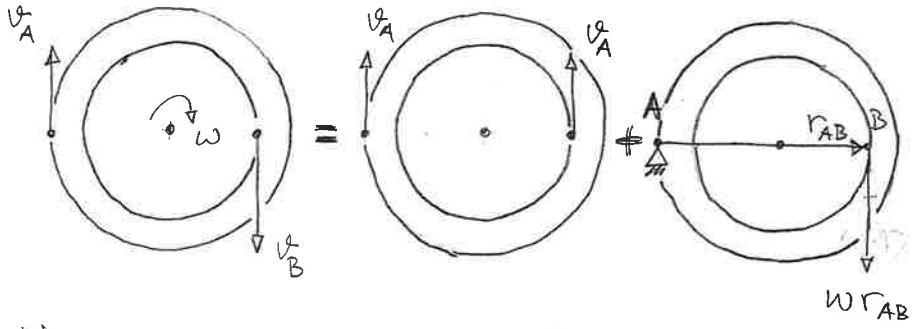
Seminariepass 20

1.

Bestäm först vinkelhast. ω:

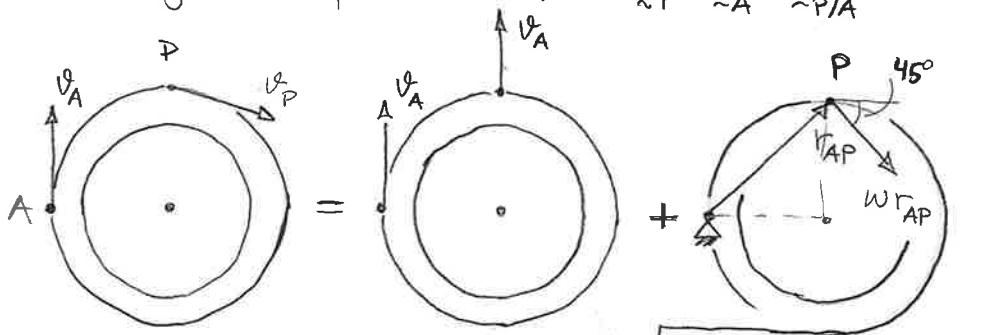
$\underset{\sim}{v}_B = \underset{\sim}{v}_A + \underset{\sim}{v}_{B/A}$ ← ren rotation



$(\downarrow)\quad v_B = -v_A + \omega r_{AB}\ ;\quad \dfrac{v_B + v_A}{r_{AB}} = \omega\ ;$

$$\omega = \frac{1.8+1.2}{(0.12+0.08)} = 15\ \text{rad/s}$$

Hastighet i punkten P: $\underset{\sim}{v}_P = \underset{\sim}{v}_A + \underset{\sim}{v}_{P/A}$



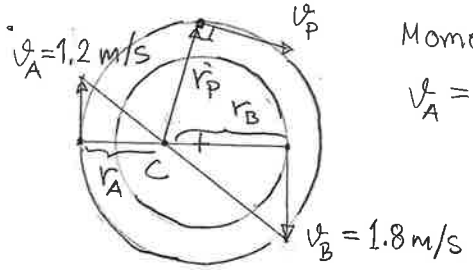
$r_{AP} = \sqrt{0.12^2+0.12^2} = 0.17\text{m}$

$(\rightarrow)\quad v_{Px} = \omega r_{AP}\cdot\cos 45° = 15\cdot 0.17\cdot\frac{1}{\sqrt{2}} = 1.8\ \text{m/s}$

$(\uparrow)\quad v_{Py} = v_A - \omega\cdot r_{AP}\cdot\sin 45° = 1.2 - 1.8 = -0.6\ \text{m/s}$

$$v_P = \sqrt{1.8^2+0.6^2} = 1.90\ \text{m/s}$$

1. Alt. Lösning m. momentancentrum:



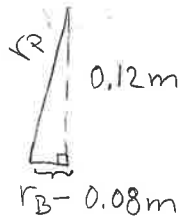
Momentancentrum C:

$v_A = r_A\omega\ ,\ v_B = r_B\omega\ ,\ v_P = r_P\omega$

$r_A + r_B = 0.12+0.08 = 0.2\text{m}$

$$\Rightarrow \frac{v_A}{\omega} + \frac{v_B}{\omega} = 0.2\text{m}\ ;\quad \frac{v_A+v_B}{\omega} = 0.2\text{m}\ ;$$

$$\omega = \frac{v_A+v_B}{0.2\text{m}} = \frac{1.2+1.8}{0.2} = \frac{3}{0.2} = 15\ \text{rad/s}$$



r_B? $\quad r_B = \dfrac{v_B}{\omega} = \dfrac{1.8}{15} = 0.12\text{m}$

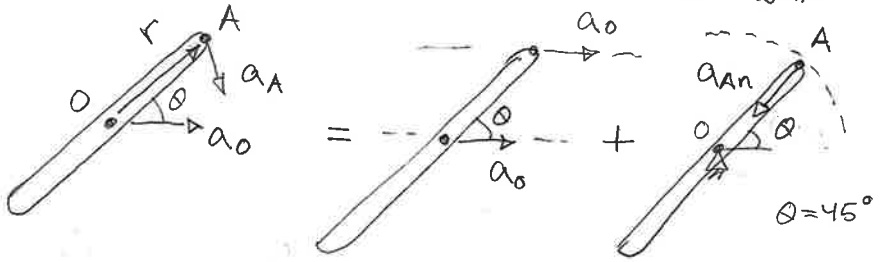
$$\Rightarrow r_P = \sqrt{0.04^2+0.12^2} = 0.126\text{m}$$

$$v_P = 0.126\text{m}\cdot 15\ \text{rad/s} = 1.90\ \text{m/s}$$

2.

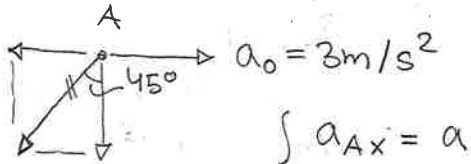
Propeller roterar med $\omega = 2\,\text{rad/s}$, $\underline{\alpha = 0}$

Translation + rotation: $\underset{\sim}{a}_A = \underset{\sim}{a}_0 + \underset{\sim}{a}_{A/0}$



Rotationsbidraget: $a_{An} = r\omega^2 = 0{,}8 \cdot 2^2 = 3{,}2\,\text{m/s}^2$

Totala acc. i punkten A:



$$\begin{cases} a_{Ax} = a_0 - 3{,}2 \cdot \sin 45^\circ = 0{,}737\,\text{m/s}^2 \\ a_{Ay} = -3{,}2\cos 45^\circ = -2{,}26\,\text{m/s}^2 \end{cases}$$

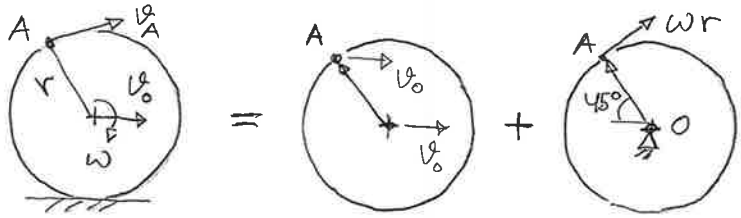
Alltså

$$a_A = \sqrt{2{,}26^2 + 0{,}737^2} = \underline{2{,}38\,\text{m/s}^2}$$

3. Hjul rullar utan glidning (enl. förel.):

$v_0 = \omega r$ ... (1) och $a_0 = r\alpha$ ... (2)

a) $\underset{\sim}{v}_A = \underset{\sim}{v}_0 + \underset{\sim}{v}_{A/0}$ ← ren rotation



$$(\rightarrow)\quad v_{Ax} = v_0 + \omega r \cos 45^\circ \overset{(1)}{=} v_0(1 + \cos 45^\circ) =$$

$$= 3 \cdot \left(1 + \frac{1}{\sqrt{2}}\right) = 5{,}12\,\text{m/s}$$

$$(\uparrow)\quad v_{Ay} = \omega r \sin 45^\circ = \frac{v_0}{\sqrt{2}} = \frac{3}{\sqrt{2}} = 2{,}12\,\text{m/s}$$

Dvs $v_A = \sqrt{5{,}12^2 + 2{,}12^2} = \underline{5{,}54\,\text{m/s}}$

Vinkelhast. behövs för b) uppg.

$(1) \Rightarrow \quad \omega = \frac{v_0}{r} = \frac{3}{0{,}4} = 7{,}5\,\text{rad/s}$

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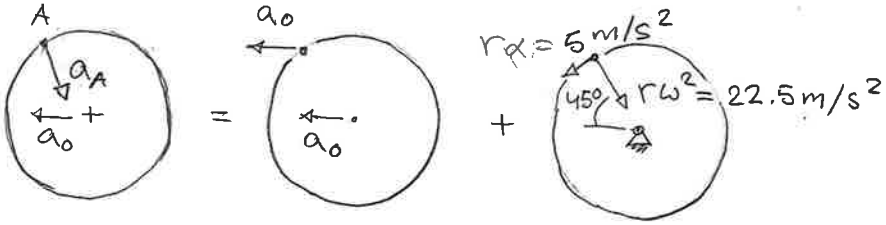
3b) $\underset{\sim}{a}_A = \underset{\sim}{a}_0 + \underset{\sim}{a}_{A/0}$ ren rotation

$$\begin{cases} (a_{A/0})_n = r\omega^2 = 0.4 \cdot 7.5^2 = 22.5\ m/s^2 \\ (a_{A/0})_s = r\alpha = (\text{ekv. (2)}) = a_0 = 5\ m/s^2 \end{cases}$$



$(\rightarrow)$ $a_{Ax} = -5 - 5 \cdot \cos 45° + 22.5 \cos 45° =$

$= -5 - 3.54 + 15.9 = 7.37\ m/s^2$

$(\uparrow)$ $a_{Ay} = -5 \sin 45° - 22.5 \sin 45° = -\frac{27.5}{\sqrt{2}} =$

$= -19.4\ m/s^2$

DVS $a_A = \sqrt{7.37^2 + 19.4^2} = 20.8\ m/s^2$