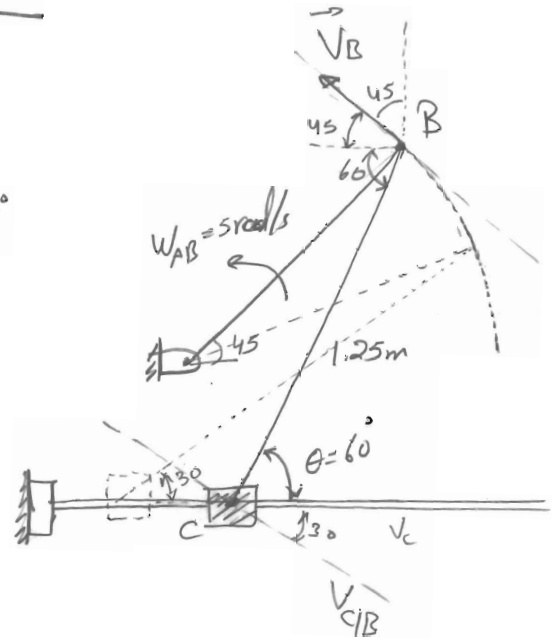
H.W. 6

16-57

$\omega_{AB} = 5$ rad/s

Determine V_c when $\theta = 60°$ & $\phi = 45°$

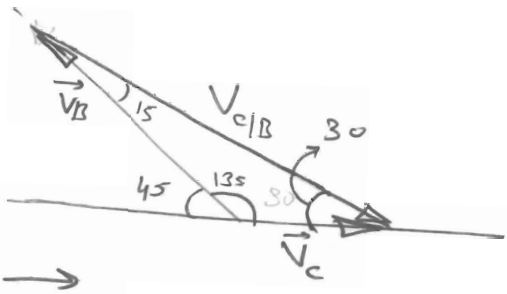


$$V_B = \omega_{AB} r_{AB}$$
$$= 5(1) = 5 \text{ m/s}$$

$$\vec{V}_c = \vec{V}_B + \vec{V}_{c/B}$$

$$\frac{V_B}{\sin 30} = \frac{V_c}{\sin 15}$$

$$\Rightarrow V_c = V_B \frac{\sin 15}{\sin 30}$$
$$= 5 \frac{\sin 15}{\sin 30}$$
$$= 2.588 \text{ m/s} \rightarrow$$



OR

$$\vec{V}_B = 5[-\cos(45)\,i + \sin(45)\,j] \text{ m/s}$$

$$\vec{V}_c = V_c\, i \quad ; \quad \vec{r}_{c/B} = 1.25[-\cos(60)\,i - \sin(60)\,j] \text{ m}$$

$$\vec{V}_c = \vec{V}_B + \vec{V}_{c/B} = \vec{V}_B + \vec{\omega}_{BC} \times \vec{r}_{c/B}$$

$$V_c\, i = -5\cos(45)\,i + 5\sin(45)\,j + (\omega_{BC} k) \times [-1.25\cos(60)\,i - 1.25\sin(60)\,j]$$

$$V_c\, i = -5\cos(45)\,i + 5\sin(45)\,j - 1.25\omega_{BC}\cos(60)\,j + 1.25\omega_{BC}\sin(60)\,i$$

j-component

$$0 = 5\sin(45) - 1.25\,\omega_{BC}\cos(60)$$

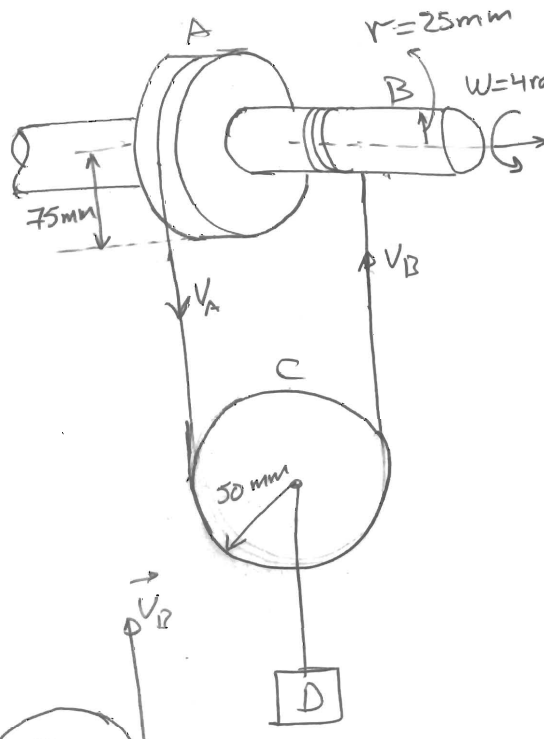
$$\Rightarrow \omega_{BC} = 5.657 \text{ rad/s}$$

i-component

$$V_c = -5\cos(45) + 1.25(5.657)\sin(60) = 2.588 \text{ m/s}$$

$$\vec{V}_c = 2.588\, i \text{ m/s}$$

16-73



$W = 4$ rad/s

Determine w_c & $\vec{V}_D$.

$V_B = (w)(r_B)$

$= 4 \times 0.025 = 0.1$ m/s ↑

$V_A = 4 \times 0.075 = 0.3$ m/s ↓

$\vec{V}_{B/A} = \vec{V}_B - \vec{V}_A$

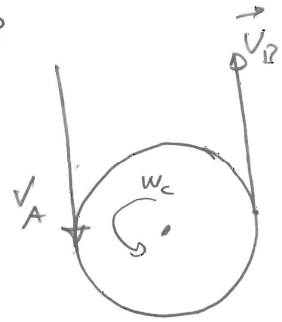
$= 0.1\,j - (-0.3\,j) = 0.4\,j$ m/s

$= 0.4$ m/s ↑

$|\vec{V}_{B/A}| = w_c r_{B/A}$

$\Rightarrow w_c = \dfrac{|\vec{V}_{B/A}|}{r_{B/A}} = \dfrac{0.4}{2(0.05)}$

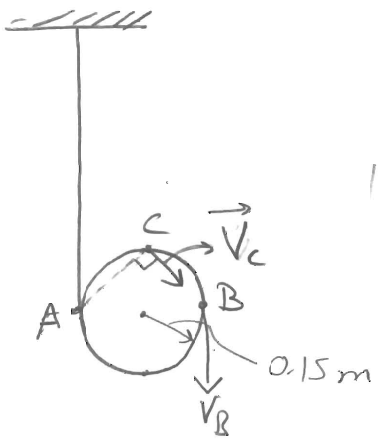
$\Rightarrow w_c = 4$ rad/s C.C.W



$\vec{V}_D = \vec{V}_A + \vec{V}_{D/A}$; $|\vec{V}_{D/A}| = w_c r_{D/A} = 4(0.05) = 0.2$ m/s ↑

$\Rightarrow \vec{V}_D = -0.3\,j + 0.2\,j = -0.1\,j$ m/s $= 0.1$ m/s ↓

16.88



$W = 4$ rad/s C.W

Determine $\vec{V}_A$, $\vec{V}_B$, and $\vec{V}_C$

$V_A = 0$

$V_B = w\, r_{AB} = 4(0.3) = 1.2$ m/s ↓

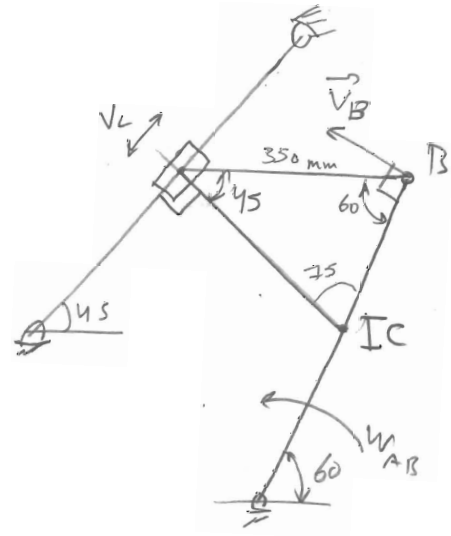
$V_C = w\, r_{AC} = 4\sqrt{0.15^2 + 0.15^2} = 0.8485$ m/s

16.94

$\omega_{AB} = 4$ rad/s

Determine V_c ? & ω_{CB}

$V_B = \omega_{AB}\, r_{B/A} = 4 \times 0.5 = 2$ m/s



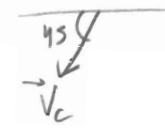
$$\frac{r_{B/C}}{\sin 75} = \frac{r_{B/Ic}}{\sin 45}$$

$$r_{B/Ic} = 350 \times \frac{\sin 45}{\sin 75} = 256.2 \text{ mm}$$

$$r_{C/Ic} = 350 \times \frac{\sin 60}{\sin 75} = 313.8 \text{ mm}$$

$$\omega_{CB} = \frac{V_B}{r_{B/Ic}} = \frac{2}{0.2562} = 7.806 \text{ rad/s} \quad \text{C.C.W}$$

$$V_c = \omega_{CB}\, r_{C/Ic} = 7.806 \times 0.3138 = 2.450 \text{ m/s}$$

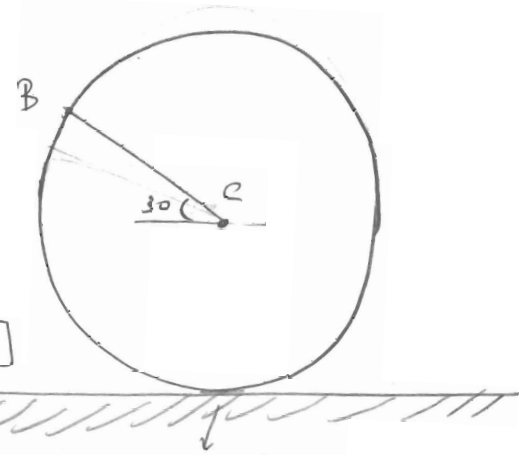


16-109

$\omega = 2$ rad/s

$\alpha = 4$ rad/s^2

Determine a_B



$$\vec{a}_c = (\alpha\, r_w)\, i = (4 \times 0.4)\, i = 1.6\, i \text{ m/s}^2$$

$$\vec{a}_B = \vec{a}_c + \vec{\alpha} \times \vec{r}_{B/c} - \omega^2 \vec{r}_{B/c}$$

$$= 1.6\, i + (-4k) \times (0.4)\left[-\cos(30)\, i + \sin(30)\, j\right] - 2^2\left[-\cos(30)\, i + \sin(30)\, j\right]$$

$$= 1.6\, i + 1.6\cos(30)\, j + 1.6\sin(30)\, i + 1.6\cos(30)\, i - 1.6\sin(30)\, j$$

$$= (3.786\, i - 0.5856\, j) \text{ m/s}^2$$

$$a_B = \sqrt{(3.786)^2 + (0.5856)^2} = 3.831 \text{ m/s}^2$$

$$\theta = \tan^{-1}\left(\frac{0.5856}{3.786}\right) = 8.793^\circ$$