{cm}{s}$

Brzina tačke C odredi se primjenom teoreme o jednakosti projekcija vektora brzina na duž, koja ih spaja



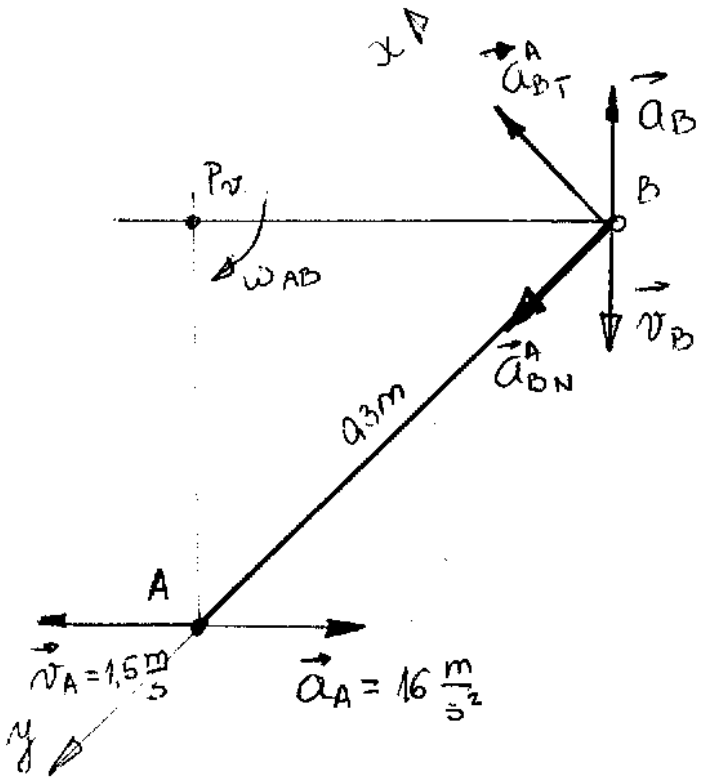
$v_B \cos 45° = v_C \cos 45°$

$v_C = \frac{v_B \cos 15°}{\cos 45°}$

$v_C = \frac{120 \cdot 0{,}966}{0{,}707}$

$v_C = 163{,}9\ \frac{cm}{s}$

2.



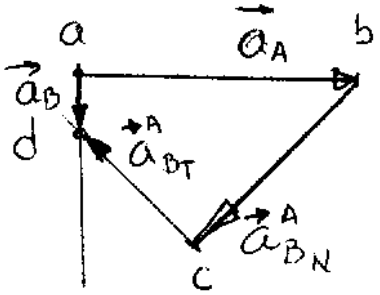
$$\overline{P_W A} = \frac{0{,}3\,m}{\sqrt{2}} = 0{,}21\,m$$

$$\omega_{AB} = \frac{v_A}{\overline{P_W A}} = \frac{1{,}5\frac{m}{s}}{0{,}21\,m}$$

$$\omega_{AB} = 7\,s^{-1}$$

$$V_B = V_A = 1{,}5\frac{m}{s}$$

$$\vec{a}_B = \vec{a}_A + \vec{a}^A_{BN} + \vec{a}^A_{BT} \quad \ldots (*)$$



J-nu (*) projektujemo na osu y:

$$-a_B \cos 45^\circ = -a_A \cos 45^\circ + a^A_{BN} + 0$$

$$a_B = a_A - \frac{a^A_{BN}}{\cos 45^\circ} = 16 - \frac{14{,}7}{0{,}707} = -4{,}8\frac{m}{s^2}$$

$$a^A_{BN} = \omega_{AB}^2 \cdot \overline{AB} = 7^2 \cdot 0{,}3 = 14{,}7\frac{m}{s^2}$$

J-nu (*) projektujemo na osu x:

$$a_B \cos 45^\circ = -a_A \sin 45 + a^A_{BT}$$

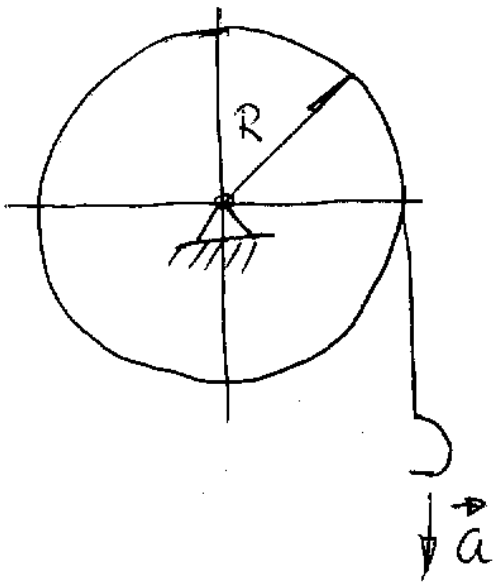
$$a^A_{BT} = 0{,}707 \cdot (a_B + a_A)$$

$$a^A_{BT} = 0{,}707 \cdot (-4{,}8 + 16)$$

$$a^A_{BT} = 7{,}9\frac{m}{s^2}$$

$$\varepsilon_{AB} = \frac{a^A_{BT}}{\overline{AB}} = \frac{7{,}9}{0{,}3} = 26{,}33\,s^{-2}$$

3.



$a_T = \varepsilon \cdot R \; ; \; a_T = a = 6 \frac{m}{s^2}$

$\varepsilon = \frac{a_T}{R} = \frac{6 \frac{m}{s^2}}{0{,}6m}$

$\varepsilon = 10 \frac{rad}{s^2}$

$\omega = \omega_0 + \varepsilon t$ - kod jednako-ubrzanog obrtanja

za $\omega_0 = 0$ i $\varphi_0 = 0$

$$\boxed{\begin{aligned} \omega &= \varepsilon \cdot t \\ \varphi &= \varepsilon \cdot t^2/2 \end{aligned}}$$

Za $N = 10$ obrtaja $\varphi = 2\tilde{\pi} \cdot N = 20\tilde{\pi}$ [rad]

$20\tilde{\pi} = \frac{10 s^{-2} \cdot t^2}{2}$

$t^2 = \frac{40\tilde{\pi}}{10 s^{-2}}$

$t = 2\sqrt{\tilde{\pi}}$ s

$\omega(t = 2\sqrt{\tilde{\pi}} s) = 10 s^{-2} \cdot 2\sqrt{\tilde{\pi}} s = 20\sqrt{\tilde{\pi}} [s^{-1}]$

U naredne 4 s broj obrtaja je:

$\varphi = \omega_0 t + \frac{\varepsilon \cdot t^2}{2}$

$\varphi = 20\sqrt{\tilde{\pi}} \cdot 4 + \frac{10 \cdot 4^2}{2}$

$\varphi = 221{,}3$ [rad]

$N = \frac{\varphi}{2\tilde{\pi}} = 35{,}3$ obrtaja

$$v_A = \vec{\omega} \times \vec{OA} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0,16 & 0 & 0,15 \\ 0 & 10,4 \cdot 6 & \end{vmatrix}$$

$$= -0,15 \cdot 10,4\, \vec{i} - \vec{j}\, 0,16 \cdot 6 + \vec{k}\, 0,16 \cdot 10,4$$

$$= -1,6\, \vec{i} - 0,96\, \vec{j} + 1,66\, \vec{k}$$