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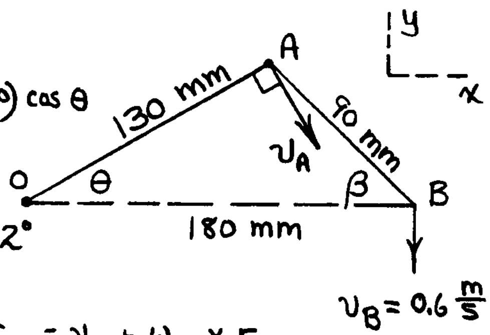


$90^2 = 180^2 + 130^2 - 2(180)(130)\cos\theta$

$\theta = 28.3°$

$\frac{130}{\sin\beta} = \frac{90}{\sin 28.3°}$, $\beta = 43.2°$

$\underline{v}_A = \underline{v}_B + \underline{v}_{A/B}$: $\underline{\omega}_{OA} \times \underline{r}_{OA} = \underline{v}_B + \underline{\omega}_{AB} \times \underline{r}_{BA}$

$\omega_{OA}\underline{k} \times 0.130\,(\cos 28.3°\underline{i} + \sin 28.3°\underline{j}) = -0.6\underline{j} +$

$\omega_{AB}\underline{k} \times 0.090\,(-\cos 43.2°\underline{i} + \sin 43.2°\underline{j})$

$\underline{i}$: $-0.0617\,\omega_{OA} = -0.0617\,\omega_{AB}$

$\underline{j}$: $0.1144\,\omega_{OA} = -0.6 - 0.0656\,\omega_{AB}$

Solve simultaneously to obtain

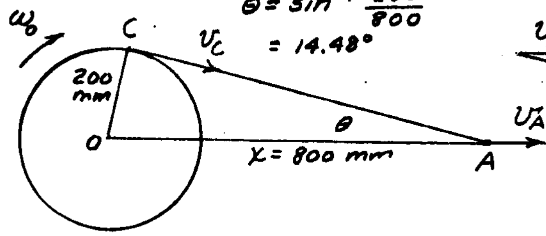
$\omega_{AB} = \omega_{OA} = -3.33$ rad/s

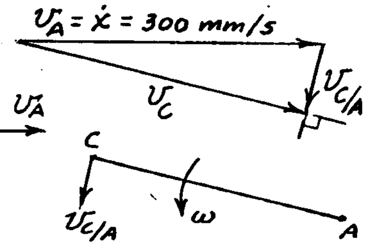
So $\underline{\omega}_{OA} = -3.33\underline{k}$ rad/s

5/72 $\underline{v}_C = \underline{v}_A + \underline{v}_{C/A}$, $v_A = 300$ mm/s

$\theta = \sin^{-1} \frac{200}{800}$

$= 14.48°$





$v_C = 300 \cos 14.48°$

$= 300(0.9682) = 290$ mm/s

$v_{C/A} = 300 \sin 14.48° = 300/4 = 75$ mm/s

$\overline{CA} = 800 \cos 14.48° = 775$ mm

$\omega_{AB} = v_{C/A}/\overline{CA} = 75/775 = \underline{0.0968 \text{ rad/s CCW}}$

$\omega_0 = v_C/\overline{CO} = 290/200 = \underline{1.452 \text{ rad/s CW}}$

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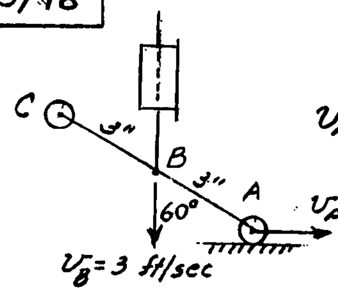
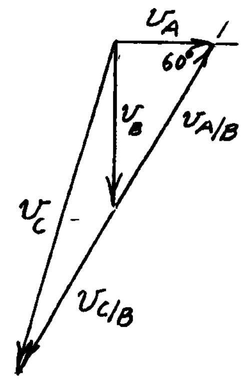


$$\underline{v}_A = \underline{v}_B + \underline{v}_{A/B}$$

$$\underline{v}_C = \underline{v}_B + \underline{v}_{C/B}$$

$$v_{A/B} = \overline{AB}\omega = \overline{CB}\omega = v_{C/B}$$



From geometry

$v_{A/B} = 3/\sin 60° = 3.46$ ft/sec , $v_A = 3/\tan 60° = 1.732 \frac{ft}{sec}$

$v_{C/B} = 3.46$ ft/sec

$v_C = \sqrt{(3+3)^2 + (1.732)^2} = \sqrt{39} = \underline{6.24 \text{ ft/sec}}$

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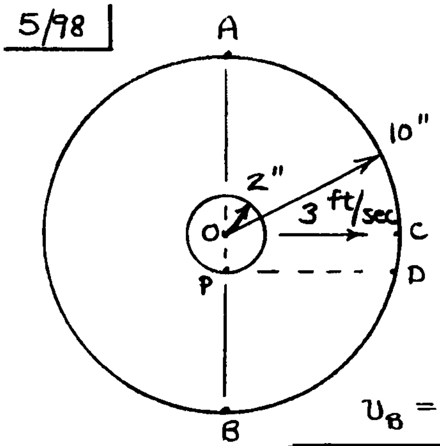

Point P is the instantaneous center

$v_O = \overline{OP}\,\omega, \quad \omega = \frac{3}{2/12}$

$\omega = 18$ rad/sec CW

$v_A = \overline{AP}\,\omega = \frac{12}{12}(18)$

$= \underline{18 \text{ ft/sec} \rightarrow}$

$v_B = \overline{BP}\,\omega = \frac{8}{12}(18) = \underline{12\,\frac{\text{ft}}{\text{sec}} \leftarrow}$

$v_C = \overline{CP}\,\omega = \sqrt{\left(\frac{2}{12}\right)^2 + \left(\frac{10}{12}\right)^2}\,(18) = \underline{15.30 \text{ ft/sec}}$

$\alpha = \tan^{-1}\frac{2}{12} = 9.46°$

$v_D = \overline{DP}\,\omega = \frac{10}{12}(18) = \underline{15 \text{ ft/sec} \downarrow}$

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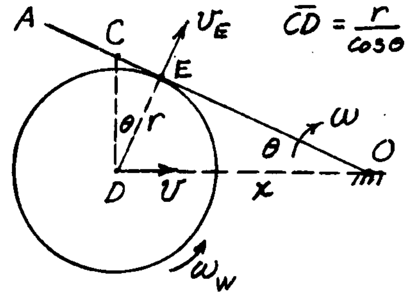


$\overline{CD} = \frac{r}{\cos\theta}$, $\overline{CE} = r\tan\theta$

C = instantaneous center of zero velocity for wheel

$$\omega_W = \frac{v_D}{\overline{CD}} = \frac{v}{r/\cos\theta}$$

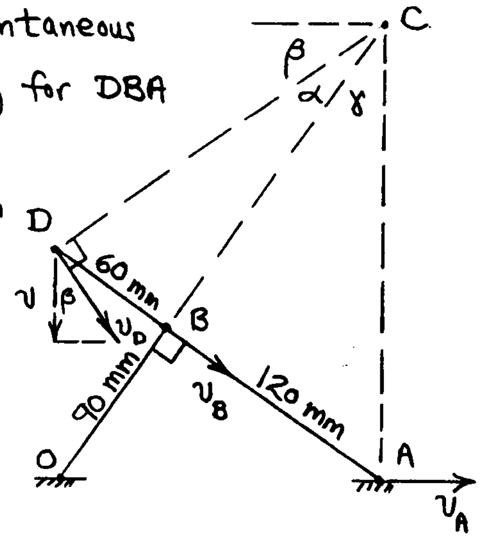
$$= \frac{v}{r}\frac{\sqrt{x^2-r^2}}{x}$$

$$\underline{\omega_W = \frac{v}{r}\sqrt{1-(r/x)^2}}$$

$$\omega = \omega_{AO} = \frac{v_E}{\overline{EO}} = \frac{1}{\overline{EO}}\, v\,\frac{\overline{CE}}{\overline{CD}}$$

$$= \frac{1}{\sqrt{x^2-r^2}}\, v\,\frac{r\tan\theta}{r/\cos\theta} = \frac{v}{\sqrt{x^2-r^2}}\frac{r}{x}, \quad \underline{\omega = \frac{v}{x\sqrt{(x/r)^2-1}}}$$

5/114 C is the instantaneous center of zero velocity for DBA



From geometry,

$\overline{AC} = \frac{5}{3}(120) = 200$ mm

$\overline{BC} = 160$ mm

$\overline{DC} = \sqrt{60^2 + 160^2}$

$= 170.9$ mm

$\gamma = \sin^{-1} \frac{120}{200} = 36.9°$

$\alpha = \tan^{-1} \frac{60}{160} = 20.6°$

$\beta = 90 - 36.9 - 20.6 = 32.6°$

$v_D = \frac{v}{\cos\beta} = \frac{0.2}{\cos 32.6°} = 0.237$ m/s

$\frac{v_D}{\overline{DC}} = \frac{v_A}{\overline{AC}}$; $v_A = \frac{200}{170.9}(0.237) = \underline{0.278 \text{ m/s}}$