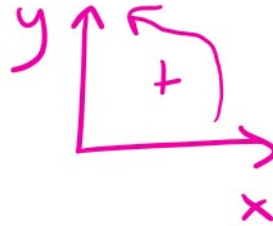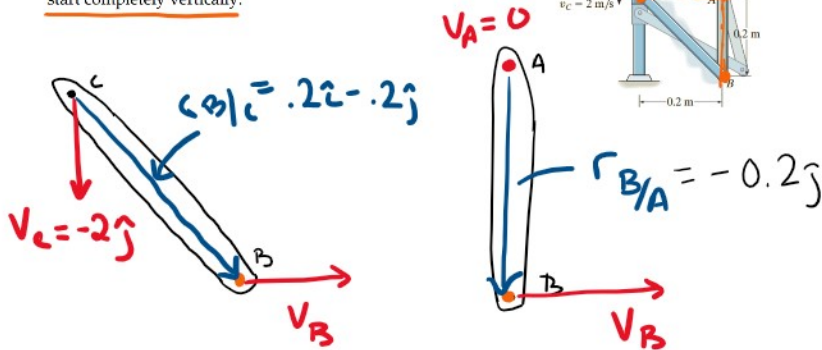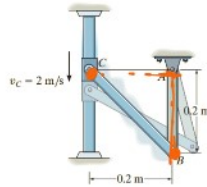**Example 3** : The collar in C is moving download with a velocity of 2 m/s. Determine the angular velocity of CB **at this instant**. CB start completely vertically.

$v_C = 2$ m/s

0.2 m

0.2 m

$V_A = 0$

$r_{B/C} = .2\hat{\imath} - .2\hat{\jmath}$

$V_C = -2\hat{\jmath}$

V_B

$r_{B/A} = -0.2\hat{\jmath}$

V_B

y

$+$

x

$$\bar{V}_B = \bar{V}_C + \bar{\omega}_{CB} \times \bar{r}_{B/C}$$

$$V_B\hat{\imath} = -2\hat{\jmath} + \omega_{CB}\hat{k} \times (0.2\hat{\imath} - 0.2\hat{\jmath})$$

$$V_B\hat{\imath} = -2\hat{\jmath} + 0.2\omega_{CB}\hat{\jmath} + 0.2\omega_{CB}\hat{\imath}$$

$\hat{\imath}:$

$$V_B = 0.2\,\omega_{CB}$$

$$V_B = 0.2(10) = 2\,^m/_s \rightarrow$$

$\hat{\jmath}:$ $0 = -2 + 0.2\,\omega_{CB}$

$$\omega = 10\,^{rad}/_s$$

$$\bar{V}_B = \overset{0}{\bar{V}_A} + \bar{\omega}_{AB} \times \bar{r}_{B/A}$$

$$V_B\hat{\imath} = \omega_{AB}\hat{k} \times (-0.2\hat{\jmath})$$
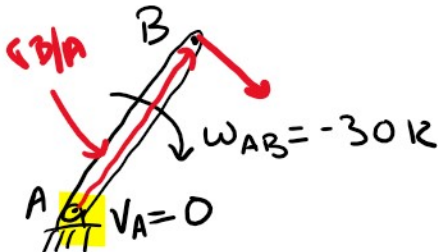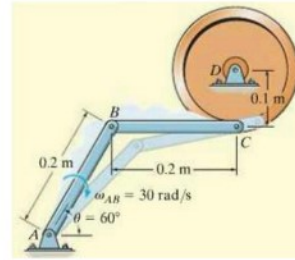
$$V_B\hat{\imath} = 0.2\,\omega_{AB}\hat{\imath}$$

$\hat{\imath}:$

$$V_B = 0.2\,\omega_{AB}$$

$$2 = 0.2\,\omega_{AB}$$

$$\omega_{AB} = 10\,^{rad}/_s$$

Example 1: The bar AB of the linkage shown, has a clockwise angular velocity of 30 rad/s when $\theta = 60°$. Determine the angular velocities of member BC and the wheel at this instant.
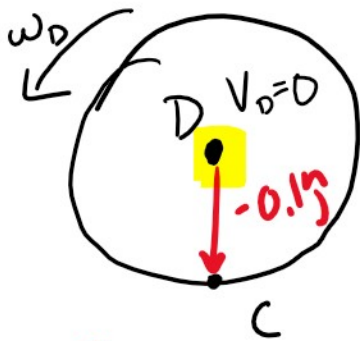

$\vec{r}_{B/A}$ B

$\omega_{AB} = -30k$

A $V_A = 0$

$$\vec{V}_B = \cancel{\vec{V}_A}^{0} + (\omega_{AB}) \times \vec{r}_{B/A}$$

$$\vec{V}_B = -30\overset{k}{k} \times (0.2\cos60\hat{i} + 0.2\sin60\hat{j})$$

$$ 0.1\hat{i} + 0.17\hat{j}$$

$$\vec{V}_B = 5.1\hat{i} -30(.1)\hat{j}$$

$$V_B = 5.2\hat{i} -3\hat{j}$$

ω_D

D $V_D = 0$

$-0.1\hat{j}$

C

$$V_C = \cancel{V_D}^{0} + \omega_D \times \vec{r}_{C/D}$$

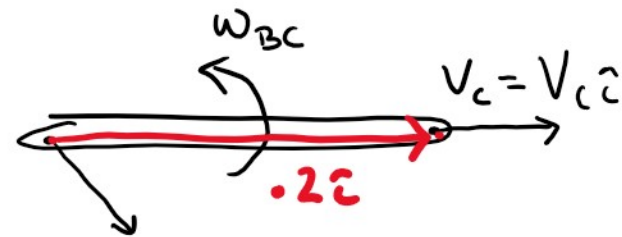$$5.2\hat{i} = \omega_D \hat{k} \times (-0.1\hat{j})$$

$$= -0.1\omega_D (k \times \hat{j})$$

$$= -0.1\omega_D (-\hat{i})$$

$$= 0.1\omega_D$$

$$\omega_D = 52 \text{ rad/s}$$

ω_{BC} $V_c = V_c\hat{i}$

$.2\hat{i}$

$$V_B = 5.2\hat{i} - 3\hat{j}$$

$$\vec{V}_C = V_B + \vec{\omega}_{BC} \times \vec{r}_{C/B}$$

$$V_c\hat{i} = 5.2\hat{i} - 3\hat{j} + \omega_{BC}\hat{k} \times 0.2\hat{i}$$

$$V_c\hat{i} = 5.2\hat{i} - 3\hat{j} + 0.2\omega_{BC}\hat{j}$$

$\hat{i}:$

$$V_c = 5.2 \text{ m/s} \longrightarrow$$

$\hat{j}:$ $0 = -3 + 0.2\omega_{BC}$

$$\omega_{BC} = 15 \text{ rad/s } \hat{j}$$

$-0.1\omega_D$

$\omega_D = 52\ \text{rad/s}$

Example 2: Block D moves with a speed of 3m/s. Determine the angular velocities of links BD and AB at the instant shown